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MITI'S SUCCESSES AND FAILURES IN CONTROLLING JAPAN'S TECHNOLOGY IMPORTS

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Abstract

Researchers have drawn conflicting conclusions about Japan's experience with government controls over technology imports in the 1950s and 1960s. Some suggest that these controls helped Japan get foreign technology at low cost. The imports of basic oxygen steelmaking and various computer technologies seem to support this position. Others argue that Japan's Ministry of International Trade and Industry (MITI) could not possibly have effectively monitored the large number of technologies imported. The controls may have been irrelevant. Other researchers point to MITI's apparent ineptitude in overseeing the import of transistor and polypropylene technology as evidence that government involvement was harmful. This paper re-examines both quantitative data on the imports and the cases that have been most often offered in assessing the role of MITI. The paper suggests that MITI did have the resources to effectively control technology imports. It suggests that the MITI role was generally positive for Japan, but largely because of unusual conditions pertaining at the time.

Government control over technology imports is often characterized as having been a central component of Japanese industrial policy in the 1950s, 60s and 70s. As Johnson (1982) puts it (p. 17): "Before the capital liberalization of the late 1960's and 1970's, no technology entered the country without MITI's [the Ministry of International Trade and Industry] approval; no joint venture was ever agreed to without MITI's scrutiny and frequent alteration of the terms; no patent rights were ever bought without MITI's pressuring the seller to lower the royalties or to make other changes advantageous to Japanese industry as a whole; and no program for the import of foreign technology was ever approved until MITI and its various advisory committees had agreed the time was right and that the industry involved was scheduled for 'nurturing' (ikusei)."

These controls, according to some writers, helped Japanese firms get technology under extremely favorable terms (see, for example, Anchordoguy, 1989; Henderson, 1972; Johnson, 1982; Lynn, 1982; MITI, 1960b; Ozawa, 1974; Peck and Tamura, 1976). Government withheld or threatened to withhold approval of agreements that were not judged to be favorable to the Japanese side. Government also, at least on occasion, organized potential buyers of foreign technology to prevent them from bidding up prices. Earlier, when foreigners distrusted the ability of Japanese firms to make royalty and other payments, government guaranteed the payments.

Some scholars, however, argue that the Japanese government's intervention in technology imports was, at best, irrelevant and may even have been harmful (see, for example, Friedman, 1988; Komiya, 1988; Trezise and Suzuki, 1976). One issue is whether the government could possibly have intelligently overseen the import of the thousands of technologies imported. The skeptics wonder if a government agency like MITI would not have been swayed to favor powerful firms, rather than acting toward the more general good. There is suspicion that government intervention may have blocked the import of promising technologies, or at least caused delays.

The Japanese experience matters at the practical level because policy makers in many countries look to the postwar Japanese experience as a model for how government can promote rapid economic development. It matters at the theoretical level because Japan is often portrayed as the most successful employer of industrial policies. If Japanese policies in the 1950s and 1960s were in fact irrelevant or harmful, it might be wondered if any seccessful examples of aggressive policy intervention exist.

Unfortunately, the debate on Japanese technology trade policy is informed by an extremely narrow empirical basis. Thousands of major technology agreements were approved by the Japanese government, but the role of government has been closely examined in no more than a handful of these, and then not necessarily in enough detail to permit confident conclusions. Further the cases that have been examined have not been brought together in any systematic analysis.

This paper begins by summarizing the general legal-bureaucratic structure under which technology was imported by the Japanese. It next critically reviews the evidence that has been offered for and against the efficacy of Japanese technology import control policies. Descriptions that have appeared in the literature are fleshed out. New cases that seem relevant are presented, most notably that of polypropylene. A final section summarizes what we might conclude from the materials that have been presented. The overall conclusion is that government involvement in the technology import process was important, though perhaps not as powerful as is often suggested. The consequences of this involvement are seen as having been positive overall for Japan, though primarily within the limited historical context of the 1950s and 1960s.

The Mechanisms for Government Control Over Technology Imports

At the end of World War II Japanese industry had fallen far behind its counterparts in the United States and Western Europe. Japan had been cut off from the flows of technical information beginning in the 1930s and until the end of the war in 1945 (Goto, 1993). Indeed, even in the first postwar years Occupation authorities tightly controlled Japan's foreign political and economic dealings and also imposed restrictions on research and industrial activities in many areas (Moritani, 1986).

As the Japanese regained control over their economy, a major goal was to close the gap with industries in the United States and Europe by importing technology. One problem was that the Japanese did not have dollars or other hard currencies to pay for technology and there was no international market for the yen. Through the 1950s and most of the 1960s Japan was plagued with balance of payments deficits. A solution might have been

to devalue the yen, but this was apparently not given serious consideration by the Japanese government (Kosai, 1989). Instead, foreign currency reserves were carefully rationed so that food, raw materials, and the most strategically important foreign technologies could be imported.

In 1949 and 1950 laws were enacted to control the flows of currency to and from Japan. The 1950 Foreign Investment Law (FIL) covered technology agreements lasting more than a year or in which royalties or other payments were to be made over a period of more than one year. Most analyses of Japan's technology imports including that in this paper focus on agreements covered by this law. Other technology agreements came under the 1949 Foreign Exchange and Foreign Trade Control Law (1960b). Under these laws government approval was required before technology could be imported into Japan. If approval were given, however, payments to the foreign suppliers of the technology could be guaranteed. The laws changed over time and controls became less and less stringent, but remained in effect until 1980. Henderson (1973) has characterized this regime as it existed until at least 1972 as the most restrictive by any major country in the world.

A common Japanese view, especially in the early 1950s, was that the purchase of foreign technologies was potentially damaging. Importing a technology just to get the right to use a foreign trademark, for example, was regarded as wasting scarce foreign exchange. Some imported technologies were seen as doing no more than replacing perfectly adequate domestic technologies. Still others were regarded as tempting companies to neglect the development of their own technology, or using funds that otherwise would have been used for domestic research. It was also feared that foreign firms would use their technologies to gain control over sectors of the Japanese economy (MITI, 1960a; 1990; Ozaki, 1972).

Thus through the 1950s technology imports were only to be approved if a good case could be made that the technology would contribute to Japan's balance of payments situation and/or to the growth and development of important industries. In practice this fear of foreign technologies diminished somewhat through the 1950s. In 1961 government policy was changed. A technology imports was now supposed to be approved unless government could show how the import would be harmful or that the agreement was unfair to the Japanese buyer.

Japan joined the OECD in 1964 and came under pressure to further liberalize its technology imports (Ozaki, 1972). Further liberalization measures in 1968 offered automatic approval within one month for contracts valued at under $50,000, though there were numerous exceptions (Wise, 1974; Henderson, 1973; Peck and Tamura, 1976). In May 1973 capital imports were liberalized except in certain designated industries such as computers. In 1976 the designated industries were also liberalized, and in 1980 the FIL was abolished (Johnson, 1982).

To a degree then, from 1950 until 1960, and then decreasingly until 1980, the Japanese government had formal control over all major technology agreements between Japanese firms and foreigners. The formal, legally mandated process was rather compiicated and involved many parts of the government.

A firm submitted its application for a technology import to the Ministry of Finance (MOF). MOF sent copies of the application to the Ministry with jurisdiction over the technology, most often MITI. MITI's Industrial Finance Section received the application from MOF, and sent it to whatever MITI section oversaw the technology. Here the actual

review of the technology would take place. Opinions would be written and reviewed at meetings that included people from competent sections and bureaus as well as representatives from the Raw Materials and Production Bureaus and, when appropriate, the Patent Bureau. The Industrial Finance Section would collect the written opinions from all concerned and write an opinion for MITI. The various applications and opinions would be reviewed at weekly meetings of the executive committee of the Foreign Exchange Advisory Council. Finally, the Council would approve the application, reject it, or send it back for renegotiation (MITI, 1990).

In the case of applications overseen by MITI the key official was generally the deputy section chief (kacho hosa) of the relevant section. This person had the most technical expertise, and the most influence over the approval decision (Ekonomisuto, 1976; Komiya, 1988). Aside from technical criteria, the government checked the various conditions in the agreement. If the agreement called for royalty payments higher than those paid for similar technologies, included export restrictions, or required the import of foreign raw materials, it might be sent back for renegotiation (MITI, 1990). Economic conditions such as balance of payments deficits might cause the government to delay the approval process. This appears to have been a factor, for example, in the drop from 120 agreements approved in 1957 to only 96 agreements approved in 1957, and the bounce back to 153 agreements approved in 1959 (MITI, 1990).

One source, not documented, but apparently primarily based on the experiences of foreign lawyers in Japan, claims that applications were seldom formally denied (Wise, 1974). Peck and Tamura (1976) report data indicating that from 1962–1966 90.4% of the applications were approved and 4.7% were still pending—only 4.6% had been rejected. It is not known, however, if the rejection rate might have been higher during the period of intensive scrutiny in the 1950s. Nor is it known how many applications were informally rejected by officials before they were formally filed. As we shall see in the case of polypropylene the power to reject applications was used on occasion to considerable effect.

MITI's Ability to Screen Technology Imports

Some have suggested that MITI officials could not have carefully evaluated the thousands of technologies that received approval. As Trezise and Suzuki (1976; 788) put it: "It is possible also to speculate whether the sheer volume of particular decisions left to the bureaucracy, especially during the years of full-scale foreign exchange and quantitative import controls, did not strain the capability of officials to make the best choices. The procedures governing imports of technology, for example, required intensive case-by-case screening until mid-1968. During the period 1949–1968 some 5,000 type A technology import agreements (those involving outlays of foreign exchange) were processed . . . ."

Friedman (1988: 121–122) notes that: "machine tools, one of 33 industrial groups in the 'general machinery' classification, alone had over 220 tie-ups. It would have been impossible for the bureaucracy, and the Industrial Machinery Bureau, to have controlled the terms of all of these agreements."

In response to this line of argument it should be noted first that the number of technologies reviewed was far smaller than the number of agreements approved, second that

many of the technologies did not require much review, and third that the government was well structured to undertake the review process.

While 5,000 Type A agreements were approved between 1949–68, this does not mean that 5,000 *different technologies* had to be reviewed. Many of the agreements were duplicates. Thirty-three Japanese firms, for example, had agreements approved to purchase the same black and white television production technology from RCA (MITI, 1990). Between 1963 and 1970 duplicate agreements accounted for between 35.6% and 73.6% of all of Japan's technology imports (Peck & Tamura, 1976).

Additionally, multiple agreements were often required to import a single technology. When the basic oxygen furnace (BOF) technology was imported, for example, separate agreements were signed for the BOF production technology, technology to make the vessels in which the steel was produced, and technology to produce brick to line the vessels (Lynn, 1982). Firms importing transistor technology needed to import both patent rights from Western Electric and production know-how from RCA (MITI, 1990). Half a dozen or more technology import agreements were involved in the construction of each of Japan's new petrochemical centers in the late 1950s and early 1960s (Kudo, 1990).

Further, many of the agreements did not require much technical evaluation on the part of officials. Often the technologies were well-established around the world before the import (e.g. DDT, streptomycin, radar). Additionally, many agreements were just for patent rights that would make it legally possible for Japanese firms to continue in an industry where they already had the technical know-how. Some accounts say this was the case with Toyo Rayon's famous import of Dupont's nylon patents (Kawamura, 1983). Nearly half the agreements in the 1950s were strictly for patent rights (MITI, 1990).

Finally, the government had a formidable bureaucracy to process the agreements. Most discussion has centered on MITI's role, but other Ministries were also involved. The Ministry of Transportation, for example, handled the large number of technologies related to shipbuilding. The Ministry of Health and Welfare processed technologies in the pharmaceuticals industry. The Ministries of Finance, Post and Telecommunications, Agriculture, and Construction also had their jurisdictions.

What kind of workload faced the bureaucracy in evaluating technologies? During the 1950s, the period Trezise and Suzuki are most concerned about, the largest number of Type A imports approved in a single year was 153 agreements in 1959. The largest number of agreements, some 33, involved chemical technology (aside from a very heterogeneous "miscellaneous machinery" category). Some of these agreements were for pharmaceutical or agricultural technology and would not have been screened by MITI.

Of the 21 technology imports classified as organic/inorganic chemicals, seven were duplicates (same technology from the same source). This leaves only 14 different technologies to be evaluated, and during the 1950s about half of the agreements for chemical technology were solely for patent rights.

The evaluation of these 14 technologies would have been divided up amongst three different sections (two for organic chemicals, the other for inorganic chemicals) in MITI's Light Industries Bureau. At the time the Light Industries Bureau included about 240 officials, around a third of whom dealt with the chemical industry and its products (MITI 1961).

It would seem, then, that a busy section at MITI during a busy year might have re-

viewed no more than one technology every month or two. To be sure, the number of agreements increased sharply during the 1960s. There were about twice as many imports per year in the early 1960s, around three times as many per year in the mid 1960s, and more than seven or eight times as many per year in the late 1960s. As has been mentioned, however, the level of scrutiny required/allowed was also sharply diminishing during those years.

How many technologies could a deputy section chief and his section be expected to review carefully? This question depends, of course, on what it meant to review a technology. MITI did not generally undertake large scale efforts to collect technological information. The firms brought the information to the Ministry when they submitted their application (Ekonomisuto, 1984). These materials were reviewed by engineers who were among the top graduates of the best university engineering programs. This was especially true in the 1950s and 1960s because owing to the lack of attractive alternatives for young engineers in the 1940s and early 1950s, many of the best of them went to work for the government (Ekonomisuto, 1984; Lynn, 1982).

In brief, it seems the magnitude of the application review process is substantially exaggerated by the authors quoted above.

Policies to Encourage Technology Imports

Two aspects of the foreign exchange control laws were intended to encourage foreign firms to export technology to Japan. First, the law required the government to list technologies needed by Japan (MITI, 1960b: p. 327; Ozawa, 1974). It is not clear, however, what, if any impact, this measure had. The literature hardly mentions it.

Perhaps more significant, the laws offered government guarantees that foreign firms supplying technology would be paid. Henderson (1973) argues that this was very important to the foreign suppliers of technology up until about 1955. Interestingly, the guarantees seem to have been somewhat controversial in Japan. A 1960 MITI publication says the guarantee policy was criticized as a national disgrace because it was the sort of measure only appropriate for a backward nation (MITI, 1960a: 7). On the other hand, a senior MITI official of the period argued in a 1985 interview that the measure was unique internationally and very important in encouraging imports (Ekonomisuto, 1984). It seems plausible that the guarantees were useful as Japan re-entered international trade, but were of diminishing consequence as Japanese companies became better known internationally.

Policies to Reduce the Price of Technology

It is widely claimed that a major part of Japan's economic success during the years of rapid growth in the 1950s and 1960s was the ability of Japanese firms to acquire foreign technologies at very low prices. Some blame U.S. and European firms for shortsightedly "giving away" technology to competitors. Another widespread image, however, is of a "Japan Incorporated," including businesses and government, collectively overpowering individual Western firms in negotiations to get technology at very low prices. On the one hand government is depicted as refusing to allow agreements that were not overwhelmingly

favorable to the Japanese; on the other hand government is depicted as coordinating the negotiating positions of Japanese firms to keep prices for technology from being bid up.

"The Two-Against-One Routine"

MITI is often depicted as having regularly intervened to make technology assistance agreements more favorable to the Japanese side. Henderson (1973: 231) calls this "the two-against-one routine," and says: "Most liaison lawyers in the field have examples of contracts previously signed by the parties but returned after preliminary talks with MITI replete with interlineations of (1) reduced duration; (2) reduced royalty rates; (3) deletions of license-back and territorial clauses; and (4) reductions of items covered." MITI (MITI, 1990) records show that, indeed, government intervened to force changes of the sort Henderson describes in about 40% of all the technology agreements submitted in the 1950s.

Furthermore, according to Friedman (1988), the threat of these adjustments led to compromises by foreign negotiators even before the agreements were submitted to the government (p. 244): "Privately, Japanese firms and international lawyers admit that MITI is sometimes used as a bargaining device to extract favorable terms from prospective partners. The Japanese side can claim that license fees, or the right to use technology, or other aspects of a contract will not be approved by the bureaucracy. In some cases firms will argue that they are legally prohibited from contracting at certain terms."

It is difficult to estimate how much benefit Japanese firms may have gained from government intervention. Peck and Tamura (1976) found that after the liberalization of technology imports in the late 1960s, royalty rates paid by the Japanese did in fact increase, suggesting that intervention by the government may have reduced costs. It is possible, however, that the nature of the technologies imported also changed. Some of the technologies brought in after liberalization may have been those that were previously excluded because foreign partners insisted on high royalties, for example. Alternatively, as Japan's economy grew and its successes with past technology introductions became better known foreign firms may have begun to seek higher royalties (Goto, 1993b).

This discussion of royalty rates should not obscure the point that the Japanese government was also very much interested in other contract conditions, some of which may have been of less importance to the Japanese firms involved. Because of its foreign exchange concerns, the Japanese government opposed agreement conditions that restricted the ability of Japanese firms to export or that required the purchase of imported equipment or raw materials. It also blocked technology imports that were accompanied by foreign managerial control. Kudo (1990) notes that Dupont had a strict policy of transferring process technologies only to foreign firms in which it had more than 50% equity, and thus managerial control. This policy was broken for the first time in a joint venture with Mitsui Petrochemical in Japan in 1960 at the insistence of the Japanese government.

While the Japanese firms involved in these negotiations may have benefitted from contract changes forced by government, it seems possible that at least in some instances there were costs to them. Firms might have preferred lower license fees or royalty payments in place of the right to export or in place of managerial control, for example. If the Japanese firm could get foreign exchange it would presumably have little concern over whether

the sources of raw materials were foreign or domestic.

Trezise and Suzuki (1976) suggest that MITI's blockage of Texas Instrument's effort to establish a more than 50% owned subsidiary to make ICs in Japan in the late 1960s delayed Japanese access to this technology. Anchordoguy (1989: 29), however, argues that by delaying Texas Instruments' access to the Japanese market, " . . . the government gave the Japanese firms, most of which were Japan's major computer and telecommunications companies, a crucial opportunity to build up economic scale before encountering foreign competition." It is difficult to reconcile these interpretations, though it is possible that Anchordoguy's view from 1989 may have revealed less damage to Japanese firms than seemed apparent when Tresize and Suzuki wrote in 1976.

Keeping Japanese Firms from Bidding up Technology Prices

Given its authority to approve technology import agreements, MITI would seem to have been in a position to keep Japanese firms from bidding up prices.

The best documented case of this actually happening involved the introduction of the basic oxygen furnace (BOF) steelmaking process from Austria in 1956–1957. Several Japanese steelmakers had become interested in this technology and were independently approaching its developers. Concerned that this would drive up the price of the technology, MITI officials called together a meeting of senior managers from the companies and orchestrated an arrangement whereby an association of the companies would collectively buy rights to the technology. In effect, two companies would jointly bargain with the Austrians on behalf of the Japanese industry. The cost to Japanese steelmakers of using the technology ended up being a fraction of a cent per ton of the steel produced with it, compared with a cost to steelmakers in other countries of 25 to 50 cents a ton.

One reason the price per ton ended up being so low was that both the Japanese and the Austrians underestimated the future growth of the Japanese steel industry. Even if their estimates had been accurate, however, the price to the Japanese would still have been only seven or eight cents per ton, less than a third that of the price to steelmakers in other countries. The major reason for the low price seems to have been the lack of competition between potential buyers on the Japanese side (Lynn, 1982).

Some sources, however, suggest that this scenario may have been unusual (Goto, 1993; Ekonomisuto, 1984; MITI, 1990). The most often cited counterexample is that of polypropylene, a polymer used in such products as film and injection molded plastics. Since this case has been widely referred to, but not described in much detail, a somewhat detailed description is provided here.

The Competition to Import Polypropylene

While the petrochemical industry grew rapidly in North America and Europe in the years after World War II, Japan had no true petrochemical industry. This was seen as a problem by government officials in the early and mid-1950s. Petrochemical imports were beginning to increase, and new demand was developing as Japanese textile firms (with strong

government encouragement) began the production of synthetic fibers. Given the concern of policy makers at the time to increase Japanese economic self-sufficiency and to move into prestigious high technology areas, it is not surprising that the government wanted to develop a domestic petrochemical industry (Hirakawa, 1972).

In 1954 and 1955 an overall policy was developed by the Light Industries Bureau of MITI in consultation with industry to "nurture" a petrochemical industry. Former Japanese Navy and Army fuel depots were sold to provide sites for "Kombinats," (petrochemical centers made up of coalitions of firms), special loans were granted by a government bank, tax benefits were offered, and the government facilitated the import of the needed technologies. As these policies were developed and enacted Japan's first specialized petrochemical firms were established, Mitsui Petrochemical and Nippon Petrochemical in 1955, and Mitsubishi Petrochemical Industries in 1956. Sumitomo Chemicals entered the industry around the same time, but without forming a specialized petrochemical firm. These four companies are generally categorized as the forerunners in the industry (Hirakawa, 1972; Kudo, 1990).

The first four companies launched their Kombinats under the first phase of MITI's plan in the late 1950s. The Kombinats focussed on the production of eythylene and polyethylene. These provided a basis for synthetic rubber, butadiene and other products. Given the perceived opportunities in this new industry, one government concern was to ensure that excessive competition did not lead to overcapacity. Since the new plants required imported technologies, the government's control over technology imports served as a major means to control entry into the industry (ironically, the subsequent lackluster performance of this industry in Japan is often blamed on its having too many firms) (Hirakawa, 1972).

The second phase plan began as the first was completed and extended through the early 1960s. Major government concerns under the second phase were to attain greater scale economies by enlarging first phase facilities, and to extend the range of raw materials and products. The four firms that had already become general petrochemical firms under the first phase plan wanted to solidify their positions. Other firms wanting to enter the industry were looking for new technologies that might give them a competitive edge. Since MITI was determined to restrict capacity to projected demand, it was essential that a firm be one of the first to import a new technology—once MITI believed there was sufficient capacity for a given petrochemical product it would not allow other firms to license technologies to make the product. Thus the four petrochemical firms and their would-be rivals saw themselves in a near life and death struggle with each other to find and get rights to important new technologies (Oyama, 1972).

Meanwhile the Japanese textile industry, one of Japan's most important industries in the prewar period and in the first decades after the war, was involved in intense competition to import or develop new fibers. Toyo Rayon had scored a major success by getting exclusive rights to nylon from Dupont in 1951. In 1957 Asahi Kasei gained an edge by being first to develop acylic fiber technology. In 1958 Teijin and Toyo Rayon had jointly imported tetron from ICI (Uchida, 1966). At the time polypropylene production was first commercialized it was described as offering potential as a miracle fiber that would rival nylon. Thus the textile firms eagerly tied up with petrochemical firms that might provide them with polypropylene as a raw material for textiles.

Another factor that contributed to the intense competition to import polypropylene technology was that the theoretical advantages of this technology were clear and its development was widely anticipated (Oyama, 1972; Uchida, 1966). The expected breakthrough occurred in 1955 when G. Natta of Milan Polytechnic University reported the results of joint research with Montecatini in which he had successfully polymerized propylene (Oyama, 1972; Uchida, 1966). In September 1957 Montecatini completed a 6,000 tpy polypropylene plant.

In 1957 four Japanese firms were still constructing the ethylene centers that were to make them general petrochemical producers. The Mitsui and Sumitomo centers began operations in April 1958, the Mitsubishi center in May 1959 and the Nippon Petrochemical center in June 1959 (Kudo, 1990).

Three of these firms, the affiliates of the old Mitsui, Mitsubishi, and Sumitomo zaibatsu, were quick to show an interest in the new technology. Of these firms Mitsui had the advantage. Mitsui had imported the Ziegler technology for making polyethylene. A variant of the Ziegler catalyst was used in the Montecatini technology, so Ziegler had good information on the polypropylene technology which he passed on to Mitsui (Sekiyu Kagaku Kogyokai, 1971). Mitsubishi had established contacts with Montecatini while building its ethylene center and was well-informed about the technology, but was inclined to wait until the technology had been proven for use in synthetic fibers and elastomers. Sumitomo Chemical was given information about the technology by an agency firm and later by Sumitomo Trading (Sumitomo Kagaku, 1981). Nippon Petrochemical, the other firm in the industry, did not show an aggressive interest in the technology at the time.

A firm that was hoping to move into the petrochemical industry, Nissan Chemical, was also very interested in polypropylene. Nissan Chemical had earlier imported Montecatini's Fauser Process technology and had served as an agent in Japan for the Italian company's technology. Senior managers from Nissan Chemical had tried to negotiate the purchase of rights to the technology around the time Montecatini started up its first commercial polypropylene plant in 1957, but were told to come back some months later (Sekiyu Kagaku Kogyo, 1971; Nissan Kagaku, 1969).

Mitsui and Nissan Chemical sent senior managers to negotiate with Montecatini as soon as Montecatini was ready to receive them. Both firms signed provisional contracts with Montecatini in February 1958. The contracts were contingent on the required approval of MITI and had to be activated within six months. On hearing of the moves by these two firms Mitsubishi and Sumitomo, both began their own negotiations with Montecatini (Mitsubishi Yuka, 1988; Sumitomo Kagaku, 1981).

The Nissan contract covered formed products, sheet, textiles, elastomers, and all polypropylene technology. The fee was 900,000 dollars, plus a royalty of 5%. The Mitsui contracts was apparently similar. Nissan hoped to begin construction on a polypropylene plant in October 1958 (Nissan Kagaku, 1969).

Both the Mitsui and Nissan agreements were submitted to MITI, and both were turned down. MITI was convinced that polypropylene should be produced in Japan, but concluded that it was too early to import the technology. The technology had only been in commercial use a short time, and had not yet been proven viable in products such as synthetic fibers and elastomers—products particularly important to Japan. Further, the Japanese petrochemical industry was still trying to get its first plants into operation. MITI

worried that the attempt to introduce another new technology at the same time might overburden the industry. Finally, polypropylene would be made from propylene gas, which was a by-product of ethylene production. It seemed prudent to MITI to wait until ethylene production was smoothly underway to ensure that this raw material would be available (Sekiyu Kagaku Kogyo Kyokai, 1971).

MITI asked Mitsui, Mitsubishi, Nissan and Sumitomo to agree to suspend negotiations until the technology was perfected. In its company history, Sumitomo claims to have followed the agreement, but complains that the other firms quickly started secret negotiations with Montecatini (Sumitomo Kagaku, 1981).

Meanwhile, several German and American firms had begun the construction of polypropylene plants (Sekiyu Kagaku Kogyo Kyokai, 1971). During this time polypropylene was attracting the attention of journalists as being the basis of a light and strong plastic, as well as a new miracle textile (Nissan Kagaku, 1969). In September 1959 the Italian ambassador asked the Japanese Minister of International Trade and Industry what the Japanese government's intentions were regarding polypropylene. MITI used this as an opportunity to re-evaluate the technology. At the time MITI was planning its second phase program for the petrochemical industry. Because of the importance of polypropylene technology, it did not just rely on information from the companies, but sent its own survey team to Europe. MITI concluded that it should approve the import of this technology. This restarted the race to import the technology (Sekiyu Kagaku Kyokai, 1971).

The intense competition between Japanese firms to import Montecatini's technology was so widespread that it has been dubbed "the Montecatini Pilgrimage." In all a dozen companies from the chemical industry and thirteen from the textile industry sent people to Montecatini in an effort to negotiate contracts (Arisawa and Nakayama, 1973). Between late 1959 and the spring of 1960, it has been claimed, hardly a day passed that Japanese negotiators could not be seen at Montecatini's offices (Oyama, 1972).

Mitsui was the first to reach an agreement, on January 16, 1960. It seemed likely that only one or two additional firms would be allowed by MITI to import the technology, since two or three plants could meet the demand for polypropylene that MITI projected at the time. The other firms rushed into negotiations. Mitsubishi signed a contract in February. The Mitsui and Mitsubishi contracts were approved in March (Mitsubishi Yuka, 1988).

The terms of the Mitsui and Mitsubishi agreements were far worse for Japan than those of the conditional agreements signed by Mitsui and Nissan in 1958, even though MITI attempted to use the "two-against-one" strategy to improve them. Instead of $900,000, the price was now $3,000,000 (Nissan Kagaku, 1969). Some have attributed this to MITI's ineptness in attempting to control competition between the Japanese firms that were seeking to import the technology (Morikawa, 1976).

Although MITI initially felt that Mitsui and Mitsubishi could handle the demand for polypropylene, other firms still desperately wanted a share of the market. When news came to Nissan Chemical in January 1960 that Mitsui had concluded a new provisional contract with Montecatini, two Nissan managing directors rushed to Italy. In the end, however, the greatly increased cost of the technology led Nissan to abandon its plans to produce polypropylene (Nissan Kagaku, 1969).

Sumitomo wanted to negotiate a low cost agreement that would cover only patent rights, but Montecatini insisted that Sumitomo accept the same terms as Mitsui and Mitsubishi

(Morikawa, 1976). Sumitomo also had to convince the government that Japan would need more polypropylene capacity than Mitsui and Mitsubishi could provide. Some months later MITI revised its estimates for polypropylene demand and Sumitomo signed a technology import agreement in December. The agreement was approved by the government in January 1961 (Sumitomo Kagaku, 1981).

Nissan had dropped out of the race, but another firm, Shin Nihon Chisso Fertilizer (now Chisso), found a new source of polypropylene technology, a joint venture of Sun Oil and American Viscose. In May 1960 Chisso submitted a contract for this technology to MITI for approval. This agreement was approved the same day as Sumitomo's (Arisawa and Nakayama, 1973; Mitsubishi Yuka, 1988). Production of polypropylene was begun in 1962. The product was successful in many applications, but ironically not in textiles (Nissan Kagaku, 1969).

In the case of the BOF technology MITI intervention seems to have reduced costs for the Japanese while in the case of polypropylene it seems to have raised them. Both involved technologies that were considered crucial to industries that were themselves considered strategic. What accounts for the difference between the two cases? And which was more typical?

It might be wondered if the historically close relations between the steel industry and government in Japan was a factor. Yawata Steel and Fuji Steel, the two leading Japanese steelmakers at the time of the basic oxygen furnace agreement had both been parts of a semi-governmental company until 1950 (Yonekura, 1994).

There seems, however, to have been no pattern of cooperation regarding technology in the steel industry and no pattern of an inability to cooperate in the petrochemical and textile industries. Managers involved in importing the basic oxygen technology described intense and sometimes bitter rivalry between the firms (Lynn, 1982). On the other hand there were episodes of cooperation to mutual benefit in buying foreign technology agreements by firms in both the petrochemical and textile industries. Sumitomo Chemicals and Mitsui Petrochemical, for example, cooperated in 1956 to get ethylene technology at a lower price from Stone & Webster of the U.S. (Kudo, 1990). Toyo Rayon and Teijin cooperated to negotiate a lower price for polyester technology from England's ICI (Nikkan Kogyo Shimbun, 1984).

One difference between the BOF and polypropylene cases is that while only about half a dozen Japanese firms, all of them steelmakers, had an interest in introducing the basic oxygen furnace, some twenty-five companies were interested in importing polypropylene technology. The problems of coordination in the latter case can readily be imagined. Sheer numbers of Japanese firms interested in a technology, however, did not in themselves always keep MITI from playing a useful coordinating role. MITI was able, for example, to organize the more than thirty diverse firms that bought television receiver production technology from RCA into a group that successfully lowered royalties for this technology (MITI, 1990).

It may be that a more important difference between the BOF and polypropylene technologies was that while the BOF was a technology to make an existing product by incumbent producers at a lower cost, the polypropylene process was a technology to make a new product in an industry that could only support a few producers. There were on-going plans to upgrade and expand steelmaking capacity. The BOF allowed this to be done at lower cost.

It was in the interest of the firms to import the technology, and it was in the interest of MITI that they all do so.

The firms hoping to import the polypropylene technology, however, planned to use the technology to enter a new industry in which minimum economic production scales and investment costs were very high. If too many firms entered the industry, many would fail and the resources they had invested in it would be wasted. Thus MITI wanted to prevent most of the firms from importing the technology, and thus MITI's policies were in direct conflict with what most of the firms wanted to do. The firms tried to evade MITI's guidance in the apparent hope that something would work out.

It would take a much larger review of cases than this to establish authoritatively which pattern, that of the basic oxygen furnace or that of polypropylene, was more typical. The reasoning outlined here, however, suggests the not surprising conclusion that MITI was most likely to succeed when the interests of both government and most of the firms seeking a technology were in accord. When MITI sought to keep powerful firms out of an industry based on questionable projections of demand it ran into difficulties. This seems to have been a problem MITI frequently encountered in the petrochemical industry (Itami, 1991), but one that has not been much noted in other industries.

The "Well-known" Sony Transistor Case

Substantial attention has been paid to the possibility that government involvement may have reduced, or at least slowed down technology transfer to Japan. Those skeptical of a beneficial role having been played by MITI most often cite MITI's initial refusal to give Sony a license to import the transistor. Most cite Trezise and Suzuki (1976) as their only source for this case (e.g. Goto, 1993a, 1993b; Kosai, 1989; Noble, 1989).

As Trezise and Suzuki (1976: 798) describe the case:

> The amount of net benefit contributed by [MITI's] control over the import of technology to economic growth may be open to argument. The Sony Corporation, for example, had to wait almost two years after 1952 to get approval to import the transistor technology that it subsequently applied so successfully to radio manufacture—the delay caused by a minor MITI official who had concluded that this then small company lacked the skills to develop an untried technology. Similar deals—and an occasional failure to complete a deal—were inevitable. There was, in other words, a price for the government's intervention, and it may have been a substantial offset to the gains derived from it.

One might speculate, based on this anecdote, about how many potential Sonys were ruined by thick-headed MITI bureaucrats. Or how many technologies were choked to death at birth by red tape. As Okimoto (1989: 65) puts it: "Imagine the enormous opportunity costs to the Japanese electronics industry if Tokyo Tsushin [Sony] had not gone ahead to sign the transistor patent agreement, which it presented to MITI as a fait accompli."

Three points need to be made about the Sony case. First, although the case is generally characterized as "well-known," it has not been described in detail in the literature on

industrial policy. Trezise and Suzuki's complete description of the case is given above (Trezise and Suzuki themselves cite interviews with high-ranking (but unidentified) Sony officials and an unpublished paper by Ibuka, then chief executive officer of Sony). Secondly, the Trezise/Suzu kiaccount is misleading. Most importantly there was nowhere near a two year delay. And third, Sony was not quite so bravely defiant of MITI as Okimoto suggests. The agreement it signed with Western Electric was contingent on MITI approval (Nakagawa, 1981), but this was not an uncommon practice (recall our discussion of the polypropylene case, or note the several cases described by Kudo, 1990).

Here is a more extended version of what happened, based on published interviews with Ibuka (Aida, 1991; Ibuka, 1992; Kojima, 1993). Apparently if there is a MITI side to the story, it has never been published.

The transistor was invented at Western Electric by Shockley and others in 1948. Ibuka says he read about the new technology in *Time* or *Newsweek* at the time, but didn't regard it as having much commercial value. Ibuka saw little reason to keep track of the progress of the transistor technology. Some others in Japan did maintain an interest in the transistor. The Electronic Communications Research Laboratory, a government research laboratory that later became part of NTT, and some private firms began research on transistors in 1949 (Shinko Kyokai, 1988; Aida, 1991).

Sony's interest in the transistor developed during a trip Ibuka made to the United States in March to May 1952. Ibuka was hoping to develop a sense of the potential U.S. market for tape recorders recently developed by Sony. He was disappointed in what he found, but while in the U.S. received a letter from an American friend in Japan. The letter mentioned that Western Electric was releasing its transistor patents and suggested that Sony should be interested in this new technology. As it happened, Ibuka was looking for a new challenge for his technical people now that they had successfully commercialized the tape recorder and so was particularly receptive to the idea of introducing a new technology.

Ibuka was unable to get an appointment with the head of Western Electric's patent division while in the United States, but a Japanese expatriate offered to continue efforts on Sony's behalf. Ibuka returned to Japan, discussed the patent with Akio Morita and other Sony officials. Ibuka and Morita persuaded the others to begin serious efforts on the transistor. Meanwhile, Sony's negotiator in the United States (a sometime stockbroker and agent for the trading firm Nissho) continued to approach Western Electric. Western Electric, perhaps not surprisingly, was initially skeptical about dealing with a company it knew nothing about.

Ibuka visited MITI to indicate Sony's intention to buy patent rights to the transistor. MITI's reaction was that it was ridiculous to consider that an unknown company like Sony with no experience producing vacuum tubes could commercialize the transistor. MITI's policy regarding the import of transistor technology favored having large firms such as Hitachi and Toshiba import not only the patent rights from Western Electric, but also related know-how and assistance from RCA. It seemed unlikely that a small firm could succeed in commercializing the technology with no guidance except patent rights. Nonetheless Sony's agent in the U.S. continued his discussions with Western Electric. It is important to note that Sony did not have an agreement yet at this time, nor did it feel that MITI's early negative reaction was reason to stop seeking one.

In the summer of 1953 Sony's negotiator in the United States finally persuaded Western

Electric that Sony was a worthy licensee for the transistor. Western Electric asked Sony to send someone to sign a license agreement. Akio Morita was planning a trip to Europe and arranged to stop in the United States where he signed the agreement contingent on MITI's approval. He returned to Japan in October 1953. When Morita reported the contingent agreement to MITI, he was rebuked for not clearing the agreement with MITI before signing it.

This reaction was obviously a setback, but was not seen as a fatal one. A Sony research group continued to develop the technology using references provided by Western Electric. At the end of 1953 MITI reassigned its personnel including those in the electric/electronics section. Sony's transistor agreement was approved on February 2, 1954. Other Japanese firms were later approved to import the technology: Toshiba in June 1954, Mitsubishi Electric in October 1954, and Kobe Kogyo (later part of Fujitsu) in November 1954.

The world's first transistor radio was introduced by Regency of the U.S. in December 1954. Sony was second, about six months later. Sony might have been first according to Ibuka, if MITI had supported Sony's efforts to license the transistor.

It can be seen from this that the Trezise and Suzuki claim that MITI intransigence delayed Sony by nearly two years is greatly inflated. Two years before the agreement was approved Sony had no interest in the transistor. Indeed, Sony did not even have a contingent agreement to take to MITI until four or five months before MITI approved the agreement. Conceivably, strong support from MITI might have caused Western Electric to act more quickly, or might have encouraged Sony to begin its development work on the transistor a few months earlier. This, however, is mere speculation and still does not add up to a two year delay. It should also be noted that though the Sony story has been taken as showing MITI discrimination against small entrepreneurial firms (Trezise and Suzuki, 1976; Okimoto, 1989), Sony received approval of its technology import ahead of the supposedly favored firms such as Toshiba and Hitachi. While MITI's disparagement of Sony must have been painful and presumably wasteful of scarce managerial time, it ultimately did not appear to make much difference.

On the issue of favoritism it should be noted that the technology import agreements of large well-connected firms were also delayed on occasion by MITI A senior Sumitomo Chemical manager involved in the competition to import polypropylene technology complained that MITI had favored Mitsui (Morikawa, 1976). Nonetheless, a few years earlier, in 1955, Mitsui Chemical also had an important agreement delayed by MITI. This was for the import of the polyethylene technology that resulted in Mitsui's entry into the general petrochemicals industry. Mitsui signed an agreement for the Ziegler Process ethylene technology on January 6, 1955. The agreement was not approved until November. In contrast, when Sumitomo, Mitsubishi and Nippon Petrochemicals imported polyethylene technologies in the late 1950s, the approval process was accomplished within two to four months (Kudo, 1990)

In retrospect MITI's caution about the Mitsui Ziegler Process agreement seems to have been justified. While the Mitsubishi, Sumitomo and Nippon Petrochemicals start-ups went smoothly, that of Mitsui did not. Mitsui's agreement called for payment of $1.2 million dollars plus royalties, not including know-how. All Mitsui was getting in addition to the rights to use the Ziegler patents was two notebooks of laboratory data. MITI hesitated to approve the contract because know-how and other assistance was not included.

MITI's misgivings were borne out: early stage losses to Mitsui due to start up problems amounted to some 250 million yen per month and the company required new infusions of capital. Mitsui finally had to contract with a German chemical firm for intensive technical assistance.

An opportunity to favor established firms clearly occurred with the import of television technology. MITI could have used a "national champion" strategy to nurture a strong domestic television production industry by closing the market to weaker firms. Instead it allowed more than thirty different companies to import the technology and enter the industry. Many of these were marginal firms, and of course most did not long survive as independent producers of television sets. The point, however, is that MITI seemed perfectly willing to let the market choose amongst them (MITI, 1990).

Conclusions

This review of MITI experiences in approving technology imports suggests several points:

First of all, images of MITI as having unlimited powers in regulating technology imports seem vastly overdrawn. The Ministry did not generally attempt to identify technologies for Japanese firms to import, but rather played the more passive role of evaluating agreements brought to it by the firms. The initiative lie with the private sector. The Ministry could refuse to approve agreements, but in fact approved more than 90% of them.

It also seems incorrect to depict MITI as having no power in controlling technology imports. As we have seen, the bureaucratic apparatus was in place to handle the numbers of agreements approved in the 1950s and perhaps through the early 1960s. The power was often exercised. Small firms such as Sony, medium sized firms such as Nissan Chemical, and even old Zaibatsu firms such as Mitsui Chemicals and Sumitomo Chemicals all had technology imports blocked or at least delayed by the Ministry. This listing itself also calls into question the assumption that there was a systematic bias in favor of old and powerful firms.

Similarly, it does not seem fair to characterize the government's involvement as generally restricting competition. This apparently was the intent in the somewhat atypical case of polypropylene, but the intent was not realized. Often MITI's actions seem to have been aimed at maintaining a certain level of competition. This seems to have been the case, for example, when MITI blocked the purchase of Orlon technology by Toyo Rayon out of concern that this technology coupled with other technologies controlled by Toyo Rayon would give the company too much market power (Morikawa, 1976).

The issue of whether government control over technology imports was generally beneficial to the Japanese economy is controversial. This limited review suggests that it was by and large beneficial in the Japanese context of the 1950s and early 1960s. It was beneficial in the following ways:

1. It made selling technology to Japan more attractive to foreign firms at a time when Japan was largely isolated from the international economy and Japanese firms were not well known.

2. It compensated, in part, for the relative lack of experience of Japanese firms in

international business. The government's records of payments and other conditions provided benchmarks for agreements. At the time, it should be recalled, travel outside Japan was difficult, many prewar ties with foreign firms had been disrupted by the war, and the general trading companies (which had played a major role in prewar technology transfers) had been weakened by Occupation reforms.

3. It provided a venue, at least, for coordinating the approaches of Japanese firms to foreign suppliers of technology. At times this seems to have reduced the price of technology to Japanese. This point should not be overstated, however. The case of polypropylene suggests its limitations. Nor was government involvement the only way in which firms could coordinate approaches to foreign suppliers of technology.

This conclusion that the controls were favorable does not necessarily suggest that such controls are more generally desirable. Japan in the 1950s was a country with high technical skills that had been cut off from technology flows and from normal commercial relationships for an extended period of time due to World War II. The country suffered from persistent shortages of foreign exchange. The numbers of relevant technologies to import was much smaller than would be true now.

The conclusion also needs to be tempered by the realization that other factors also contributed to the ability of Japanese firms to get the foreign technologies they needed under favorable terms. Kudo (1990), for example, notes that in the petrochemical industry there was often intense competition on the part of the sellers of technology to transfer technology to Japan. This may have been true in some other industries as well. I have noted elsewhere the role of non-government organizations such as trade associations and trading companies in facilitating the search for technologies by Japanese firms (Lynn, 1982; Lynn, and McKeown, 1988). The Japanese firms themselves put a high priority on collecting technical information overseas. Foreign sellers often underestimated the potential growth of the Japanese market and the ability of Japanese firms to commercialize technology, and thus may have underpriced their technologies. Finally, the world environment for commercial technology transfer was unusually favorable.

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