

## LETTER TO THE EDITOR

# The Impact of the Prohibition of Waste Trade on Reducing Environmental Pollution

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There is a mutual promotion between ecological security and international trade, as well as frequent friction. Aiming at the problem that the traditional model has poor application effect, a VECM-based impact model of the prohibition of waste trade on reducing environmental pollution is designed. With VAR vector autoregressive model, each endogenous variable of the system is set as a function of the hysteresis of all endogenous variables in the system. Then, the ADF test is used to test the stability of the variables, and the EG cointegration test is used to perform the cointegration test to construct the Vector Error Correction Model (VECM). Finally, using the Granger Causality Test, the causal relationship between the prohibition of rubbish trade and the reduction of environmental pollution was analyzed. The experimental results show that there is a long-term causal relationship between prohibiting long-term garbage trade and reducing environmental pollution, which verifies the effectiveness of the designed model.

Prohibition of waste trade; reducing environmental pollution; VECM; VAR Vector Autoregressive Model; Granger Causality Test

### 1 Introduction

China is a big trading country, mostly engaged in junk trade with Japan. Japan mainly exports five types of waste to China, including non-ferrous metals, paper or cardboard, copper, plastics and electronic aluminum scrap. More than 90% of Japan's non-ferrous scrap materials, such as copper and aluminum, are shipped to China. So far, Japan's garbage exports have increased year by year, and 90% of the garbage has been dumped into China. There is a mutual promotion between ecological security and international trade, as well as frequent friction. The state must be alert to international trade that threatens ecological security when it comes to foreign economic and trade exchanges, especially pollution imports, including pollution projects and hazardous waste imports. Garbage trade refers to the import of some hazardous wastes that have a serious impact on the environment, which will pollute the domestic environment and endanger the national ecological security. According to the international division of labor and technology life cycle theory, the introduction of foreign trade in waste trade projects refers to the transfer of relatively backward technology and sunset industries from developed countries to developing countries. Part of it is because it has a greater harm to the environment and cannot survive in developed countries. The other part is to look at the lower environmental standards in developing countries to reduce costs. This is actually transferred internationally to reduce environmental pollution. After the waste trade in developing countries, it may aggravate the domestic environmental pollution,

cause environmental pollution and endanger the ecological security of the country. The status quo in China cannot be optimistic. Another way for foreign countries to transfer environmental risks to China is also the most direct way to do garbage trade. Although there are multilateral environmental agreements in the world, they have not been successfully reduced to a minimum. Garbage trade is usually the behavior of domestic businesses and individuals. Although individuals profit from trade (such as the use of inferior technology to extract precious metals), this often leads to pollution of soil, groundwater, and rivers, and even threatens national ecological security, especially security issues about the environment and health. In China, this situation has become increasingly intense. China's junk trade with Japan and other developed countries is economically profitable and in line with China's actual national conditions. It can solve the problem of domestic resource shortage in China and create employment opportunities for China. However, China's environmental legal system is still not perfect, and some waste trade projects lack comprehensive environmental impact assessment. In some places, at the expense of the environment, the development of the economy has caused serious environmental problems and even ethnic sentiment problems. Various examples show that China's waste trade has brought about secondary pollution that reduces environmental pollution or processing. In particular, toxic foreign garbage in illegal trade is seriously harmful and more difficult to accept. Therefore, research prohibiting the use of waste trade is essential to reduce the impact of environmental pollution. Many experts and scholars have studied the relationship between waste trade and the environment, and have achieved good research results.

Fangmiao Hou, Zhongyu Shen, Yong Chen, Yixin Yang published an article in Ekoloji (Issue 107, 2019), entitled "Environmental Performances of Foreign Trade-Taking China's Manufacturing Industry as an Example" (Hou et al. 2019). This article uses the data from 2006 to 2015 to analyze the trend of pollution in China's manufacturing industry, and analyzes the impact of the three major factors of China's manufacturing foreign trade on reducing environmental pollution. According to the analysis, in the foreign trade of manufacturing industry, the technical effect plays a decisive role in reducing environmental pollution. The improvement of structural effects has also promoted the improvement of the environment, and proposed countermeasures and suggestions to improve the environmental impact of China's manufacturing industry. However, there is no mention in this article of the relationship between the prohibition of waste trade and the reduction of environmental pollution. So this article has studied this point.

Liu (2017) proposed the dynamic model of the impact of international trade on environmental pollution in developing countries. This question introduces environmental pollution into the welfare function. The results of dynamic model analysis show that international trade has formed a new saddle-point equilibrium path through environmental division of international specialization. The EKC under open conditions in developing countries is similar in nature to traditional EKC, and environmental pollution is also increased first and then decreased with economic growth. The regression analysis of the EKC shape under open conditions using international panel data shows that the EKC shape of developing countries can be approximated as inverted U-shape, while the EKC shape of developed countries is uncertain. International trade will increase the level of environmental pollution in developing countries, but it will reduce the level of environmental pollution in developed countries. However, the actual application of the model is not good. Zhang et al (2017) proposed a model of the impact of trade liberalization on China's environmental pollution. The purpose of this method is to study the impact of trade liberalization on China's environmental pollution. By establishing a general equilibrium theoretical model of the relationship between trade and environmental pollution, and rationally selecting data, the scale effect, composition effect and technical effect of trade liberalization on China's environmental pollution are quantitatively analyzed. The regression results show that the scale effect will aggravate the level of environmental

pollution in China, and the compositional effects and technical effects will reduce the degree of environmental pollution in China. Trade liberalization will benefit China's environmental protection (Farahmandkia et al. 2017; Weiss et al. 2018). However, this model is difficult to achieve the desired application effect.

Aiming at the problem that the traditional model has poor application effect, the VECM-based model of the impact of the prohibition of waste trade on reducing environmental pollution is designed.

## 2 Idea description

### 2.1 Description of the model setting and measurement method

This article uses the VAR Vector Autoregressive Model to set each endogenous variable of the system as a function of the hysteresis of all endogenous variables in the system. This allows for better prediction of time series with correlation and the dynamic effects of the perturbation term on the variable system (Dmuchowski et al. 2018). However, when the variables in question contain unit roots and there is a cointegration relationship (long-term equilibrium relationship) between variables, it is necessary to construct a vector error correction model (VECM) in order to correctly study the relationship between variables. The existence of a cointegration relationship can only explain the long-term relationship and trend between variables. Therefore, the Granger causality test is used to investigate whether there is a causal relationship between the prohibition of rubbish trade and the reduction of environmental pollution.

### 2.2 Indicator selection and data description

The data is from 2008 to 2018. The specific indicators and data sources are as follows: The environmental data comes from the China Statistical Yearbook and the New China 55 Years Statistical Data Collection. The garbage trade export data comes from the China Statistical Yearbook. The data was collated and processed using Excel 2010 and EViews 6.0 software. The raw data prohibiting the export of junk trade is denominated in US dollars. In order to make the data comparable, first use the annual average exchange rate of the RMB against the US dollar to convert into RMB, and then use the consumer price index (1983=100) to reduce it to eliminate the impact of inflation. Exports of prohibited rubbish trade are taken from natural logarithms to avoid the effects of heteroscedasticity in time series economic data (Asumadu and Owusu 2017).

## 3 Results

### 3.1 Unit root inspection

The variables were tested for stationarity using the ADF test. Based on the data graph, the appropriate model with intercept and trend terms was obtained. Use the AIC principle to select the ADF test lag order. According to the ADF test results, the level values of each variable have the unit root, and the first-order difference values reject the null hypothesis of the unit root. So it can be determined that all variables are 1st order monolithic.

### 3.2 Determination of VAR model

In order to study the impact of the prohibition of waste trade on reducing environmental pollution, a system including one set of VAR models was established. The determination of the lag period  $k$  is critical when building a VAR model. If the lag period is too small, the autocorrelation of the error term is sometimes very serious and leads to a non-uniform estimation of the parameters, but on the other hand, the  $k$  value should not be too large, and the  $k$  value is too large, resulting in a large decrease in the degree of freedom. It directly affects the validity of the model's parameter estimates. In order to select the most suitable  $k$  value, the judgment is based on five indicators: LR statistic, FPE, SC information criterion, AIC information criterion and HQ information criterion. After several actual calculations and comparisons, it is finally determined that the lag order of this model is 2.

**3.3 Cointegration Test and Vector Error Correction Model (VECM)**

Since each variable is an I(1) sequence, it can be analyzed by the cointegration method. Commonly used cointegration test methods are EG test and Johansen cointegration test. The EG test is more suitable for tests with less cointegration between variables, while the Johansen cointegration test is suitable for tests with more covariance between variables (Hao et al. 2018). Therefore, the EG cointegration test method is selected for cointegration test. According to the co-integration equation obtained, the long-term correlation between prohibiting garbage trade and reducing environmental pollution is explained. Because the cointegration test based on VAR model is the VECM model obtained by co-integration constraint on unconstrained VAR model, the lag period is the lag period of the first-order difference variable of unconstrained VAR model. Therefore, the lag period of the cointegration test is 1. The results show that there is one cointegration equation. In the above EG cointegration test results, if there is the cointegration relationship between the variables, the cointegration relationship including all variables is the long-term equilibrium relationship.

The expression of the cointegration relationship in each VAR system is:

$$LnSW = 0.62 - 0.6LnPE \tag{1}$$

Where, PE is forbidden to trade in garbage, and Ln is the degree of environmental pollution. It can be known from the cointegration equation that there is a long-term stable equilibrium relationship between variables, and it is forbidden to reduce the environmental pressure of China to a certain extent.

**3.4 Granger causality test based on VECM**

The test of causality between variables usually uses the causal test proposed by Granger. The VECM-based Granger causality test not only considers the short-term causality between the variables examined by the traditional causality test, but also the long-term causal relationship formed by the cointegration relationship between variables. When there is a cointegration relationship between variables, if the coefficient test of the lag difference term is significant, there is a short-term causal relationship between the variables; if the coefficient of the error correction term is significant, there is a long-term causal relationship between the variables. In addition, the error correction model builds a model of a vector time series to estimate the dynamic relationship of the joint endogenous variables, rather than modeling all of the individual time series. All possible relationships between variables can be examined without any prior constraints. More importantly, the variables in the error correction model have a stationary characteristic, which guarantees the validity of the Granger causality test.

**Table 1 Results of the Granger causality test**

Zero hypothesis	Results
PE is the Granger reason for Ln	4.103575 (0.0428)
PE is not the Granger reason for Ln	5.006657 (0.9350)

It can be seen from the above test results that there is a long-term causal relationship between prohibiting long-term garbage trade and reducing environmental pollution. Conversely, if the garbage trade increases, it will inevitably increase the ecological environment pollution. Although in the process of economic globalization, some regions are engaged in garbage trade, they do not pay attention to the quality of investment and adjust the structure of attracting investment. China's environmental supervision system is still not perfect, and the garbage trade has indeed caused certain negative impacts on China's environment. But conversely, if the ban on rubbish trade will reduce the economic income of some parts of the country, it will certainly slow down the level of environmental pollution and fundamentally limit the inflow of garbage. With the improvement of environmental pollution prevention and control technology, this has alleviated the pressure on domestic environmental pollution

control to some extent. On the other hand, since a large part of China's export products prohibiting waste trade is pollution-intensive and resource-consuming, it is prohibited to reduce environmental pollution in the long run.

According to the results, it can be concluded that there is the one-way causal relationship between prohibiting garbage trade and reducing environmental pollution. That is, the prohibition of waste trade is the Granger cause of the environment, and reducing environmental pollution is not the main influencing factor of the prohibition of waste trade.

#### 4 Conclusions

The theory of environmental economics points out that environment and resources are the basic conditions for human survival and development. The relationship between economic development and environmental protection should be coordinated to achieve optimal allocation and utilization of environmental resources and truly achieve sustainable economic development. The Sino-Japanese garbage trade will have a negative impact on the environment, and its harm to the environment and the potential of the waste itself cannot be ignored. The resources, energy, and environmental crises that we are now aware of are inextricably linked to the rationalization of waste disposal, which has become another breakthrough in China's sustainable development and circular economy. Therefore, the VECM-based model of the impact of prohibition of waste trade on reducing environmental pollution is proposed. Experiments show that the designed model has the better application effect. According to the research data in this paper, China should strengthen import and export management, improve regulations, and ban garbage trade. Learning from foreign advanced technology and experience, it should raise public environmental awareness and cultivate saving living habits.

We must re-recognize the dangers of waste trade, accelerate economic transformation, and raise the level of international trade. It is necessary to fully understand the value and significance of controlling imported foreign garbage and promote the legalization process of imported foreign garbage control. The public should be more fully involved in the process of importing foreign garbage, economic transformation and upgrading of international trade. While minimizing the impact on the environment, we will truly achieve the goal of managing imported foreign waste, economic transformation and upgrading of international trade.

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