HOW SHADOW ENTERPRISING, GOVERNANCE, AND ENVIRONMENTAL TAXES SHAPE ENVIRONMENTAL OUTCOMES

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Abstract

This paper investigates the impact of shadow enterprising, governance and environmental taxes on environmental outcomes. Ordinary Least Square Regression is carried out on the data. Then the likelihood ratio test for heteroskedasticity and test for serial autocorrelation by Wooldridge is undertaken. Fixed effects and random effects are performed to remove unobserved characteristics; then Hausman test is applied to check which test is more efficient. Fixed effects proved to be more efficient, so further post estimation technique was applied (Prais-Winsten regression). Specifically with increase in shadow economy, environmental pollution rises, whereas with increase in environmental taxes environmental pollution reduces. Environmental taxes also cause informal economy to lessen, which as a result has a positive impact on environment. This study implies that policy makers should formulate policies that encourage firms to move towards formal sectors. Developing countries, especially, should create harmony among their neighboring countries in order to curtail environmental pollution and existing regulatory bodies should be strengthened.

Keywords: Shadow Economy, Enterprising, Pollution tax

1. Introduction

Environmental degradation has become a serious dilemma for countries worldwide. In order to achieve the Sustainable Development Goals (SDGs) linked with environment; identification of environmental degradation sources is important. Researchers are focusing on the relation between environmental degradation and economic growth; even environmental economics is a grasping field for researchers. Nowadays it is said that drivers of air pollution are mostly the source of greenhouse gas emission. Air pollution is the leading risk to the lives of living; according to the World Bank globally air pollution cost about $8.1 trillion in 2019. Also, 90 percent of deaths are caused by air pollution annually in middle- and low-income countries. Air pollution poses risk in Asian countries; approximately 92 percent people which makes almost 4 billion people experience air pollution. According to reports China is said to be the most polluted Asian country. Burning fossil fuel is the prime reason of air pollution; according to UN-Habitat report outdated vehicles that are involved in informal transportation also cause air pollution in developing countries.

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Shadow economy or informal sector is an important factor in environmental degradation as the firms are not held accountable to follow environmental regulations and they evade the pollution emission index. Shadow economy or illegal sector of economy comprises not only of illegal activities but also includes the unregistered activities in any economy. In developing economies shadow economy is a major problem as it constitutes about 35 to 44 percent of GDP; according to a survey conducted the shadow economy has been rising at an alarming rate in developing and transition countries. The foremost reason that has caused rise in shadow economy is the lack of accountability, regulations and higher taxes. Macroeconomic surveys have emphasized the fact that shadow economy is rising due to spike in taxes and security payments, and due to strict labor laws. The average shadow economy for Zimbabwe is calculated to be 60.6 percent which is highest globally; for Austria shadow economy comprises of 8.9 percent of the total GDP which is lowest globally. Economists have been arguing on the negative and positive impacts shadow economy has; some say that it contributes to the labor sector by providing job opportunities whereas others do believe that they reduce formal sectors which cause economic disruption. Developing countries are combating many evils such as inflation, poverty, unemployment and current account deficit.

Environmental degradation and informal economy are closely related as air pollution is rising day by day due to harmful emissions from industries and vehicles. Leather tanning, brick making, urban transportation and metal working are also some of the activities that come under informal economic conditions and cause pollution in environment. It is astonishing that not much research is done to analyze the shadow economy's relation to pollution. This paper not only emphasis the impact shadow economy has on pollution but also explains the role environmental taxes can play to curb this effect.

To promote reduced emissions and industrial upgrading environmental taxes were introduced in 1990 in Finland. This law was imposed on all enterprises and institutions responsible for discharging pollutants directly into the environment. On the other hand, developed countries have been implementing green taxes since 1980's on firms emitting pollutants. Li et al. (2021) observed that an inverted U-shape is formed between tax rates and pollutants reduction. A limited role is played by environmental taxes in high environmental regulations. Shadow economy is directly affected by increase in environmental taxes; with increase in environmental taxes the activities done by informal sector are taxed which ultimately causes the percentage of informal economy to reduce. Eventually this leads to reduction in carbon-dioxide emissions.

From the previous research it is quite evident that rate of shadow economy is low in countries where good governance is prevailing. It is also analyzed that the reason of shadow economy is not the amount of taxes, but it is

ineffective taxation system. The conditions under which shadow economy flourishes are weak administration and ineffectual taxation and ordinance system. Corruption, which is commonly known as the abuse of power officials have is considered to have a strong relation with shadow economy, as shadow economy paves way for all informal activities. Regulatory control in any economy weakens when public officials are bribed by the people doing illegal activities so they can continue their work without any political intervention. The economies having sturdy institutions enhance the morale of investors as well as enhance just allocation of capital among masses that eventually results in abating shadow economy. Growth of any economy is largely impacted by the role institutions play in controlling corruption. Even if a country lies in the category of low-income countries; if it controls corruption, it can curb environmental degradation. When institutions are stronger the environmental quality would increase which will enhance growth. This paper contributes to the present writing in three aspects. Mainly it will investigate the impact informal economy has on environmental contamination. Secondly, it will explore the impact of governance on environmental pollution. Lastly current study will emphasize the impact of environmental taxes on environment.

2. Literature Review

Shadow economy plays a significant role in developing and transitioning economies; recently work has been done to determine impact shadow economy has on economies. Torgler and Schneider (2007) analyzed the impact of government and tax morale on illegal sector of economy. This study has concluded that increase in institutional quality or strong institutions leads to smaller shadow economy and with increase in tax morale the size of shadow economy reduces. Climate change is one of the prevalent issues being faced as greenhouse gas emission is rising at an alarming rate. Bilen et. al (2008) studied the production and consumption of energy and the impact of environmental pollution; and the road to attaining the goal of sustainable development. To attain sustainable and clean energy, renewable energy resources are considered an effective solution. Elgin (2010) empirically studied that higher taxes are related to lower levels of informal economy. Many examples of such text are available; with the help of panel data and cross-section they have proved that higher taxes lead to a lower level of informal economy. If political turnover is controlled, it is observed that there is no relation between informal economy and taxes. Log Mean Divisia Index (LMDI) methodology is applied by Akbostanci et. al (2011) to calculate carbon dioxide emission of Turkish companies. The methodology helps in decomposing changes in emissions into further components. It is predicted that changes in industrial activities and energy intensity are the major components that are used in determining carbon dioxide emissions.

Many developing countries are facing serious problems like contaminated water and environmental pollution. Biswas et. al (2012) investigated the impact the shadow economy has on pollution and the role corruption has in this linkage. Pollution and the informal economy are reliant on the level of corruption. In any economy subsistence of the underground economy indicates incentives individuals obtain in concealing the economic activities. Blackburn et. al (2012) scrutinizes the relationship among underground economy and financial development with the help of tax evasion and intermediation of banks. It is observed that marginal benefit increases with increase in financial development. This research paper deduced that when financial development is lower, tax evasion is high and so is the informal economy. Strengthening of taxation systems to eradicate the evil of the informal economy is a major step that developing economies are taking nowadays. Joshi et. al (2014) showed that limited revenue, high collection cost and negative impact on small firms are some of the reservations under debate when it comes to deciding whether to tax or not. Recently many researches are being undertaken and it has been under debate that informal economy indirectly benefits economic growth. Kireenko and Nevzorova (2015) determined the impact of informal economy on quality of life. It was observed that the stage of life is optimistically impacted by the underground economy whereas quality of life is negatively impacted by the underground economy. Shadow economy's growth has an influence on the level of life. The hypothesis presented between informal economy and quality of life is proved in this research.

Halkos and Piazanos (2016) examine the impact fiscal policy has on carbon dioxide emission. Expansionary fiscal policies have enhanced impact on emissions by both production and consumption, whereas deficit financing tax cuts have impact on emissions due to consumption. Pereira and Pereira (2016) presented a model containing marginal abatement cost curves. These cost curves act as tools to understand the rate at which the level of taxes changes with the level of environmental effectiveness, budgetary cost and economic cost. The study results that carbon dioxide taxes act as a prime policy tool to reduce emission and to promote fiscal consolidation with economic performance acting as cost. After recession hit the globe in 2009 many changes were observed in governance in major economies across Europe and Middle Eastern countries. Galinato and Islam (2017) developed a theoretical model that predicts the relation between governance, spending of government and pollution. This research determines the enhancing effect government spending has, for example subsidies provided to the poor; subsidies specifically environmental subsidies cause reduction in environmental pollution.

Dadgar (2017) in this paper investigated the impact of good governance on environmental pollution. Huynh and Hong (2018) studied the effect of FDI

on air pollution and the role institutions play in this regard. Chen et. al (2018) scrutinizes the impact environmental regulation has on environmental quality and the factors affecting it. Direct (shadow economy and corruption) and indirect impact (interactive term shadow economy and pollution) of environmental regulation is considered on environmental pollution. Informal sector in developing economies is considered as a means of sustenance; such unregistered activities add up to the income of the country. Omodero (2019) investigated the financial and economic impact of the informal economy in developing countries. Case study of Nigeria proves that the informal economy proves to be more harmful in comparison with the good impact it has on the government. Informal economy results in misallocation of resources, reduces the amount of taxes people pay and alters distribution of income among masses. Huynh and Nguyen (2019) studied the impact fiscal policy has on the informal sector by using tools of government and taxation and the role corruption plays in this regard. The results conclude that expansionary fiscal policy has a negative impact on informal economy and contractionary fiscal policy has a positive impact on informal economy. Huynh (2020) undertook a study to examine the effect of shadow economy on air pollution and the role fiscal policy has in minimizing the effect by using government expenditure and taxation as tools. Shadow economy data employed in this study is taken from Medina and Schneider (2018) in which MIMIC approach is employed. A positive relationship is observed between shadow economy and air pollution and consequently a negative relationship is observed between government expenditure and shadow economy.

Nowadays, economies are focusing on sustainable development, and the shadow economy is the main hindrance in achieving it. Gharleghi (2020) investigated the threshold association between shadow economy and financial development. This paper demonstrates that financial development has a pessimistic yet significant impact on the shadow economy of countries having per capita GDP below threshold. Shadow economy is prevailing in developed, developing as well as transition economies. Luong et. al (2020) investigated the relation between economic growth, rule of law and informal economy. Researchers suggest that with the help of effective laws the size of the informal economy can be curbed, and economies can move towards growth specifically in transition countries. By using dynamic stochastic general equilibrium model (DSGE) Tu and Wang (2021) analyzed and predicted the effectiveness of new environment tax policies in China. A significant increase in environmental quality would be seen due to new environmental taxes as pollution will reduce in long and medium run. Shao et. al (2021) identify the impact of the underground economy on emission of polluting gases keeping in view the role of globalization, trade and size of market. A negative relationship can be seen in the short run between underground economies and environmental pollution. Whereas, in the long

run with an increase in the underground economy, the shadow economy also changes.

In many developing economies the ratio of informal economy is increasing day by day, which directly contributes to the quality of the environment. A dual economy structure is said to be prevailing; this study implores the relation between informal sectors and environmental degradation. Baloch et. al (2021) tested the relation between informal sector and environmental degradation by examining the size of the informal sector determining level of environmental degradation. The presence of the informal sector paves way for environmental pollution and induces various sources that lead to environmental pollution. There is enough literature available that links environmental pollution with economic activity; environmental economics is one of the emerging subjects in today's world. Sohail et. al (2021) investigated both the symmetric and asymmetric impact of informal economy on environmental pollution and clean energy. In Pakistan informal economy increases carbon dioxide emissions; whereas in Bangladesh and Nepal informal economy decreases carbon dioxide emissions and no effect is observed in Sri Lanka.

3. Theoretical Framework

An evident link is present between informal activities and taxations leading to emission of harmful wastes within environment. Many researchers have worked over the years to prove this relationship. Environmental taxes are imposed on firms or enterprises involved in emission of harmful chemicals in the environment. The concept is not just about taxing the ones polluting environment but also about providing relief to the ones who are not involved in such activities. Shadow economy is considerably reduced due to presence of green taxes. Whereas control of corruption also leads informal economy to reduce as controlling corruption is an indication of good governance. Ultimately it leads to reduction in environmental pollution. In most developing countries policy makers usually suggest that stricter regulations should be imposed to curb the effect of informal economy. Not much literature is found highlighting the impact of shadow economy on environment. Few research indicates that shadow economy adversely affects environment. Suppose we consider that shadow economy is operating on a small scale and is highly labor intensive but less capital intensive. Shadow economy is mostly prevailing in developing economies where employment rate is lower; so shadow economy provides employment. Masses not even considering the long run negative impact it has on environment become a part of this sector. Whereas capital is the department where they lack; this is where formal sector can be distinguished from the informal sector. Strict environmental policies implemented like higher taxes on pollution emission cause the activity in informal sector to increase as people in order to escape pollution index move towards informal sector. As per capita income rises

pollution rises. Arthur C. Pigou introduced the concept of externalities. According to his study, many malfunctions can be avoided by internalizing externalities. The prime method to do is that polluters should pay for the pollution. This will constitute a 'price signal' that will be sent to all economic agents. When people will be held accountable for their actions they develop a sense of responsibility. Firms having adequate knowledge that their actions will have consequences; will be mindful before indulging in any extensive pollution activity.

4. Methodology

In this research secondary data is used. The data for dependent variable and control variables, i.e. carbon dioxide emissions, energy use and GDP growth is collected from World Development Indicators. Whereas the data for independent variables; control of corruption is extracted from World Governance Indicator; the data for shadow economy is obtained from Medina and Schneider (2018). Lastly the data for environmental taxes is obtained from OECD website. The impact of informal economy, governance and taxation on environmental pollution is investigated in this research paper, using panel data.

Carbon dioxide is also known as greenhouse gas emissions that are result of burning of fossil fuels and manufacturing of cement. Such activities add pollutants to environment which are harmful for humans as well as other living organisms. Shadow economy is also known as underground economy. Shadow economy involves activities that are not reported to government and are beyond the reach of tax collectors. It may include illegal as well as non-licensed legal activities. Shadow economy prevails when restrictions and excessive taxations are being imposed by the government. Control of corruption is an indicator used for governance; it measures the power of public exercises in order to capture state elites and private interest groups. Environmental taxes, also known as green taxes or eco-taxes are type of taxes imposed on business and private individuals in order to reduce pollution causing activities. Energy use refers to amount of energy consumed by individuals or firms. It is directly related to environmental pollution

Medina and Schneider (2018) using MIMIC approach calculated data for shadow economy; this data is percentage to GDP. The model representation for estimations is provided below:

$$CO_{2it} = \beta_1 SE_{it} - \beta_2 COC_{it} - \beta_3 LET_{it} - \beta_4 GDPG_{it} + \beta_5 GDPG2_{it} + \beta_6 LENER_{it} + \varepsilon_{it} \ldots\ldots (4.1)$$

Where CO_2 represents carbon dioxide emissions (SE) represents shadow economy, COC represents control of corruption, LET represents log of environmental taxes, GDPG represents GDP growth, LENER represents log of energy, The subscripts i and t represent country and year respectively; ε_{it}

is the error term. T is 20 years, and N is 158 countries. Shadow economy, economic growth and energy consumption have a positive impact, whereas, environmental taxes have a negative impact on carbon dioxide emissions.

Firstly, Pooled OLS method was applied; then post estimation techniques like Breusch-Pagan test, Ramsey test and Variance Inflating factor (VIF) are used to check heteroskedasticity, omitted variables and multicollinearity. F-test was applied after pooled OLS technique to check if country-specific or time-specific effects need to be considered in the estimation. F-test confirms to use panel data technique so as to include the unobserved characteristics i.e., fixed effect or random effect estimation technique. Then to choose between fixed or random effect, the Hausman test is applied. Hausman test showed that fixed effects are best model. The post estimation for fixed effect showed the presence of heteroskedasticity and autocorrelation. Therefore, the Prais-Winsten regression is applied to correct for heteroskedasticity and autocorrelation. Serial correlation of type AR (1) is considered by Prais-Winsten regression estimation. This process is used to estimate error autocorrelation and beta coefficient of a specific model until (AR) 1 coefficient is attained.

5. Results and Interpretation

With the help of Table1 the study formulates equation for data using coefficient list of estimated parameters. Estimated coefficients of Pooled OLS, fixed effect, random effect and Prais-Winsten regression are described in the given below model.

$$CO_{2it} = 0.004SE_{it} - 0.012COC_{it} - 0.043LET_{it} + 0.002GDPG_{it} - 0.0001GDPG2_{it} + 0.028LENER_{it} + \varepsilon_{it}$$

The above equation indicates that environmental pollution is positively impacted by shadow economy and is negatively impacted by control of corruption. To observe the role governance plays in moderating the impact of shadow economy on environmental pollution control of corruption is used. Simultaneously, we observe the impact of environmental taxes on environmental pollution; negative sign indicates that increase in environmental taxes causes carbon dioxide emissions to reduce. Energy consumption and economic growth have a positive and significant relationship with environmental pollution.

Table 1: Estimated Results of Equation

Dependent Variable: Carbon Dioxide Emissions N= 158 T=21

Independent variables	Pooled OLS	Fixed effect (FE)	Random effect (RE)	Prais-Winsten regression
Shadow Economy	0.00451** (0.00153) [2.94]	0.0424*** (0.00455) [9.31]	0.0275*** (0.00327) [8.41]	0.0417*** (0.0044053) [9.48]
Control of Corruption	-0.155*** (0.124) [-12.44]	0.0202* (0.00796) [2.54]	0.0149 (0.00822) [1.81]	0.0121 (0.00821) [1.47]
Environmental Taxes	-0.00668 (0.00527) [-1.27]	-0.0555*** (0.00759) [-7.30]	-0.0565*** (0.00699) [-8.07]	-0.0431*** (0.00785) [-5.49]
GDPG	0.0106*** (0.00281) [3.78]	0.00380*** (0.000766) [4.96]	0.00303*** (0.000767) [3.94]	0.00243*** (0.000623) [3.90]
GDPG2	-0.000324 (0.000246) [-1.32]	-0.000176** (0.0000622) [-2.83]	-0.000174** (0.0000652) [-2.67]	-0.000192*** (0.000045) [-4.27]
Energy	0.0908*** (0.0180) [5.03]	0.183*** (0.0270) [6.77]	0.179*** (0.0251) [7.11]	0.201*** (0.0289) [6.95]
Diagnostic Test	F-test: prob.=0.0000***	Hausman Test:Prob.>chi2=0.0000*** Modified Wald test: Prob>chi2 = 0.0000*** Wooldridge test for autocorrelation: Prob > F = 0.0000***		
	Breusch-Pagan for heteroskedasticity: 0.0000***			
	Ramsey Test = Prob > F = 0.0084*** VIF = 1.68			

Noted: *, **, *** significant at 10%, 5% and 1% respectively; Standard Errors are given in bracket ( ). t-statistics is given in parenthesis [ ]. Source: Authors own calculations

Table 1 indicates results; according to which shadow economy, energy consumption and economic growth have positive and significant relationship with carbon dioxide emissions, whereas, environmental taxes have negative and significant relation with carbon dioxide emissions. One percent increase in shadow economy causes carbon dioxide emissions to increase by .0417 units. Regulations and supervision adversely affect environmental pollution; developing countries usually are more affected by shadow economy as they face serious challenges in implementing regulations. Biswas et al. (2012) argued that larger pollution levels and larger shadow economy move simultaneously as underground firms elope from regulations. Current results do not support the role of control of corruption in the model; whereas literature has evidence that control of corruption plays a significant role in curbing the effect of informal economy. High level of corruption causes economic instability and reduces environmental quality. Corruption Perceptions Index (CPI) in January 2022 released a list of most corrupt countries which are as following, Colombia, Mexico, Brazil, Russia, Guatemala, Kazakhstan, Lebanon, El Salvador and Azerbaijan. All these countries are included in our data, which is the main reason that these results do not support control of corruption. On the other hand, one percent increase in environmental taxes causes carbon dioxide emissions to reduce by .0431 percent. Bashir et al. (2020) yielded the result that implying environmental taxes can help in enhancing environmental quality. The main aim of environmental taxes is to reduce greenhouse gas emissions which are achieved by taxing carbon emissions. One percent increase in economic growth causes carbon dioxide emissions to increase by .00243 units. Economic expansion is one of the major reasons for air pollution as with increase in production possibility frontier consumption and production activities are increased which proves to be harmful for environment. Barra and Zotti (2017) studied the Environmental Kuznets Curve (EKC) which indicates that environment is initially worsened by economic growth but gradually it starts to get better after certain level of development is attained. Economic growth rate is used because many developing countries are in initial stages of development with high rates. Whereas one percent increase in energy consumption causes carbon dioxide emissions to increase by .201 percent. Bilen et al. (2008) examined the positive impact of energy consumption on environmental pollution. Burning coal and petroleum causes carbon dioxide emissions to increase. In developing countries, we have observed that there is a dominant effect of shadow economy on carbon dioxide emissions as compared to negative impact of environmental taxes. These results agree with previous studies as justified in choosing control variables.

6. Conclusion

This study investigates the impact of shadow economy, governance and environmental taxes on carbon dioxide emissions. This research is a panel

data analysis of countries ranging from years 2000 to 2020. Carbon dioxide is taken as indicator to measure environmental pollution due to its robust technique. This study uses estimation techniques such Prais-Winsten regression to achieve the objective stated above. New insights are being provided by this study among informal economy, governance, taxations and emission in developing, developed and least developed countries. The first and foremost result of this study is that informal economy has a destructive impact on environment in all these regions. By this we can deduce that shadow economy is the cause of worsening situation. Environmental taxes are one of the main reasons for curbing air pollution. The combined impact of informal economic and environmental taxes has yielded many interesting results. The shadow economy has a negative impact on environmental quality whereas environmental taxes have a positive impact on environmental quality. As when taxes are not present masses will not be mindful of number of emissions they are producing. As per the results, control of corruption has no role to play. Lastly, this study emphasizes the use of energy and economic growth which are used as control variables. Energy consumption and economic growth both adversely affect environment. Energy consumption comprises of increase in fossil fuels which ultimately leads to increase in environmental pollution.

Nowadays more emphasis is being paid on Sustainable Development Goals; environment is one the major goals that many developing countries are striving to achieve. This study has made a significant contribution in the already existing literature by determining the impact shadow economy has on environmental pollution and the impact environmental taxes have on environmental pollution. This study focuses on all the countries in which shadow economy is prevailing and which are high in pollution. This study is limited due to unavailability of some data in these countries. Renewable energy resources are to be promoted by the government to reduce air pollution. Policies should be promoted to regulate energy consumption and economic growth to lessen air pollution. Strict environment regulations are to be implemented in order to conserve environment. Environmentally friendly cars should be made common. One way is that government lowers the tax on environmentally friendly cars and increases tax on pollution emitting vehicles. Taxes should be reduced on companies that have introduced clean technologies. This will work as an incentive for companies and firms to move towards this initiative. Already existing regulatory bodies need to be strengthened to reduce the impact informal economy has on environment. Harmony should be developed among neighboring countries by institutions in order to curtail informal economic and pollution. This research contributes pragmatic evidence to existing literature on shadow economy and environmental taxes. Policy makers can take these results to in order to control size of informal sector and to improve quality of law.

Compliance with Ethical Standards

- **Conflict of Interest:** There is no conflict of Interest.
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