# Chapter 2

# International Trade of Recyclables in Asia: Is Cross-border Recycling Sustainable?

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#### Abstract

International trade of recyclables surge in Asia. This chapter shows the recent trend of the recyclable trade in the Asian region and examines the factors behind on both demand and supply side. We describe a mechanism how changes in trade and environmental regulations on the recyclables interact with the trade flow and the illegal trade. Revealed comparative advantage shows that each country has different comparative advantage in importing the recyclables. Especially, China has high comparative advantage in importing waste plastic and waste paper. However, geographical concentration of recyclable imports might pose risks for the sustainable trade flow due to sudden policy change.

Key words: recyclables, international trade, comparative advantage, environmental regulations

#### Introduction

A rise in demand has driven an increase in the cross-border trade of recyclables such as iron, copper, and aluminum scrap, as well as waste paper and plastic<sup>2</sup>. From 1990 to 2008, waste plastic trade increased by as much as 100 times and the trade of metal scraps went up by about 10 times in the same period (Graph 1). Backed by a large demand for raw materials, Asia is now a center of recyclable import; in 2007, 80% of the world's export of copper scrap, 80% of waste plastic, 60% of waste paper, 50% of aluminum scrap, and 30% of iron and steel scrap was directed to Asia<sup>3</sup>.

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<sup>&</sup>lt;sup>2</sup> HS statistics code for recyclables are as follows: Waste Paper (4707), Waste Plastic (3915), Waste glass (7001), Aluminum (7602) Iron and Steel scrap (7204), Copper scrap (7404), Precious metals (7112)

<sup>&</sup>lt;sup>3</sup> Asia refers to China, Japan, the Republic of Korea (South Korea), Taiwan, and ASEAN 5 (Indonesia, Malaysia, Philippines, Thailand, Vietnam )



Graph 1: An Increase of Recyclables Trade in Asia from 1990 to 2009

Source: Created by Author using UN Comtrade

Note: Asia refers to Cambodia, China, Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

The importance of the recyclable trade cannot be underestimated. The volume of traded recyclables has become significant in the resource trade which includes the trade of virgin resources, recycled resources, and recyclables. In China in 2007, iron and steel (HS72) scrap was 15% of imports in terms of weight and accounted for 68% of the aluminum and articles imported (HS76). Waste paper accounted for 73% of the import of raw materials for paper including wood pulp and cellulosic fiber (HS47).

Recyclables are substitutes for scarce natural resources, and the utilization of recyclables across borders contributes to increased resource productivity. An increase in the trade flow of recyclables leads to a more efficient use of resources. However, in some cases the traded recyclables have caused environmental problems in the importing countries. If pollution and waste is not appropriately controlled in the importing countries, the gains of trade and benefits of resource utilization might be nullified due to negative externalities. Asian governments have been tackling the challenge of pollution caused by traded recyclables by adjusting environmental and trade regulations. Policies attempt to maximize the benefits of recyclable resource utilization and minimize the negative externalities by restricting the recyclables that cause damage to the

environment. However, setting efficient regulation is not an easy task. Regulations and border control procedures need to be updated constantly as smuggling of hazardous waste disguised as recyclables is rampant and adjustment of control methods is necessary to ensure regulatory effectiveness. It is a challenge for importing countries to balance the benefits and the negative externalities of imported recyclables by setting appropriate regulations.

Regulatory changes in the import countries have an impact on exporting countries' waste management through a change in trade flows. For example, Japan ships a large amount of recyclables to neighboring countries as domestic recycling is not economically viable due to the high cost of resource recovery and a low demand for recycled resources. The recyclable trade helps Japan to reduce waste as some recyclables might be dumped as waste within the country, which shortens the lifetime of final disposal sites. Moreover in the case that recyclables cannot be exported, these will become waste as the domestic recycling industry does not have the capacity to handle all the recyclables that are domestically produced.

Therefore, keeping the recyclable trade sustainable is beneficial for both import and export countries. Maintaining environmental sustainability and, at the same time, increasing resource productivity across borders has become an important and challenging policy issue. As we will see, the large trade flow of recyclables poses risks to trading countries because some imported recyclables are concentrated in certain countries for processing, and a single country's regulatory changes could affect the world trade flow of these recyclables.

This chapter describes the situation of recyclable trade in Asia and discusses how the growing recyclable trade can be made sustainable. Section 1 describes trends in recyclable trade flows in Asia. Section 2 discusses the factors that affect recyclable trade flows. In Section 3, after showing that a geographical concentration of some recycling processes has occurred, the factors that determine the location of these industries are discussed. Section 4 shows how Asian governments implement trade and environmental regulations related to imported recyclables. Then the impact of these regulations on trade flows is examined. Section 4 shows how a quality perspective determines the direction of trade for recyclables.

#### 2.1 Trade Flow of Recyclables in Asia

As we saw in the introduction, the importation of recyclables in Asian countries has

increased in the past decades. This demand comes mainly from emerging Asian countries. Table 1 shows the imports of recyclables in 2008 for individual countries. While China offers the largest demand for waste paper, waste plastic and copper scrap in the region, ASEAN 6 countries import a large volume of iron, steel, and aluminum scrap. South Korea and Taiwan are major importers of iron and steel scrap.

Table 2 shows Asia's share of the market as a destination for recyclable imports as well as the Asian share as a destination for recyclable exports for each country. It shows that the Asian share is relatively high for regional recyclable exports but each country imports a smaller fraction from Asia. Actually, these countries import a large fraction from regions outside of Asia. This suggests that Asia collects recyclables from all over the world.

Table 1: Im	ports of Recy	clables in	Asian C	Countries in 2008

unit: 1,000 ton

		Waste	Iron	Glass	Copper	Precious	Aluminum
	Waste	Plastic	and	Cullet	Scrap	Metal	Scrap
	Paper		Steel			Scrap	
			Scrap				
Japan	61	2.8	699	7	139	33	158
S.Korea	1,307	47	7,313	108	217	3	503
Taiwan	834	150	5,539	3	107	NA	162
China	24,257	11,577	4,106	6	5,787		2,202
Mainland	24,205	7,074	3,589	4	5,577		2,155
HongKong	52	4,503	517	2	210		47
ASEAN6	4,202	156	102,955		4,285	6	19,369
Indonesia	2,080	9	1,899	32	10		42
Philippines	110	2	63	2	4		2
Malaysia	201	41	93,425	186	4,258	3	19,217
Singapore	67	8	388	1	4	3	6
Vietnam	526	87	567*	0	4*		8**
Thailand	1,217	9	2,577	19	9		101
India	1,740	98	4,603	77	103		241

Note: Vietnam figure with \* is the figure for 2006 and \*\* for 2007 due to missing data. Period(.) refers to values less than zero.

The significance of such imports and their growth can be shown in the waste paper and waste plastic imports of China (Graph 2 and 3). These show that China demands resources from all over the world. Almost all the exported waste plastic from the European Union, the United States, and Japan is directed to China and Hong Kong. More than half of the waste paper from the European Union, the United States, and Japan is exported to China and Hong Kong. We will come back to this observation and discuss its implications in a later section.

Graph 2 Trade Flows of Waste Plastic and the Changes in 1997 and 2007



Source: Author's drawing. UN Comtrade and World Trade Atlas

Note: 1) Dark gray shows 1997 figures and light gray shows 2007 figures.

 Percentages are export shares for exporting countries and import shares for importing countries.



Graph 3: Trade Flows of Waste Paper and the Changes in 1997 and 2007

#### Source: Same as in Graph 3

Japan is a major supplier of recyclables to the region except for precious metal scrap. It should be noted that Japan used to be a recyclable importer and became a net exporter of some recyclables after the 1990s (Graph 4). With changes in domestic demand and the supply of recyclables, a country may shift from importer to exporter.

Graph 4: Japanese Export and Import of Recyclables from 1988 to 2008 (---- Import —Export)



Iron and Steel Scrap

Copper Scrap



Aluminum Scrap

1,000 ton 

Waste Plastic





Waste Paper

Source: World Trade Atlas

## 2.2 Factors that Affect Recyclable Trade Flows

Recyclables without sufficient demand in the countries of generation are shipped to other countries and utilized more efficiently. Major destinations are often developing countries. There are several factors behind the surge in the recyclable trade in Asia. On the demand side, import countries are often those developing countries that are more competitive in the labor-intensive separation work of the recycling processes. Consequently resources are recovered at lower costs in developing countries. Moreover, it is often observed that developing countries have looser environmental regulations as the government's ability to implement the regulations is not sufficient. Because of these reasons, high-polluting recycling processes tend to relocate to these lower-income countries. This observation is backed by an empirical study. Michida et al. (2011) indicates that in the case of iron and steel scrap, imported and exported scrap is different in quality. Indeed, we observe from customs statistics that prices of traded IS scrap vary significantly depending on the trading partners. For example, the unit value of IS scrap (HS7204) exported from Japan to the United States was 10 times higher than the IS scrap exported to China in 2007. The empirical analysis of the paper shows that recyclables of lower separation quality, which are therefore lower priced, are sent to lower income countries as well as to countries with looser environmental regulations<sup>4</sup>.

<sup>&</sup>lt;sup>4</sup> Michida et al. (2011) also shows that the quality of exported scrap rises with income levels. This suggests that as income rises, further separation of recyclables is conducted and higher quality

Second, more demand for recycled resources is found in these developing countries because some products using recycled resources can be produced competitively due to lower labor costs and sold in domestic as well as international markets. The waste plastic trade is a good example of this. In China, plastic recovered from waste plastic bottles are used for making synthetic fiber and toys, while in Japan these same recyclables are used to make plastic trays for eggs. Japan does not have a competitive advantage in producing synthetic fiber and toys but these goods have higher value added than egg trays. Due to the lower recovery costs of waste plastic and the higher value-added products produced from recycled plastic in China, waste plastic is exported from Japan to China at higher prices than when exchanged domestically.

Third, in terms of consumption patterns, it is often suggested that consumers of lower income demand cheaper products rather than their higher-quality and higher-priced counterparts. Lower grade but cheaper products produced from recycled resources are in greater demand in developing countries compared to developed countries.

On the supply side, recycling policies have been introduced in developed and middle income countries which contribute to an increase in the collection of recyclables. In Japan, recycling policies such as the Containers and Packaging Recycling Law of 2000, the Construction Waste Recycling law of 2002, and the End-of-Life Vehicle Recycling Law of 2005 were introduced. These policies have increased the collection of these recyclables.

### 2.3 Other Determinants in Location of Recycling Industry

Emerging Asian countries import recyclables and utilize recycled materials to satisfy domestic resource demand. Where do recycling industries locate? Countries with lower labor costs are competitive in using recyclables, and this seems to be a major factor in the exportation of recyclables to developing countries. However, as we discussed, labor cost is not the only determinant of location for recycling industries. If income levels were the only determinant for the recycling industry locations, all the recyclables would be exported to the lower income countries, but this is not what we observe in Table 1. Table 3 shows the import competitiveness in the region across some recyclables. Depending on the recyclables, import competitiveness differs among countries (See

recyclables are produced.

Table 2).

					(%)		
		Waste	Waste	Iron and	Copper	Aluminum	
		Plastic	Paper	Steel Scrap	Scrap	Scrap	
Japan	Export	86	6	29	69	21	
	Import	94	95	92	100	99	
China	Export	18	20	48	51	30	
	Import	32	5	7	88	90	
South Korea	Export	82	9	51	29	17	
	Import	98	80	73	98	74	
Taiwan	Export	79	36	30	43	2	
	Import	97	100	89	100	100	
Singapore	Export	43	70	36	49	71	
	Import	87	90	83	97	60	
Malaysia	Export	58	37	6	97	63	
	Import	88	100	8	91	100	
Thailand	Export	66	50	9	56	24	
	Import	93	83	83	97	60	
Philippines	Export	51	26	92	47	73	
	Import	90	100	69	95	95	
Indonesia	Export	74	19	25	77	28	
	Import	94	99	97	89	67	
Vietnam	Export	33	56	Na	Na	2	
	Import	82	79		91	100	

Table 2:	The Shares of Export to Asia and the Shares of Import to Asia
	for each country in Weight in 2007

Source: UN Comtrade、 World Trade Atlas for Taiwan

Note (1) Asia refers to ASEAN6 (Indonesia, Singapore, Thailand, Malaysia, Philippines, Vietnam), Japan, China, South Korea, and Taiwan.

(2) Data is not available.

	Waste	Waste	Waste	Precious	Iron/	Copper	Aluminum
	Plastic	Paper	Glass	Metal	Steel	Scrap	Scrap
				Scrap	Scrap		
Japan	0.0074	0.0550	1.6083	1.4417	0.3053	0.9166	0.5422
China	6.8482	6.6612	0.8780	0.0009	1.1081	4.8705	3.1107
HongKong	10.2652	0.0692	0.0496	0.9454	0.0978	0.8121	0.1123
S.Korea	0.0868	1.4095	1.9647	1.2322	3.1366	2.8940	2.8462
Taiwan	0.4753	1.0560	0.1490	0.0444	3.4113	2.6469	1.5687
Singapore	0.0579	0.0435	0.6358	1.1689	0.1828	0.2405	0.0513
Thailand	0.0190	2.0862	1.1349	0.0112	1.4447	0.1945	0.8236
Malaysia	0.5157	0.4629	4.2813	0.2772	2.3781	0.5232	0.7623
Indonesia	0.0490	9.1672	0.6177	0.0001	1.8305	0.1341	0.8640
Philippines	0.0676	1.0598	0.3828	0.0001	0.0391	0.2087	0.0120
Vietnam	0.9735	1.4793	0.2911	0.0055	1.3191	0.2069	0.1112

 Table 3
 Revealed Comparative Advantage in Import 2005-2007 average

Source: Author' s calculation from UN ComTrade.

Note: Let M denote import value. For good k of country i, the index is calculated as  $\frac{M_k^i/M_K^i}{M_K^W/M_K^W}$  where K denotes all goods and W denotes the world.  $M_k^W/M_K^W$  is the world import share of good k in total imports of the world.

The top and the second highest indices are shown by bold letters for each recyclable.

China and Hong Kong have higher competitiveness in importing waste paper and waste plastic as seen in Graph 2 and 3, but with regard to aluminum and copper scrap, South Korea is relatively competitive in comparison to China. For iron and steel scrap, South Korea and Taiwan have a relative advantage. Therefore, in addition to labor costs, there are some other determinants that affect location. First, the market size that provides demand for recycled materials is also an important factor. If countries have larger markets for the recycled materials, firms have an incentive to import and process recyclables as they can easily sell the recycled materials within the country. For example, China exports parts of electrical appliances as well as final goods such as toys all over the world. Card-board is necessary for packing and shipping goods. The waste paper is used to produce card-board and this demand for card-board creates a large market for recycled paper.

Know-how and technology is another important factor. Precious metals scrap is imported to Japan because of the higher level of technology required to recover the precious metals. In China, the government has encouraged recycled material use for a long time and people thus have experience in utilization of the materials (Yamaguchi 2003). This background enables the country to accommodate large-scale recycling. In Vietnam, villages specialize in dealing with specific recycled materials and residents share the knowledge needed to do the recycling (Sakata 2010).

Third, path dependency also plays a role. An example is the Indonesian import of waste paper. Indonesia has vast forest resources and the country has large paper mills to utilize the country's abundant wood pulp. Partly because of a lack of raw materials, Indonesia imports waste paper to feed the mills. This background explains the higher competitiveness of waste paper imports in Indonesia. Another example is waste glass. A large amount of CRT monitors have been wasted as the demand for TV sets has shifted from products with CRTs to those with flat panels. CRT monitor contains lead so the best method of recycling a CRT is to reproduce the CRT monitors. However, there are few factories that still produce CRT monitors as the product demand has decreased globally but these factories are the only places that can properly recycle the increasing number of waste CRT monitors. In the Asian region, only Korea and Malaysia have factories large enough to recycle the imported waste CRT monitors and produce new products. Because of this, waste glass is shipped to South Korea and Malaysia.

#### 2.4 Trade Flow and Environmental/Trade Regulation

The increased trade in recyclables has caused environmental problems in Asian countries. There are two types of problems. The first is pollution from the recycling processes in the developing countries where informal sectors without appropriate pollution treatment facilities are often involved in the recycling activities. Moreover, residue after separation of the recyclables ends up in waste and may be dumped illegally.

The second problem is the illegal trade of recyclables. The Basel Convention set up international rules to prevent hazardous waste dumping in developing countries. However, the trade of recyclables is not restricted by international treaties as recyclables are considered normal goods or resources. However, some illegal trade cases have caused problems. For example, hazardous waste that should be controlled under the Basel Convention is mixed up with recyclables or disguised as recyclables and exported

to developing countries where monitoring at the borders is not strictly enforced (See column 1).

Yoshida (2010) has detailed the types of import regulations in China. To combat environmental problems, the Chinese government requires recyclable importers to obtain permits from the government and show that they are able to control pollution appropriately. Moreover, the government issues a list of importable recyclables divided into two categories: the recyclables of lower environmental impact and those of higher environmental impact. The listed recyclables are regulated according to pollution risks. The list has been updated every year and underwent major revisions in 2001, 2002, and 2003. Some goods were added or re-categorized in the revisions.

Stricter regulation is necessary to prevent pollution. However, if regulations are too stringent this acts as an impediment to the trade of recyclable resources. Therefore, there are also some cases of deregulation. For example, technological development makes some recycling processes less polluting. This allows governments to lift the import ban on these recyclables or loosen regulations to improve utilization. Column 2 shows some examples.

# $\star \star \star$ Column 1: Cases of illegal export $\star \star \star$

CRT monitors and lead batteries are often found in illegal exports. These goods are claimed as second-hand goods, but actual conditions suggest these are waste. There are thirteen cases of ship-backs of CRTs and lead batteries from Hong Kong to Japan from 2005 to 2007, according to the homepage of the Japanese Ministry of the Environment. There are also dozens of ship-back cases of waste lead battery from Hong Kong to the United States. According to American Metal Market, the ship-back cases include those where the shipment was reported as scrap when exported but it was considered as waste lead battery in the Chinese customs office.

In 2009, CRT monitors were illegally shipped to Semarang, Central Java in Indonesia from Massachusetts, United States. It was suggested that CRT monitors contain lead and should have been subject to the rules set by the Basel Convention.

Exporting countries have taken measures to prevent such illegal exports. The Japanese Ministry of Economy, Trade and Industry (METI) issues guidelines and criteria for second-hand CRTs. The U.S. Environmental Protection Agency (EPA) imposes penalties on illegal shipping of CRTs with the cooperation of the Chinese government.

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#### $\star \star \star$ Column 2: examples of regulatory changes $\star \star \star$

Indonesia has banned the import of waste as well as some recyclables by Regulation No.642/MPP/Kep/9/2002 Article I issued by the Ministry of Trade and Industry. In 2008, the Indonesian government made clear that it would import recyclables under some conditions with Regulation No.39/M-DAG/PER/9/2009. The decision might reflect the fact that domestic pollution control is tightening and recycling industries are on the rise in the country.

China had imposed regulation requiring that waste plastic bottles to be crushed into pellets or flakes when importing. The government changed the regulation and allows importation the plastic bottles without crushing. This regulatory change was made because new factories were established that can process the pet-bottles now.

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#### **2.5 Discussions**

The processing of some recyclables such as waste paper and waste plastic has been concentrated in China. Waste glass from CRT monitors has been imported and recycled only in Malaysia and South Korea. As such, many countries both inside and outside the region rely on a small number of countries for the recycling of certain materials. The geographical concentration of some recycling processes poses some risks to the exporting countries because the deterrence of trade due to a sudden introduction of import controls results in a stockpile of the recyclables in these countries. In March, 2004, the Chinese government claimed that 4,000 tons of waste plastic exported from Japan to Chintao, China, was against the law. Subsequently, China banned all imports of waste plastic from Japan from May to September of that same year. This regulation decreased waste plastic exports from Japan to mainland China during the period as in Graph 4 (See Yoshida (2010) for details of the Chintao Incident). Many Japanese export firms were later able to redirect their shipments to Hong Kong (Kojima and Yoshida (2005)). However, for some time, waste plastic collected for recycling piled up domestically as the recycling capacity within the country was far from sufficient to process all the collected plastic. The Chintao incident was a lesson to Japan that a regulatory change in a single country can have a significant impact on the trade of recyclables.



Graph 4: Waste Plastic Export from Japan to China

Procurement of rare metals is becoming a hot issue as China is the largest single source of these metals and export controls of rare metals affect the production of industries such as car manufacturers, electronics, etc. Control of risk in procurement for inputs is very important. Similar risks exist in the recyclable trade flow. Although concentration of recycling activities in certain countries is often one economic consequence of the various factors discussed, it is also important to consider risk diversification in terms of locations.

In order to ensure a sustainable trade of recyclables in the region, I present two policy recommendations. The first is related to the prevention of environmental pollution related to imported recyclables. As we saw, the countries that import recyclables can adjust import regulations as well as domestic environmental pollution controls by, for example, allowing only licensed firms to import and process the recyclables. Exporting countries may also try to tighten monitoring of illegal exports of hazardous wastes mixed with recyclables at their ports. The big challenge for both importing and exporting countries is to control smuggling and the activities of the informal sectors. Policies need to be implemented to formalize the informal sectors (see Hosoda (2008) for discussion) to reduce the uncertainty related to these illegal and informal flows. The regional coordination of the extended producer responsibility

Source: World Trade Atlas

(EPR) and international standards is also an important direction as discussed in Hotta et al. (2008).

The second issue is related to increased recycling in developed countries. Debates have begun in Japan, for example, over the utilization of rare metals as well as other metals with increased prices. Urban mining, a reference to extraction of the various metals contained in electric or construction scrap, has attracted much attention in policy debate as waste metal recycling could improve resource efficiency. Recent price increases for natural resources due to increased demand in emerging countries has led to higher demand for scrap as a substitute. Generally speaking, scrap is exported from developed countries, where it is discarded in a relatively large volume, to developing countries with high resource demand. In the resource-poor developed countries such as Japan, an increase in scrap exports has given rise to a debate as to how to efficiently utilize urban mining domestically. It is often discussed how the export of recyclable waste is regarded as a leakage of resources by the exporting country. In fact, although a large volume of IS scrap is exported to developing countries, some scrap is exported to developed countries. This implies that there might be some room for developed countries to increase domestic recycling if the appropriate quality of recyclables is available. Some recyclables, such as rare and precious metals, require more sophisticated technology to process, so for these items, developed countries have an advantage. Other recyclables, if well-separated and not requiring labor-intensive work to utilize, there may be a chance for developed countries to do the recycling domestically. Policies should be implemented to increase the supply of recyclables that corresponds with the technology in developed countries.

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