Chapter 5 The Rise and Fall of "Mixed Metal Scrap" Recovery Industry in Taiwan: International Trade of Scraps and Transboundary Relocation of the Business

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The Rise and Fall of "Mixed Metal Scrap" Recovery Industry in Taiwan: International Trade of Scraps and Transboundary Relocation of the Business

Tadayoshi Terao

INTRODUCTION

Since the Second World War, Taiwan's economy has grown rapidly guided by a policy of export-led industrialization. Taiwanese economy has become increasingly linked to those of the US and Japan. Japan is an important trade partner, particularly in the supply of imported capital goods, while the significance of the US has grown as a destination for exports of manufactured product. On the flipside of this trade in industrial goods, "waste" from used manufactured goods has flooded into Taiwan from the US and Japan as recyclable wastes[1] engendering various problems, including the pollution of its soil, rivers and atmosphere during the collection of valuable resources, and residual that is being left abandoned for long periods having been illegally dumped.

The small country that is Taiwan has attained relative dominance in the long term and achieved rapid industrialization and economic growth through the active use of foreign trade and foreign direct investment, and by adapting to climatic changes in the global economy. Due to a scarcity of natural resources, Taiwan has continued to import vast quantities of resources in the course of rapid economic growth. It is also an importer of many types of recyclable wastes generally speaking. However, since the second half of the 1990s, Taiwanese exports of recyclable wastes have been increasing at a rapid pace. In recent years, economic relationship between Taiwan and mainland China has been deepening. In case of most of recyclable waste, exports from Taiwan to Hong Kong and mainland China are increasing rapidly.

This chapter opens with an overview of trends in the import and export of key recyclable wastes (waste plastics, used paper, iron and steel scrap, copper scrap, aluminum scrap, and lead scrap) from the early 1970s through the present day. It goes on to present examples of transboundary movements of wastes and recyclable resources involving Taiwan that caused problems at the global level, such as Taiwan's imports of battery waste through the end of the 1980s and the problems that arose in consequence of a consignment of hazardous wastes containing mercury that was exported to Cambodia in 1998, and provides a brief introduction to the measures adopted by Taiwan in respect of the Basel Convention on the transboundary movements of hazardous wastes. This is followed by a detailed discussion of the "mixed metal scrap" ("*fei-wuchin*" in Mandarin Chinese), originating from household appliances etc., which represents an important example of a problem contingent upon transboundary movements of recyclable resources and wastes that has involved Taiwan and is one of the key topics of this paper. The chapter concludes by examining controls on international flows of recyclables and Taiwan's domestic recycling system as revealed by the case of mixed metal scrap, together with issues relating to its recycling industry.

1. As used here, the term "recyclable wastes" refers to "wastes for recycle" that have been used but not yet recycled. It does not refer to "recycled resources," i.e. end-of-life products that have already been recycled. In international trade statistics, with the exclusion of commodities such as metal products that are difficult to distinguish those of recycled material from products of mineral ore, in many instances, products that are predominantly manufactured from recycled materials are separately classified in case of plastics, textiles, paper, etc.. Imports and exports of these "recycled resources" are not discussed in this chapter. Further and specifically in regard to plastics, in order to clarify the distinction between "recycled plastics," this term is not used and instead plastics are referred to as "waste plastics" (for recycling). Paper is referred to as "used paper" and not "recycled paper."

SECTION 1: TRENDS IN IMPORTS AND EXPORTS OF MAJOR RECYCLABLE WASTES

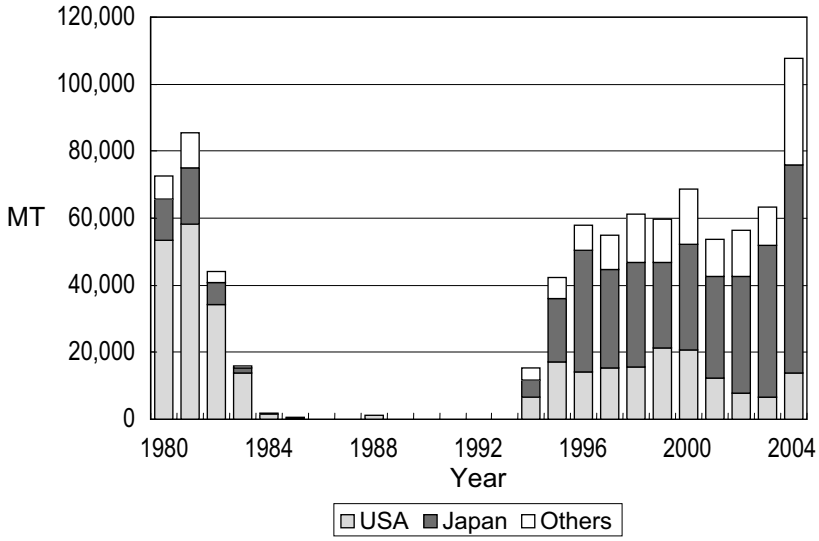
Waste plastics, used paper, scrap of iron and steel, copper scrap, aluminum scrap, and lead scrap represent the major recyclable waste resources, and trends in Taiwan's imports and exports of these commodities and their causes are analyzed hereunder from 1972, the year in which it became possible to categorize trade in recyclable resources in the import/export statistics in Taiwan.[2]

Without rich endowment of natural resources, Taiwan has been an active player in global markets, achieving rapid economic growth by importing energy resources and raw materials for processing and re-export. It has also traded vigorously in recyclable resources. Until recently, the prevailing trend with most of the recyclable resources was to import. But in recent years, and particularly since the second half of the 1990s, exports of most recyclable resources have been on a fast-rising trajectory, and it is no longer necessarily valid to refer to Taiwan as a recyclable resource importer. The following paragraphs provide an overview of Taiwan's trade in the various renewable waste resources.

Imports of waste plastics fell rapidly after hitting 85 thousand tons in 1981, and between 1984 and 1993 had decreased to imperceptible levels. Levels have risen rapidly since 1994, however, and have fluctuated at around 60 thousand tons since 1996.[3] Japan and the US are responsible for 80 percent of all import supply. A comparison between the early 1980s and the latter half of the 1990s reveal that the US's share of imports has dwindled while Japan's has risen (see Figure 5-1).

By contrast, exports of waste plastics remained at low levels throughout the 1980s but have risen slowly, from a few thousand tons in the early 1990s to around 20 thousand tons in the latter half of that decade. The majority of Tai-

Figure 5-1: Taiwan's Imports of Waste Plastics (by origin)



Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Data for years preceding 1979 have not been categorized.

2. The product categories used in Taiwan's international trade statistics have been changed on numerous occasions during this period. There was a particularly significant change in 1989, when all product categories are believed to have been subject to sweeping review. The categories for the recyclable wastes discussed hereunder have also been changed several times. Where possible, the import and export figures given for these recyclable wastes were tabulated using a diachronic approach in order to keep track of these fluctuations. However, for those recyclable wastes that were not categorized in Taiwan's international trade statistics in 1972 the figures are given from when the classifications first started to be used. Generally speaking, it is difficult to provide explicit definitions of recyclable resources; added to which, it is difficult to rule out subjective and/or arbitrary interpretations on the part of applicants and inspectors in respect of the categories used at customs. There is also a strong possibility that such practices are used intentionally in order to conduct illegal trade.
3. Recyclable plastics (waste plastics) were separately classified in trade statistics from 1980 onwards.

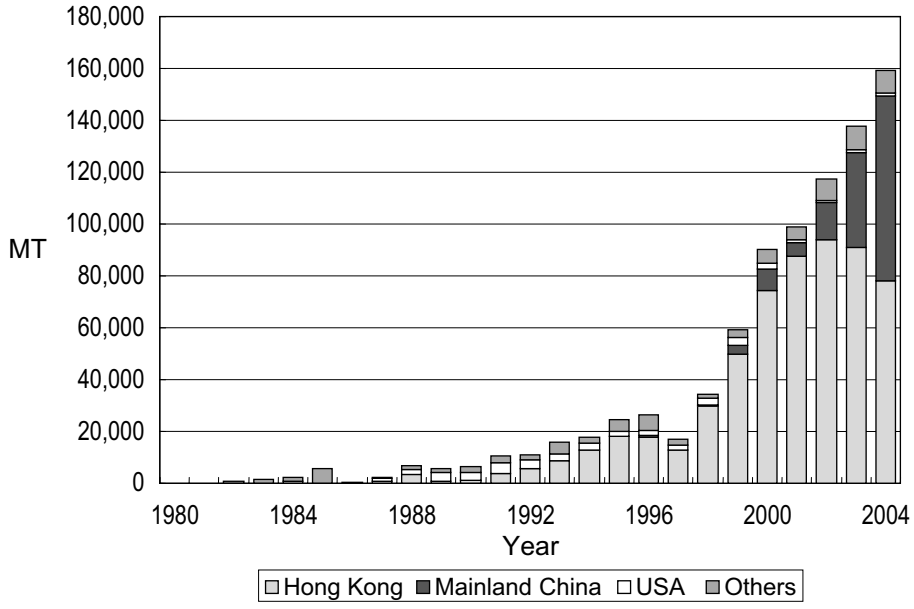
wan's waste plastics exports go to Hong Kong. Exports began picking up speed in 1998 and 1999, overtaking imports in 2000 in a shift to export surplus that has continued unbroken since. Since 1999, the ration of exports bound for mainland China has been rising continuously. In 2003, exports to Hong Kong fell slightly over levels for the previous year, but shipments to the mainland China have continued to rise (see Figure 5-2). In general, most of Taiwan's exports to Hong Kong are believed to be re-exported from there to mainland China.

With used paper, Taiwan has maintained a massive import surplus, but import levels have been falling off and there are signs that exports are on the rise. Imports rose continuously from less than 200 thousand tons a year in the late 1970s to peak at around 1.9 million tons in 1991. This was followed by a downward trend through 1998, since which time they have fluctuated in the region of 1 million tons per year. The US was the major supplier during the peak years, but even imports from the US are decreasing in terms of both share and volume. It might be said that overall trends in imports are susceptible to and fluctuate with trends in the US market. With imports hovering at around 1 million tons annually since 1998, supplies from the US have also been falling, and in recent years its share of the import market has dropped to below 50 percent. Taiwan also receives supplies of used paper from Germany, the Netherlands and Japan (see Figure 5-3).

In contrast to imports, Taiwan's export tonnage of this commodity is exceptionally small. Between 1972 and 1988 it exported almost no waste paper, with the exclusion of a number of exceptional years. The following figure illustrates only its exports from 1984 onwards. In 1989, Taiwan recorded exports of around 30 thousand tons, the majority of which were shipped to Japan, but exports fell rapidly through 1991, and stayed at around 1–3 thousand tons until 2000. There is evidence that exports have been on the rise since 2001, and in 2003 they had risen to 15 thousand tons. Taiwan's used paper exports go to numerous destinations, but shipments to the Asia region predominate (see Figure 5-4).

Regarding Taiwan's trade in recyclable metals, an in-depth analysis on the background to and the problems connected with "*fei-wuchin*" ("mixed metal scrap," the definition of this term is given below, but it principally refers to mixture of metal scraps comprised of waste electrical wire and household appliances, etc.) will be undertaken later in this chapter, but this section is limited to an overview of trends in the import and export of scrap of iron and steel, copper

Figure 5-2: Taiwan's Exports of Waste Plastics (by destination)



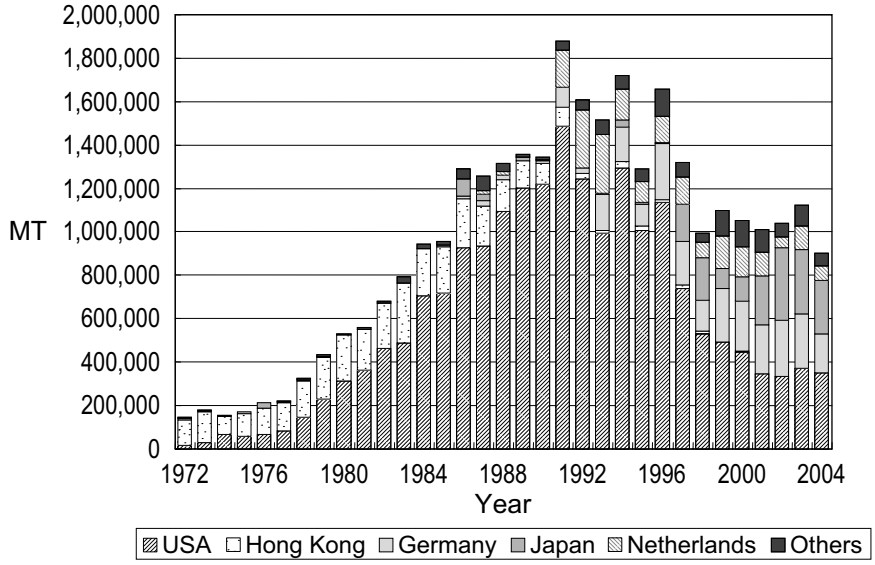
Source: Compiled from the "Monthly Statistics of Exports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Data for years preceding 1979 have not been categorized.

scrap, aluminum scrap and lead scrap.

The import market for scrap of iron and steel has been consistently larger than the export market. This reflects Taiwan's booming steel industry, which requires vast quantities of scrap steel as the raw materials for steel manufacture. The recycled steel produced from Taiwan's imports of scrap of iron and steel is processed into various manufactured goods domestically with a portion being exported to foreign destinations.

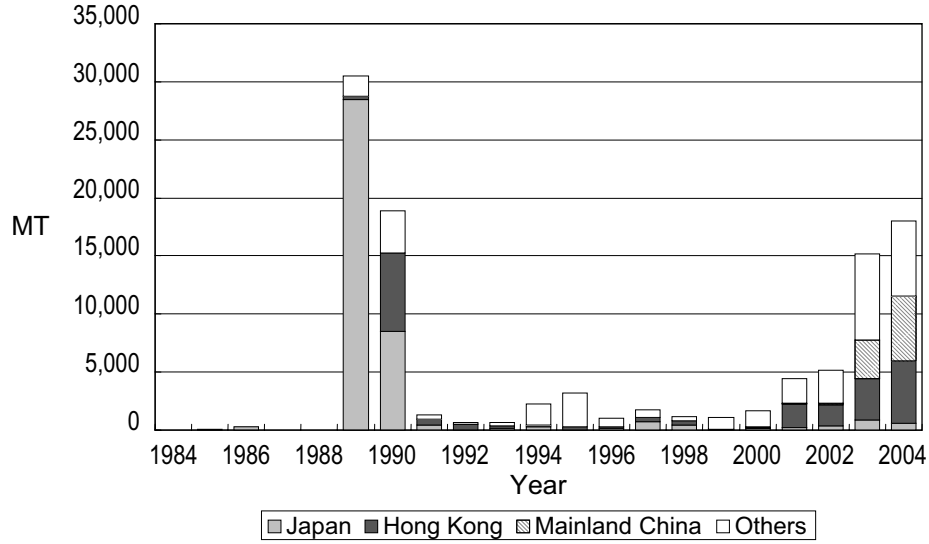
The Taiwanese market for imported scrap of iron and steel changed little between 1972 and 1988, fluctuating at levels below 1 million tons. There were subsequent signs of an upward trend, with imports peaking once at around 2.26 million tons in 1991 before dropping to around 670 thousand tons in 1995; the market then began rising and has stayed buoyant ever since,

Figure 5-3: Taiwan's Imports of Used Paper (by origin)



Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.

Figure 5-4: Taiwan's Exports of Used Paper (by destination)



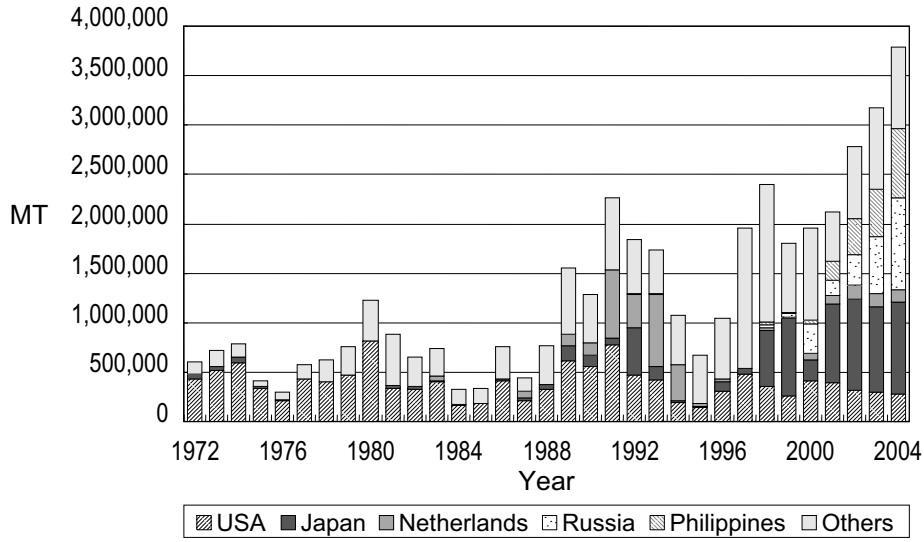
Source: Compiled from the "Monthly Statistics of Exports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Since Taiwan's exports have been very small before 1984, the data have not been shown.

despite a slight dip in 1999. Taiwan's scrap of iron and steel imports exceeded 3.5 million tons in 2004. Approximately 50 percent of supply has come from the US around 1990, but that country's share of the overall market has been decreasing. There have been recent increases in imports from Japan, Russia and the Philippines (see Figure 5-5).

During the mid 1980s, Taiwan's exports of scrap steel were between 20–40 thousand tons, but have fallen sharply since 1987. The leading destination for mid-1980s shipments was Thailand. On aggregate, the market was rising through 2001 but the tonnage never rose above 180 thousand tons, even at peak. Japan, the leading destination for exports since the end of the 1980s, has seen its share of the market shrink, and recent years have seen diversification in export destinations with shipments to Korea, Hong Kong, mainland China and Vietnam on the rise (see Figure 5-6).

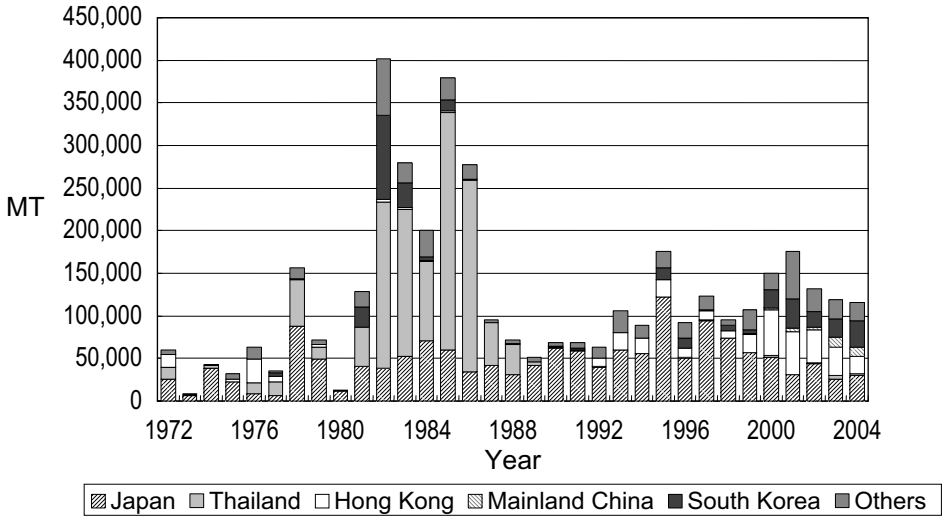
Both imports and exports of copper scrap (including scrap of copper alloy such as brass and bronze) appear to be on a long-term rising

Figure 5-5: Taiwan's Imports of Scrap Iron and Steel (by origin)



Source: Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.

Figure 5-6: Taiwan's Exports of Scrap Iron and Steel (by destination)

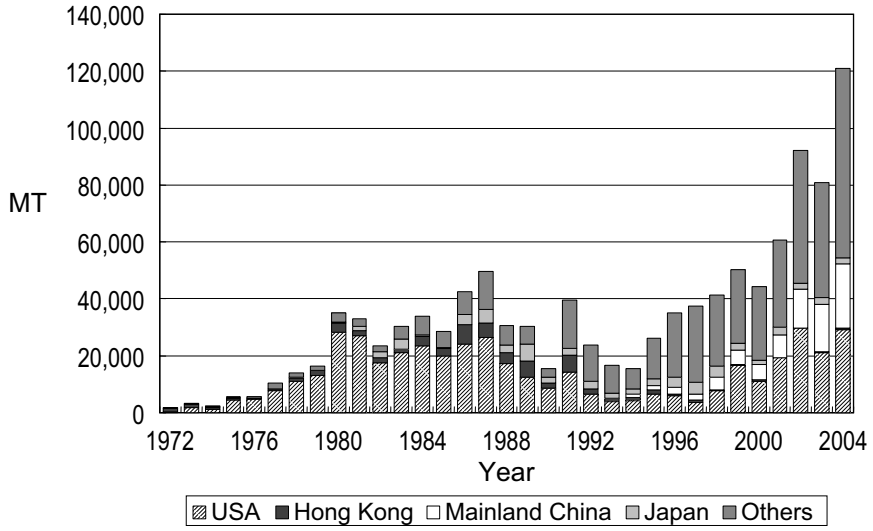


Source: Compiled from the "Monthly Statistics of Exports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.

trajectory and there is no evidence of a marked unbalance between the respective tonnages. After dipping briefly during the late 1980s through the early 1990s, imports of copper scrap rose rapidly through 2004, when they peaked at more than 120 thousand tons. Supplies of this commodity come from various countries, and although the US accounted for the largest share of the market it has seen that ratio drop. Recent years have witnessed a marked increase in import from mainland China, and its overall share of the market is increasing (see Figure 5-7).

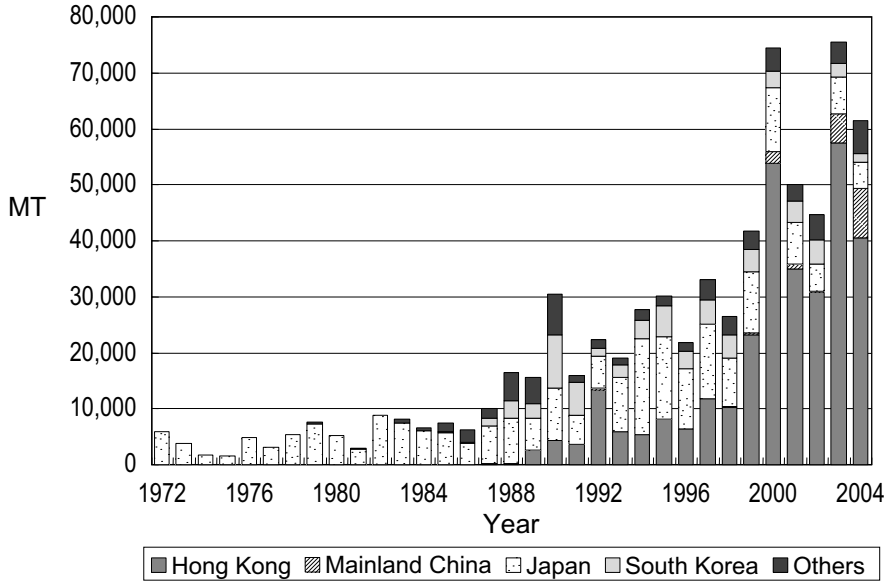
As with imports, the export market for copper scrap appears to be on an increasing trend. The proportion of shipments bound for Hong Kong has grown larger since 1999, and this is affect-

Figure 5-7: Taiwan's Imports of Copper Scrap (by origin)



Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Scraps of copper alloy, such as brass and bronze, are included.

Figure 5-8: Taiwan's Exports of Copper Scrap (by destination)



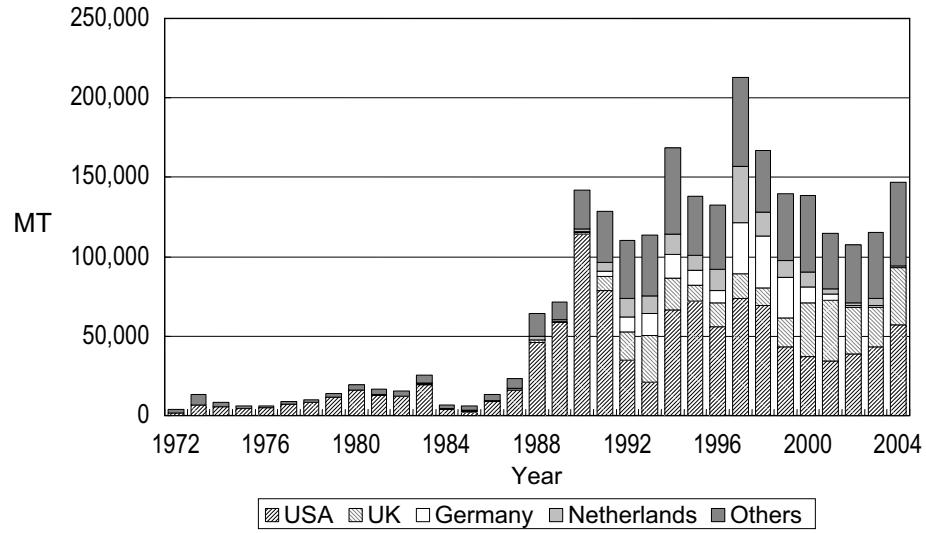
Source: Compiled from the "Monthly Statistics of Exports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Scraps of copper alloy, such as brass and bronze, are included.

ing the export market as a whole. Export tonnage at 2000 and 2003 has been in the region of 70 thousand tons (see Figure 5-8).

The market for aluminum scrap has had a large trade gap, but recent years have seen a drop in imports and a rapid increase in exports, and the gap between the two has diminished considerably. Imports rose rapidly from 1988, peaking in 1997 at more than 200 thousand tons. The market has been shrinking, and between 2000 and 2003 had dropped to levels around half those seen at peak. The US was the leading supplier in 1990, but its share of the market has fallen sharply since and Taiwan is now diversifying its import sources (see Figure 5-9).

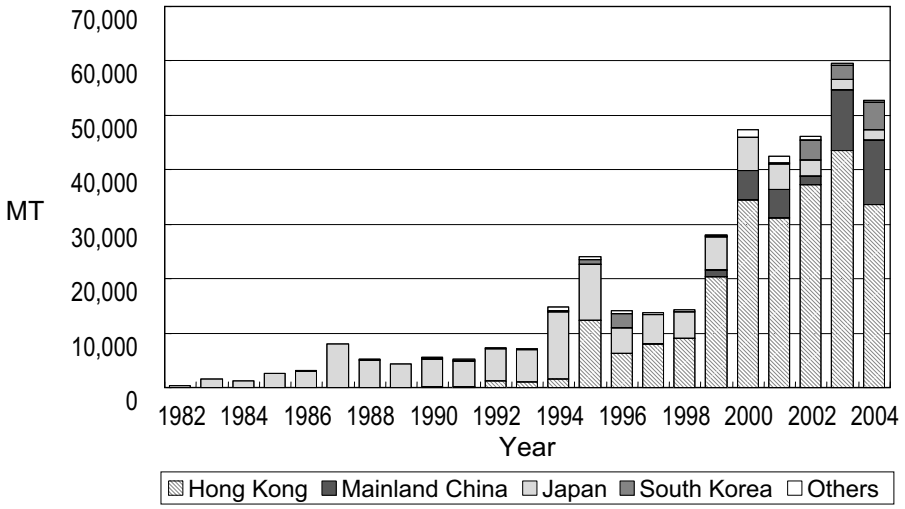
Annual exports of aluminum scrap were less than 10 thousand tons up to 1993, and there was an overwhelming trade imbalance in favor of exports. Export tonnage increased rapidly in 1994 and 1995 when it surpassed the level of 20-thousand, but then dropped to the low ten thousands again where it stayed until 1998.

Figure 5-9: Taiwan's Imports of Aluminum Scrap (by origin)



Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.

Figure 5-10: Taiwan's Exports of Aluminum Scrap (by destination)



Source: Compiled from the "Monthly Statistics of Exports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Since Taiwan's exports have been close to zero since 1981, the data have not been given.

There was a sharp increase in 1999, and in 2003 exports had reached around 60 thousand tons. Japan was the main recipient of Taiwanese exports until 1994, but Hong Kong's share of the market has risen rapidly since 1995, and most of the increase in tonnage seen since 1999 has been the result of a surge in exports to Hong Kong and mainland China (see Figure 5-10).

Aside from the above, as recyclable metals, Taiwan has long been an importer of massive quantities of lead scrap, including battery wastage from automobiles, etc. Taiwan had a booming industry specializing in the recycling of lead from imported battery waste until the early 1990s. Imports of lead scrap began rising in the mid-1970s, peaking at around 48 thousand tons in 1979, after which they fell through 1982 before again shifting upwards. As detailed later in this chapter, because accusations of health damage from workers in Taiwan's lead recycling factories and residents in neighboring areas caused the government to begin imposing restrictions on imports of lead scrap from 1990, imports, which were around 73 thousand tons in 1989, fell sharply, and there was almost no market for the commodity in 1993. The leading suppliers were the US, Australia and Japan (see Figure 5-11).

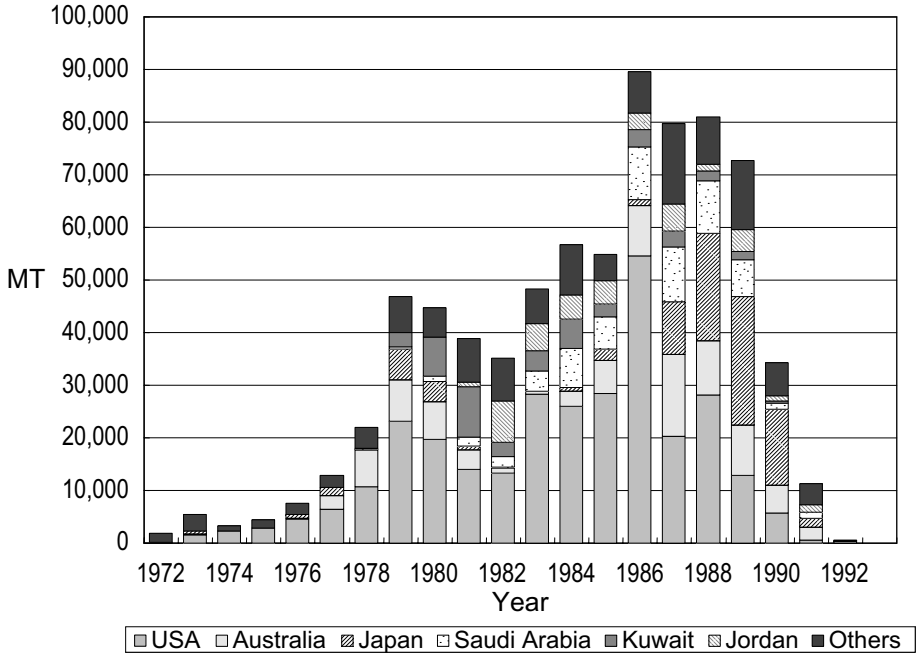
Exports of lead scrap, which were a negligible 100kg in 1989, rose rapidly thereafter to peak at around 7,000 tons in 1993. However, the Taiwanese government began responding to the Basel Convention, and tougher restrictions on both inbound and outbound trade resulted in a sharp decrease in exports; it has not exported any lead scrap since 1995. Indonesia, the Philippines and Hong Kong were the recipients of the majority of Taiwan's lead scrap exports (see Figure 5-12).

The above represents an overview of the trends in Taiwan's trade in the major recyclables, i.e. waste plastics, used paper, scrap of iron and steel, copper scrap, aluminum scrap and lead scrap. There are massive trade imbalances in both used paper and lead scrap markets, with imports exceeding exports by wide margins, which offer strong evidence in favor of Taiwan's status as an importer of recyclables. Generally speaking, the statistics evidence a major increase in exports particularly to Hong Kong and mainland China in recent years. In specific terms, Hong Kong and mainland China have become important destinations for shipments of waste plastics, copper scrap and aluminum scrap, and this has had a major impact on the expansion of the export market as a whole. Exports of scrap iron and steel to Hong Kong and mainland China are also on the increase. Likewise, export tonnage of used paper is still smaller than import tonnage, but there are signs of a similar surge in shipments bound for these two destinations. It is generally accepted that the majority of Taiwan's exports to Hong Kong are subsequently re-exported to mainland China, and given that mainland China has been buying in these resources from throughout the world in vast quantities in recent years, it is suggested that most of Taiwan's exports of the recyclable wastes discussed here are being shipped to Hong Kong for re-export to mainland China.

The US's share of the import markets for all recyclables: used paper, scrap of iron and steel, copper scrap, aluminum scrap and lead scrap, appears to be on the decline. There has also been a conspicuous fall off in shipments of scrap of iron and steel to Japan, which was the leading destination for this resource. In recent years, there have been signs of a fall-off in imports of waste plastics, scrap of iron and steel and aluminum scrap, while incoming supplies of used paper and copper scrap are rising. Imports of lead scrap have fallen sharply due to the toughening of restrictions imposed as a measure to address the pollution being generated by the recycling industry.

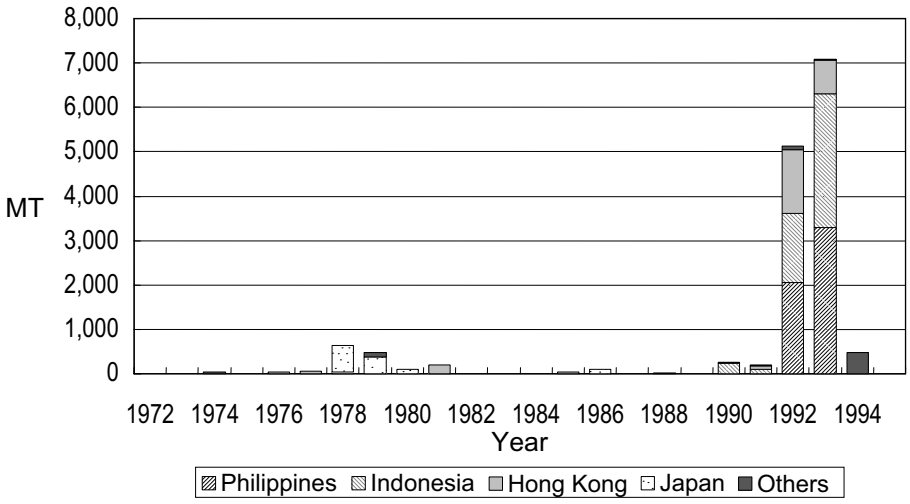
The various recycling systems that the Taiwanese government has been phasing in since the late 1990s have altered domestic flows of recyclable resources, and it is considered that this has had a certain impact on the trends in the import and export markets for the waste resources discussed above. Long-term changes in the structure and location of Taiwanese industry are also believed to have had a major impact on the trade in recyclables. The rapid increases in exports of all recyclables to Hong Kong and mainland China have been particularly conspicuous since 1999.

Figure 5-11: Taiwan's Imports of Lead Scrap (by origin)



Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Since Taiwan's imports have been close to zero since 1994, the data have not been given.

Figure 5-12: Taiwan's Exports of Lead Scrap (by destination)



Source: Compiled from the "Monthly Statistics of Exports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Since Taiwan's exports have been close to zero since 1996, the data have not been given.

SECTION 2: TRANSBOUNDARY MOVEMENTS OF WASTE PROBLEMS AND RESPONSE TO THE BASEL CONVENTION

This section takes a look at the transboundary movements of "wastes" (including those for recycling) involving Taiwan that have become major issues, with the exclusion of "*fei-wuchin*" (mixed metal scrap), which is discussed later.

In 1990, it became clear that a factory for recycling lead from battery wastage from automobile in Keelung City, northern Taiwan was polluting the local environment. As already stated, most battery wastage was being imported from the US, Japan, and the Middle East. The damage to the health of workers at the lead recycling factory and the impact on local residents was uncovered in an epidemiological study undertaken by Professor Jung-Der Wang of the College of Public Health, National Taiwan University (Institute of Occupational Medicine and Industrial Hygiene). In response to this incident, in 1990 the government imposed gradual restriction and ban on the import of waste batteries containing sulfuric acid. Prior to the import ban, Taiwan had been the number-one destination for Japan's exports of lead scrap (mainly battery wastage from vehicles). After the Taiwanese government blocked imports of waste batteries containing sulfuric acid, Japan ceased exporting to Taiwan and instead, there was a rapid increase in shipments to countries with more lenient import restrictions, such as Indonesia. Imposing restrictions on a recycling industry that is prone to generate pollution is considered to be an example of using international trade to shift the pollution problem to countries with looser restrictions.[4]

The incident involving an illegal shipment of approximately 3,000 tons of mercury-contaminated hazardous waste from Kaohsiung Port in southern Taiwan to Cambodia occurred between December 1998 and early 1999. The waste came from a chemical factory belonging to Taiwan's largest private-sector corporation, the Formosa Plastics Group. The industrial waste in question had lain for years in a chemical factory in Kaohsiung, and had given rise to conflicts with local residents. Transport workers on the outskirts of Sihanoukville (Kampong Som), where the hazardous waste had been dumped, complained of poor health and there was one fatality, leading to protests and rising anger among residents and even rioting in some areas. The cause of death was not specified for the deceased transport worker. At the time, neither Cambodia nor Taiwan had acceded to the Basel Convention on the transboundary movements of hazardous wastes, and the two countries were unable to resolve the problem promptly using existing international frameworks. Added to which, the Cambodian government, citing the absence of any diplomatic ties with Taiwan, expressed a desire to negotiate with the government in mainland China and there was a period of deep confusion. The Formosa Plastics Group looked into transporting the waste to the US for treatment and disposal, but this option was rejected by the US, and the waste was eventually shipped back to Kaohsiung in April 1999. Environmental Protection Administration (EPA) of the Executive Yuan, the body responsible for environmental and waste policy within central government in Taiwan, ordered the Formosa Plastics Group to construct a waste treatment plant and dispose of the returned consignment of hazardous industrial waste appropriately. However, the company was unable to complete the treatment within the government's deadline and was penalized in the form of a fine. Cambodia has subsequently become a Party to the Basel Convention, and it is believed that this incident was the catalyst for that move. The incident received widespread international coverage and is considered to have heightened awareness of the severity of transboundary movements of hazardous waste in government and business and among the citizens of Taiwan.[5]

In 1971, the People's Republic of China (PRC) joined the United Nations and Taiwan (Republic of China) withdrew; it has subsequently rejected all the international agreements that form the basis for the UN. The only international frameworks and organizations with which Taiwan is

4. In Ueta [1992a] and Ueta [1992b], the reduction in Japan's exports of lead scrap to Taiwan consequent upon Taiwanese import restrictions followed by a shift in export destinations to countries such as Indonesia that have more lenient regulations, is cited as a quintessential example of the "billiard of pollution." On pollution problems caused by the export of waste automobile battery and metal scrap from the US to Taiwan, see Center for Investigative Reporting and Moyers [1990], pp.70–75, and 75–78.
5. For details of this incidence of illegal hazardous waste export to Cambodia, see Chen and Ueta [2000].

officially involved are based on economic relation; such as WTO (the World Trade Organization), APEC (Asia-Pacific Economic Cooperation) and ADB (the Asian Development Bank). Since it began promoting democratization, Taiwan has been petitioning to be reinstated by the UN, by establishing diplomatic relations with various UN Member countries, and it is the government's aim to have Taiwan reinstated by the international community. As part of its efforts to achieve this end, Taiwan has been instituting domestic laws that impose similar requirements to those being made of the Parties to a number of international agreements in an attempt to impose parallel obligations to those on contracting states and to create similar conditions within the country. The Taiwanese government has also instituted independent initiatives to address global environmental problems such as those being tackled under the Washington Convention (Convention on international trade in endangered species of wild fauna and flora), and the Basel Convention. Aside from wishing to evidence its desire to be reinstated by the international community, in pursuing independent initiatives the Taiwanese government is also fulfilling its obligations to the international trade system. In the case of the Washington Convention, the government's response was the direct result of pressure from the international environmental NGOs for the US to impose trade sanctions on Taiwan.

Taiwan's "Management Regulations for the Restriction or Prohibition of the Import or Export of Hazardous Industrial Wastes" was promulgated on January 29, 1993 in response to the Basel Convention. On the basis of these regulations, the government is attempting to control trade in hazardous wastes and recyclable waste and to impose similar obligations to those required of Parties to the Convention.[6] The import bans and export restrictions on lead scrap, including battery waste (already discussed) and "*fei-wuchin*" (to be discussed hereunder) are grounded in these regulations on international trade of waste.

SECTION 3: "MIXED METAL SCRAP" RECOVERY AND SHIP BREAKING INDUSTRIES IN TAIWAN[7]

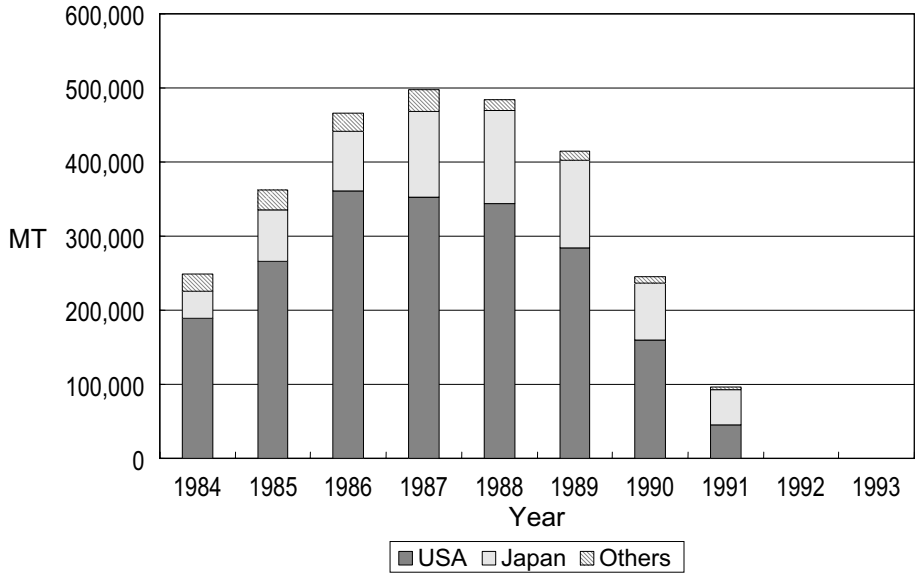
The pollution caused by improper processing and treatment of imported "*fei-wuchin*" (refers to waste and scrap that contains valuable metals, i.e. mixed metal scrap) ; "*wuchin*" generally refers to the valuable metals extended from "five metals," i.e. gold, silver, copper, iron and tin was a major waste-related problem for Taiwan from the mid-1980s through the early 1990s. Iron is considered to be one of the "wuchin" (five metals), but in many cases scrap of iron and steel is categorized as being separate to "mixed metal scrap," and the term '*fei-wuchin*' as used in the following paragraphs does not include metal scraps containing iron and steel as its main constituents.

The collection of valuable resources, and particularly valuable metals, from household appliances, electric wire and so forth, is an activity that has long been standard practice in Japan and other developed countries. The recycling of scraps containing valuable metals is also a well-established practice and where processing safety is assured, pollutants are appropriately treated and residues are properly controlled and disposed of, there is no problem, per se, in the cyclical movement of recyclable wastes across international boundaries for reasons of economic efficiency. However, in Taiwan, improper treatment in fact led to a succession of pollution and waste problems. There is also the view that having transboundary bureaucracies and systems to control the movement of waste renders it difficult to impose appropriate and

6. The law that formed the basis for these regulations is the "Resource Recycling and Reuse Act." The "Hazardous Industrial Waste Import, Export, Transit and Transshipment Management Measures" were renamed the "Management Regulations for the Restriction or Prohibition of the Import or Export of Renewable Resources" on January 2, 2003 in line with their amendment. Amendments to the law were also made on August 13, 1997 and January 5, 2005. Despite having developed equivalent laws, Taiwan is viewed as a non-Party by the Parties to the Basel Convention and in certain instances is unable to sufficiently enjoy the favor afforded to acceding countries. In order for Taiwan to achieve conditions that closer approximate to those of the Parties to the Convention it needs to conduct negotiations and conclude agreements with the various Parties. In fact, the Taiwanese government is currently involved in negotiations with the government of Japan with a view to forming an agreement of a similar nature to the Basel Convention with its main trading partner.

7. For details of Taiwan's "*fei-wuchin*" (mixed metal scrap) pollution problems up to the early 1990s, see Terao [1993], pp. 167–171.

Figure 5-13: Taiwan's Imports of "Mixed Metal Scrap" (by origin)



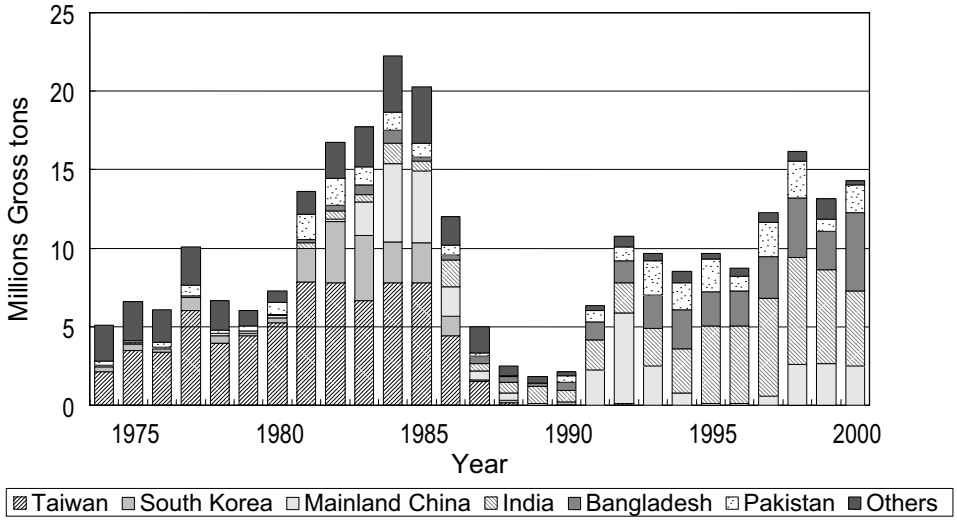
Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note 1: "Mixed metal scrap" for years preceding 1983 have not been categorized in international trade statistics.
Note 2: As there has been ban on imports since 1993 in principle, there is virtually no observation of import since this year.

efficient controls.

In Taiwan, the recovery activities of non-ferrous mixed metal scrap imported from the developed countries began expanding in the mid-1960s, and the pollution problems stemming from improper treatment have been around ever since. The pollution problems deepened and became a serious social issue around 1983 when there was another surge in imports of mixed scrap metals. At that time, some 30 to 40 thousand people were employed in the treatment of mixed scrap metals in Kaohsiung and Tainan, the two areas of southern Taiwan where recycling businesses had congregated, and it is believed that the livelihoods of some 100 thousand people, including extended families, were being made in this industry.[8] Much of the mixed metal scrap that was imported and processed in Taiwan had been exported from the US and Japan. In the late 1980s at the peak of the import market and after the trade statistics began to be categorized, and before its import restrictions had been tightened. Taiwan was importing between 400 to 500 thousand tons of "mixed metal scrap" per year (see Figure 5-13). It is believed that Taiwan was also importing wastes that were not be categorized under "mixed metal scrap" in the custom procedure and its statistics under different categories (falsely labeled as scrap of iron and steel and other non-ferrous metal scrap, or as used PCs/used household appliances), and that this was in fact being processed in the same way as "mixed metal scrap."[9] It is thus conceivable that the figures are under-recorded. The government estimates that when the import market was nearing its peak one-third of the mixed metal scrap being treated in Taiwan was generated within country, which means that at least 700 thousand tons of mixed metal scrap was being processed at that time in Taiwan. In specific terms, the waste

8. See Environmental Protection Administration, Executive Yuan [1987], pp. 199–202.
9. "Mixed metal scrap" as recorded in trade statistics refers to metal scrap comprised of a mixture of various metals (or plastics and other materials derived from the original products) cannot easily be separated and that cannot be categorized as the scrap of a single metal, such as lead scrap, copper scrap, aluminum scrap, etc. It should be assumed that most of the metal scraps from waste consumer electronics products, etc. discussed above was classified in the international trade statistics and cleared customs as "mixed metal scrap." The "mixed metal scrap" category first appeared in Taiwan's international trade statistics in 1984. Prior to 1983, it is conceivable that "mixed metal scrap" was broken up by major component into individual metal scraps, such as scrap of iron and steel, copper scrap, and so forth.

Figure 5-14: World Ship Breaking Volume (by major ship-breaker nation)



Source: Compiled from the "Ship Building Data for 2002" published by the Ship Builder's Association of Japan.

Note 1: Vessels with a gross tonnage of 100 tons or more are covered.

Note 2: The raw data is from Lloyd's Register (Casualty returns for years up to 1993, world casualty statistics for years from 1994 onwards).

Note 3: "Gross tonnage" is the unit used to express the internal capacity of a vessel. 1 gross ton is equivalent to 100 cubic feet.

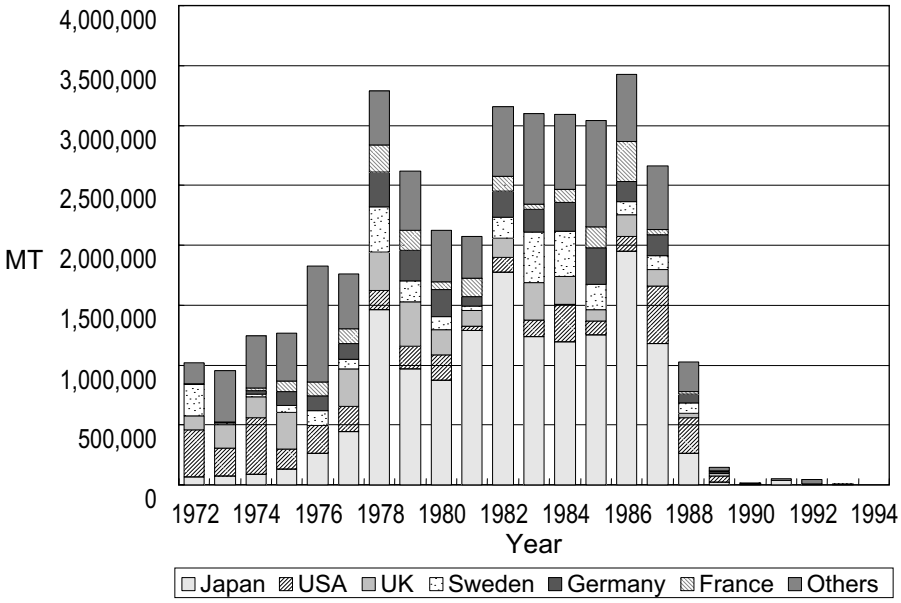
originated from large household appliances, such as refrigerators, electrical wire, motors, computers and so forth.[10] Most of the enterprises involved in mixed metal scrap recovery and metal collection were small and medium businesses and the collection and dismantling work was a labor-intensive process that was performed mainly by hand. Many mixed metal scrap recovery business were located in Kaohsiung and Tainan in southern Taiwan. There were some in northern and central areas of the country, but the largest concentrations were to be found in the two counties of Kaohsiung and Tainan in the south. Why the recovery of useful metal from imported mixed metal scrap became such big business in Taiwan could be attributed to the following factors.

Rapid industrialization led to the emergence of many iron and steel manufacturers using electric furnaces fed by scrap of iron and steel, particularly in southern regions of Taiwan. Since the 1960s, there has also been a booming trade in the collection of scrap of iron and steel and other non-ferrous metals obtained from the imported ship for dismantling in the international port of Kaohsiung and its environs. Taiwan's ship-breaking industry was at its most prosperous during the latter half of 1970s and the first half of 1980s, when the oil shocks caused resource prices to soar and also sent scrap of iron and steel prices skyward. At that time, Kaohsiung was the center of the international ship-breaking industry and Taiwan was the world's largest ship-breaking country (see Figure 5-14). Most of the ships dismantled in Taiwan were imported. The ship-breaking industry grew rapidly after restrictions were lifted on the importation of ships for dismantling in 1966. In 1976, 92 ship-breakers were crowded into the Kaohsiung area. Many of these companies also operated side businesses, securing raw materials for the iron and steel manufacturers of electric furnaces.[11] Japan was the leading supplier of vessels for Taiwan's ship-breaking industry (see Figure 5-15). In contrast, there was virtually no

[10] This is believed to correspond to the recently topical "e-waste" (although the definition of this waste is not necessarily clear). However, this term had yet to be coined during the late 1980s and early 1990s when Taiwan was experiencing its most serious "*fei-wuchin*" pollution problems. Taiwan's experience with pollution caused by mixed metal scrap recovery industry might be of reference to the e-waste problems currently confronting many developing nations of the world.

[11] For details on Taiwan's ship-breaking industry, see Sato [2004], pp. 21–22. "Gross Tonnage" as used in Figure 5-14 is the unit used to express the internal capacity of a vessel and differs from the metric tonnage (MT: deadweight tonnage) used to express the weight of vessels in other figures, for instance Figure 5-15. 1 gross ton is equivalent to 100 cubic feet.

Figure 5-15: Taiwan's Imports of Vessels for Dismantling (by origin)



Source: Compiled from the "Monthly Statistics of Imports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: Taiwan's imports have been close to zero since 1995.

market for exports in ships for scrap in Taiwan. Until 1977, when China Steel Company, a state-owned enterprise, began operating an integrated blast furnace steelworks in Kaohsiung, scrap of iron and steel was the main raw material used by Taiwan's steel manufacturers. Ship-breaking is dangerous work, and hazardous substances must be controlled and pollution prevention measures instituted. Ship-breaking work in and around Kaohsiung actually led to accidents and polluted land and coastal waters.

As demonstrated from the above, seen in terms of the metal recycling industry as a whole (including scrap of iron and steel), the mixed metal scrap merchants may be said to represent part of the metal scrap import and recycling business that flourished in southern Taiwan ("*fei-wuchin*" recovery not only yields nonferrous metals, but in many instances also produces scrap of iron and steel). Of all the metal recycling industries, the mixed metal scrap recovery industry caused the most severe environmental pollution problems. The most significant factor behind the boom in ship-breaking, mixed metal scrap recovery and other types of metal recycling in southern Taiwan was the existence of the many manufacturers requiring metals as raw materials that had sprung up nearby as Taiwan industrialized. As in the electric furnace steel manufacturing industry, many businesses requiring huge quantities of scrap of iron and steel also congregated in southern Taiwan. The fact that processing and recycling costs were low because wage inflation had yet to take hold, and that little money was required for pollution controls because the environmental problems had yet to become manifest, are also considered to be major factors.

From the late 1980s, the Kaohsiung Port Authority began regulating the ship-breaking industry and many ship-breaking yards inside the port were converted to container yards, which resulted in the rapid downsizing of the industry. Imports of vessels for dismantling fell sharply. Since 1990, the world's ship-breaking industry has moved from Taiwan to South Asia (India, Bangladesh and Pakistan) and mainland China. As Taiwan's ship-breaking industry has declined, some ship-breaking business have turned to mixed metal scrap recovery. There were numerous traders and distributors dealing in the scrap of iron and steel produced from ship-breaking in southern Taiwan, home to the country's flourishing steel industry. In some instances, businesses handling scrap of iron and steel have entered the mixed metal scrap recovery trade or, more recently, the home appliance recycling and auto recycling industries.[12]

While import of ship for dismantling was phased out in the late 1980s, import of scrap iron and steel is increasing from the late 1980s as a trend (Fig.5-5). It could be considered that importation of scrap iron and steel in the form of ship for dismantling was replaced by importation of scrap iron and steel itself.

SECTION 4: ENVIRONMENTAL POLLUTION CAUSED BY "MIXED METAL SCRAP" RECOVERY AND GOVERNMENT REGULATION

The "*fei-wuchin*" (mixed metal scrap) recovery industry has caused various pollution problems and incidents in Taiwan. Open burning of electrical wire cladding and residual plastic and vinyl from household appliances has generated dioxins and toxic gases, the country's soil and rivers have been polluted by untreated waste water containing toxic substances including heavy-metal contaminants and highly acidic solutions, and abandoned piles of debris have spontaneously combusted.

Among pollution incidents caused by the mixed metal scrap recovery industry, the "Green Oyster Incident" of 1986 was the incident that came to symbolize the "*fei-wuchin*" pollution problem: it resulted in major public dispute and was widely covered by the media. The incident occurred in January 1986 when the shells of oysters being raised outside estuary of the Erhjen-hsi River, which flows between Tainan (County and City) and Kaohsiung County, were turned green by pollutants. A 450-hectare area was affected and the oyster farmers were forced to dispose of contaminated oysters and culturing rafts. The contaminated green oysters became symbolic of the problems of river pollution, which were becoming progressively worse at this time, and the incident received massive media coverage. The source of the pollution was not initially identified, and the oyster farmers, seeking retribution, decided that the Hsinta Thermal Power Plant owned by Taipower (Taiwan Power Company: the state-owned power company) was responsible and demanded compensation. Taipower refused to accept responsibility for the pollution, but the member of the Legislative Yuan (the congressional representative) elected from Kaohsiung County intervened between parties, and Taipower and the Kaohsiung County Government each paid out 10 million NT$ (New Taiwan dollars) to the oyster farmers. A government study undertaken in 1987 revealed that effluent containing copper and other heavy-metal contaminants being discharged by scrap metal smelters operating along the Erhjen-hsi River was the cause of the "Green Oyster Incident," but because small business operators had no means of recompensing the oyster farmers, no additional compensation was made at all. This incident might also be said to have highlighted the problems inherent in the government compensating for damage without undertaking an appropriate assessment aimed at resolving the public dispute.[13]

In 1983, when the pollution problems had become conspicuous, the Taiwanese government—as a means of addressing pollution caused by metal scrap recovery—moved/grouped mixed metal scrap treatment facilities and smelters into two districts for administrative purpose: a custom-built zone in Tafa Industrial District, Kaohsiung County, and Wangli Industrial District, which was established on the Tainan City side of the Erhjen-hsi River estuary; both southern areas that had long been home to large numbers of industry proponents. The government also began restricting imports of "mixed metal scrap" gradually, and phased out from pollution causing category first. At the end of 1985, there were 200 mixed metal scrap treatment facilities and smelters operating out of the custom-built zone at the Tafa Industrial District and employing 1,800 fulltime employees/laborers, and 188 businesses operating out of the Wangli Industrial District.[14] In the early 1990s, there were still some 400 mixed metal scrap treatment facilities operating in Taiwan.

Restrictions on the importation of "mixed metal scrap" were introduced incrementally from

12. The information on mixed metal scrap processors is base on Murakami [2004] and the field surveys that were undertaken in southern Taiwan in February 2003 and December 2004.
13. For details of the 1986 "Green Oyster Incident," see Terao [1993], pp. 167–171.
14. See Environmental Protection Administration, Executive Yuan [1987], pp. 199–202.

1983 when the pollution generated during processing had become significant, and by January 1993 there was an almost total ban in place; there have been almost no subsequent imports of this commodity (see Figure 5-13). In 1988 the government requested that "mixed metal scrap" treatment facilities operating in the industrial districts join forces to build an incinerator for post-processing residues, but because the businesses failed to respond it halved the number of mixed metal scrap import licenses as a penalty. In 1989, the government again requested that incinerators be built, but because the smelters failed to submit construction plans it imposed a temporary ban on imports in October of that year. No incinerators were built and post-processing waste was left to build up inside the industrial districts; illegal open burning continued to be undertaken by some mixed metal scrap treatment facilities. In 1989, an untended pile of mixed metal scrap debris spontaneously combusted at the Tafa Industrial District and the area was surrounded by outraged local residents. An incinerator for hazardous wastes was installed at the Tafa Industrial District in 1999.[15]

As the above shows, approaches of concentration to control metal scrap treatment facilities in designated industrial districts were not necessarily sufficient to effectively counter-measure against the spread of pollution or the abandoning of residues, but the ban on imports of "mixed metal scrap" has undoubtedly curtailed the activities of these businesses and environmental pollution has been mitigated as a result. The appreciation of the yen since the Plaza Accord of 1985 has had an impact on the Taiwanese currency, and surging wage inflation has put an end to Taiwan's comparative advantage as a location for the mixed metal scrap recovery industry, which involves labor-intensive dismantling and processing work.

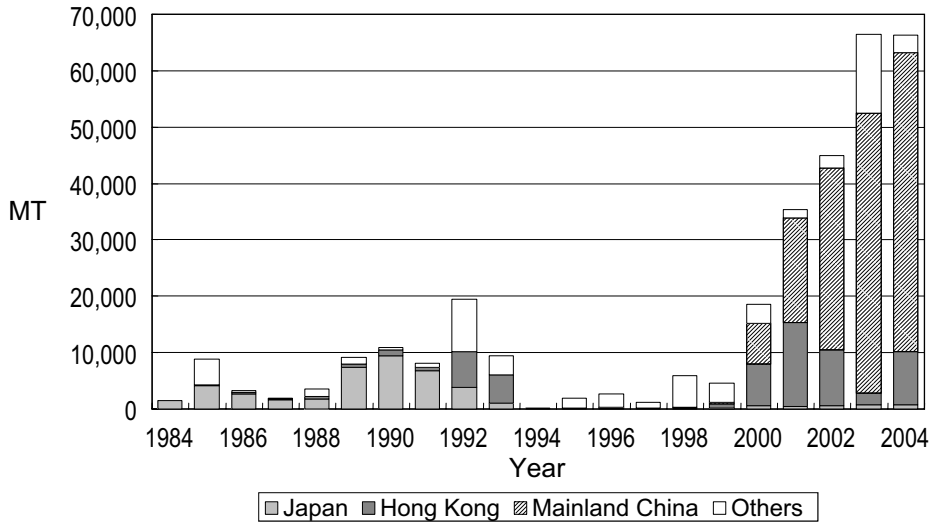
SECTION 5: INCREASING RELOCATION OF "MIXED METAL SCRAP" RECOVERY AND EXPORT FROM TAIWAN

With the ban on "*fei-wuchin*" (mixed metal scrap) imports having restricted the activities of Taiwan's mixed metal scrap recovery industry, some proponents began to look beyond its boundaries for new business opportunities. By the early 1990s, some businesses had already relocated to mainland China and to countries in Southeast Asia such as Indonesia, Malaysia, Thailand and Vietnam. The pace of transfers to mainland China gathered speed after January 1993 when the ban on mixed metal scarp imports was imposed. At the beginning of the 1990s, most of the businesses that had relocated to mainland China were concentrated around Shenzhen and Shanghai. Mainland China and Southeast Asia represented more favorable locations to Taiwan's mixed metal scrap businesses than Taiwan with its restrictions on imports, comparatively stringent pollution emission regulations and controls on wastes, and high labor costs. As with the industrial zone at Ningbo in Jiangsu Province, there are some areas that have served as a magnet for Taiwanese mixed metal scrap recovery business as relocation destinations.[16] It is believed that those businesses that have relocated, utilizing the international trade networks established in Taiwan, have served to expand US and Japanese exports of "mixed metal scrap" to mainland China.

With Taiwan no longer accepting imports, while it is possible that the absolute tonnage of "mixed metal scrap" exports the US and Japan had been exporting to Taiwan decreased in consequence of the international trade restrictions imposed by the Basel Convention and domestic policies promoting reuse, it is also conceivable that it has been shipped to mainland China and Southeast Asia, the new homes to Taiwan's metal scrap recovery business.[17]

15. See Terao [1993], and Chen and Ueta [2000], etc.
16. Among those mixed metals scrap recovery businesses still active in Taiwan, political instability was cited as the main reason for not advancing into/relocating to mainland China in spite of the lower processing costs. Many of the businesses that have moved to mainland China have had local government officials demanding them to pay backhanders, have been harassed if failing to hand over sufficient amounts, and in some instances been unjustifiably arrested. It was also reported that those processors refusing to pay the pollution control costs needed to remain in business in Taiwan had been the first to relocate to the mainland China. Findings from a hearing held in December 2004 at the Tafa Industrial District.

Figure 5-16: Taiwan's Exports of "Mixed Metal Scrap" (by destination)



Source: Compiled from the "Monthly Statistics of Exports, Taiwan District, Republic of China," the Statistics Office, Directorate General of Customs, Ministry of Finance, various issues.
Note: "Mixed metal scrap" for years preceding 1983 have not been categorized in international trade statistics.

Taiwan, which imported huge quantities of "mixed metal scrap" from the US and Japan up to the 1980s, has been increasing its export tonnage at a rapid clip since the end of the 1990s. Between 1984, when exports of "mixed metal scrap" began to be classified as such in order to control import flows, and 1992 Taiwan's exports where on an upward trajectory, but in boom years were still only around 10–20 thousand tons, a very low level in terms of volume as compared to the imports of 50 thousand tons per year in the late 1980s when the market was nearing its peak. Japan was the leading destination for Taiwan's "mixed metal scrap" exports at this time, but exports to Hong Kong increased sharply in 1992 and have since overtaken those to Japan. It is believed that the majority of Taiwan's exports to Hong Kong are ultimately bound for mainland China (see Figure 5-16).

Taiwan's response to the Basel Convention, the "Hazardous Industrial Waste Import, Export, Transit and Transshipment Measures," were promulgated in January 1993, and because they not only essentially prohibited imports but also tightened the controls on exports as well, exports of "*fei-wuchin*" fell rapidly and by the following year had dropped to just over hundred tons, and stayed at several thousand tons annually until 1997. It is believed that Taiwan's exporters were unable to respond immediately to the newly-introduced, stricter controls, such as the license requirement. Exports began rising in 1998, rocketed in 2000 and continued to increase rapidly through 2003. Up to 2001, shipments bound for Hong Kong and mainland China were increasing at parallel rates, but those to Hong Kong have been falling rapidly in 2002 and 2003, while there has been a sharp increase in exports to mainland China over the same period. Exports reached around 65 thousand tons in 2003, suggesting that much of Taiwan's "mixed metal scrap" is being shipped to mainland China.

Some "mixed metal scrap" is classified as industrial waste and when this is exported, the Industrial Waste Control Center, a regulatory body established by the government in 2000, requires both domestic and foreign traders to cooperate in collecting Internet-based cargo manifest information.[18] However, even with such restrictions and controls in place, as was the case with "mixed metal scrap" imports, it is known that illegal exporting via non-official channels occurs.[19]

[17] For details on the forays of Taiwan's mixed metal scarp businesses into mainland China, see "Economic Daily News," dated October 20, 1992, and "Commercial Times," dated April 16, 1998. And also, Center for Investigative Reporting and Moyers [1990], pp. 78–82.

SECTION 6: DEVELOPMENT OF GOVERNMENT'S RECYCLING SYSTEM AND TAIWAN'S "MIXED METAL SCRAP" RECOVERY BUSINESS

While imports of "mixed metal scrap" ("*fei-wuchin*") have been banned since January 1993 and some of Taiwan's "mixed metal scrap" is being shipped to the Taiwanese businesses operating in mainland China, this does not mean that the country's "mixed metal scrap" recovery industry has ceased to exist. Some businesses are processing this waste legally and appropriately under government control inside Taiwan's industrial districts, but this is not true of all industry proponents and evidence of open burning and illegal dumping of mixed metal scrap debris can still be found in riverbeds in southern areas of the country. There are also mounds of the debris that is left behind after useful metals have been recovered that have lain untouched for many years.

Since 1997, waste household appliances have also become subject to the resource recycling system being promoted by the government. Under the system, manufacturers pay an amount equivalent to the number of appliances shipped/ imported into a government-controlled fund, which is then used to subsidize businesses engaged in the collection and recycling of these goods.[20]

Taiwan's electronic appliances manufacturers' association has built a recycling plant in order to collect their outlay in subsidies, and recycling plants are being established by other industry groups too. However, considerable quantities of waste electronic appliances continue to be collected and passed to mixed metal scrap processors operating outside the government's recycling system. The government system provides an economic incentive to reduce illegal dumping that is premised on the idea that used electronic appliances are almost worthless or represent an inverse onerous contract, and given the resource price and collecting/recycling costs, subsidies and so forth available, it is perhaps inevitable that mixed metal scrap dealers are charging to collect used electronic appliances as a resource with a positive revenue .

The government does not pay out subsidies for waste electronic appliances that have been collected and recycled outside the recycling system, but the used components and recyclable waste that can be removed from electronic appliances fetch fairly high prices which exceed the cost of collection and processing, meaning that it continues to be worthwhile for Taiwan's mixed metal scrap recovery business to operate outside the system. By contrast, businesses hoping to receive subsidies from the government's

18. According to a presentation by Chun-Chao Lin (Institute of Environment and Resources) at the Third NIES E-Waste Workshop (December 14–15, 2004, National Institute of Environmental Studies (NIES), Tsukuba, Japan), entitled "The E-waste status and management structure in Taiwan," it has not been possible to collect manifest information from the local businesses that have received shipments of industrial waste exported by Taiwan to mainland China. Furthermore, according to Lin's presentation, the amounts of "mixed metal scrap" reported to the Industrial Waste Control Center were, 68,837 metric tons in 2001, 100,718 tons in 2002, and 102,031 tons in 2003, respectively. Total amounts of industrial waste reported the Center, were 11,443, 340 metric tons in 2001, 11,774, 386 tons in 2002, and 12,435,139 tons in 2003, respectively. The ratio of "mixed metal scrap" in total industrial waste was less than 1% every year. Compared to the amount of the "mixed metal scrap" export from Taiwan shown on the figure 5-13, the amount reported to the Center seems to be too small. In 2003, for example, export of "mixed metal scrap" was about 65,000 metric tons, while the reported amount was about 100,000 tons. If we could consider that the amount reported to the Center represents total domestic generation of the "mixed metal scrap", about two third of the domestic generation should be exported in 2003. It could be considered that the ratio of the export should be overvalued, as the coverage of the amount reported to the Center might be not high enough. According to Chun-Chao Lin, only 11,000 out of total 80,000 establishments reported the amount of industrial waste to the Center, although most of the large enterprises were reporting to the Center. In addition, significant part of "mixed metal scrap" might not be considered as "industrial waste" which should be reported to the Center. And also, the definitions and aggregation process of "mixed metal scrap" might not be exactly the same between the Center and the custom administration.

19. For instance, in November 2004, an enterprise in Taichung, central Taiwan was discovered attempting to illegally export a 20-ton consignment of waste printed-circuit boards (PCB) originating from used electronic equipment without following the procedures set forth in the "Hazardous Industrial Waste Import, Export, Transit and Transshipment Measures." A fine of NT$ 60,000 was imposed based on the Measures. The Department of Environmental Protection, Taichung City Government stated that this was the third incidence of this type of illegal exporting to be uncovered that year ("United Daily News [Central Taiwan edition]," December 1, 2004). According to a report submitted to EPA (Environment and Development Foundation [2001], Appenndix Volume), from March to September 2001, seven cases of illegal exports of "mixed metal scrap" including waste wire cable from Taiwan were detected by the Customs Offices. The total volume of seven cases was 234 metric tons. The six cases were detected by Taichung Customs Office, and one case was by Kaohsiung Customs Office. The destinations for exports were Hong Kong (5 cases), mainland China, and Vietnam.

20. For details of Taiwan's recycling system, see Japan Economic Research Institute [2000], Togawa and Murakami [2001], and Murakami [2004].

recycling fund are required to undergo rigorous checks on their pollution controls and safety measures and be approved by the government, which represent a considerable barrier to the small and medium-sized mixed metal scrap dealers and recycling businesses wishing to participate in the government's recycling system. This might go part way to explaining the significant volumes of waste electronic appliances that exist outside the control of the recycling system.

While introduction of government's recycling system functioned as entry barrier for small and medium enterprises, it was pointed out that frequent revisions of the government recycling system might encourage new entry and conduced to persistent excessive competition as a result. The government's recycling system was revised many times, in terms of its mechanism, coverage, subsidy rates, etc. Minor adjustment of the newly introduced system is necessary to operate the system effectively. And encouragement of new entry and market creation by introduction of the new system and frequent revision, also, could be considered a sound economic fluctuation from the point of view on efficiency in the long run. However, in order to promote recycling industry and establish sound and appropriate industrial organization of the industry, as long as the change in regulation policy and the recycling system dominate market environment of recycling industries, the government should provide long run prospect of the recycling policy and make individual enterprises reduce strategic incentive for investment which might brought about excessive investment within the industry as a whole and persistent excessive competition as a result.

Taiwan's Environmental Protection Administration (EPA) has recently constructed "Environmental Science and Technology Parks" as centers for waste treatment and resource recycling industries, and is pursuing policies aimed at developing an environmental industry and promoting proper resource recycling. The construction of "Eco-Towns" in Kita-Kyushu and other cities that is being promoted by the Japanese government has served as a model for this initiative. Environmental Science and Technology Parks have already been built in Fenglin, Hualien County in the south and inside the Benchou Industrial District in Kaohsiung County, and construction is progressing at the Taoyuan Science Park, Taoyuan County in the north and at the Dahsinying Industrial District, Tainan County in the south. In the early stages a study was undertaken into developing the Tafa Industrial District, where mixed metal scrap treatment facilities had been grouped and managed, into an "Environmental Science and Technology Park," but the idea was abandoned due to difficulties in acquiring the additional land required. However, the recycling businesses envisaged for the "Environmental Science and Technology Parks" are not the "*fei-wuchin*" (mixed metal scrap) business that caused serious pollution problems in the past but those businesses that will undertake proper, controlled resource recycling.

Dr. Juu-En Chang, the Minister of EPA, who visited the Environmental Science and Technology Park in Kaohsiung County in September 2004, announced that the government was investigating plans to reopen import channels for foreign recyclable wastes (many of which are essentially banned under the "Waste Import, Export, Transit and Transshipment Measures" premised on the establishment of proper recycling methods differing from the ones used for "*fei-wuchin*" (mixed metal scrap) that had caused serious pollution problems in the past. The idea behind this is to promote the Environmental Science and Technology Parks as part of global resource recycling efforts.[21] Given that the comparative advantage of undertaking labor-intensive work processes in Taiwan has already disappeared, and not just in the mixed metal scrap recovery industry but across the board, it is unlikely that there will be a repeat of the improper processing by small businesses seen in the past, even if the country does start importing mixed metal wastes again. Were Taiwan to acquire comparative advantage for importing and processing recyclable wastes, it would likely require the incorporation of more skill-intensive processes. Moreover, in view of the fact that the domestic household appliances

21. "China Times [Southern Taiwan edition]," dated September 2, 2004. The Environmental Protection Administration, Executive Yuan [2004], released in March 2004, states that the government was reviewing controls on the import and export of wastes, and that it was exploring the partial reopening of import channels for those wastes under embargo in reference to raw material demand trends in the recycling industry.

recycling system is not yet operating effectively, the government will need to reinvestigate the establishment of a system guaranteeing rigorous control in order to ensure that the recovery work is appropriately undertaken. To build social consensus to accept the reopening of import channels into Taiwan, where the recovery of imported "mixed metal scrap" caused such major problems in the past, the government will need to show that it is working to establish a system and the recovery and treatment technologies required for proper management.

SECTION 7: CONCLUSIONS AND PROSPECTS

Many of the "*fei-wuchin*" (mixed metal scrap) recovery businesses that caused pollution problems in the past, having had their operations in Taiwan curtailed by stricter domestic restriction on pollution controls and a ban on importing, have relocated to mainland China and other countries with more lenient regulations and cheaper labor cost. With the relocation of these vicious businesses from Taiwan, the mixed metal scrap recovery business that are continuing to operate legally in Taiwan under government control are believed to be processing the waste appropriately and to be contributing to effective resource recycling in the country.

In many instances, businesses need to invest in larger, more expensive equipment in order to process the waste properly. Mixed metal scrap processors operating legally in Taiwan seeking to recover this large investment want stable and cheap supplies of the mixed metal scrap that feeds their businesses. Under the ban on imports of "mixed metal scrap" that has been in place since January 1993, with a few exceptions, the only resources available to these businesses is the mixed metal scrap being generated in country. Meanwhile, there are sufficient grounds for the belief that Taiwan's economy is too small to accommodate the skills needed to process the various recyclable wastes in such way as to enable these businesses to exist in appropriately competitive conditions. The concept of making aggressive use of international trade is considered to be reasonable both in terms of accessing cheap supplies of the recyclable wastes that feed the industry and of economy-of-scale efficiencies. It goes without saying that appropriate controls are critical to preventing the many pollution problems that accompany international trade in wastes, such as the incidents already discussed.

Imposing a ban on imports of "mixed metal scrap" in the early 1990s, when resolving the pollution problems that had been caused by its "mixed metal scrap" processors had become an urgent issue, is considered to have been an appropriate measure, but the necessity of maintaining a blanket ban thereafter may not have been as pressing. Nevertheless, the government is now making concrete progress with its plans for an incremental removal of the bans on imports of "mixed metal scrap" for which appropriate recovery and treatment technologies and control procedures have been established, and that are no longer the cause of pollution.[22] In specific terms, the government could make use of incentives, granting import licenses, for example, as a means of attracting private-sector businesses into the Environmental Science and Technology Parks being promoted by EPA.[23]

Examining the case of "*fei-wuchin*" has afforded an overview of the shifts in Taiwan's trade in recyclable wastes over the past few decades. Taiwan's mixed metal scrap recovery industry highlights many of the problems that accompany the transboundary movements of recyclable wastes, including import restrictions as a means of controlling pollution, the reloca-

22. The government authorized imports of limited quantities of "oil-free waste electric wire," which is not liable to generate pollution during processing that is conducted using proper equipment and under supervision, on a trial basis in 2003. It imposed a ceiling of 10 thousand tons per year on licensed importers (although the trade statistics show no evidence of any imports on this scale). Imports were only permitted upon application from those mixed metal scrap processors certified as "Class *Chia* (Class *A*)" by the government. This purportedly came about as the result of lobbying activities among the businesses operating in Taiwan, who began petitioning for the ban on imports of electric wire to be lifted from around 2002. The above is based on findings from a hearing conducted with waste electric wire processors at the Tafa Industrial District in December 2004, and one conducted with Division of Sustainable Development, Industrial Development Bureau, Ministry of Economic Affairs in January 2005. These businesses are being invited to enter the government's Environmental Science and Technology Parks, but stated that if import volumes are not expanded and supplies of raw materials are not increased they have no intention of making the new investment needed to move into the Parks.

tion of industry proponents to countries with more lenient environmental regulations, the expanding market in recyclable waste exports, the relationship between the development of the recycling system and existing recycling businesses, and efforts to restart imports in pursuit of efficiency. A review of trends in the import and export of the other recyclable wastes—waste plastics, used paper, scrap iron and steel, copper scrap, aluminum scrap and lead scrap—revealed similar currents to those evident for "mixed metal scrap"; for instance, the increases in exports bound for Hong Kong and mainland China. The transitions in imports of lead scrap (Figure 5-11) present a very similar pattern to those for "mixed metal scrap" (Figure 5-13). A similar pattern is also evident in imports of ships for dismantling (Figure 5-15). Fed by imported raw materials, Taiwan's metal recycling industries flourished in various forms during virtually the same period, falling into decline thereafter in consequence of the import ban imposed when the problems of environmental pollution and labor safety had become too big to ignore, and the shift to mainland China and the countries of South and Southeast Asia where labor is cheap and restrictions are more lenient.

The Taiwanese economy, which made aggressive use of international trade and direct investment to achieve fast industrialization and economic growth, was forced to become more flexible in responding to changes in its comparative advantage in terms of both the structure and location of industry. It might also be said that the recyclable wastes processing industry, buffeted by government regulation, has also made long-term use of international trade and direct investment, achieving comparative advantage, rising and falling with the times, and been flexible in adapting its location and industrial structure. The domestic recycling system and the system for controlling international trade in recyclable wastes have been critical to efforts to incorporate environmental pollution prevention costs appropriately, in the context of a long-term trend towards realizing comparative advantage. However, prompt adjustment and flexible operation of the systems are essential to maintaining economic growth in the face of perpetual change in the global economy, technologies and so forth, while achieving comparative advantage and ensuring efficient resource allocation.

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[23] The procedural requirements on businesses for import and export were partially simplified in the January 5, 2005 amendments to the "Waste Import, Export, Transit and Transshipment Management Measures," with a view to promoting trade in resources and wastes for recycling. Taiwan's EPA is hoping that the amendments, by easing the trade in recyclable wastes, will serve to attract recycling businesses into its Environmental Science and Technology Parks. The aforementioned manifest which the Industrial Waste Control Center requests the businesses in the destination country receiving the industrial wastes exported from Taiwan to return, was altered by these amendments in order that it can be substituted for the certificates of consent-to-accept issued by the competent authorities in the recipient country. With these amendments, Taiwan's EPA has announced its policy on the future orientation of controls on the import and export of recyclable wastes, i.e. when Taiwan's domestic recycling industries have spare processing capability, exports of recyclable wastes will be restricted and imports permitted, while exports will be permitted when there is no spare domestic processing capability but only when the destination is a developed country.

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