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The Impact of Sustainable Procurement on Environment: A Three Country Data Analysis

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Abstract:

This study investigates the impacts and inter-relations between sustainable procurement and environment empirically by utilizing panel data. Past studies, particularly on the econometric specifications, are inserted. Carbon emission is considered as an environmental factor and government expenditure as sustainability indicator is analyzed. The outcome indicates that sustainable procurement has a negative impact on carbon emission as well as having a poor relationship. Additionally, other explanatory variables show negative effect and relationship. Utilizing the Fixed and Random effects approach of estimating, the results add up to the knowledge on the impact of sustainable procurement on environment to some extent and confirming the indirect impacts and relationships. The Hausman test was affected to ascertain the suitable method for estimation. The final result shows the indirect relationship and impact of sustainable procurement, including all other variables employed. The Random effects method was set to be the approachable method of evaluation for this examination.

Keywords: Sustainable procurement, carbon emissions, government expenditure, random effects, fixed effects

1. Introduction

Much has, as of now been written around the world, economic order and its effect on the world's environment and on emerging countries' conceivable outcomes to protect the environmental issues they are confronting. (Korvenoja, 1993). Most emerging countries are right now experiencing considerable macroeconomic alterations. It isn't clear how such programs are influencing government expenditure and subsequent longer-term economic growth and environmental quality. In this way, it is critical to monitor patterns within the levels and composition of government expenditures, and to evaluate the causes of alter over time. It is indeed more critical to analyze the relative commitment of different expenditures to generation development and natural conditions (Fan, Yu, & Saurkar, 2008).

Government expenditure has lately been used in numerous nations to reduce the antagonistic impacts of environment degradation. A large percentage of GDP has been used by governments and administrations to help reduce environmental problems. Most studies propose that government expenditure is a critical determinant of environmental quality (Bernauer & Koubi, 2006; Frederik & Lundström, 2001; R. Lopez, Galinato, & Islam, 2011). The instruments through which production, government expenditure and the environment are connected with each other are examined in hypothetical papers by (Sim, 2006).

In addition, government expenditure in terms of measure has been found to decrease the growth (Bajo-Rubio, 2000; Bergh & Karlsson, 2010; Fölster & Henrekson, 2001) which may in turn lead to lower pollution at a few levels and to higher pollution at others, depending on the shape of the EKC as appeared by (Grossman & Krueger, 1995). Subsequently, the overall impact of government expenditure on the environment cannot be under estimated. Given this foundation and taking after a comparable experimental procedure to that utilized by (Cole & Elliott, 2003; Welsch, 2004) the reason is to explore sustainable procurement named as government expenditure influences carbon emissions at a given period of time with additional control variables.

The rest of the study is prepared as follows: Section 2 records, literature review of the connections between expenditure and environment. Section 3 discusses the data, model and methods utilized in the analysis. The empirical results and findings are stated in Section 4 while the ending section concludes the paper.

2. Literature Review

Most literatures have appeared to confirm the importance of government expenditure to be as a tool for reducing environmental problems. Government spending has appeared to upgrade long-run economic development, by expanding the level of human capital, as well as investigate and improve expenditure, and by moving forward public framework (Barro, 1990; Lucas Jr, 1988; Romer, 1990). On the other hand, there's prove that a more note worthy estimate

of government spending may be less productive and, so, not fundamentally related with superior arrangement of public goodies and higher economic development (Afonso & Furceri, 2010; Bergh & Karlsson, 2010). Environmental degradation is causing global warming, which is of the utmost concern to both physical and social scientists as it has adverse effects on human beings (Stern & Stern, 2007).

Nowadays, not a single region or nation is exclusively responsible for global warming; in this manner, each locale or country should take steps to make strides in the quality of the environment by reducing the emissions of greenhouse gasses, which are a cause of global warming. Be that as it may, among the greenhouse gasses, carbon emissions contribute the foremost to global warming. This is often the reason that carbon emissions are utilized as an intermediary for environmental degradation in a number of empirical studies (Naradda Gamage, Hewa Kuruppuge, & Haq, 2017a; Nasir & Rehman, 2011; ul Haq, Zhu, & Shafiq, 2016).

Numerous nations and districts have paid an extraordinary cost in terms of the environment amid the method of economic development. Within the period of treating environment pollution or keeping up good environment quality, the foremost common arrangement is to supply financial subsidies in the quest to reduce environmental degradation and keep the economy improving consistently. Concurring to the estimation of Coady, Parry, Sears, and Shang (2017) approximately 4.9 trillion US Dollars were utilized in 2013 as endowments for fossil fuels all over the world; the endowments increased to 5.3 trillion US Dollars in 2015.

From the historical progress of many developed countries, with the development of the economy, the relationship between environmental quality and economic evolution has shown an inverted U-shaped correlation, which means during the process of economic development, the environmental quality will become worse first and then get better (Grossman & Krueger, 1991).

2.1. Government Spending & Environment Connections

In later times, there has been more hypothetical and observational studies recommending that government expenditure is additionally a significant determinant of environmental condition (Bernauer & Koubi, 2006; Frederik & Lundström, 2001; Halkos & Paizanos, 2013; R. Lopez et al., 2011; Yuxiang & Chen, 2011). At the same time, numerous writers set an interface between a few other variables and environmental pollution, counting on economic development, political institutions, population, trade and investment (Bernauer & Koubi, 2009; Cole & Elliott, 2003; Grossman & Krueger, 1995). Since these components may be connected with government expenditure and its impact on environmental value, it's now clear that most studies are now examining the impact of government expenditure on environmental conditions. As of late, R. Lopez et al. (2011) give a hypothetical premise for deciding the impact of government expenditure on contamination. Particularly, they push the significance and gauge empirically the impact of fiscal spending composition on the environment. They contend that a reallocation of government spending composition towards social and public merchandise diminishes pollution. In addition, they discover that expanding adds up to government measure, without changing its introduction, encompasses a non-positive effect on environmental quality. Again, in a related study by R. E. Lopez and Palacios (2010) who looked at the impact of government expenditure and environmental expenditure on environmental quality in Europe, they recorded that government expenditure has a negative impact and is seen as a critical determinant when discussing environmental pollution. In addition to the above Bernauer and Koubi (2009) an increment within the government spending % of GDP is related to more air pollution and this relationship isn't influenced by the quality of the government. Be that as it may, they don't consider quadratic or cubic terms of pay in their examination and they attribute their finding to the vague hypothesis that higher salary leads to both greater government and superior air quality.

In more ways, R. Lopez et al. (2011) evaluated both the direct impact of government spending on pollution and the indirect impact which works through government spending effect on per capita growth and the ensuing the impact of income on pollution. In arranging to require under consideration the dynamic nature of the relationships inspected, suitable econometric methods are utilized. They stated that Government spending is assessed to have a negative coordinate effect on emissions.

Gupta, Miranda, and Parry (1995) recognizes ranges of public expenditure arrangement that interact with the environment. They contended that this framework has some appropriations, expanded operations and maintenance expenditures, and a careful environmental assessment of capital ventures will improve environmental quality, in this manner moving an economy toward 'sustainable' development.

An evaluated sign of the coordinate impact of the government estimate in terms of expenditure on pollution is vague within the experimental writing. Frederik and Lundström (2001) explore the impact of political and economic flexibility on the level of CO₂ emissions and discover that the impact of government estimate on levels of pollution contrasts agreeing to the beginning government measure. They propose that expanded economic opportunity, in terms of lower government estimate, diminishes CO₂ emissions when the estimate of government is less but increases emissions when the estimate is expansive.

Pearce and Palmer (2001) utilizing an OECD data, finds small prove to appear that environmental expenditures adversely affect economic growth, in spite of the fact that there's irregularity between the 'no effects' finding of the competitiveness literature and the 'negative effects' finding of most of the efficiency writing. Once more, they recorded that the elasticity of expenditure with regard to income is found to be 1.2, lower than would be anticipated in the event that the 'environmental demand effect' is critical in clarifying the descending slope of the EKC.

3. Data

The sample is comprised of 3 nations with a full dataset for Carbon Emission (CO₂) as environment, government expenditure (GOEx) as sustain able procurement and other significant informative variable data for the period 1990-2014. The data for variables are from the World Bank Indicators (2018); the other variables in corporate GDPPC as growth, ENE as energy consumption with POP as total population. The whole adds up to observations of the sample is 375 with each variable having 75 observations. The descriptive statistics of the variables are portrayed within the table underneath:

Variable	Obs	Mean	Std. Dev.	Min	Max
CO ₂	75	.4344462	.1289654	.25441	.770794
GDPPC	75	7.28e+10	1.25e+11	5.00e+09	5.70e+11
GOEx	75	5.38e+09	9.84e+09	4.70e+08	3.80e+10
ENE	75	504.8266	177.3587	266.12	798.63
POP	75	5.65e+07	5.55e+07	1.20e+07	1.80e+08

Table 1: Descriptive Statistics

Source: Authors' Calculations

3.1. Empirical Model Development

The empirical model of the examination is clarified as follows. As of late various empirical researches inspected energy as the contributing factor of environmental degradation in the EKC setting (Ahmed, Shahbaz, Qasim, & Long, 2015; Naradda Gamage, Hewa Kuruppuge, & Haq, 2017b; ul Haq et al., 2016). Likewise, financial development, alongside energy utilization, is recognized as a basis of environmental degradation in the empirical investigations of Tamazian, Chousa, and Vadlamannati (2009) and (Shahbaz, Solarin, Mahmood, & Arouri, 2013). Government expenditure is viewed as a factor of environmental degradation in a number of studies (Bernauer & Koubi, 2006; Halkos & Paizanos, 2013; R. Lopez et al., 2011). In this way, this study built up the accompanying model:

$$CO_2 = F(GDPPC, GOEx, ENE, POP) \dots \dots \dots \text{(Equation 1)}$$

An econometric model for the equation above is written as:

$$CO_2 = \alpha + \beta_1 GDPPC_{it} + \beta_2 GOEx_{it} + \beta_3 ENE_{it} + \beta_4 POP_{it} + \epsilon_{it} \dots \dots \dots \text{(Equation 2)}$$

Where CO₂, GDPPC, GOEx, ENE, and POP speak to carbon emissions, GDP growth, and energy utilize, and total population individually. The paper anticipates a positive impact of government expenditure on the environment. Energy Consumption and total population counting GDP growth may carry a positive or a negative sign depending on their effect on environmental condition.

3.2. Methodology

To set up the determination between the environment and sustainable procurement, the study begun with the estimation of panel unit root test to check the stationarity of the data to maintain a strategic distance from and restrain spurious outcomes. The IPS strategy of unit root test was utilized which is additionally utilized by (Appiah, Amoasi, & Frowne, 2019). On the next portion, the fixed and random effects, methods for testing the effect and critical of sustainable procurement on the environment. This method of estimation has been used and adopted by Appiah, Frowne, and Frowne (2019) on panel dataset evaluation. The Hausman test impacts are utilized to distinguish the suitable strategy of estimation for the study.

4. Empirical Findings & Results

This section of the study deals with the interpretation of findings and results. The interpretations start with the descriptive statistical analysis, followed by unit root results, regression analysis including Hausman examination result. Table 1 demonstrates the descriptive statistics on the variables. Remarkably, the mean and standard deviation of the reliant variable is 0.4344462 and 0.1289654 respectively, with the concerned variable government expenditure also having a mean of 5.38 and a standard deviation of 9.84. It can be recorded that each variable has an observation of 75.

Im-Pesaran-Shin Unit-Root Test	Level Panel Means: Trend		1 st Dif Panel Means: Trend	
Variables	T. Statistics	Prob	T. Statistics	Prob
CO ₂	-1.0031	0.1579	-4.3380	0.0000***
GDPPC	1.6347	0.9489	-5.0413	0.0000***
GOEx	-0.2032	0.4195	-4.5169	0.0000***
ENE	-1.1552	0.1240	-4.2256	0.0000***
POP	-4.3001	0.0000***	-6.5073	0.0000***

Table 2: Unit Root Test

Nb: *** Shows Significant at 1% Level

Source: Authors' Calculations

The assessment begins with the examination of panel unit root tests for the variables considered within the model definition. Testing for unit roots in panel data requires consideration of both T and N measurements. Since the panel data set we have looked at consists of both N and T measurements, the tests of stationarity performed are based on the Im, Pesaran & Shin unit root test, which is more fitting in this case. Panel unit root tests are detailed in Table 2. The outcomes of tests show that panel data variables have a unit root. Thus, these come about lead us to conclude that our panel data variables are characterized as and I (1) handle.

Variables	Fixed Effects	Random Effects
GDPPC	(-4.49e-13) 0.418	(5.87e-13) 0.301
GOEx	(-5.67e-12) 0.273	(-4.66e-12) 0.423
ENE	(-.0000366) 0.844	(.0000954) 0.518
POP	(9.32e-09) 0.0000***	(7.56e-10) 0.266
Prob	0.0000	0.0000

Table 3: Random & Fixed Effects Regression Analysis

Nb: 0 Represents Values of the Coefficients. ***, ** Represents Significant at 1% and 5% Respectively

Source: Authors Calculations

The contention concerning the commitment of GDP growth, having an unfavorable environmental impact cannot be thought little of. The anticipated results give it clear that GDP growth has no impact and significant influence on environmental conditions. It's apparent that an increment in GDP growth comes about in a non-stop increment in environmental conditions particularly carbon emissions. This outcome is empirically related to an investigation by (Grossman & Krueger, 1995). In most cases there is a contrary situation where there exists an existence of the EKC.

The coefficient of government expenditure defined as sustainable procurement is essentially negative and has no effect on carbon emissions, meaning a 1 percent increment in government expenditure will not have any impacts on carbon emissions. This result is in line with the contention put forward by Bernauer and Koubi (2006) that government expenditure falls apart the quality of the environment, and its impact on the environment does not depend on the quality of the government. So also, R. Lopez et al. (2011) summarize that increments in government expenditure will contrarily influence the environment unless the consumption is moved toward social and public products, which would result in lower pollution.

The impact of government expenditure taught as sustainable procurement can be clarified by scale, composition, and method impacts. The scale effect hypothesizes that government expenditure will put weight on the environment as it enhances economic movement and consequently, will hurt the quality of the environment. On the other hand, government expenditure, by changing the composition of the economy, would positively influence the environment since it would produce strongly human capital rather than physical capital that would negatively influence the environment. So also, the impact of government expenditure will make strides the quality of the environment.

Within the outcomes above, the circumstance of the energy consumption on environmental condition cannot be underestimated. The results clearly show that there's an unfavorable impact of energy consumption on the environment. The increment in carbon emission is as a result of an increment in energy utilization related to mass production and mass consumption. This result is experimentally supported by Gao, Long, Ren, and Ojima (2002) when they explored the effect of energy consumption on the environment in Shanghai, China.

With the outcomes above it proves that Population growth carries a negative effect on the quality of the environment. Statistically it is demonstrated that a 1 percent increment in population result in over 100 metric tons of carbon emissions into the environment. This result is clearly apparent in a think about by Kahn and Yardley (2007) who recorded that increment in population as well as industrialization brings about air pollution. Once more, Preston (1996) confirmed that population growth has an unfavorable impact on the environment.

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	1.40	2	0.2370

Table 4: Hausman Test Results

Source: Authors Calculations

The choice of a fitting method for the assessment is decided by the estimation of the Hausman test with the null hypothesis that random effects strategy is legitimate and the alternative is selecting the fixed effects strategy. The outcomes show that the random effects estimation is suitable with the null hypothesis chosen.

5. Conclusion

In this study, a sample of 3 nations for the period 1990-2014 was utilized to experimentally test the effect of sustainable procurement measured as government expenditure on carbon emissions. For that reason, an econometric model was evaluated taking specific care to consider the dynamic nature of the connections examined.

The impact of sustainable procurement was found to be negative on carbon emission as well as having a poor negative relationship. Additionally, other explanatory variables show negative effect and relationship. Utilizing the Fixed and Random effects approach of estimating, the assessed add up to impact of sustainable procurement is to a great extent decided and takes over the design of the more prevailing indirect impact and relationship. In specific, for carbon emissions, the whole effect of government expenditure is negative, in spite of the fact that diminishing in absolute value, for GDPPC, it appears to be negative for all countries under study.

The evidence of a non-positive coordinate impact of sustainable procurement on carbon emission is in line with later discoveries by (R. Lopez et al., 2011; R. E. Lopez & Palacios, 2010). The outcome affirms the theoretical and empirical advancements on the existence of an indirect relationship between sustainable procurement and carbon as well between energy consumption and population.

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