



The effect of industrial exports on environmental quality in selected countries

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ABSTRACT

During the last two decades, Relation between trade liberalization & increasing exports with the achievement measure to environmental standards has attracted the attention of researchers. In economy area, this subject has been considered with a specific approach. For this purpose, in this article we are tried with the using of dates ways panel, the exports impact of industrial goods, besides the other effective variables on the environment as income, population & Value Added of industry sector for two groups of The organization of economic & development member countries(OECD) and selected developing countries, like Iran in the period of (1991-2007) has been studied on emission measure of carbon dioxide's greenhouse gas .Also, the effective of variable model on emission measure of sulfur dioxide and nitrogen dioxide as the dependent variable, in OECD member countries has been tested in the period of (1991-2002).The relations between variables with the using of estimation to the ways of fixed impacts , random effects & the way of Generalized method of moments is estimated .The results of model estimation is indicated that the economic development, population growth & the add value of industry sector have positive & significant effect on the emission measure of Pollution in both groups of selected countries. Exports of industrial goods in OECD member countries have positive & significant effect on the emission measure of Pollution & in developing countries have the positive & significant effect too.

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Introduction

During the last two decades, the dangers & the damages of environmental is more evident. This destruction is the resulting of combination factors, like the increasing of population growth, economic development & industrial activities (Dincer 1999). Furthermore, the advocators of environmental & the opponents of trade liberalization stated that export expansion & the increasing the competitive pressures between the domestic entrepreneur & Foreign competitors, they caused to unimportant of appropriate environmental laws in own country & even delays the approval & implementation of environmental laws in the process of trade liberalization .On the other hand, in the new scenario that by some economists like,Helpman (1998), Daniel and Giradina(1998) has been introduced, expansion of trade volume through the increasing competition can help to improve the quality of goods production, services & also implementation of environmental laws. According to the ideas of these economists, expansion of trade volume can help the improvement of living standards in developing countries & the environmental quality.

The beginning of public's attention to the environmental issues occurred in during the1960's & because of growing industrial economies the focus of these attentions was on the industrial pollutions. At the end of 1970's trade & environment issues reached to the highest level & the advocators of environmental to protest the horrible situation of environmental organize the widely oppositions in around the world that with the mentioned protests ,also some countries that by the environmental pollution(such as, Acid rains, Greenhouse Effects, Ozone puncture,.....)Involved the great damages, they

having a request of institutions & international organizations that pay attention to the issue of environmental pollutions & even they wanted the damage restoration of polluter countries. Therefore, the issues of environmental were entered into the trade negotiations from 1980's, that in the period of 1990's by the following of the laws enforcement & environmental regulations in some countries & on the some industries in order to control the destructive impacts of trade on the environment, trade pattern & the competitiveness of industries & countries involved the major changes .

This article is included of five parts: After introduction in second part, a review on Theoretical Foundations of research, has been done, in third part, the conducted experimental studies shall be considered in domestic & foreign of country; Introducing the model & its estimation is presented in fourth part, in fifth part, the results of tests & suggestions is done.

Theoretical Foundations

There are two views about how the effecting of trade volume on environmental quality. In the first view that has been considered by Bhagwati (1993) & Gallagher (2004). Intensification of environmental policies based on the Pollution safe & re-locating industries hypothesis has affected the investment mobility & trade patterns between the countries & the following of it, it will change the measure of Pollution emission. According to this hypothesis, since the developed countries apply the strong environmental policies into the developing countries, the active industrial pollution in the developed countries, they transfer the their operations & production process with the weak environmental policies of own countries to the developing countries, & thus the developing

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countries become a resort for attracting the industrial pollution. Becoming of developing countries as a resort for industrial pollution, according to the access of these countries to comparative advantage, it is justifiable. Because, according to the theory of Comparative advantage, the concerned country in production of goods & services will be professional that, those goods & services with the less comparative cost in compared to other countries to produce and will enter the goods & services that it can produce those goods comparatively with more cost in compared to the other countries.

Therefore, as the situation of lower environmental standards in a country as a source of comparative advantage is Considered & be as a factor for transferring the polluting industries to these countries, in this case the confirmed hypothesis of pollution resort & this is causes some changes in trade patterns between countries¹. In the other hand, with the trade expansion & the transfer of polluting industries to developing countries, environmental quality in these countries can drop. The second view that refers to the positive effect of trade on environmental quality, has been considered by Grossman & Kruger, (1993). According to their study they have separated the effects of trade liberalization, export expansion on the environment situation into three effects, Scale Effect, Composition Effect & Technique Effect. The using of method by these researchers is included the implications for mathematics and geometry. In geometric, they reach to this point that trade liberalization & expanding volume of trade for goods and services pollutants when it can lead to a reduction of environmental pollution that the technique effect to overcome both effects, the scale effect & composition effect. In this method, Scale Effect imply on changing in the measure of economic activities, composition Effect imply in the changing of composition or basket-of-products & Technique effect, Shows the changing in technology and production style & changing to use of clean technology².

So in following of trade liberalization, scale effect tend to increase the environmental destruction & technique effect tend to reduce the environmental destruction. The influence measurement of composition effect is depends on the type of comparative advantage so that according to comparative advantage in a country, if a country has comparative advantage in polluting goods & become professional in producing goods, in this case the composition impact by the changing the composition of the country product goods in order to polluting goods, has negative impacts on environment, a country become specialized in the production of clean products, in this case, composition effect will has a Positive effects on environmental Quality. Generally in following of trade liberalization if technique effect to overcome the scale effect, composition effect (in a country with the comparative advantage in Polluting industries) or if technique effect with the composition Effect (in a country with comparative advantage in clean industries) to overcome the scale effect, in this case trade liberalization lead to positive results of environmental³. So, according to this view can see that trade liberalization through the scale, composition & technique effect can be influential on the measurement of environmental Pollution. About the scale effects can be stated that Pollution emission was a by-product of the process of production and consumption & with the scale increasing of

economic activities, environmental pollution will increase. Technique effects also been included the using of different methods of production will have different effects on environmental pollution in due to possibility of substitution between factors, Composition effects also imply on this that each product has its own appropriate level of pollution & hence composition of traded goods can effect on the measurement of pollution⁴.

Empirical Studies

In this part are discussed about the studies on the study of relation between trade volume, exports and environmental quality.

Antweiler et al (2001) with the using of scale, composition & technique effects have studies on the manner of exports effecting on environmental quality. The results of researchers studied, indicates that exports had a negative effect on the environmental quality.

Copeland & Taylor (2003) in their study have shown that the net effect of pressure of trade volume on the sulfur dioxide emission (SO₂) has been negative and significant. In the other hand, with the expanding of trade volume, at first in due to expansion of production scale the measurement of sulfur dioxide has increased but finally in due to dominance of technique effect on the scale effect, the measurement of sulfur dioxide's concentration decreases.

Frenkel & Rose (2005) have studies about the influence of trade volume on the indicators of environmental quality like carbon dioxide, nitrogen dioxide in America. They in this study understand that increasing of trade volume has significant & negative effects on the indicators of air pollution & especially on carbon dioxide emission.

Jie He (2005) with the using of simultaneous equations system & the Panel dates techniques has studied on the influence of trade volume on indicators of environmental quality in China in during the years 1993 – 2001. He in this study has reached to this result that the increasing of exports causes the reducing of carbon dioxide emission & also other indicators of environmental quality.

Mangi (2006) in a study with the using of panel data method, studied about relation between exports, economic growth & environmental quality in 115 countries, in countries with high and low per capita income during the years 1960 – 1999. The results indicates that for all countries that have been investigated, export causes the increasing of environmental pollution, but for countries with high per capita income, export variable has significant & negative effect on environmental Pollution. Moreover, in all estimation conditions of model, the influence of scale variable into influence of technology variable is more.

Jha & Muthukumara (2006) in their study have studied about the influence of trade volume on environmental quality in Vietnam for the period 1997 – 2002. The results of this study show that, exports have positive and significant on carbon dioxide emission in this country.

Khalil & Inam (2006) in their study with the using of cointegration method of Johansen Jodelius have studied on long-time relation between foreign trade and environmental quality in Pakistan during the years 1960 – 2004. The results of this study indicates that there were long-time equilibrium relation between exports and the indicators of environmental

¹. Holinger (2008)

². Antweiler et al (2001)

³. Mukhopadhyay (2006)

⁴. Khalil et al, (2007)

quality(The variable of carbon dioxide emission & Arable lands), exports & foreign direct investment have positive effect on the emission of carbon dioxide & have positive & non-Significant on arable lands.

Shen (2008) in his study with the using of panel dates techniques have studied on the scale effects, the combination & the technology on environment destruction in the states of China during the years 1993 – 2002. The results of this study indicates that, the Factor Endowment Hypothesis has been confirmed for the states in China & the increasing of export lead to environmental destruction(The more emission of environmental pollutants, like so₂).

Kazerony & Feshary (2011) Studied the effective of exports industrial on the Iran environmental have studied on the long-time relation between exports of industrial goods & the indicators of environmental quality in Iran during the years 1974 –2007. Autoregressive distributed lag method of there for studying on Long-Run relation between the variables of industrial exports &the indicators of air pollution & the exports variables of industrial goods, GDP⁵ per capita & the density of population have positive and significant effects on the emission measurement of carbon dioxide, finally, the findings from this study show that the influence variable of industrial goods exports on the carbon dioxide emission is positive but it is far less than other variables.

Lash Kari zadeh & Nabavi(2009) have studied about influence of Foreign Direct investment & environmental pollutants with the using of cointegration method in six developing countries, Malaysia, Thailand, Singapore, Indonesia, Philippines & Iran during the years 1975 – 2005. The results showed that Foreign Direct Investment has long-time and short-time positive & significant effect on carbon dioxide pollutant in all studied countries except Singapore.

Introducing of model& research dates

In this subject in order to studying of influence factors on the exports of industrial goods & environment & realize the importance of each factor, we use of Grossman & Kruger's proposed model as follows:

$$(1) CO_t = F(GDP, POP, EXP, IND, GDP^2)$$

So, we can use of the above model like the under equation:

$$(2) \text{Log } CO_{it} = X_0 + X_1 \text{Log}GDP_{it} + X_2 \text{Log}POP_{it} + X_3 \text{Log}EXP_{it} + X_4 \text{Log}IV_{it} + X_5 \text{Log}(GDP)_{it}^2 + \epsilon_{it}$$

Where,

CO₂: The emission of Carbon dioxide (Kilo Ton)

GDP: Cross domestic product (The fixed price of year \$ 2000)

POP: Population

EXP: Exports of industrial goods (As a percentage of trade exports goods)

IV: The added value of industry sector (As a percentage of GDP)

GDP²: Square of GDP

In the above equation, indices i and t, are indicated respectively for countries and years. In addition to, carbon dioxide, also Sulfur dioxide & nitrogen dioxide are also as most important air pollutants, So in the continuing of this subject, the under models has been added for completing the research.

$$3) \text{Log } SO_2 = X_0 + X_1 \text{Log } GDP_{it} + X_2 \text{Log}POP_{it} + X_3 \text{Log}EXP_{it} + X_4 \text{Log}IV_{it} + X_5 \text{Log}(GDP)_{it}^2 + \epsilon_{it}$$

$$4) \text{Log } NO_2 = X_0 + X_1 \text{Log } GDP_{it} + X_2 \text{Log}POP_{it} + X_3 \text{Log}EXP_{it} + X_4 \text{Log}IV_{it} + X_5 \text{Log}(GDP)_{it}^2 + \epsilon_{it}$$

That in these equations SO₂, the emission of Sulfur dioxide & NO₂, and the emission of Nitrogen dioxide per ton has been considered.

It should be noted that the studied period of time was in years 1991-2007 & the needed statistics to estimate the model is provided from the site of World Bank & the site of OECD member countries.

The Estimation of model

Since, the related dates of this study are as combination of cross-sectional dates & are time series, therefore, according to the tests of individual effects, for estimation the model can use of panel Data. In the ways of panel dates, at first two tests are performed:For determining the way of Pooled least squares and Fixed Effects use F test also & for recognition the way of Fixed Effects or Random Effect Hausman test is used. Results in F-test in both groups of countries with considering the carbon dioxide as a dependent variable, emphasize on the way of fixed effects. The results in the Hausman test show that for OECD member countries the way of fixed effects is valid. But in developing countries according to the Hausman's test, are emphasized on random effects. If SO₂ & NO₂ are as an indicators dependent variable, the method of fixed effects for estimation the model will be valid and reliable.

The table 1, shows the results of model estimation for the OECD member countries through the way of fixed effects & random effects. The variables of GDP, population & the added value of industry sector in the probability level above 95% have positive and significant relation with the logarithm of carbon dioxide emission.

The variable of export goods factory in OECD member countries has Negative and significant relation on the pollution emission of carbon dioxide. Indeed, with the increasing of exports for these goods in the mentioned countries the measurement of pollution emission have been reduced.

The table 2 The variables of GDP, Population, Manufacturing exports & the added value of industry sector in developing countries, according to both ways of fixed effects and random effects , show the positive and significant relation with the emission pollution of Carbon dioxide in the probability level above 95%.

GDP² which is expression the environmental Kuznets curve in the group of OECD member countries & developing countries are indicates a significant negative relation with the release of pollution. The conclusion has implications for the accuracy of environmental the environmental Kuznets curve. Indeed, with increasing of economic growth the measurement of CO₂ emission pollution with the reducing rate is rising.

The results of the estimation model for both dependent variable SO₂ & NO₂ in the way of fixed effects in the table 3 on the positive and significant relation of GDP variables & the added value of industry sector with the logarithm of SO₂ & NO₂ emission is implies. The variables of population & export of industrial goods are having significant & negative relation with the release of SO₂ and NO₂ pollution.

⁵ . Gross Domestic Product

Table 1: Results of Estimation model in the OECD member countries (Dependent variable is LOG(CO2))

Estimation Explanation variables	Random effects		Fixed effects	
	T Statistic	Coefficient	T Statistic	Coefficient
C	-3.92	-2.16*	-5.650	-7.65*
Log(GDP)	3.858	0.726*	3.010	0.565*
Log(POP)	3.939	0.179*	6.144	0.927*
Log(EXP)	-3.805	-0.294*	-1.894	-0.112*
Log(IND)	6.948	0.429*	11.78	0.5001*
Log(GDP ²)	-3.438	-0.075*	-2.787	-0.062*
R ²	0.162		0.988	
F	12.906		988	
DW	0.558		0.851	
Significant at 5%* ,** Significant at 10%				

Source: Computing research of the result of EvIEWS6 output program.

Table 2: The results of the estimation model in developing countries (Dependent variable is LOG(CO2))

Explanation Variable \ Estimation	Random effects		Fixed effects	
	T Statistic	Coefficient	T Statistic	Coefficient
C	-3.865	-4.543*	-5.6134	-7.1739
Log(GDP)	3.06	1.862*	6.2112	2.4437*
Log(POP)	2.021	0.127*	2.0212	0.35656*
Log(EXP)	1.806	0.068**	2.5393	0.08126*
Log(IND)	2.193	0.250*	3.0233	0.2028*
Log(GDP²)	-2.774	-0.238*	-5.8896	-0.3216*
R²	0.356		0.991	
F	12.51		513.3	
DW	0.497		.917	
* Significant at 5% , ** Significant at 10%				

Source: Computing research of the result of EvIEWS6 output program.

Table 3: The results of the estimation model in OECD countries with the using of fixed effects

Table 5: The Results of the estimation model in OECD countries with the using of fixed effects				
Dependent variable Explanatory variables	Log(NO2)		Log(SO2)	
	Fixed Effect			
	T Statistics	Coefficient	T Statistics	Coefficient
C	4/511	9/632*	6.524	41.04*
Log(GDP)	2/762	1/254*	2.239	1.887*
Log(POP)	-6/583	-1/460*	-7.947	-5.912*
Log(EXP)	-2/691	-0/281*	-3.526	-0.820*
Log(IND)	14/123	1/117*	8.942	1.765*
Log(GDP')	-2/523	-0/137*	-2.095	-0.218*
R'	0/998		0/994	
F	4653		1239/5	
DW	0/566		0/712	
Significant at 10%** Significant at 5%*				

Source: Computing research of the result of EvIEWS6 output program.

Table 4: The results of the estimation model in OECD member countries with the using of random effects

Table 47: The Results of the estimation model in OECD member countries with the using of Random effect.				
Dependent Variable Explanatory variable	Log(NO2)		Log(SO2)	
	Random Effects			
	T Statistics	Coefficient	T Statistics	Coefficient
C	-9/439	-11/67*	-6.275	-17.701*
Log(GDP)	6/245	3/358*	5.097	6.405*
Log(POP)	16/486	1/008*	10.845	1.165*
Log(EXP)	-5/549	-0/918*	-4.962	-1.835*
Log(IND)	10/122	1/208 *	6.260	2.020*
Log(GDP[*])	-6/212	-0/396*	-5.418	-0.819*
R²	0/75		0/513	
F	59/44		36/74	
DW	0/327		0/451	
Significant at 10%** Significant at 5% *				

Source: Computing research of the result of EvIEWS6 output program.

Table 5: The results of the estimation model with using of GMM method (Depended variable is (LOG(CO2))

<div>Countries Group</div> <div>Explanatory variables</div>	Developing countries		OECD countries	
	T Statistic	Coefficient	T Statistic	Coefficient
C	-20/98	-0/153*	-133/9	-0/79*
LogCO2(-1)	2889/5	0/972	3734/6	0/96*
Log(GDP)	14/62	0/059*	127/8	0/35*
Log(POP)	45/02	0/004*	77/03	0/008*
Log(EXP)	19/97	0/005*	-52/79	-0/047*
Log(IND)	21/61	0/011*	116/4	0/076*
Log(GDP[†])	-9/94	-0/005*	-124.1	-0/041*
N	17		20	
R[†]	0/97		0/977	
Instrument rank	8		8	
J-statistic	206/8		13/53	
* Significant at 5% ,** Significant at 10%				

Source: Computing research of the result of EvIEWS6 output program.

Table 6: The results of the estimation model with using of GMM method in the OECD member countries

The results of the estimation model with using of GMM method in the OECD member				
Dependent variable Explanatory variables	Log(NO2)		Log(SO2)	
	T Statistic	Coefficient	T Statistic	Coefficient
C	-52/02	-0/417*	-40/37	-1/48*
LogSO2(-1)	-	-	979/03	0/936*
LogNO2(-1)	4992/9	0/996*	-	-
Log(GDP)	67/7	0/233*	48/35	0/782*
Log(POP)	14/63	0/003*	55/99	0/061*
Log(EXP)	-67/85	-0/067*	-57/34	-0/352*
Log(IND)	43/43	0/032*	52/87	0/206*
Log(GDP[*])	-68/36	-0/028*	-48/41	-0/098*
N	20		20	
R²	0/996		0/987	
Instrument rank	8		8	
J-statistic	74/17		61/21	
* Significant at 5% ,** Significant at 10%				

Source: Computing research of the result of EvIEWS6 output program.

The estimation of above model in the way of random effects for both mentioned dependent variable, states positive and significant relation of GDP variables, population & added value of industry sector with the emission of SO₂ & NO₂. Only, the variable of industrial exports has negative & significant effect on the emission of above gases.

In the presented statistics models, the statistic of Durbin-Watson states the existence of residual correlation components. For solving this problem, based on dynamic panel models be discussed on GMM. To estimate the model by this method, at first it is necessary to determine the instrumental variables used in the model. In order that the results in these methods be more reliable, should the number of observations to be enough large, because in this method, when the number of observations is small, due to the high bias, it is possible that the interpretation of results be confronted with the problem⁶. GMM by reducing the sample bias increases the stability of estimation.

The results of the estimation model with regard to carbon dioxide as the dependent variable, for OECD member countries & developing countries, can be seen in the table 5. The lag variable of CO₂, GDP, population & added value of industry sector, for both groups of selected countries have positive & significant relation with the emission logarithm of carbon dioxide. The exports variable of industrial goods is having of negative relation in OECD member countries & the positive relation with the emission of carbon dioxide pollution in developing countries.

Conclusions and suggestions

Most advocate economists of expansion foreign trade believe that trade liberalization is considered as an important & influence factor on economic growth of communities. But in recent decades has been noted that the growing trade without considering of environmental standards & just in order to access the market products in other countries, lead to indiscriminate & incorrect use of resources & energy & it has caused much pollution in the world in order to emission of greenhouse gases like Carbon dioxide. Hence, due to the importance of environmental quality, in this research, the exports effects of industrial goods research on Environmental Quality has been investigated in two groups countries, OECD member countries & developing countries.

The results of this study are as follows:

The Coefficient variable of GDP in the model shows that this variable on the dependent variable, environmental pollution (Carbon dioxide) has positive and significant effect in both groups of countries. So increasing in GDP or income has significant effect on the increasing of environmental pollution, so that in countries that are in initial steps toward developing or in other words are in the lower levels of development with efforts to attain higher levels through cause to increase of GDP, such as agricultural activities, intensify to mining with using of old and inefficient infrastructures & because of technological & industrialization & followed by it, cause destruction of natural resources & Production wastes, the increasing of environmental pollution would not be unexpected.

The coefficient variable of population for both groups of countries has positive and significant effect on the increasing of emission measurement of carbon dioxide pollution. So, uncontrolled growth of population is effective in the destruction

of environmental resources & for avoiding of these negative environmental effects, necessary programs should be performed. About the relation of variable value added in industry sector with the amount of carbon dioxide emission as indicator of environmental, the Result of this research show that there is a positive and significant relation between them in the studied countries. In other words, with the changing of economic structure & expansion of the industrial sector because of more emission of pollutants, the environmental quality will worse.

The coefficient variable of industrial goods exports in the OECD member countries in this research implies a significant negative relation with carbon dioxide emission as indicators of environmental. In the other side there is developing countries that this relation is positive and significant which itself is a reason to emphasize on the Pollution haven hypothesis.

The indicator coefficient variable of industrial goods exports in the OECD member countries as indicators of environmental shows a significant & negative relation with the emission of sulfur dioxide & nitrogen dioxide pollution.

According to the results of this research, suggested that governments in developing countries such as Iran that they are passing from agriculture to industry, with the enactment of laws & environmental standards, like apply taxes on pollution, should have to the industrial manufacturers use of technologies that creates less pollution or reduce the created pollution. As it is necessary to use of the specific technologies to control the pollution is the best common diplomacy in protecting the environment and reduce air pollutants in economy of most developed countries.

It also recommended economic policymakers with appropriate policy proceed to development of export goods that provides the green business in the future. In other words, government can combine reasonably the both trade, policies & environmental such a way that, benefits of expanded trade be provided with environmental protection.

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