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Green Tax and Environment

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ABSTRACT

Taxes as a reliable revenue source have always been taken into consideration by governments. Tax imposition creates many disorders in economics but "green taxes" do not have such quality. Since the green tax is applied based on the cost and expense, they have a large scope and bring about good income for the government. Therefore, they can be replaced to other tax bases. On one hand, it reduces the effect of creating disorder by the other taxes; on the other hand, it increases the benefits of the society because of the reduction of the pollution. In this study, the effect of the green tax along with other influential variables on environment such as the index related to technology and GDP per capita, Population and degree of trade freedom on the amount of the pollutant, carbon dioxide and Nitrogen dioxide, sulfur dioxide and also the influence of these taxes on EPI (Environmental Performance Index) was examined in 34 countries which were the members of OECD countries during the period (1995 to 2006) have been studied. The findings show that the imposition of such tax has caused the reduction of air pollution and the improvement of environment in the selected countries.

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Introduction

Economic development causing the excessive pressure to environment in recent decades and nature has been faced with irreversible damage. Then nowadays attention to environmental effects and development in economic issues are very important. Fiscal policies are an important economic tool for implementing of environmental policies in each country. So the environmental taxes are as a sustainable development topic in countries also are an Effective policies in the field of controlling the environmental factors with using of economic instruments.

Although in the economics literature the taxes to be assumed as a deviation in allocation of efficient resources and the deviation from optimal condition of Pareto and the argument is that the taxes condition will cause the waste of economic resources but nowadays the economists believe that the tax condition on pollutant is as an important factor in order to reach the environment goals and the improvement of financial System. On the one hand the tax condition on pollutant reduce the pollutants production also cause reforming the structure of industries technological on the other hand it create an appropriate financial resources for government which provides the implementation program of government's environmental policies. Some types of these taxes are used in different countries including: Tax on waste and trash, tax on energy (Electricity and Gas), tax on carbon dioxide emissions, tax on the existent carbon in fossil fuels, tax on mineral oils and crude oil, tax on nitrogen oxide and sulfur dioxide, tax on underground aquifers, tax on sand and pristine cliffs, the complications of climate changing caused by industrial and energy usage in jobs. Various studies have done in order to investigate the mentioned environmental taxes' types on the amount of pollutants in different countries. Also one of important indicators of countries developing is environmental performance in the 21st century. Global reports of countries' environmental performance

indicator is one quantitative factor in the controlling of pollution and the consequences of natural resource management which jointly the research centers, especially Yale and Columbia Universities in America, World Economic Forum in Davos of Switzerland, Research Centre of Union Europe to codify it. This indicator has determined the broad and accessible targets for the environmental performance of countries which based on can evaluate that each of the world countries how much are close to these goals. Fulton (1998), in a research with "Green Policies" title with using a simple general equilibrium model presented a estimation about the price of waste and also the subsidy which should be paid for its recycling. He in his research has been calculated the price per unit of household waste disposal and the absorbing of factories trash and he concluded that taxes action on the waste disposal has a significant impact on the reduction amount of trash production.

However, the experience of one country is possible be not useful for other country because the development level besides many other factors such as culture, traditions and political and administrative infrastructure are different from qualitative and quantitative aspect.

Nevertheless can use of other countries experiences also can use of common elements and can see the obvious differences. In this paper in order to study on the positive and significant hypothesis of green taxes on reduction of air pollution in OECD countries also the significant and positive impact of these taxes in improvement of environmental performance indicator is use of panel data and generalized method of moments (GMM). In this paper first of all we have discussed on the definition of green taxes then we have introduced the model and data and research method and results of the model's estimation finally we have studied on conclusions and suggestions.

The definition of green tax

Nowadays the environment is as one of the main elements of sustainable development. The development of other economic and public sectors is significant with its stability and proper function. Also for this reason in previous years and especially since the early 90AD also at the same time with leaders conference in 1992 in Rio de Janeiro of Brazil, the attention of global community were focused on the subject of environmental protection and also for this reason the process of policies developments and the environmental programs shows the developmental process in during the past year and is indicated the promotion of environmental status in the country planning System and the attention of various departments to environmental considerations.

Environmental taxes are one of the important tax bases. This taxation as an instrument of fiscal policy has allocative effects. Green taxes can be divided into two groups:

1. The Direct taxes (pigou tax)
2. The indirect environmental taxes

Direct taxes have certain rate in such a way that is determined toward any unit of pollutant emissions or environmental degradation. Tax rate is equal to social final cost in socially efficient level of emissions. The socially efficient level of emissions when it occurs that the ultimate benefits resulting from pollution removing for companies is equal to social final cost of emissions. Generally the direct taxes by raising the pollution costs through increasing the social costs causes that those who create the pollution be faced with personal and social costs of his actions.

Indirect environmental taxes with using the incentive pricing mechanism causes until the producers and consumers change their disposal and emissions behaviors. In this type of tax instead of catching the direct taxation according to pollution unit determine the taxes on production inputs or the consumption of goods which using of them will damage the environment. For this reason it is possible that the emissions level of socially efficient obtained somewhat.

According to the financial market of green taxes for enterprises and people also because the imposing of such taxes is new their implementation will be faced with some resistances. On the other hand all economic sectors which use of government's helps, exemptions and subsidies and their existence is dependent on government support will react against the new basis of this tax. Also the accuracy of pollution cost was not possible also is not well known. The green tax's design and implementation process are different in countries. Below a brief history of this process in OECD member countries are discussed.

Research Background

Amin Rashti (2006), in a research with using of Rotterdam system studied on green taxes performance on polluting goods and shows that the performance of this type of tax can reduce the amount of demand for polluting goods. Finally, the researcher concludes that:

- 1- With tax performance on pollution; the consumption amount of these goods reduced according to the own price elasticity.
- 2- With tax performance on fuel and transportation the demand for other goods will increase comparatively.
- 3- In between introduced environmental goods the domestic fuel has the lowest income elasticity.

Gilbert E. Metcalf (2009), in a research with this title "Reacting to Greenhouse Gas Emissions: A Carbon Tax to Meet Emission Targets" his paper describes a variant to address concerns of environmentalists that a carbon tax does not provide certainty of emission reductions over the control period. The Responsive Emissions Autonomous Carbon Tax (REACT) combines the short-run price stability of a carbon tax with the long-run certainty of emission reductions over a control period.

KIM, TAE HEON (2009), in his research with this title "Differential Effects of Green Tax Reform over Economies" show under revenue-neutral assumption, that in the Korean economy which already has a high rate of tax on energy products how much introducing carbon taxes could decrease the revenue amount of preexisting energy taxes which could be returned to household also show that the welfare cost of carbon taxes could be reduced when the revenue of carbon taxes is returned to cut preexisting energy taxes.

Moreover he shows that in the framework of general equilibrium, that introducing carbon tax could achieve welfare gain if the rate of carbon taxes is in appropriate range and the revenue of carbon taxes is returned to cut preexisting distortionary taxes. Finally, the simulation results show introducing carbon taxes heavily affects the production in energy intensive sectors.

Pajoyan and lashkarizadeh (2010), in a research with using of panel data way discussed on the effect of economic growth, technical changes, preferences and political (Environmental taxes) on the amount of major air pollutants in 56 selected countries with different levels of development such as Iran during the period 1995 – 2005. The results indicate that despite the positive impact of economic growth on the amount of pollutants, the promotion of technology level has an important role in reduction of sulfur dioxide, nitrogen pollutants and also the improvement of related indicators to political effect (Environmental taxes) has an important role in reduction of carbon dioxide pollutants.

Carlos de Miguel and Baltasar Manzano (2010), in his paper "Green tax reforms and habits" the findings show that, when taxes on household energy consumption increase, habits and transitional dynamics alter household decisions, and change the efficiency dividend. However, when the tax increase is on energy used as an input, reform always induces a welfare cost in terms of efficiency. In this case, habits play a less important role.

Steffen Kallbekken and Hakon Sælen (2011), studied on "Public acceptance for environmental taxes: Self-interest, environmental and distributional concerns" Their results suggest that support for fuel taxation is best predicted by beliefs about environmental consequences, followed by beliefs about consequences to others. Beliefs about consequences to self (self-interest) are the factor that explains the least variation in support for fuel taxation. The academically interesting result that support cannot be well explained without capturing a broad range of motivational factors is also highly policy relevant. It implies that there is no magic formula for increasing public support for environmental taxes.

Edenhofer, Ottamar, and Matthias Kalkuhl (2011) in a research refer to green contradiction term. "Green contradiction" Means that progressive taxes on resources make faster the global warming. Because the resource owners believe that increasing of short-term extractions is because of tax increasing in future. In this paper it has been shown that this effect just occurs for

specific set of carbon taxes which increase with higher speed from effective speed of resources owners' discount.

The introduction of models and data

With using of presented model can consider that influencing factors on environment are related to following effects:

1. Scale Effect
2. Technical Effect
3. Political Effect
4. Open economic effect

- Scale effect: It means that at the time of income increasing which is arising from the economic wider activity will create more pollution. It is expected that scale effect on pollution according to other two effects is an increasing monotonic function of income. In this paper in order to measure the effect of scale is used of GDP per capita variable and the index of total population.

-Technical Effect: Basically the pollution reduction activities are function of used technology level in theme. The improvement of technology is effective in pollution reduction like two below forms:

The first one, with technology improvement and with using of new technologies the production functions will have less require to environmental goods or as production complementary goods will produce less pollution. It means that goods production will damage the environment less.

The second, the technology improvement can also occur in industries reduction pollution and cause that these industries to act efficiently and will act with lower costs in order to disposal of pollution.

-Political Effect: The results studies show that in stages of economic development the governments usually do not pay attention to environmental degradation also people do not show to think and act about the environment condition just think about the level of their income in order to make money. The governments with high political maturity lead the society towards people preferences. The used political variable in the model is the green tax index.

-Open economic effect: The commercial exchanges can be affected on environmental pollution. There are environmental taxes (green taxes) in OECD countries, for this reason these countries are in the following of cleaning goods (Goods that have less pollution) production and produce the environmental pollutants goods in other countries. Thus, the trade liberalization is useful for developed countries and reduce the air pollution also increase the efficiency of environmental performance indicator (Epi). In this paper is used of trade openness degree's indicator in order to measure the effect of open economy.

The used model in this study is of Grossman and Krueger's studies (1992) which are considered as follows:

1. $Co_2 = f(GDP_p, GT, POP, R \& D, DF)$
2. $So_2 = f(GDP_p, GT, POP, R \& D, DF)$
3. $No_2 = f(GDP_p, GT, POP, R \& D, DF)$
4. $Epi = f(GDP_p, GT, POP, R \& D, DF)$

For creating the relationship between green taxes and emissions of gases such as carbon dioxide, sulfur dioxide and nitrogen dioxide also the environmental performance indicator as environmental indicators and with mentioned theoretical foundations then the above model can be considered as the following equation:

$$5. \log Co_2 = \alpha_0 + \alpha_1 \log GDP_{pit} + \alpha_3 \log GT_{it}$$

$$+ \alpha_4 \log POP_{it} + \alpha_5 \log RD_{it} + \alpha_6 DF_{it} + \varepsilon_{it}$$

$$6. So_2 = \alpha_0 + \alpha_1 GDP_{pit} + \alpha_3 GT_{it}$$

$$+ \alpha_4 POP_{it} + \alpha_5 RD_{it} + \alpha_6 DF_{it} + \varepsilon_{it}$$

$$7. No_2 = \alpha_0 + \alpha_1 GDP_{pit} + \alpha_3 GT_{it}$$

$$+ \alpha_4 POP_{it} + \alpha_5 RD_{it} + \alpha_6 DF_{it} + \varepsilon_{it}$$

$$8. E_{pi} = \alpha_0 + \alpha_1 GDP_{pit} + \alpha_2 GT_{it} + \alpha_3 POP_{it}$$

$$+ \alpha_4 RD_{it} + \alpha_5 DF_{it} + \varepsilon_{it}$$

In the above equations the used variables are as follows:

Co_2 : The emissions of carbon dioxide (According to KT)

So_2 : The amount of sulfur dioxide emissions (According to KT)

No_2 : The amount of nitrogen dioxide emissions (According to KT)

GDP_P : GDP (Constant price\$ 2,000)

POP : Population

GT: Green tax

R&D: Research and development expenses

DF: Degree of trade freedom (The sum proportion of exports and imports on GDP)

ε : Error term

The research method

In this study for statistical analysis and for doing the econometric methods is used of Eviews 6.0 software. For estimating the models' variables coefficients according to models specification are used of Panel data and GMM method. One of the over-identifying restrictions tests is Sargan test and the reported J statistic in GMM estimation is the statistic Sargan (The amount of GMM objective function in the estimated parameters). So is used of the mentioned statistics for making the Sargan test of over-identifying restrictions. (Wooldridge, 2001)

The results of models Estimation

About the model estimation (The effect of environmental taxes on reducing the carbon dioxide emissions) can be expressed that the obtained coefficients are in probability level over 5%. Although the F statistic indicate that whole model is significant with constant effects method. But the Durbin Watson statistic shows the correlation of residual parts with dynamic panel method in estimation. To resolve this problem and for determining the model coefficients 'consistency in quantitative have been used of dynamic panel method. In GMM method all the variables have significant relationship with emissions. In continue we study on the analysis of coefficients and the obtained values in conducted estimation:

-With considering the obtained signs and coefficients of estimation can be seen that the role of environmental taxes is significant in reduction of pollutants such as CO₂, NO₂, SO₂ in OECD countries and coefficient of environmental taxes are negative (With the increasing of environmental tax the air pollutants are reduced). Also the role of environmental taxes is significant and positive because of pollution reducing on environmental performance indicator.

- Being positive of GDP coefficient in the models results such as the effect of green tax on the reduction of air pollutants, SO₂, NO₂, CO₂ is indicate the increasing of the released pollution level for increasing of each unit in GDP per capita in the OECD countries. Also the amount of GDP per capita coefficient for pollutants such as CO₂, SO₂, NO₂ in OECD

countries shows that the amount of these pollutants' emissions has significant increasing because of produced per capita income in the most studied countries which it is because of economic activities, especially industrialization and the increasing of the cars number in the last few years which leads to intensive exploitation from fossil fuels such as coal, oil and gas for production and transportation also being negative of GDP coefficient in model(The effect of green taxes on the environmental performance indicator) indicate that the reduction of environmental performance amount is because of pollution increasing, because the GDP growth is associated with the increasing of environmental pollution.

-The variable coefficient of technology in the estimated models (The effect of green taxes on the air pollutants "N02, SO2 CO2" reduction) is negative and significant. It means that with the promotion of technology level the pollution will be reduced. Most OECD countries in recent years with the achieved progress related to new technologies they have been able to do both, reduction the pollution also the do some acts in order to prevent of new pollution with achieving to standard level of pollution also being significant and positive of technology coefficient in the model's results(The effect of green taxes on environmental performance indicator) means that with increasing the technology coefficient the amount of pollution

will reduce in these countries and caused that the environmental performance index increases.

-Being positive of population coefficient in the results of the green taxes effect on the air pollutants (N02, SO2, CO2) reductions' model is indicate the increasing of released pollution in the OECD countries. In other words the increasing of population is associated with increasing of pollution. Being negative of population coefficient in the results of the green taxes effect on environmental performance indicator's model shows that the increasing of population will increase the pollution and because of that will reduce the environmental performance.

-Being negative of trade's freedom degree coefficient in the results of green taxes effect on the reduction of air pollutants' models (N02 , SO2 , CO2) indicates that commercial exchanges in the OECD countries cause the reduction of air pollutants and in model "the effect of green taxes on environmental performance indicator" the increasing of commercial exchanges will improve the environmental performance.

-In the model "the effect of green taxes on the reduction of carbon dioxide emissions" sargan statistic shows that used tools are valid.

- The determination coefficient of (R2) in all models shows that more than 60% of the dependent variables are described by model's explanatory variables in OECD countries.

Country	Explanation
Australia	Tax on waste was performed in this country in 1989 and taxes on gas and electricity energy was introduced in 1996. The tax rate on electricity increased in mid-2000.
Belgium	This country introduced the new taxes about energy products in 1993.
Denmark	The tax on fuels'carbon dioxide was introduced in 1992 and the reforming of tax system was scheduled with the continuous evolution of the energy taxes until 2002. The main aims of reforms including: Reduction of final tax rates at all income levels. Gradual transfer of tax revenue from work and revenue to new pollution sources and environmental. Of course many of these taxes have numerous exemption and complex structure which it is possible reduce the environmental effectiveness.
Finland	This country is the first country that introduced the taxes which particularly reduce the carbon dioxide emissions .Tax on fossil fuels carbon was introduced in 1990.
France	Restructuring of related taxes to environmental was started in 1990 which was including the expansion of public tax on the polluting activities of taxes on fossil fuels and electricity.
Germany	Germany performed the ecological tax reform in April 1990. The main purpose of these reforms was the creation of encouragement in order to energy savings and facilitating changing of industrial also the providing of finance renewable energy programs and increasing of working through the reduction of tax burden on labor. These reforms were including on rate increases for electricity and oil tax.
Italy	Environmental taxes including taxes on Co2 fossil fuels were introduced in 1998.
Netherlands	This country was introduced the public tax of fuel in 1988 and a number of environmental taxes include waste tax and tax on underground aquifers in 1995, 1996.
Swedish	The major tax modification was performed in Swedish in 1991.
England	Tax on waste was performed in 1996, the income from these taxes been allocated for reducing the social security rights and the "complication of climate changing "on industry and the application of energy job was introduced in 2001.Tax on sands and pristine cliffs was introduced in 2002.
Norway	Tax on crude oil Co2 was introduced in 1991.
Switzerland	In a referendum which was held in this country in 2000, two plans related to green tax modification were rejected which includes: 1.Tax on all renewable energies that the revenues from them were used for reducing the social security rights. 2. The low complication of nonrenewable energies which its revenue was used for promotion of renewable energy sources and the increasing of energy efficiency.

Source: Database of (OECD) countries

Table 4: The results of green taxes effect's estimation on the reduction of carbon dioxide pollutant in OECD country with the constant effects and GMM method

Co2(GMM method)		Co2(Constant method)		Explanatory variables	
Probability	Coefficients	Probability	Coefficients	Logarithm of GDP (Constant price 2000)	Scale effect
0.0000	5.244596	0.0000	1.719863		
0.0000	1.189729	0.012	0.707598	Logarithm of total population	
0.0000	-0.176767	0.0144	-0.040954	The logarithm of Research and development expenses(Percent of GDP)	Technology effect
0.0087	-0.035242	0.0000	-0.025673	Logarithm of green tax(Percent of GDP)	Political effect
0.0024	-0.106629	0.0000	-0.197736	Degree of trade freedom	Effect of open economy
0.739535		.9999		R2	
		P-val=(0.0000) F(33.293)=721.143096		F statistic	
		p-val=(0.0001) CHISQ(6)=27.95071		Houseman statistics	
32.20686				Sargan test	
Significant in 5%					

Source: researcher's findings

Table 5: The estimation of green taxes effect on environmental variables (so2, no2, Epi) in OECD country of panel least squares method

Explanatory variables		SO2		NO2		Epi	
scale Effect	GDP(Constant price 2000)	Coefficients	Probability	Coefficients	Probability	Coefficients	Probability
	The total population	1.10E-09	0.000	2.13E-09	0.0000	-0.00597	0.0585
		1.17E-05	0.0387	0.000139	0.0000	-2.50E-07	.0002
Technology Effect	Research and development expenses(percent of GDP)	-461.967	0.0002	-0.00576	0.0175	6.68960	0.0029
Political Effect	Green tax(Percent of GDP)	-1.35248	0.0210	-669.423	0.0137	13.0146	0/0000
open economy Effect	Degree of trade freedom	-0.00576	0.0175	-1389.16	0.0010	17.4842	0.0000
R2		0.775617		0.692100		0.915593	
F statistic		P-VAL=(0.6346) F(29.205)=6.14517		P-VAL=(0.73452) F(29.205)=5.920317		P-VAL=(0.6521) F(33.61)=6.56547	
Significant in 5%							

Conclusions and Suggestions

By using of environmental taxes can control the pollution level through creation the economic motivation and adjustment the comparative prices also can impose the tax on a certain level of inputs or certain levels of emissions. The imposed of taxation on emissions is as kind of common policy which recommended by economists for achieving to some environmental goals and elimination of pollution. The green tax removes the difference between private and social cost efficient which is resulting from the side damages of emissions.

In order to achieve a pollution level of economically efficient the tax should be imposed with a rate equal to monetary value of pollution's final damage on every unit of released emissions. Such a tax would internalize the external effects.

Generally according to previous studies can say that because an economic become benefited of environmental taxes' additional profit it is better that taxes be imposed on emissions and pollution not on polluting goods also the resulting from it be used on taxes reduction on capital. Based on the estimation results, can say besides the technology improvement the green taxes are as one of the affecting factors on pollution reduction in developing countries.

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