Do Pollution Havens Exist? Evidence from East Asia

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Abstract

The environmental policy about producing the dirty product has existed in East Asia. But in practice, countries in East Asia are often not strict in implementing the agreed policy. So until recently, environmental degradation due to pollution still occurs. The purpose of this study was to analyze indications of pollution havens in the East Asia and the trade patterns of dirty products in East Asia. This research uses secondary data, 10 East Asian countries namely Japan, Malaysia, Indonesia, Macao, Hong Kong, Singapore, Thailand, China, Korea, and Philippines are sourced from the United Nations Commodity Trade Statistics Database (UN-COMTRADE). The analysis was performed with the Trade Balance Index to analyze the trade in dirty products, the unit root test to see stationery data to identify indications of pollution havens. The research found that the weak indication of pollution havens. The existence of pollution havens but the trend is not significant, and the existence of comparative advantage in dirty products in East Asia.

Keywords: Dirty Product, Pollution Havens, Environmental Policy
JEL: F13, F17

1. Introduction

The existence of sectoral changes in GDP is one of the strategies used by developing and developed countries in the development process (Chenery, 1960). The development process will be started from the dominant roles of agriculture in GDP of a country (Parr, 2001). However, industrialization will be the main booster in promoting economic growth. In the process of development, developing countries will focus on the structural change from agricultural to industrial sector. This is caused by the rising of domestic demand for industrial products. Another factors, is a boost in exports of a country to manufacture industrial products. In the process of structural change, international trade will accelerate the shift in demand for agricultural products to the industrial sector. This is demonstrated by the composition of industrial sectors in international trade in a country. These conditions indicate a relationship between output growth, demand, and export manufacturing sector in the economy (Blomqvist, 1990). There are some facts about the structural changes in developing countries. First, the lower the income per capita, the higher the proportion of primary sector production and services than the secondary sector in GDP.

Second, the lower income, the higher the proportion of labor force working in the primary sector compared to working in secondary and service sectors.

Sources of economic growth and development of a country come from the contribution of industrial sector (Chenery and Syrquin, 1989). This is demonstrated by the success of industrialization in a country. In most developed countries, structural changes occur in the development process. These changes are indicated by: 1) changes in the structure of national production, 2) shifts in employment structure, 3) changes in institutional structures, and 4) changes in the balance of payments. These structural changes are caused by industrialization that intensively promote growth and economic development in developing countries.

Investment is a strategy in the process of industrialization in developing countries (Sen, 2008). There are several kinds of investment. One of them is Foreign Direct Investment (FDI). FDI will generate trade capital movements between countries. The investment will encourage structural change from the dominance of the agricultural sector to the industrial and services sectors. The dominance in the industry will accelerate the process of development and economic growth in developing countries. International trade as one of the strategies of industrialization in a developing country, has positive and negative impacts (Commission for Environmental Cooperation, 1997). With the international trade, a country can obtain an efficient industrial product, increase financial resources, reduce poverty and protect the environment due to the production process. On the other hand, international trade in manufactured goods makes problems, especially environmental problems, in a country. The increase of the trade of industrial products will cause high environmental problems. Through the international trade, then economic growth will increase in line with the increase in pollution generated in manufacturing industries. Moreover, the speed of consumption of non-renewable resources will increase.

Industrialization affects the environment. Choung (2008) shows the importance of economic policies which based on the environment. These economic policies aim to protect the environment from the impact of the development process and economic growth. The negative impact is largely the result of the production process of products manufacturing industry in a country. Manufacture industry requires low-pollution modern technologies. China's attitude toward FDI is a good example. China is the largest developing country in the world with a population over 1.3 billion. Like other developing economies, China has taken an open attitude towards international trade and investment. In 2002, China surpassed the U.S. and became the world's largest Foreign Direct Investment (FDI) recipient. Since 2004 it has become the 3rd largest trading country in the world both in import and export. In the meantime, China had a notorious record for mass industrialization at the cost of environmental protection. In a sense, China has the potential of becoming a "pollution haven. Furthermore, as China's international influence increases with its expanding economic power, many other developing countries tend to emulate China in their economic and social policies. Hence a clear understanding on China's attitude towards Dirty Industry Migration (DIM) not only has policy implications for the country itself, but also for other developing countries which are seeking similar development strategies to that of China (Lu and Huang, 2008).

East Asia has always had the reputation, deservedly so, for being very open in terms of its manufacturing sector. It has built its manufactured exports on the back of that openness. It has lagged behind, however, other regions in terms of its openness and efficiency in the services sector. Now increasingly, there's a realization that weaknesses in the services side can seriously undercut one's competitiveness more broadly, especially as regional production networks become the basis for manufacturing strength and greater competitiveness. If there could be improvements in the

efficiency of the services sector. It will help not just the service sector itself, it will really help to underpin manufacturing sector. So the researcher think there is a strong sense for this needs to be addressed.

So along with the global trade liberalization, the researcher thinks that a reduced value of the preferences that have been given to the poorest countries of the world would bring them along in the global system. That is not a terribly effective strategy because the poorest countries weren't really able to avail too much of those preferences. However, these countries will still be hurt, and that means the attention needs to shift to other areas, like logistics, where they can gain some real benefits. In one hand, environmental policies in developing countries are tight. On the other side, there is low enforcement in institutional problems because developing countries still need investment from developed countries. In East Asia, the production of dirty products move from developed countries to developing countries. This is caused by the need for complementary. The developed countries have strict environmental policies and strong market, developing countries in East Asia need foreign direct investment for their industrialization. Therefore, this study aims to analyze the existence of pollution havens in East Asia. The rest of this paper is organized as follows. Part 2 describes literature review. Part 3 exhibits the methodology. Results and discussion are presented in Part 4. Finally, conclusions and policy implications are in Part 5.

2. Literature Review

What happens to the environment when international trade is liberalized? Economic theory suggests that trade between countries with differing levels of environmental protection could lead pollution-intensive industry to concentrate in the nations where regulations are lax. Developing countries frequently have less stringent environmental regulations than developed countries. Thus

free trade might give developing countries a comparative advantage in industries that are associated with relatively large environmental externalities. Evoking this theory, nations that are attractive to industry due to their looser pollution controls are often referred to as "pollution havens" (Ackerman and Gallagher, 2000).

Extensive trade flows could result in a flood of *cheap but dirty products* from other countries to the domestic market. This situation may cause the relocation of industries from countries with relatively strict environmental standards to those with relatively lax standards (pollution havens). Should this situation occur, the recipient country (in this case, world) would be flooded with environment-polluting industries, which in turn giving rise to social problems. Therefore, trade liberalization is associated not only with economic problems, but also undoubtedly gives rise to social and environment-related problems, which, of course, need to be attended appropriately and judiciously (Abimanyu, 2000).

Composition effects occur when increased trade leads nations to specialize in the sectors where they enjoy a comparative advantage. When comparative advantage is derived from differences in environmental stringency (i.e., the pollution haven effect), then the composition effect of trade exacerbate existing environmental problems in the countries with relatively lax regulations. Technique effects or changes in resource extraction and production technologies can potentially lead to a decline in pollution per unit of output for two reasons. First, the liberalization of trade and investment may encourage multinational corporations to transfer cleaner technologies to developing countries. Second, if economic liberalization increases income levels, the newly affluent citizens may demand a cleaner environment. Of the three effects, the scale effect is a straightforward consequence of economic growth.

Dirty industries can be defined as industries that are causing high rates of pollution. In other words, those are industries which have highly intensive pollution. Pollution haven hypothesis argues that dirty industries have been migrating from developed countries to the developing countries. Dirty industries moved to developing countries because of the environmental regulations in developed countries. The existences of the strict environmental regulations have increased the cost of production of dirty industries at home. On the other hand, the conditions (low wages and lax environmental regulations) in developing countries have been attractive alternative producers in these sectors. At the same time, dirty industries' movement is also beneficial for developing countries that are in need of financial resources for industrial development (Akbostanci et al, 2004: 3).

The International Development Research Centre defines dirty industries as industries that has certain negative externalities: polluting, it causes ill health and disabilities, degrading the environment, and it inducing natural disasters. Dirty industries are characterized largely by (1) high intensity of energy use per unit of output; (2) high intensity of toxic release per unit of output; (3) high cost of pollution abatement per unit of operating cost; (4) high level of environmental pollution; and (5) high socioeconomic costs (e.g., ill health) relative to the benefits (e.g., employment).

In December 12, 1991, the chief economist for the World Bank, Lawrence Summers, wrote an internal memo about the migration of dirty industries to developing countries. He outlined three reasons why World Bank shouldn't encourage more migration of dirty industries to developing countries (The Whirled Bank Group, 2001).

1) The measurement of the costs of health impairing pollution depends on the foregone earnings from increased morbidity and mortality. From this point of

view, a given amount of health impairing pollution should be done in the country with the lowest cost, which will be the country with the lowest wages. Summers thought that the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable and people should face up to that.

2) The costs of pollution are likely to be non-linear as the initial increments of pollution probably have very low cost. According to Summers, under-populated countries in Africa are vastly UNDER-polluted. Their air quality is probably vastly inefficiently low compared to Los Angeles or Mexico City. Only the lamentable facts that so much pollution is generated by non-tradable industries (transport, electrical generation). Moreover, the unit transport costs of solid waste are so high and prevent world welfare from enhancing trade in air pollution and waste.
3) The demand for a clean environment for aesthetic and health reasons is likely to have very high income elasticity. The concern over an agent that causes a one in a million change in the odds of prostate cancer is obviously going to be much higher in a country where people survive to get prostate cancer than in a country where children under 5 mortality is 200 per thousand. Also, much of the concern over industrial atmosphere discharge is about visibility impairing particulates. These discharges may have very little direct health impact. Clearly trade in goods that embody aesthetic pollution concerns could be welfare enhancing. When the production is mobile, the consumption of pretty air is a non-tradable.

Olekesusi and Ogbu (2009) assert that dirty industries are partly dirty, a result of the unclean technologies which is exploited directly in extraction, processing, and production as for the features of a dirty industries are as follows.

1) High intensity of energy use per unit of output.
2) High intensity of toxic release per unit of output.
3) High cost of pollution abatement per unit of operating cost
4) High level of environmental pollution.
5) High socioeconomic costs (e.g., ill health) relative to the benefits (e.g., employment).

Dirty industries both create and contribute to global environmental problems. The examples of concrete global environmental problems are the greenhouse effect, ozone depletion, and acid rain. At the national level, common problems are land degradation, lake eutrophication, human illness, biotic destruction, and forced relocation.

Tobey (1990) defines pollution-intensive industries, as "those whose direct and indirect abatement costs in the U.S. are equal to or greater than 1.85 percent of total costs". Based on Tobey's definition about pollution-intensive industries, these five industries aggregate three-digit SITC industries in the following manner:

- Metal Mining: SITC (Revision 2) 281, 283
- Primary Nonferrous Metals: 681, 682, 683, 684, 685, 686, 687, 689
- Pulp and Paper: 251, 641, 642
- Primary Iron and Steel: 671, 672, 673, 674, 675, 676, 677, 678
- Chemicals: 512, 513, 514, 582,583,584,585

Xing and Kolstad (1997) conducts a research on lax environmental regulations and Foreign Direct Investment. This finding provides indirect support to the "pollution haven" hypothesis, which postulates that developing countries may utilize lenient environmental

regulations as a strategy to compete for the investment of polluting industry from developed countries. Abimanyu (1996) conducts a research on trade policy and environmental management in Indonesia. The results of this paper are influenced by the lack of evidence on the effects of freer trade policies and the choice of production techniques due to strengthened environmental standards of exporters. It is rather premature to draw conclusions regarding the connections between freer (or protectionist) trade and environmental effects, especially conclusions as to whether pollution havens are present or not.

Tobey (1990) conducts a research on effects of domestic environmental policies on patterns of world trade. Several tests are undertaken under a variety of specifications, but in no case is there any evidence that the introduction of environmental control measures has caused trade patterns to deviate from the HOV predictions. This results is important in that it casts serious doubt on the 'balance-of-trade' argument against environmental control which, as mentioned above, can be a strong deterrent to the implementation of new or stronger pollution control measures. The test results also lend support to the less empirically rigorous location-of-industry studies which maintain that the world distribution of 'dirty' industries has not been affected by differing country levels of environmental stringency.

3. Methodology

3.1. Trade Balance Index (TBI)

To analyze the trade performance in "dirty products", this research employs Trade Balance Index (TBI) by Lafay (1992). This index could show whether a country has specialization in export

(as net-exporter) or import (as net-importer) in the "dirty products" for a specific group of products (SITC)[1]. TBI is simply formulated as follows:

$$TBI_{ij} = \left(x_{ij} - m_{ij}\right) / \left(x_{ij} + m_{ij}\right) \quad (1)$$

where TBI_{ij} denotes trade balance index of country i for group of products (SITC) j; x_{ij} and m_{ij} represents exports and imports of group of products j by country i, respectively.

This index ranges from minus one to one. Extremely, the TBI equals to minus one if a country only imports. In contrast, the TBI equals to one if a country only exports. Indeed, the index is not defined when a country neither exports nor imports. In this case, this research puts zero since it shows either potentially to be exported or imported. Any values within minus one and one implies that the country exports and imports good j simultaneously, "net-importer" (if the TBI is negative) or "net-exporter" (if the TBI is positive).

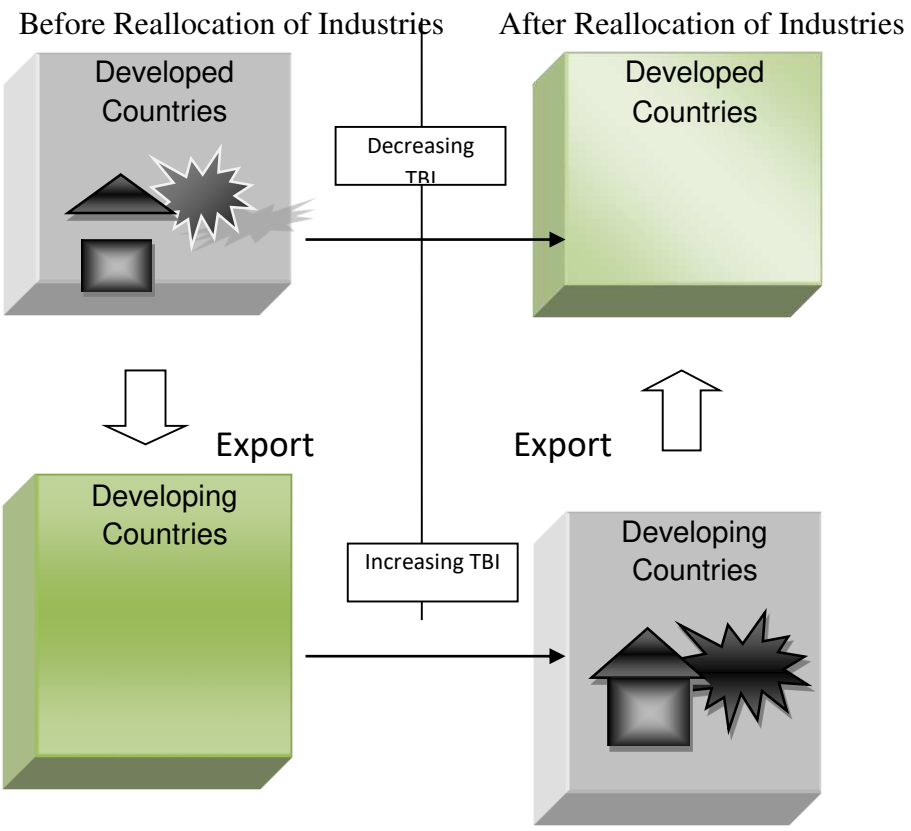
Figure 1. Theoretical Framework

[1] As far as the "pollution heaven" hypothesis is concerned, the TBI is suitable indicator instead of inter-industry and intra-industry trade index by Grubel and Lloyd (1975:21):

Inter-industry trade: $A_{ij} = \left[\frac{\left| x_{ij} - m_{ij} \right|}{\left(x_{ij} + m_{ij} \right)} \right] * 100$

Intra-industry trade: $A_i = \left[\frac{\left(x_{ji} + m_{ij} \right) - \left| x_{ij} - m_{ij} \right|}{\left(x_{ij} + m_{ij} \right)} \right] * 100$

The TBI can indicates clearly whether a country as a net-exporter or net-importer in the "dirty products".



In the beginning, before the reallocation of industries, developed countries produce and export dirty products to the developing countries but after the reallocation of industries, developing countries that produce and export dirty products to developed countries. So there is a decreasing of TBI in developed countries, and an increasing in TBI in developing countries.

3.2. Data

To calculate the index, this research uses data on trade published by the United Nations (UN) namely the United Nations Commodity Trade Statistics Database (UN-COMTRADE). Internationally traded products are classified according to some international standards of classification such as the Standard International Trade Classification (SITC), the Harmonized

Commodity Description and Coding System (HS) and the Broad Economic Categories (BEC) [2]. This research uses the 3-digit SITC Revision 2 and focuses on 237 groups of products. There are still two groups (SITC) which are not covered in this chapter i.e. Hoop and strip of iron or steel, hot-rolled or cold-rolled (SITC 675) and Postal packages not classified according to kind (SITC 911)[3]. Under the SITC, products are classified according to (a) the materials used in production, (b) the processing stage, (c) market practice and uses of the products, (d) the importance of the commodities in terms of the world trade, and (e) technological changes. The structure of classification is: level 1 (one-digit code) for Sections, level 2 (2-digit codes) for Divisions, level 3 (3-digit codes) for Groups, level 4 (4-digit codes) for Subgroups and level 5 (5-digit codes) for Items (UN, 2004).

The 3-digit SITC Revision 2 is nicely chosen for some reasons. *First,* the 3-digit will give more detailed and distinctive descriptions than the 1-digit or the 2-digit. It also avoids the massive information when the 4-digit or the 5-digit is used. *Second,* since this chapter aims to analyze the dynamic shifts in comparative advantages, it requires time series in the long-term sense. The SITC Revision 2 has been available since 1976 and has been used as the standard report in the International Trade Statistics Yearbook – the United Nations. It gives more detailed classification than the SITC Revision 1 which has 177 Groups and has been available since 1962 (Ximing and Fukao, 1997). In term of the number of groups, there have been insignificant differences between

[2] The UN-COMTRADE provides us with the detailed data on trade (export, import, re-export and re-import) by countries of reporter, by countries of partner, by years, and by commodity classification systems i.e. the Standard International Trade Classification (SITC) Revision 1 (1961), SITC Revision 2 (1975), SITC Revision 3 (1986), the Harmonized Commodity Description and Coding System (HS) 1992, HS 1996, HS 2002 and the Broad Economic Categories (BEC). The HS was adopted in 1983 and entered into force on 1 January 1988. The BEC is designed to serve as a means for converting external trade data compiled by using the SITC into end-use categories that are meaningful within the System National Accounts (SNA) framework.

[3] The two SITC have been not reported since 2001 in the world market. Technically, the Revealed Symmetric Comparative Advantage index, which is extensively employed in this research, is not defined when there is no trade in the world market. For 1976-2000, the average share of export of the two SITC in the world export was only 0.13 percent.

the SITC Revision 2 and the SITC Revision 3. In addition, the SITC Revision 3 has been just available since 1988. This research identifies 239 Groups in the 3-digit SITC Revision 2 and 240 Groups in the 3-digit SITC Revision 3 (although the remark is 261) [4]. Therefore, the SITC Revision 2 is suitable for this research since it provides appropriately the detailed groups of commodities as well as the range of available data.

3.2.Unit Root Test

A test of stationarity (or non stationarity) that has become widely popular over the past several years is the unit root test. We will first explain it, then illustrate it and then consider some limitations of this test.

The starting point is the unit root (stochastic) process that we discussed. We start with

$$TBI_t = \rho TBI_{t-1} + u_t \qquad -1 \leq \rho \leq 1 \tag{2}$$

Where u_t is a white noise error term.

We know all if $\rho=1$, that is, in the case of the unit root, becomes a random walk model without drift, which we know is a nonstationary stochastic process. Therefore, why not simply regress TBI_t on its (one period) lagged value TBI_{t-1} and find out if the estimated ρ is statistically equal to 1? If it is, the TBI_t is nonstationary. This is the general idea behind the unit root test of stationary.

For theoretical reasons, we manipulate as follows: Substract TBI_{t-1} from both sides of (2) to obtain:

$$TBI_t - TBI_{t-1} = \rho TBI_{t-1} - TBI_{t-1} + u_t$$

$$= (\rho-1)\, TBI_{t-1} + u_t \tag{3}$$

Which can be alternatively written as

$$\Delta TBI_t = \delta TBI_{t-1} + u_t \tag{4}$$

Where $\delta = (\rho-1)$ and Δ, as usual, is the first-difference operator.

In practice, therefore, instead of estimating (2), we estimate (4) and test the (null) hypothesis that $\delta = 0$. If $\delta = 0$, then $\rho = 1$, that is we have a unit root, meaning the time series under consideration is nonstationary. Before we proceed to estimate (4), it may be noted that if $\varepsilon = 0$, (4) will become

$$\Delta TBI_t = (TBI_t - TBI_{t-1}) = u_t \quad (5)$$

Since u_t is a white noise error term, it is stationary, which means that the first differences of a random walk time series are stationary, a point we have already made before.

$$\Delta TBI_t = \alpha + \beta TBI_t + \varepsilon \Delta TBI_{t-1} + u_t \quad (6)$$

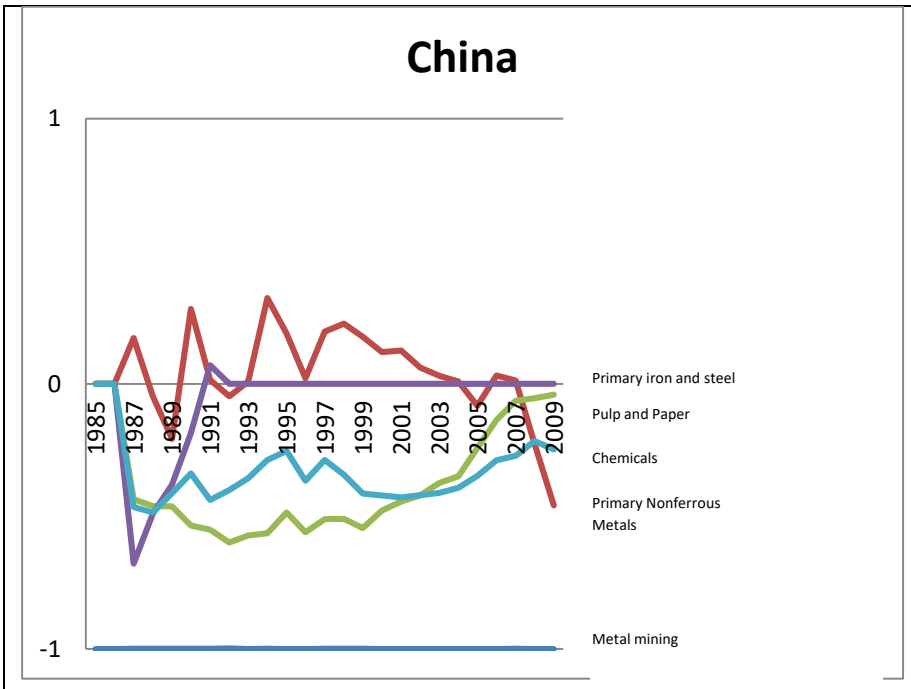
4. Results and Discussion

This research employs Trade Balance Index (TBI) by Lafay (1992). This index could show whether a country has specialization in export (as net-exporter) or import (as net-importer) in the "dirty products" for a specific group of products (SITC).

This index ranges from minus one to one. Extremely, the TBI equals to minus one if a country only imports. In contrast, the TBI equals to one if a country only exports. Indeed, the index is not defined when a country neither exports nor imports. In this case, this research puts zero since it shows either potentially to be exported or imported. Any values within minus one and one implies that the country exports and imports goods j simultaneously, "net-importer" (if the TBI negative) or "net exporter" (if the TBI positive) and the results are presented in Figures 2 -11 for China, Hong Kong, Macao, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore and Thailand, respectively.

China

Figure 2. Estimation Results: Dirty Products of China



Unit Root Test of TBI		
	F	Result
Metal Mining	-4.08*	Has unit root (pollution haven does)
Primary Nonferrous Metal	0.57	Has not unit root (pollution haven does not)
Pulp & Paper	-2.64	Has not unit root (pollution haven does not)
Primary Iron and Steel	-2.89	Has not unit root (pollution haven does not)
Chemicals	-3.94*	Has unit root (pollution haven does)

In Figure 1, there are dirty products in China, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals shows that pollution haven does exist. However, the data of Metal Mining shows the presence of pollution haven. It has strong relation with environmental policies taken by the government of China. All

five products illustrate rising, falling, and flat developments. The development of dirty product in China can be described as follow:

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven. In addition, TBI of metal mining shows stagnancy in 1985 to 2009. Metal mining shows unit root, so pollution haven does exist. This development relates to the environmental policy in China from the late 1970s, China began implementation of a number of environmental policies, and the number of these regulations has been steadily increasing (Sinkule and Ortolano, 1995).

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1986 to 1987, 1989-1990, 1992-1994, 1996-1998, and 2005-2006. The declining of TBI are in 1987 to 1989, 1990-1992, 1994-1996, 1998-2005, and 2007-2009. Primary Nonferrous Metals has no unit root, so pollution haven does not exist. Furthermore, these progresses also relate to the environmental policy. The State Environmental Protection Administration (SEPA) in China has also declared control of industrial pollution to be a top priority for Chinese regulators.

Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1992 to 1995, 1996-1997, and 1999-2009. Pulp and Paper has no unit root, so pollution haven does not exist. This progress relates to the environmental policy taken by the government of China. Responding to this severe environmental pollution, the National Environmental Protection Agency (NEPA) and the State Planning Commission (SPC) jointly proposed China's Environmental Action Plan for 1991–2000. The plan highlights the environmental issues that officials at the national level consider particularly significant.

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 1985-87 and 1987-1991. Beside going up and down, TBI of Primary Iron and Steel also shows flat progress in 1992 to 2009. Primary Iron and Steel has no unit root, so pollution haven does not exist. The environmental policy taken by the government of China influence the development of Primary Iron and Steel TBI is the plan highlights the environmental issues that officials at the national level consider particularly significant. The top three (of seven) problems listed deal with water pollution, air pollution, and hazardous waste. The next three involve conservation of natural resources in the form of water, land, forests and grasslands. The final problem centers on the balance and integrity of China's ecosystems (Ma and Ortolano, 2000).

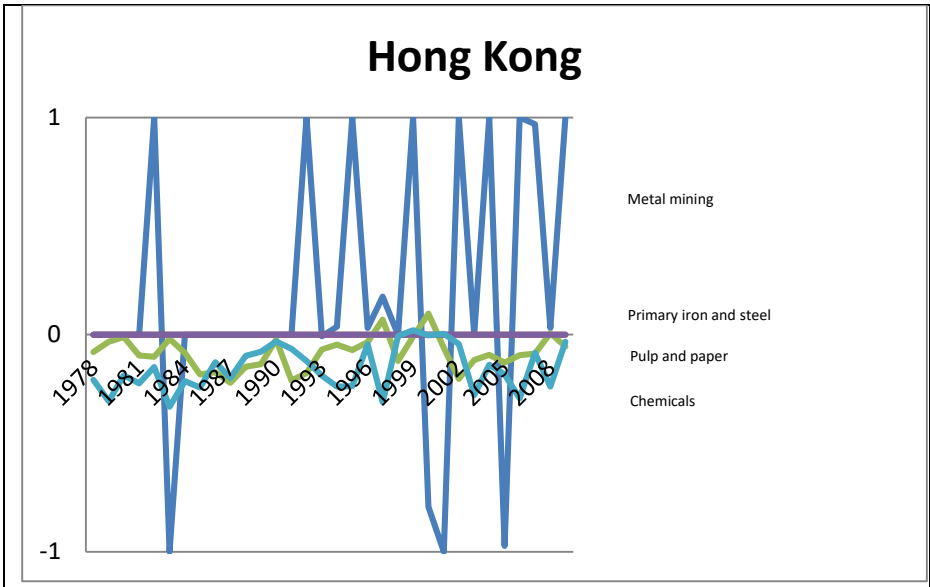
Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1988 to 1990, 1991-1995, 1996-1997, and 1999-2008. TBI of Chemicals shows falling progress in 1986 to 1987, 1990-1991, 1995-1996, and 1997-1999. Chemicals has unit root, so pollution haven does exist. However, weak enforcement of environmental regulations has been recognized as a major problem in China.

Hong Kong

From Graph 3 of dirty products in Hong Kong, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals show that pollution haven do not exist. However, the data of Metal Mining shows the presence of pollution haven. It has strong relation with environmental policies taken by the government of Hong Kong. All five products illustrate rising, falling, and flat developments. The development of dirty product in Hong Kong can be described as follows.

Figure 3. Estimation Results: Dirty Products of Hong Kong

	Unit Root Test of TBI		
		F	Result



Metal Mining	-7.79*	Has unit root (pollution haven does)
Primary Nonferrous Metals		Has not unit root (pollution haven does not)
Pulp & Paper	-3.53	Has not unit root (pollution haven does not)
Primary Iron and Steel		Has not unit root (pollution haven does not)
Chemicals	-3.53	Has not unit root (pollution haven does not)

Metal Mining: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1981 to 1983, 1991-1992, 1993-1995, 1998-1999, 2002-2003, 2004-2005, 2007-2008 and 2008-2009. The declining of TBI are in 1983 to 1984, 1989-1990, 1992-1993, 1997-1999, and 2007-2009. Metal Mining has unit root, so pollution haven does exist. These progresses also relate to the environmental policy. For the past 20 years, environmental policy in Hong Kong has been driven by responses to a variety of local problems resulting in an array of environmental ordinances and supporting regulations addressing air, water and noise pollution problems, waste management and the use of EIA in the development planning process.

Primary Nonferrous Metals: Trade Balance Index (TBI) of metal mining shows pollution haven. Significant not defined from 1978 to 2009. Primary Nonferrous Metals has no unit root, so pollution haven does not exist. These developments relate to the environmental policy in Hong Kong. Hong Kong's approach to environmental policy has been based on the conventional 'command and control' model of environmental management.

Pulp and Paper: Trade Balance Index (TBI) of Primary Iron and Steel goes up in to 1980, 1982-1983, 1987-1990, 1992-1996, 1998-2001 and 2003-2008. Pulp and Paper has no unit root, so pollution haven does not exist. The environmental policy taken by the government of Hong Kong influence the development of Primary Iron and Steel TBI, become increasingly apparent that many of Hong Kong's environmental problems cannot be effectively addressed solely by local initiatives but must involve broader collaborative efforts with authorities in neighboring Guangdong Province.

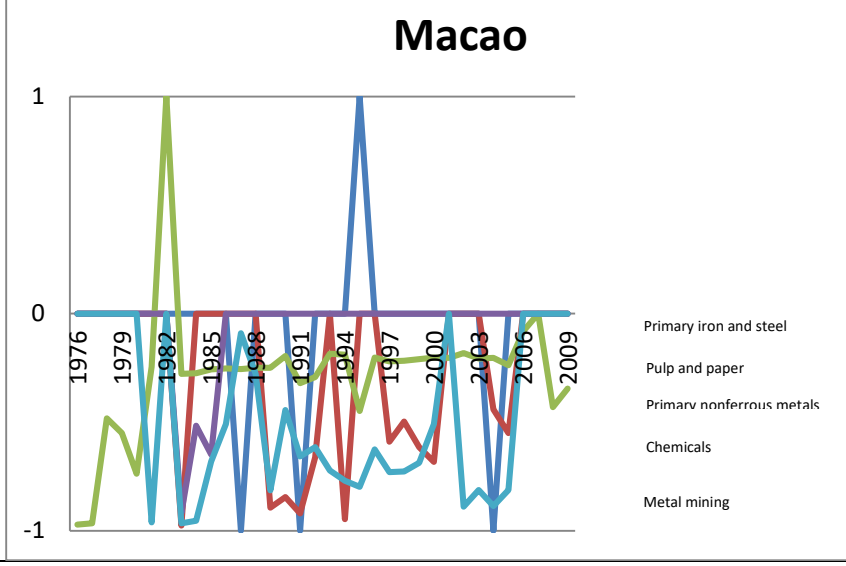
Primary Iron and Steel: TBI of Pulp and Paper are stagnant from year to year. Primary Iron and Steel has no unit root, so pollution haven does not exist.

Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1980 to 1983, 1984 to 1987, 1988 to 1990, 1995-1996, 1998-1999, 2004-2005 and 2007-2008. TBI of Chemicals shows falling progress in 1981 to 1982, 1983-1984, 1987-1988, 1990-1995, 1996-1998, 2002-2003, 2005-2007, and 2008-2009. Chemicals has not unit root, so pollution haven does not exist.

Macao

Figure 4. Estimation Results: Dirty Products of Macao

	Unit Root Test of TBI		
		F	Result
	Metal Mining	-5.65*	Has unit root (pollution haven does)



Primary Nonferrous Metals	-4.15*	Has unit root (pollution haven does)
Pulp & Paper	-4.57*	Has unit root (pollution haven does)
Primary Iron and Steel	-3.11	Has not unit root (pollution haven does not)
Chemicals	-3.55*	Has unit root (pollution haven does)

In Figure 4, dirty products in Macao, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals show that pollution haven do not exist. However, the data of Metal Mining shows the presence of pollution haven. It has strong relation with environmental policies taken by the government of Macao. All five products illustrate rising, falling, and flat developments. The development of dirty product in Macao can be described as follow:

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven. Significant increase happens in 1987-1988, 1991-1992, 1994-1996, and 2004-2005. Decreasing trend of TBI occurs in 1986-1987, 1990-1991, 1996-1997, and 2003-2004. Metal Mining has unit root, so pollution haven does exist. These developments relate to the environmental policy in Macao. The SAR government will try its best to facilitate and demonstrate the low carbon urban development in coping with national emission reduction policies and the "Kyoto Protocol", which is applicable in Macao Special Administration Region.

Primary Nonferrous Metal: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1984 to 1985, 1989-1990, 1991-1993, 1994-1995, 1997-1998, 2000-2001, and 2005-2006. The declining of TBI are in 1988 to 1989, 1990-1991, 1993-1994, 1996-1997, 1998-2000, and 2003-2005. Primary Nonferrous Metals has unit root, so pollution haven does exist. These progresses also relate to the environmental policy. Macao will continuously improve the environment; provide a low carbon, convenient, comfortable, pleasant space for living and activity through integration of urban and environmental planning, transport and environmental infrastructures to achieve the above goals and objectives.

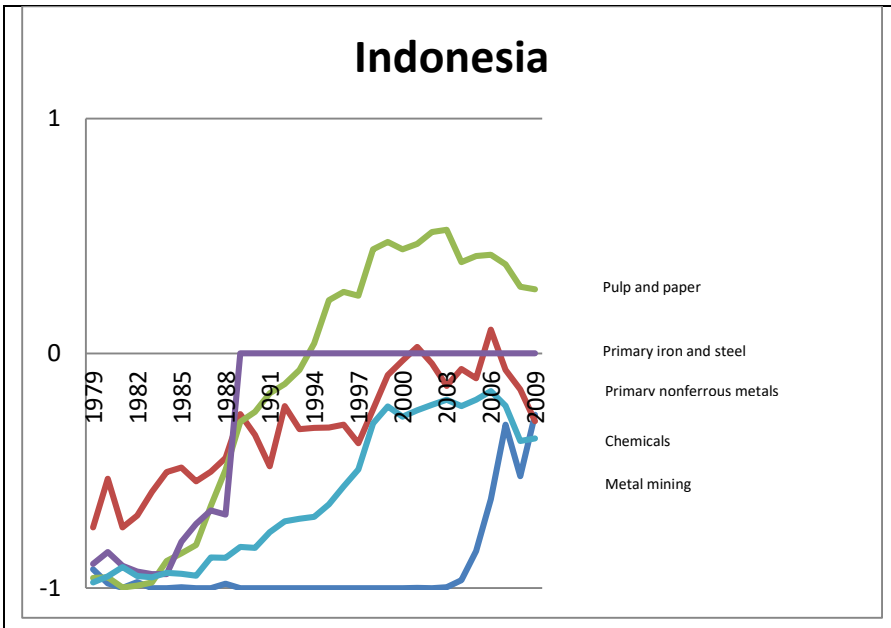
Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1976 to 1978, 1980-1982, 1983-1990, 1991-1994, 1995-2007, and 2008-2009. TBI of Pulp and Paper descends in 1978 to 1980, 1982-1983, 1990-1991, 1994-1995, and 2007-2008. Pulp and Paper has unit root, so pollution haven does exist.

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up from 1983 to 1984, and 1985-1986. Trade balance index shows falling progress in 1984 to 1985. Besides going up and down, TBI of Primary Iron and Steel also shows flat progress in from 1986 to 2006. Primary Iron and Steel has no unit root, so pollution haven does not exist.

Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1981 to 1982, 1983-1987, 1989-1990, 1991-1992, 1994-1996, 1998-2001, 2003-2004, and 2005-2006. TBI of Chemicals shows falling progress in 1980 to 1981, 1982-1983, 1987-1989, 1990-1991, 1992-1994, 1996-1997, 2001-2003, and 2004-2005. Chemicals has unit root, so pollution haven does exist.

Indonesia

Figure 5. Estimation Results: Dirty Products of Indonesia



Unit Root Test of TBI		
	F	Result
Metal Mining	-0.34	Has no unit root (pollution haven does not)
Primary Nonferrous Metals	-2.86	Has no unit root (pollution haven does not)
Pulp & Paper	0.23	Has no unit root (pollution haven does not)
Primary Iron and Steel	-1.25	Has no unit root (pollution haven does not)
Chemicals	-0.66	Has no unit root (pollution haven does not)

From the above graph of dirty products in Indonesia, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals show that pollution haven do not exist. However, the data of Metal Mining shows the presence of pollution haven. It has strong relation with environmental policies taken by the government of Indonesia. All five products illustrate rising, falling, and flat developments. The development of dirty product in Indonesia can be described as follow:

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven. Significant increase happens in 1979 to 2007, 2008-2009. Decreasing trend of TBI occurs in from 2007 to 2008. Metal Mining has no unit root, so pollution haven does not exist. These developments relate to the environmental policy in Indonesia. Although the legal instruments are more than adequate for sustainable environmental management, both implementation and enforcement of these laws are very weak.

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in from 1979 to 2006. The declining TBI of Primary Nonferrous Metals from 2006 to 2009. Primary Nonferrous Metals has no unit root, so pollution haven does not exist. These progresses also relate to the environmental policy. There is due to lack of political will.

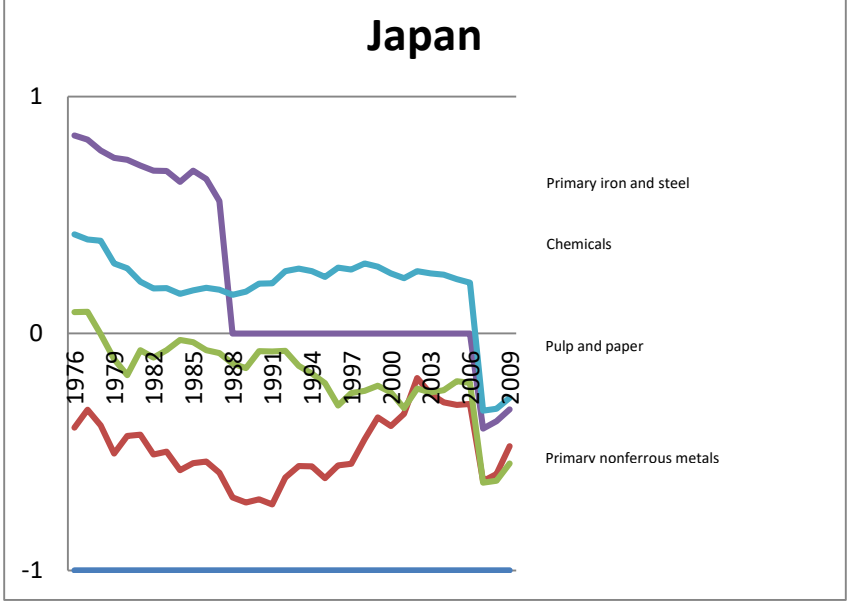
Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1979 to 2003. TBI of Pulp and Paper descends in 2003 to 2009. Pulp and Paper has no unit root, so pollution haven does not exist. This progress relates to the environmental policy taken by the government of Indonesia. There is an inadequate coordination among various agencies.

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 1979 to 1989. Primary Iron and Steel has no unit root, so pollution haven does not exist. Furthermore, TBI of Primary Iron and Steel also shows flat progress in 1989 to 2009. Low technical capability for proving violations influence the development of Primary Iron and Steel TBI.

Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1979 to 1989. TBI of Chemicals shows falling progress in 2006 to 2009. Chemicals has not unit root, so pollution haven does not exist. Chemicals TBI progress can be linked to the environmental policy taken. So, limited access to information, and lack of adequate funding is the reason why enforcement policy is not good.

Japan

Figure 6. Estimation Results: Dirty Products of Japan



Unit Root Test of TBI		
	F	Result
Metal Mining	-2.91	Has no unit root (pollution haven does not)
Primary Nonferrous Metals	-1.99	Has no unit root (pollution haven does not)
Pulp & Paper	-2.86	Has no unit root (pollution haven does not)
Primary Iron and Steel	-2.02	Has no unit root (pollution haven does not)
Chemicals	-1.26	Has no unit root (pollution haven does not)

In Figure 6, dirty products in Japan, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals show that pollution haven do not exist. It has strong relation with environmental policies taken by the government of Japan. All five products illustrate rising, falling, and flat developments. The development of dirty product in Japan can be described as follow:

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven. TBI of metal mining shows stagnancy in 1976 to 2009. Metal Mining has no unit root, so pollution haven does not exist. In Japan, the government defines voluntary initiatives as "actions that firms take voluntarily, in which they establish non-binding targets as a means of implementing environmental conservation measures" and its *Basic Environmental Plan* has characterized them as a tool for actively working on issues such as preserving the global environment and treatment of industrial waste and chemical substances.

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1991 to 2006, and 2008-2009. The declining of TBI are in 1976 to 1991, and 2006-2008. Primary Nonferrous Metals has no unit root, so pollution haven does not exist. These progresses also relate to the environmental policy. The government's growing interest in voluntary initiatives can mainly be attributed to two facts: (1) It takes tremendous time to reach consensus on the implementation of economic measures such as regulations and environmental taxes, and (2) Voluntary approaches give firms flexibility and assist in the reduction of costs incurred when reducing their environmental impacts.

Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 2001 to 2006, and 2008-2009. TBI of Pulp and Paper descends in 1976-2001, and 2006-2008. Pulp and Paper has no unit root, so pollution haven does not exist. This progress relates to the environmental policy taken by the government of Japan. The adoption of environmental management systems is expected to help firms significantly reduce their environmental impacts, in spite of being entirely voluntary. In Japan, a growing number of firms and facilities are introducing environmental management system, most of which follow ISO 14001, an environmental management system certified by the International Standardization Organization (ISO).

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 2008 to 2009. Furthermore, TBI of Primary Iron and Steel go down in 1976 to 1988, and 2006-2008. Besides going up and down, TBI of Primary Iron and Steel also shows flat progress in 1988 to 2006. Primary Iron and Steel has no unit root, so pollution haven does not exist. The environmental policy taken by the government of Japan influence the development of Primary Iron and Steel TBI is the number of acquisitions of ISO 14001 certification has been increasing rapidly

since it was first introduced in Japan in 1995. The number of acquisitions was 1,395 at the end of 1998, and exceeded 10,000 in 2002. It stood at 12,392 as of June 30, 2003.

Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1988 to 1998, and 2007-2008. TBI of Chemicals shows falling progress in 1976 to 1988, and 1998-2007. Chemicals has not unit root, so pollution haven does not exist. Chemicals TBI progress can be linked to the environmental policy taken. The cumulative number of acquisitions ISO 14001 has grown almost 10-fold during the past four years, indicating that attitudes towards its acquisition are generally positive.

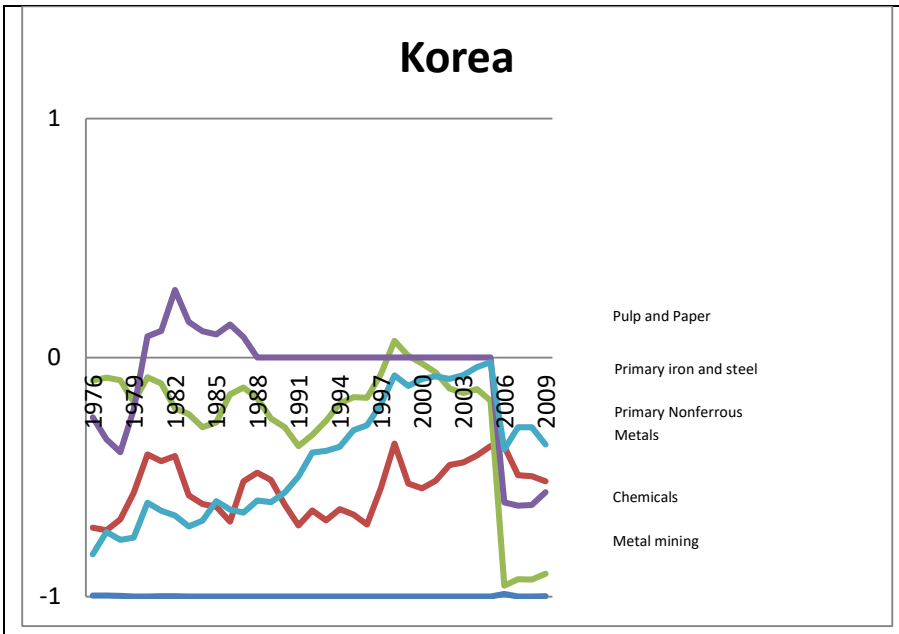
Korea

From Grap 7 of dirty products in Korea, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Iron and Steel, and Chemicals show that pollution haven do not exist. However, the data of Metal Mining shows the presence of pollution haven. It has strong relation with environmental policies taken by the government of Korea. All five products illustrate rising, falling, and flat developments. The development of dirty product in Korea can be described as follows.

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven. TBI of metal mining shows stagnancy in 1976 to 2009. Metal Mining has unit root, so pollution haven does exist. These developments relate to the environmental policy in Korea. There is some evidence that, besides environmental policy instruments and regulation, soft instruments such as voluntary commitments, eco-audits and eco-labels play a role as determinants of innovative behavior in firms.

Figure 7. Estimation Results: Dirty Products of Korea

	Unit Root Test of TBI



	F	Result
Metal Mining	-4.99*	Has unit root (pollution haven does)
Primary Nonferrous Metals	-3.26	Has not unit root (pollution haven does not)
Pulp & Paper	-1.22	Has not unit root (pollution haven does not)
Primary Iron and Steel	-1.64	Has not unit root (pollution haven does not)
Chemicals	-3.29	Has not unit root (pollution haven does not)

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1976 to 1980, 1986-1988, 1995-1998, and 2000-2006. The declining TBI of Primary Nonferrous Metals in 1980 to 1986, 1988-1995, 1998-2000, and 2006-2009. Primary Nonferrous Metals has no unit root, so pollution haven does not exist. These progresses also relate to the environmental policy. Voluntary initiatives can become mandatory over time (cf. Stand-by Korea). Industry initiatives abound and, in particular contexts, can change the relationship between the administration in charge of environment policies and the business sector.

Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1979 to 1981, 1985-1988, 1991-1998, and 2006-2009. TBI of Pulp and Paper descends in 1976 to 1979, 1981-1985, 1988-1991, and 1998-2006. Pulp and Paper has no unit root, so pollution haven does not exist. This progress relates to the environmental policy taken by the government of Korea. Industry initiatives abound and, in particular contexts, can change the relationship between the

administration in charge of environment policies and the business sector. This typifies what can be seen as a new phase in environmental policies which sets out to promote broader sustainability, rather than address one single environmental issue. In that perspective, governments rely less on regulatory tools and endeavor to work with industries, in sectors which use materials and/or energy.

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 1978 to 1982, and 2006-2009. Furthermore, TBI of Primary Iron and Steel go down in 1976 to 1978, 1982-1988, and 2005-2006. Besides going up and down, TBI of Primary Iron and Steel also shows flat progress in 1988 to 2005. Primary iron and Steel has no unit root, so pollution haven does not exist. The environmental policy taken by the government of Korea influence the development of Primary Iron and Steel TBI in line with the OECD Council Recommendation on Improving the Environmental Performance of Public Procurement [C(2002)3], green procurement initiatives are burgeoning at local and national levels. Guidelines are supported by websites, green products databases, and *pro forma* requests for tenders. The Green Purchasing Network is an international network active in this area.

Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1976 to 2005, and 2006-2008. TBI of Chemicals shows falling progress in 2005 to 2006, and 2008-2009. Chemicals has not unit root, so pollution haven does not exist. Chemicals TBI progress can be linked to the environmental policy taken. Some initiatives set out to promote technologies and products developed by one country. Others try to alleviate barriers to the deployment of environment-friendly technologies and products; shared definitions, standards and labels contribute to a level playing field for the creation and diffusion of environment-friendly technologies, products and life-styles. Such efforts are still plagued by institutional problems related to intellectual property rights and international

monetary transfers. Typically, the capacity of a national agency to (financially) support one country's side of a multinational joint venture depends on how countries will share the intellectual property rights. Few cooperation projects reach developing countries (with the exception of East Asia, and China in particular).

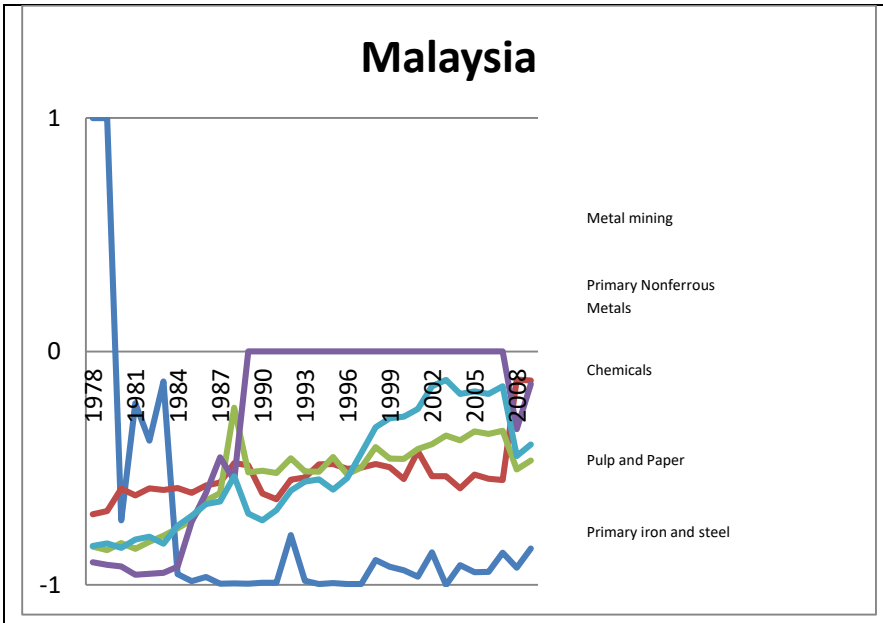
Malaysia

From Graph 8, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals show that pollution haven do not exist. However, the data of Metal Mining shows the presence of pollution haven. It has strong relation with environmental policies taken by the government of Malaysia. All five products illustrate rising, falling, and flat developments. The development of dirty product in Malaysia can be described as follows.

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven and . Significant increase happens in 1981 to 1982, 1983-1984, 1992-1993, 1998-1999, 2002-2003, 2004-2005, 2006-2007, and 2008-2009. Decreasing trend of TBI occurs in 1978 to 1981, 1982-1983, 1984-1986, 1993-1994, 1999-2002, 2003-2004, 2005-2006, and 2007-2008. In addition, TBI of metal mining shows stagnancy in 1986 to 1992, and 1994-1998. Trade balance index decrease from 1978 to 1981, 1982-1983, 1984-1986, 1993-1994, 1999-2002, 2003-2004, 2005-2006, and 2007-2008. Metal Mining has unit root, so pollution haven does exist. These developments relate to the environmental policy in Malaysia. Malaysia recognizes the need to achieve sustainable development through well formulated environmental and industrial policies and providing financial support for environmentally sound technologies. Therefore, environmental

sound technologies play an important role in the maintenance of the environmental quality and for the economic growth of our country.

Figure 8. Estimation Results: Dirty Products of Malaysia



Unit Root Test of TBI		
	F	Result
Metal Mining	-4.03*	Has unit root (pollution haven does)
Primary Nonferrous Metals	-2.91	Has not unit root (pollution haven does not)
Pulp & Paper	-2.69	Has not unit root (pollution haven does not)
Primary Iron and Steel	-0.41	Has not unit root (pollution haven does not)
Chemicals	-1.55	Has not unit root (pollution haven does not)

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in the inclining TBI of Primary Nonferrous Metals in 1978 to 2009. Primary Iron and Steel has no unit root, so pollution haven does not exist. These progresses also relate to the environmental policy. Malaysia has adopted various financial schemes and strategies to implement environmentally sound technologies in coherence with its Environmental and Industrial Policies.

Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1978 to 1990, and 1997-2008. Trade Balance Index of Pulp and Paper decrease from 1990 to 1997, and 2008-

2009. TBI of Pulp and Paper descends in 1990 to 1997, and 2008-2009. Pulp and Paper has no unit root, so pollution haven does not exist.

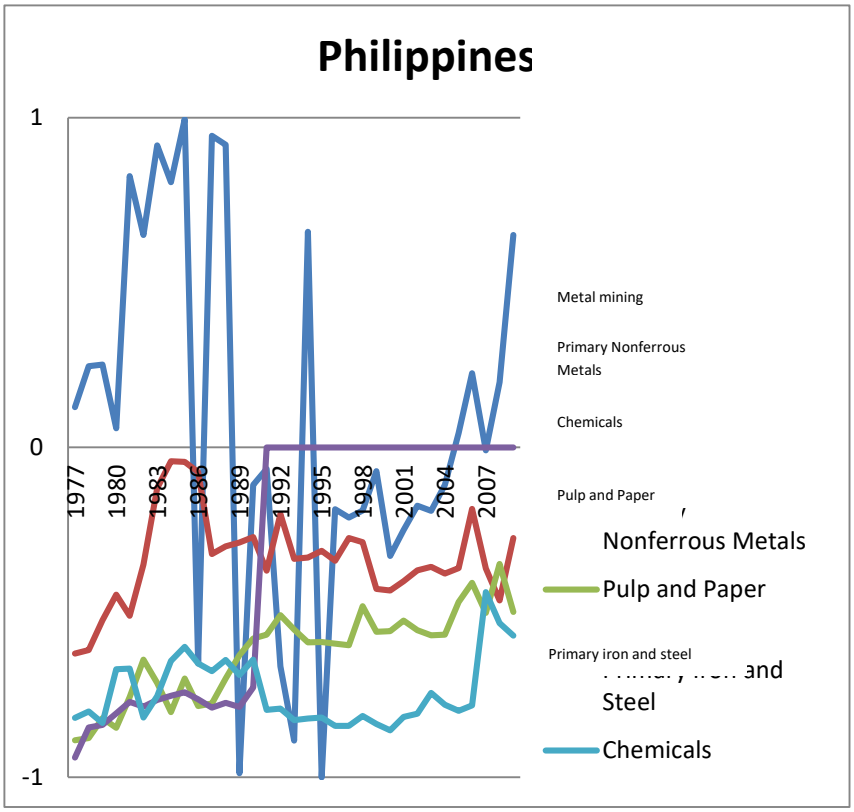
Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 1978 to 1990. Furthermore, TBI of Primary Iron and Steel go down in 2008 to 2009. Beside going up and down, TBI of Primary Iron and Steel also shows flat progress in 1990 to 2008. Primary Iron and Steel has no unit root, so pollution haven does not exist.

Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1978 to 1989, and 1992-2008. TBI of Chemicals shows falling progress in 1989 to 1992, and 2008-2009. Chemicals has not unit root, so pollution haven does not exist. Chemicals TBI progress can be linked to the environmental policy taken. The Malaysian Government also welcomes foreign supported cooperation programs in cleaner and environmentally sound technologies. We also encourage cooperation through institutional, professional, public and private sector partnerships. It is our vision to adopt environmentally sound technologies to improve our environmental quality and economic competitiveness in our key sectors.

The Philippines

In Figure 9, dirty products in Philippines, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals show that pollution haven do not exist. It has strong relation with environmental policies taken by the government of Philippines. All five products illustrate rising, falling, and flat developments. The development of dirty product in Philippines can be described as follow:

Figure 9. Estimation Results: Dirty Products of Philippines



Unit Root Test of TBI		
	F	Result
Metal Mining	-0.82	Has no unit root (pollution haven does not)
Primary Nonferrous Metals	-2.82	Has no unit root (pollution haven does not)
Pulp & Paper	-0.94	Has no unit root (pollution haven does not)
Primary Iron and Steel	-1.63	Has no unit root (pollution haven does not)
Chemicals	-2.27	Has no unit root (pollution haven does not)

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven. Significant increase happens in 1977 to 1985, 1986-1987, 1989-1992, 1994-1995, 1997-2000, and 2001-2009. Decreasing trend of TBI occurs in 1985 to 1986, 1987-1989, 1992-1994, 1995-1997, and 2000-2001. Metal Mining has no unit root, so pollution haven does not exist. These developments relate to the environmental policy in Philippines. In general, the investment incentive system reinforced trade policy, especially until export incentives were introduced in the 1970s. The attention paid to exports mitigated the bias of trade policy somewhat, but because of its limited coverage the approach was inadequate and resulted in export concentration on a few products (garments in the 1970s, and electronics starting in the late 1980s). There was some

improvement in the incentive system with the enactment of BP 391 during the period 1983-1987, manifested in the higher share of exports, lower capital- labor ratio, and smaller average size of firms during that period. However, these trends were reversed with the termination of BP 391 and the passing of EO 226 in 1986, by which the capital-intensity and size biases were restored. Furthermore, there were fewer incentives to export. The results of the PIDS-DIA study confirm that activities within the framework of the EPP have on average a higher ERP 4.

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1977 to 1985, 1992-2007, and 2008-2009. The declining TBI of Primary Nonferrous Metals are in 1985 to 1992, and 2007-2008. Primary Nonferrous Metals has no unit root, so pollution haven does not exist. These progresses also relate to the environmental policy. The impact on the environment is thereby likely to be similar. The investment incentive system would, however, have a specific impact on industrial dispersal through the promotion of regional investment. Only investments in industrial estates have been approved in the NCR. The dispersal of industries would helps to reduce pollution in Metro Manila

Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1977 to 2008. TBI of Pulp and Paper descends in 2008 to 2009. Pulp and Paper has no unit root, so pollution haven does not exist. This progress relates to the environmental policy taken by the government of Philippines. Foreign investment policy runs parallel to the overall investment incentive system. This was especially true before the passing of the 1992 Foreign Investment Act (FIA). Before this, BOI had an implicit positive list for foreign investments which closely coincided with its IPP. There were restrictions on foreign investment in some areas, generally related to natural resource exploitation, but most EPP areas were open to DFIs. Hence, foreign investments were not likely

to have had a more negative impact on the environment than domestic investments. On the contrary, foreign firms are usually found to adhere more closely to environmental regulations.

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 1977 to 1992. Furthermore, TBI of Primary Iron and Steel also shows flat progress in 1992 to 2009. Primary Iron and Steel has no unit root, so pollution haven does not exist. The environmental policy taken by the government of Philippines influence the development of Primary Iron and Steel TBI, the new FIA has liberalized entry of foreign equity. The negative list where DFI is restricted has been limited to firms exploiting natural resources, those dealing with the production of firearms and other national-security related activities, and small enterprises catering to the domestic market with less than US$100,000 paid-up capital.

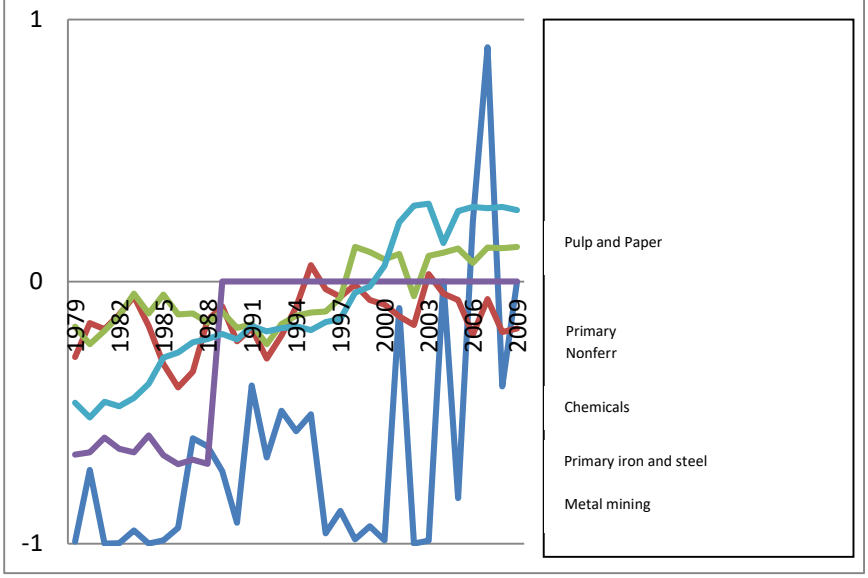
Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1977 to 1986, and 2001-2007. TBI of Chemicals shows falling progress in 1986 to 2001, and 2007-2009. Chemicals has not unit root, so pollution haven does not exist. Chemicals TBI progress can be linked to the environmental policy taken. It is too early to determine whether such opening up will lead to cleaner technology and production or will encourage the emergence of pollution havens.

Singapore

From Graph 10 of dirty products in Singapore, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals show that pollution haven do not exist. It has strong relation with environmental policies taken by the government of Singapore. All five products illustrate rising, falling, and flat developments. The development of dirty product in Singapore can be described as follows.

Metal Mining: Trade Balance Index (TBI) of metal mining significant increase happens in 1979 to 1980, 1981-1982, 1983-1987, 1990-1991, 1992-1993, 1994-1995, 1999-2001, 2003-2004, 2005-2006, and 2008-2009. Decreasing trend of TBI occurs in 1980 to 1981, 1982-1983, 1987-1990, 1991-1992, 1993-1994, 1995-1999, 2001-2003, 2004-2005, and 2006-2008. Metal Mining has no unit root, so pollution haven does not exist. These developments relate to the environmental policy in Singapore. Overall management of the environment lies with the Ministry of Environment (ENV). The ENV was first established in the 1970s as a department within the Prime Minister's Office before eventually becoming a full-fledged Ministry.

Figure 10. Estimation Results: Dirty Products of Singapore



Unit Root Test of TBI		
	F	Result
Metal Mining	-2.01	Has no unit root (pollution haven does not)
Primary Nonferrous Metals	-3.01	Has no unit root (pollution haven does not)
Pulp & Paper	-2.84	Has no unit root (pollution haven does not)
Primary Iron and Steel	-1.74	Has no unit root (pollution haven does not)
Chemicals	-2.3	Has no unit root (pollution haven does not)

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1979 to 1983, 1986-1989, 1992-1995, 2002-1995, 2002-2003, and 2006-2007. The declining of TBI are in 1983 to 1986, 1989-1992, 1995-2002, 2003-2006, and 2007-

2009. Primary Nonferrous Metals has no unit root, so pollution haven does not exist. These progresses also relate to the environmental policy. It is responsible for providing the infrastructure for waste management, as well as enforcing and administering legislation relating to pollution control and public health.

Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1979 to 2009. Pulp and Paper has no unit root, so pollution haven does not exist. This progress relates to the environmental policy taken by the government of Singapore. The Pollution Control Department (PCD) within the ENV is in charge of environmental planning and building development control, air and water pollution control and the regulation of hazardous substances and wastes.

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 1988 to 1989. Furthermore, TBI of Primary Iron and Steel go down in 1979 to 1988. Besides going up and down, TBI of Primary Iron and Steel also shows flat progress in 1989 to 2009. Primary Iron and Steel has no unit root, so pollution haven does not exist.

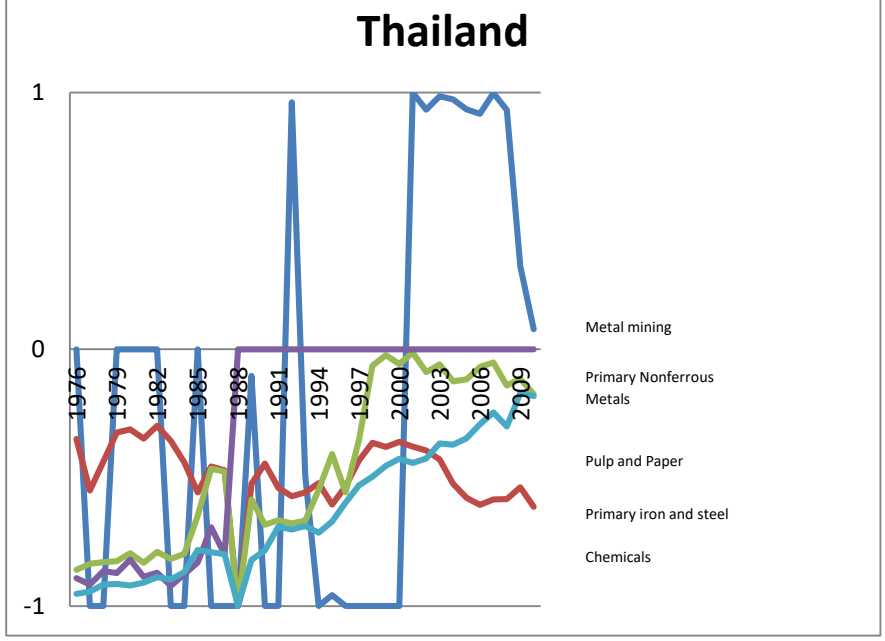
Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1979 to 2003, and 2004-2009. TBI of Chemicals shows falling progress in 2003 to 2004. Chemicals has not unit root, so pollution haven does not exist. Chemicals TBI progress can be linked to the environmental policy taken. Due to the government's strong commitment to pollution control and also to Singapore's small size, the ENV has been largely successful in implementing its pollution control programs throughout Singapore.

Thailand

In Figure 11, dirty products in Thailand, it is known that five dirty products, including Primary Nonferrous Metals, Pulp and Paper, Primary Iron and Steel, and Chemicals. Pollution

haven has strong relation with environmental policies taken by the government of Thailand. All five products illustrate rising, falling, and flat developments. The development of dirty product in Thailand can be described as follows.

Figure 11. Estimation Results: Dirty Products of Thailand



Unit Root Test of TBI		
	F	Result
Metal Mining	-3.38	Has not unit root (pollution haven does not)
Primary Nonferrous Metals	-3.79*	Has unit root (pollution haven does)
Pulp & Paper	-3.08	Has unit root (pollution haven does)
Primary Iron and Steel	-1.56	Has unit root (pollution haven does)
Chemicals	-3.14	Has unit root (pollution haven does)

Metal Mining: Trade Balance Index (TBI) of metal mining shows pollution haven. Significant increase happens in 1978 to 1979, 1984-1985, 1988-1989, 1991-1992, and 2000-2001. Decreasing trend of TBI occurs in 1976 to 1977, 1982-1983, 1985-1986, 1989-1990, 1992-1994, and 2007-2009. In addition, TBI of metal mining shows stagnancy in 1977 to 1978, 1979-1982, 1983-1984, 1986-1988, 1994-2000, and 2001-2007. Metal Mining has no unit root, so pollution haven does not exist. These developments relate to the environmental policy in Thailand. Since

UNCED at Rio in 1992, most countries, including Thailand, pay specific attention to sustainable development so as to meet the recommendations in Agenda 21.

Primary Nonferrous Metals: Trade Balance Index (TBI) of Primary Nonferrous Metals shows enhancement in 1978 to 1982, 1988-1990, and 1995-1998. The declining of TBI are in 1976 to 1978, 1982-1988, 1990-1995, and 1998-2009. Primary Nonferrous Metals has unit root, so pollution haven does exist. These progresses also relate to the environmental policy. At the same time, it was recognized that *indicators* should be developed to be an appropriate tool for evaluation of sustainable development and to measure the progress towards the goals of Agenda 21.

Pulp and Paper: Trade Balance Index (TBI) of Pulp and Paper ascends in 1976 to 1986, 1988-1995, and 1996-2001. TBI of Pulp and Paper descends in 1986 to 1988, 1995-1996, and 2001-2009. Pulp and Paper has unit root, so pollution haven does exist. This progress relates to the environmental policy taken by the government of Thailand. After the public sector reform in October 2002, the Ministry of Natural Resources and Environment was established under the Environmental Act 1992. Several resource-oriented departments were then established.

Primary Iron and Steel: Trade Balance Index (TBI) of Primary Iron and Steel goes up in 1976 to 1988. Furthermore, TBI of Primary Iron and Steel also shows flat progress in 1988 to 2009. Primary iron and Steel has unit root, so pollution haven does exist. The environmental policy taken by the government of Malaysia influence the development of Primary Iron and Steel TBI, the systematic monitoring and evaluation is conducted under the Office of Natural Resources and Environment Policy and Planning and is harmonized with the national monitoring and evaluation of government policy performance.

Chemicals: Trade Balance Index (TBI) of Chemicals rises in 1976 to 1984, and 1987-2009. TBI of Chemicals shows falling progress in 1984 to 1987. Chemicals has unit root, so pollution haven does exist. Chemicals TBI progress can be linked to the environmental policy taken. Nationwide key performance indicators (KPI) have become the main issue in public administration and also in the field of environmental management.

5. Conclusions and Policy Implication

Based on the research and analysis on the pollution haven in East Asian countries, it can be deduced from various aspects under study that all countries have weak pollution haven. There are the positive of TBI trend but not significant statistically. Environmental Management issues are quickly becoming critical issues for business seeking to comply with environmental regulations and, going beyond compliance, to achieve the cost savings and quality improvements associated with adopting creative approaches to industrial ecology. In the near future, the rapidly globalizing world economy will offer diminishing opportunities for polluting companies to be environmental "free riders" and to locate plants that generate hazardous emissions in developing countries with weak environmental regulations. The enforcement of environmental policies should be improved, then do not continue to be pollution havens.

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