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Article

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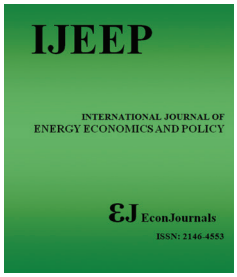

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Impact of Environmental Tax Collection on CO_2 Emission in Vietnam

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ABSTRACT

Studying the impact of environmental tax collection on the amount of CO_2 emissions in Vietnam; then, assessing the impact of environmental tax collection on envirommental protection, CO_2 emission reduction facing to the climate change in Vietnam. In this paper, the data are collected from 2001 to 2018 at General Statistics Office, General Department of Taxation of Vietnam, World Bank, and related researches of scholars. The data collected include: the amount of CO_2 emissions of Vietnam, the environmental tax collection, the amount of natural resource consumption tax collection, the amount of excise tax and total population of Vietnam. The research used multivariate regression analysis to assess the impacts of each independent variable on the amount of CO_2 emissions in the period 2001-2018. The results showed that the amount of environmental tax collection has strong and negative impact on the amount of CO_2 emissions. The findings provide the significant perspectives of adjusting the environmental tax policy towards increasing collection amounts, CO_2 emissions of Vietnam tend to decrease.

Keywords: CO_2, Emission, Environmental Tax, Excise Tax, Population, Vietnam
JEL Classifications: Q32, Q43, E62

1. INTRODUCTION

To speed up green growth and sustainable development, different countries may have different ways, but all focus on green production and consumption for: reducing the emissions of CO_2 that cause the greenhouse effect; adapting to climate change; developing green technology and industries that use less resources; applying clean production methods, etc. to force manufacturers to include environmental protection costs in product cost; encouraging manufacturers to invest in environmental protection. Thus, to protect the environment, reducing greenhouse gas emissions to cope with climate change are the goals of all countries in the world. In their environmental protection endeavours to green economies, countries have different ways: while developed countries focus on shifting to a low-carbon society (with an emphasis on environment factors), less developed countries stress growth factors in a low-carbon society (Ngoc and Thu, 2015). To protect the environment and reduce greenhouse gas emissions, countries use also different tools. Specifically, in its report, the organization for economic co-operation and development (OECD, 2012I) put forth nine policies to solve the problems arising in the green growth processes in countries, where tax policies were proposed to solve 4 out of 9 problems of the economy. Or as reported by the OECD (2012e), World Bank (2012a) and UN ESCAP (2010) on the combination between green growth and sustainable development policy, there are three issues that the economy needs to address with many tools used towards green growth. Of which, tax policies area referred to solve 2/3 problems: improving framework policies and implementing environmental policy instruments. Especially, Sebastian and Mauricio (2013) carried out research and observed that the amount of CO_2 emissions is influenced by a series of economic activities, the most influential of which is the total sales of environmentally related taxes.

Environmental tax has the effect of stimulating and adjusting production and consumption towards protecting the environment,

promoting research to find clean energy sources to meet the growing needs of people or to lead to the introduction of new technologies, production cycles and products, thus minimizing the consumption of polluting raw materials and waste from the production process and creating revenue for the budget. Nevertheless, the possibility of bringing into play the effects of taxes and fees in environmental protection is also at different levels. Of which, the main fee instruments aiming generate revenue to cover the costs of environmental pollution treatment and the effect of adjusting behaviors of the subject causing pollution have not been strong enough. Tax instruments often have high level collection, legality and coercion for implementation exert a very strong impact on the subject causing pollution to prevent and reduce emissions of environmental pollutants. Appropriately studying and applying tax instruments or fees to each subject of emissions causing environmental pollution therefore is necessary.

Furthermore, the scope of impact polluting the environment of waste gases is very wide, from a city, region, country to globe. The international community, therefore, has been seeking policies and solutions to addressing this issue, including the Kyoto International Convention, Montreal, Convention, Bonn Convention on the program to limit and cut down greenhouse gas emissions with the commitment to engagement of many countries in the world. The developed countries in the OECD are studying the construction of air environmental tax against waste gases, known as "carbon tax," to exert an impact on the awareness and behaviors of the subject of emissions (Goulder, 1996).

Air environmental tax – "carbon tax," applies to reduce emissions of CO_2, waste gases from the use of refrigeration equipment (such as air conditioners, fridges, etc.) and air dusts that cause the greenhouse effect, global warming. Carbon tax is a component of the price of gasoline, coal, other fuels, refrigeration equipment, thereby having the effect of preventing and limiting emissions into the air environment. Through the encouragement to apply modern technology to use economically and efficiently combustible fuels, to use other forms of "clean" energy such as hydroelectricity, solar energy, natural wind energy, atomic energy, etc.

In Vietnam, actually, the purpose of environmental protection tax is to generate revenue to offset part of costs of waste treatment, restoration and improvement of environmental quality. However, environmental protection fees as a whole are very diverse and associated with activities of environmental management and non-business agencies. For example, such environmental protection fees as wastewater charges, cleaning (solid waste collection and treatment) fees, in fact, due to being at relatively low rates, have little effect of preventing and limiting the emission of environmental pollutants. However, the collection hereof has generated revenue to partially cover the costs, thereby having a certain impact on the awareness of the subject of emissions of environmental pollutants. By applying tax policy, Vietnam Government will orient businesses in considering, selecting investment options, choosing production technologies, fields of business, etc. At the same time, tax policy has a great impact on the consumer behavior of individuals. However, the performance of using of tax instruments for environmental protection activities in Vietnam is still limited; CO_2 emissions in Vietnam are still at high levels. Therefore, this paper will explore into the impact of environmental tax collection – this is the tax type that has the most direct and biggest impact on the environment in Vietnam – on CO_2 emissions.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

The litterautre review on impact of tax policy on environmental pollution shows that a majority of researchers assessed this impact by using the multiple linear regression model; in addition to that, the researchers' approaches to choosing dependent and independent variables vary considerably, specifically:

The studies of Brannlund et al. (2007) and Bosquet (2000) concluded that increased environmental tax and Environmental Tax Reform can have beneficial effects on the environment. In addition there has recently been a substantial level of research into determinants of pollution and energy usage. In addition, the use of environmental taxes to reduce pollution has had at best mixed results (Millock and Lauges, 2006).

Sebastian and Mauricio (2013) carried out a study of how tax policies influence the environment of countries. The paper analyzes the efficiency of taxes related to the environment by checking environmental performance and the amount of collection from such taxes in 50 countries. The study observes that the amount of CO_2 emissions is under the influence of a series of economic activities, the most of which is the total sales of environmentally related taxes. Accordingly, the study affirms that the amount of environmental tax collection is a good representation of the tax rate, having the effect of cutting down polluting waste consumption, reducing CO_2 and fine dust emissions. The study further shows that countries with larger amounts of environmental tax collection also have better reductions of CO_2 emissions per capita, energy consumption, fossil energy consumption and water pollutants.

Morley (2012) assessed the impact of environmental taxes on environmental protection activities by checking the impact of environmental taxes on the levels of air pollution and energy consumption. Data used in the study was taken from Statistical Office of the European Union, including real GDP, capital formation, population and environmental tax collection in EU member states and Norway between 1995 and 2006. In the first model, Morley used the dependent variable as CO_2 per capita; in the second model, the dependent variable as energy consumption per capita. The study findings show that the amount of greenhouse gases is considered as a dependent variable when studying the issue of environmental protection. The introduction of environmental taxes in the EU has a great impact on limiting pollution, but have a negligible effect on the use of natural resources. The study also suggests that the efficiency of environmental taxes depends heavily on the proportion of environmental tax collection amount to other taxes and to the total tax collection amount.

A study by Douglas and Thomas (1995) explored the relationship between GDP growth and CO_2 emissions – the main gas that causes greenhouse effect and global warming. The study conducted explorations in 130 countries and obtained complete data tables of CO_2 emissions, of GDP and population in 108 countries between 1951 and 1986. From such data, the study identified the relationship between CO_2 emissions and GDP, as well as used these estimates to predict global CO_2 emissions. Four main results were given: Firstly, the study showed that the amount of CO_2 has a marginal propensity to decrease gradually as GDP per capita increases. Secondly, despite the fact that the amount of CO_2 has a marginal propensity to decrease gradually as GDP per capita increases, the study suggested that global CO_2 emissions will continue to increase at an annual rate of 1.8%. Thirdly, the fastest economic growth and population will be achieved in countries with middle to low income and with a marginal propensity to have the largest amount of CO_2 emissions. Finally, the study's sensitivity analysis indicated that the overall rate of economic development does not significantly change the amount of CO_2 emissions in the future. Another study by Goulder (1995) evidenced that the environmental tax relative to GDP and total taxes are negative and significant, suggesting as environmental taxes have risen, so air pollution within the EU has, as expected fallen, particularly with environmental taxes relative to the total tax revenue, which is significant at the 1% level, indicating that environmental taxes need to be considered in relation to other taxes.

Reyer and Bob (2006) studied five policy instruments for reducing CO_2 gas, i.e. carbon tax, fossil fuel tax, non-carbon energy subsidy (renewable energy subsidy), portfolio standards with carbon emissions and non-carbon portfolio standards. These five instruments are compared together in terms of cost, efficiency and impact when using them to reduce CO_2 emissions. The paper draws conclusions that renewable energy subsidy is probably the most expensive plan to control climate change. Issuing portfolio standards with carbon emissions is the cheapest option to mitigate global climate change in the context of energy scarcity. Levying carbon taxes is an effective policy instrument for achieving rigorous objectives related to climate change control. The study also made a comparison between two different options for carbon taxes: Taxes levied directly on amount of CO_2 emissions and taxes levied on the use of fossil fuels (causing CO_2 emissions). Reusing the amounts collected to support renewable energy reduces costs related to overcoming climate change up to 40% over the case of normal taxation only. The study also identifies that taxing fossil fuels is some 20% more expensive than levying taxes on CO_2 emissions, without relying on the goal of climate stabilization and if the amounts collected from taxes can be reused to invest in renewable fuels or not.

On the basis of the literature review, this study can see that there are many factors that influence CO_2 emissions. Douglas and Thomas (1995) put forward a research model with two factors influencing CO_2 emissions, including GDP per capita and population. Morley (2012) brought a research model with four factors influencing CO_2 emissions including real GDP, capital formation, population and environmental tax collection. The model by Sebastian and Mauricio (2013) consists of four factors of environmental performance and environmental tax collection. The model by Reyer and Bob (2006) includes carbon tax, fossil fuel tax, non-carbon energy subsidy (renewable energy subsidy), a portfolio standard with carbon emissions and non-carbon portfolio standards.

So, on the basis of researches of Douglas and Thomas (1995), adjusted by Morley (2012), the first research hypothesis is proposed in assessing the impact of environmental tax collection on CO_2 emissions in Vietnam:

H_1: The environment tax collection is negatively associated with the CO_2 emissions.

3. RESEARCH MODEL AND RESEARCH DESIGN

3.1. Research Model

In order to assess the impact of environmental tax collection on CO_2 emissions in Vietnam, the research model is based on the researches of Douglas and Thomas (1995) and Morley (2012) with the dependent variable as CO_2 emissions (Y) and independent variables, respectively, as environmental tax collection ($X1$), natural resource consumption tax collection ($X2$), excise tax collection ($X3$) and population of Vietnam ($X4$). The research model is established as follows:

$$Y\,(CO_2) = \beta_0 + \beta_1 X1 + \beta_2 X2 + \beta_3 X3 + \beta_4 X4 + U_i$$

Where:

Y = amount of CO2 emissions of Vietnam; unit: million tons;

$X1$ = Environmental tax collection: Amount of environmental tax collection of Vietnam; unit: VND billion

$X2$ = Natural resource tax collection: Amount of natural resource tax collection of Vietnam; unit: VND billion

$X3$ = Excise tax collection: Amount of excise tax collection of Vietnam; unit: VND billion

$X4$ = Population: Population of Vietnam; unit: million people

β_0: Intercept; βi: Coefficient (i=1.4); U_i: error of the model.

3.2. Research Design

For verifying the negative relationship between the amount of environmental tax collection and CO_2 emissions in Vietnam, the research process is designed as follows:

Firstly, the research is conducted by a quantitative method: On the basis of the litteraure review, the research is sumed up factors that influence CO_2 emissions. Then, through data collected from the General Department of Taxation, General Statistics Office of Vietnam, World Bank and by studying the targets of tax policies issued by the State, This paper is determined the overall model of the impact of tax policies on CO_2 emissions, including environmental tax collection, natural resource tax collection, excise tax collection and population of Vietnam.

Next, the research is conducted by a qualitative method: By collecting the secondary data from domestic and foreign organizations, the software used for the data analysis is Statistical Package for the Social Sciences (SPSS) version 20 by using multiple linear regression model.

Table 1: Correlation

Code		X1	X2	X3	X4	Y
X1	Pearson Correlation	1				
	Sig. (2-tailed)					
X2	Pearson Correlation	0.957**	1			
	Sig. (2-tailed)	0.000				
X3	Pearson Correlation	0.941**	0.977**	1		
	Sig. (2-tailed)	0.000	0.000			
X4	Pearson Correlation	0.766**	0.810**	0.850**	1	
	Sig. (2-tailed)	0.000	0.000	0.000		
Y	Pearson Correlation	-0.829**	-0.896**	0.957**	0.880**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	

**Correlation is significant at the 0.01 level (2-tailed). **P<0.001

4. DATA AND RESEARCH METHODOLOGY

4.1. Data Methodology

In Vietnam, the information technology was introduced in taxation implementation and management since 2000. Therefore, the research sample is based on all data collected from the General Department of Taxation, General Statistics Office of Vietnam, World Bank; from research works of scientists at home and abroad with regard to Vietnam's data between 2001 and 2018 on CO_2 emissions, environmental tax collection, natural resource tax collection, excise tax collection and population of Vietnam.

4.2. Research Methodology

This research used the multiple linear regression with SPSS 20. As for all the data collected, the paper is implemented through following steps: (1) Assessing the correlation coefficient to assess the close correlation among the factors included in the model; (2) Testing the stability of the model through the quantity R^2 with the research hypothesis H_1; (3) Using the linear regression with enter method by introducing all independent variables into the equation in one step for observing the impacts of independent variables on the amount of CO_2 emissions in the period 2001-2018.

5. ANALYSIS AND FINDINGS

5.1. Assessing the Correlation Coefficients

The research conducted a correlation test between the four independent variables and the dependent variable of amount of CO_2 emissions. The mean values and correlation test result of 4 independent variables (X1, X2, X3, X4) and 1 dependent variable (Y) are as Table 1:

The correlation analysis indicates a strong correlation among the factors included in the research model. The factors have a high pearson correlation coefficient from 0.766 to 0.977 with $P < 0.001$, expressing strong correlation of factors (Table 1). The correlation analysis shows also the negative relationship between the amount of environmental tax collection and the amount of CO_2 emissions. This means that when the State increases the amount of environmental tax collection, the amount of CO_2 emissions tends to decrease and vice versa.

5.2. Assessing the Validity of Research Model

To make sure that the model constructed does not violate the basic hypotheses, the validity of research model was conducted by the quantity R^2. So as to know if the model is valid or not, assessing the hypothesis was taken:

a. H_0: $R^2 = 0 \sim H_0$: $\forall\beta_i = 0$: the model is invalid
b. H_1: $R^2 \neq 0 \sim H_1$: $\forall\beta i \neq 0$: the model is valid

Table 2: ANOVA[a]

Model		Sum of squares	Df	Mean square	F	Sig.
1	Regression	41212.135	4	10303.034	101.074	0.000[b]
	Residual	1325.165	13	101.936		
	Total	42537.300	17			

[a]Dependent Variable: CO_2. [b]Predictors: (Constant), X4, X1, X3, X2

The results of variance analysis are as follows (Table 2):

The results of variance analysis show that the whole variation of the observed dependent variable is divided into two parts: Regression and Residual. The results of ANOVA analysis show the Sum of Squares Residual of 1325.165 and the Sum of Squares Regression of 41212.135, and their sum is called the sum of squares of 42537.300. From which, the result of squares regression is 41212.135/4 = 10303.034 and squares residual is 41212.135/13 = 101.936. The figures that are stated in the table 2 is the values of F= 10303.034 /101.936. =101.074 with Sig = 0.000. So, the p value of the F-assessment is very small and the research can be concluded that the model analyzed consists with the observed data.

5.3. Assessing the Variable Correlation

So as to know if in the research model there is a phenomenon known as autocorrelation, this study was conducted assessing the hypothesis:

a. H_0: $r = 0$; H_1: $r > 0$. If $d < dU$, then reject H_0 and accept H_1 (with significance level a), meaning there is a positive correlation
b. H_0: $r = 0$; H_1: $r < 0$. If $d > (4 - dU)$, then reject H_0 and accept H_1 (with significance level a), meaning there is a negative correlation
c. H_0: $r = 0$; H_1: $r \neq 0$. If $d < dU$ or $d > (4 - dU)$, then reject H_0 and accept H_1 (with significance level 2a), meaning there is a (negative or positive) correlation.

In the table of Durbin-Watson coefficient, with n = 18, independent factor = 4 = > dU=1.604 and 4-dU= 4-1.604=2.396.

The Durbin-Watson coefficient of the research model equals to

Table 3: Model summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.984[a]	0.969	0.959	10.09633	2.271

[a]Predictors: (Constant), X4, X1, X3, X2. [b]Dependent variable: CO_2

Table 4: Coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	–46.928	66.783		–0.703	0.495		
X1- Environmental tax	–0.001	0.001	–0.464	–2.790	0.015	0.087	1.534
X2 -Natural resource tax	–0.003	0.002	–0.410	–1.511	0.155	0.032	3.774
X3 - Excise tax	0.003	0.000	1.667	6.448	0.000	0.036	2.904
X4 - Population	1.367	0.821	0.150	1.666	0.120	0.295	3.386

Dependent variable: CO_2

2.271. So, dU < 2.271 < 4-dU => Factors in the regression model have no first order correlation (Table 3).

5.4. Assessing the Multicollinearity

So as to know if there is any multicollinearity problem, the research is considered the variance inflation factor (VIF) (Table 4).

According to the regression results, all VIFs are smaller than 10 (in which the coefficient respective to the environmental tax collection variable is 1.534), demonstrating that among the independent variables there is no perfect multicollinearity. Nevertheless, with Vietnam's macro data, there is a correlation between the independent variables to a certain extent in essence. For instance, with regard to some special items, the excise tax, after calculation, will again be one of the bases for calculating environmental tax. Accordingly, increasing excise tax is also one of the reasons for the increase in environment tax. Or as the population increases, the demand for goods also increases and the amount the State collects from taxes levied on goods increases, too.

5.5. Figure of Normal Distribution of Research Model

The research results show that data has normal distribution with a bell-shaped curve on the histogram (Figure 1).

The result shows the mean value very close to 0 and Std.Dev = 0.874 indicate that the normal distribution factors and data are relatively concentrated.

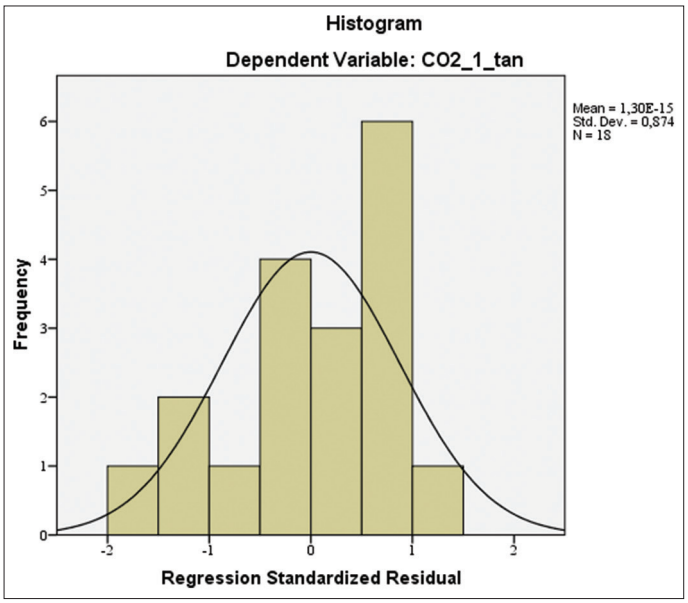
5.6. Regression Results

After many times processing the regression model by different methods, the Enter method (introducing all variables in the regression equation) was chosen to give the best regression model results as follows:

$$Y\,(CO_2) = -46.928 - 0.001*X1 - 0.003*X2 + 0.003*X3 + 1.367*X4.$$

This paper analyzed the regression model by the method of introducing each observed dependent variable in to see the influence of factors on the change in the amount of CO_2 emissions in the period 2001-2018. The model with F = 101.074 and Sig = 0.000 demonstrates its conformity with reality, the variables in it are all statistically significant. The adjusted R^2 coefficient is

Figure 1: Normal distribution of research model



0.959, suggesting that independent factors can account for 95.9% of the change in CO_2 emissions. Through the standardized β coefficient, this study can assess that the amount of environmental tax collected is the factor which has a strong and negative impact on the amount of CO_2 emitted (–0.464).

6. CONCLUSION

The research results show that in Vietnam, the amount of environmental tax collected has a negative impact on the amount of CO_2 emitted. As such, when the environmental tax policy is adjusted towards increasing collection amounts, CO_2 emissions tend to decrease. This can be accounted for as follows: Currently subjects to environmental tax in Vietnam include eight types of goods when used causing adverse impacts of the environment. As the level of environmental tax goes higher and higher, the individuals and units that exploit, produce and consume products subject to environment tax will tend to reduce production and consumption scale or seek to build systems to reduce CO_2 emissions during the manufacturing process so as to get support from the State. Because Vietnam's environment tax collection has

a negative impact on the whole country's CO_2 emissions, adjusting the tax policy factors, such as adding some items that have negative impacts of the environment to the list of taxable items (chemical fertilizer, detergent, coal gas, natural gas, tobacco, etc.), mapping out the roadmap for raising environment tax rates, or adjusting taxable prices… will be solutions to reducing the amount of CO_2 emitted to the environment.

In Vietnam at current time, according to the Circular No. 24/2017/Cir-MONRE of the Ministry of Natural Resources and Environment stipulating environmental monitoring techniques, businesses involved in outdoor air environment monitoring activities should compulsorily conduct environment monitoring on a periodical basis with 53 constituent elements. In these parameters, there is no regulation necessitating measurement of the amount of CO_2 that businesses emit into the environment, therefore, within the scope of research, the results have not determined the amount of CO_2 emitted from each business – entity directly causing CO_2 emissions into the environment – to examine how changes in tax rates, taxable output, taxable prices, tax calculation methods, etc. have influenced the amount of CO_2 emitted from businesses. Hopefully, along with ourrcompleting the State regulations in the control of emissions, the above-mentioned contents will continue to be improved by future studies.

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