

Environmental Disclosure Practices and Stock Market Return Volatility in The Nigerian Stock Market

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Abstract

Volatility of stock market return is of great concern to providers of funds as it increases the uncertainty of their future wealth. Many studies have address of environmental disclosure and the Nigerian stock market but few considered the effect of environmental disclosure on the volatility in the stock market. This study investigated the combined effects of environmental pollution and control policy (EPC), energy policy (ENP), impact of biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), cost of compliance to environmental laws (CCEL), firm size (FSZ), and firm age (FA) on stock market return volatility. The study adopted ex post facto research design. The target population for the study comprised 48 companies quoted on the Nigerian Stock Exchange, under the consumer goods and industrial goods sectors, as at December 31, 2016. A sample size of 17 companies was determined using Cochran's formula. Stratified proportionate sampling was adopted to select the number of companies studied from each stratum and samples from each stratum were purposively selected based on companies with higher total asset as at December 31, 2016. The results revealed that EPC, ENP, IB, WMC, ERD, CCEL, FSZ and FAG jointly had significant effect on Stock Market Return Volatility (SMRV). The individually ENP, IB, FSZ and FAG had significant negative effect on SMRV ($\beta = -.053, -.131, -.026, -.006$; $t_{(253)} = -2.28, -5.00, -5.82, -8.67$; $p < .05$); while WMC had significant positive effect on SMRV ($\beta = .113$, $t_{(253)} = 2.43$, $p < .05$). The study concluded that environmental disclosure practices were important factors in determining the stability of the Nigerian stock market. The study recommended that financial reporting council of Nigeria and other regulatory agencies should establish and implement environmental disclosure standards to mandate consistent disclosure of environmental information.

Keywords: Environmental disclosure, Stakeholders, Stock market, Volatility, Investors, Consumer goods sector, Industrial goods sector.

1. Introduction

Volatility of stock market return is of great concern to providers of funds as it increases the uncertainty of their future wealth (Errais & Bahri, 2016). Higher volatility may increase the likelihood of incurring losses and this may cause investors' confidence in the stock market to dwindle. Lack of investors' confidence in the stock market may increase risk premium thereby increasing the cost of

raising capital in the market or motivate the investors to divert their funds to a less risky investment. The diversion of fund from the stock market reduces market liquidity and will increase the cost of raising funds in the market. The increase in risk premium and transaction cost could discourage both domestic and foreign direct investment. The instability of the stock market return could negatively influence investors' decisions and may starve companies using the stock market to raise funds to finance business expansion or take advantage of new business opportunity. Volatility of stock market return may hinder the stock market from effectively performing its role in mobilizing saving from the surplus part of the economy and redistributing it to the deficit side of the economy to motivate economic growth. Information plays a central role in the inner working

Increase in socially responsible investment have forced manager to align their business strategies with the stock market valuation of their environmental performance. One of such market valuation of environmental information is the effect of company-specific environmental news on stock return. According to Indrabudiman (2017) stock return is one of the major factors that motivated investor to invest in a company and it was also the reward of taking the risk to invest in the shares. Deak and Karali (2014) stated that where a company has a good environmental reputation, investors may positively react to the shares of the company thereby increasing stock return. They further stated that the effect of environmental violation penalties may affect the profitability of a company depending on its size, and it may also contribute to its riskiness. Riskier companies are a major concern to investors and may affect their perception of investing in such company as such affects stock return. Stock return of a company is also influenced by the quality of information at the disposal of the investing public. Mwangi and Mwiti (2015) stated that Voluntary disclosure of information is considered to be one of the major factors that affects stock returns.

There are studies that reviewed the place of environmental disclosure and Stock return of companies. Essajee and Wambugu (2016) revealed that financial disclosure increased the level of stock return of companies listed on the Nairobi Stock Exchange. He added that increase in corporate social responsibility disclosure would increase stock return. Jones, Frost, Loftus and Van der Laan (2007) also affirmed that an abnormal market return was generally viewed to be an infringement on the performance of firms and investors expectation about future performance of the firm. Mwangi and Mwiti (2015) considered stock market yield as the gain an individual or institutional investor obtained from his investment in the share of a company. Zhou and Yin (2017) affirmed that the stock market in china penalized firms associated with unfavourable environmental news. Thomas (2001) also submitted that the adoption of environmental policy and prosecution for breach of environmental standards have significant explanatory power in the analysis of excess return. Grewal, Riedl, and Serafiem (2015); Brammer, Brooks and Pavelin (2006) opined that the stock return of companies with sufficient nonfinancial disclosure could be higher than those of companies with minimal nonfinancial disclosure.

1.1. Statement of the Problem

Stock market return is influenced by the stability of share prices in the market. Where share prices are highly volatile, the predictability of stock returns becomes difficult and that can affect investors' confidence. Share price volatility affects the proper functioning of the financial system and negatively affects stock market performance. High volatility above a certain level will increase investment's risk hence the possibility of losses becomes apparent. Many studies have been carried out to address environmental disclosure and the Nigerian stock market return but few considered the effect of environmental disclosure on the volatility in the stock market return. This study investigated the combined effect of environmental pollution and control policy (EPC), energy policy (ENP), impact of biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), cost of compliance to environmental laws (CCEL), firm size (FSZ), and firm age (FA) on stock market return volatility.

1.2. Objective of the Study

The main objective of this study was to determine the effect of environmental disclosure practices of companies on the volatility of the stock market return in the Nigerian stock market.

1.3. Research Question

This study answered the research question

How effective is environmental disclosure in influencing the volatility of stock market return of companies quoted on the Nigerian Stock Exchange?

1.4. Hypothesis

The study hypothesis was tested at 5% level of significance

H₀. Volatility of stock market return is not significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange

2. Review of Literature

2.1. Theoretical Framework

2.1.1. Signaling Theory

Signaling theory was propounded by Spence in 1973. The theory had been adopted in explaining the behavior of individuals or organizations with access to different information (Connelly, Certo, Ireland, & Reutzel, 2011). Fundamentally, signaling theory is concerned with minimizing information asymmetry between parties (Bae, Masud, & Kim, 2018; Su, Peng, Tan, & cheung, 2014; Spence, 2002).

2.1.2. Political Economy Theory

This theory was propounded by Jevons in 1871. Political economy is the study of production and trades and how it is influenced by law, custom and government; and political economy theory has been the most widely used theory to explain why organizations seem to yield to government or public pressure for the disclosure of information about the impact of their operations within and without the communities in which they operate (Liu & Anbumozhi, 2009; Deegan, 2002; Cormier & Gordon, 2001; Guthrie & Parker, 1990; Dowling & Pfeffer, 1975). Political economy theory has been used to explain the disclosure of social and environmental information by corporate organizations (Deegan & Unerman, 2006).

Signaling theory was adopted for this study because it explained the behavior of individuals or organization with access to different information (Connelly, Certo, Ireland, & Reutzel 2011). It also shows how corporate organizations disclosed information to notify the investing public about their capability in running the operations of the companies.

2.2. Empirical Review

Dutt and Humphery-Jenner (2013) investigated stock market return volatility, operating performance and stock return in the USA. The study found that low volatile stocks earned higher returns than highly volatile shares. Deak and Karali (2014) reviewed stock market reaction to environmental news in the food industry in the US. The study found that positive or negative events that are directly connected to companies' activities led to increase in share prices and returns more than environmental events that were outside the control of the companies. Haider, Hashmi and Ahmed (2017) studied the impact of systematic risk factors on stock return volatility in Pakistani stock exchange. The study concluded that variation in some microeconomics indices will induce volatility in stock

return. Che (2018) studied types of investors in Norway stock exchange and their impact on stock return volatility. The study found that foreign investors, because of the volume of their transaction and the little time in which they kept their investment, spurred volatility in stock return which is in contrast to individual investors' activities that reduced stock return volatility because they have minimal volume of transaction. Chaklader and Gulati (2015) carried out a study of corporate environmental disclosure practices of companies doing business in India. The study found out that bigger company in India disclosed environmental information for fear of scrutiny from the public, media, government and the various stakeholders including investors in the share of those companies. They also concluded that environmental information helped companies to sustain themselves in a global market over a longer period of time.

In Nigeria, Okoli (2012) reviewed return-volatility interaction in the Nigerian market. The study found that while volatility in local variables could influence stock market volatility, international variables do not have significant influence on stock return in Nigeria. This implied that international volatility is not transmitted across borders. Emenike (2010) modelled stock returns volatility in Nigeria using GARCH. The result of the study showed an evidence of volatility clustering in the Nigerian stock exchange return series. Volatility makes it difficult for investors to hold stock for fear of uncertainty. Okey and James (2018) investigated how monthly stock return could influence volatility in the Nigerian capital market. The study found a significant volatility of stock return in the Nigerian stock exchange.

3. Research Methodology

The study adopted *ex post facto* research design. The target population for the study comprised 48 companies quoted on the Nigerian Stock Exchange, under the consumer goods and industrial goods sectors, as at December 31, 2016. A sample size of 17 companies was determined using Cochran's formula. Stratified proportionate sampling was adopted to select the number of companies studied from each stratum and samples from each stratum were purposively selected based on companies with higher total asset as at December 31, 2016. Validated data were extracted from the financial reports of the 17 companies and other published documents for the period of 15 years (2002-2016) which constituted the 255 firm-year observations used for this study.

4. Data Analysis, Interpretation and Discussion

4.1. Data Analysis

The result of the data analysis is shown in Appendix 1

4.2. Interpretation of Results

This subsection presents the result of the regression analysis to examine the relationship between volatility of stock market return (VSMR) and each of the Environmental Disclosure Practices Indicators as well as the control variables. In this case, the dependent variable is volatility of stock market return (VSMR) while the independent variables are Environmental Pollution and Control Policy (EPC), Energy Policy (ENP), Impact on Biodiversity (IB), Waste Management Cost (WMC), Environmental Research and Development Cost (ERD), Cost of Compliance with Environmental Law (CCEL), and Firm Size (FSZ) and Firm Age (FAG) as moderating variables. The hypothesis for model three is stated as follows:

H_{01} : Volatility of stock market return is not significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange

This is functionally stated as follows:

$$VSMR_{it} = \beta_0 + \beta_1 EPC_{it} + \beta_2 ENP_{it} + \beta_3 IB_{it} + \beta_4 WMC_{it} + \beta_5 ERD_{it} + \beta_6 CCEL_{it} + \mu_{it} \dots \text{Model 3}$$

In order to select the most appropriate model for hypothesis without the effect of moderating variables, hausman test was conducted to determine whether the unique errors (error term) are correlated with the repressors. The null hypothesis for the test suggested the appropriateness of random effect while the alternative hypothesis suggested fixed effect. The result of the hausman test showed a *p-value* of 1.000, that is 100. % percent which is more than 5% level of significance adopted for this study. The result suggested random effect model as the most appropriate model for hypothesis without the effect of moderating variables. To confirm the result of the hausman test, lagrangian multiplier (LM) tests was conducted. These test was conducted to determine the most appropriate model between the random effect and the pooled ordinary least squares (OLS) regression. The null hypotheses of this test is that OLS is an appropriate model and the alternative hypothesis suggests random effect model as the appropriate model. The results of the LM tests showed a coefficient and *p-value* of 992.29 (0.000), which is less than the 5% level of significance adopted by this study. The results also suggested random effect model as the most appropriate model for hypothesis three without the effect of moderating variables.

To determine the robustness of the model, diagnostics test for cross sectional dependence, heteroscedasticity, and auto correlation was carried out. According to Hsiao, Pesaran, and Pick (2017) panel data are assumed to be independent across individual observation and where this assumption does not hold for panel data, the estimators based on the assumption of cross sectional independence be inconsistent. The null hypothesis for cross sectional independence is that the residuals of the model are uncorrelated over time. The test was carried out using Pesaran's test of cross sectional independence and the result showed a *P-value* of 0.000, which is less than 5% percent level of significance adopted for this study. The result rejected the null hypothesis of cross sectional independence and showed that the standard errors of the model are correlated over time, this suggested that the model has cross-sectional dependence problem.

The test for heteroscedasticity is carried out to ensure that variation in standard error is constant across all observations. Where heteroscedasticity is present in a panel data, the efficient of the estimators is weakened. The null hypothesis states that the standard errors of the model are constant over time. The result of the heteroscedasticity test showed *p-value* of 0.000 which is less than the 5% adopted for this study. This indicates the presence of heteroscedasticity; that is the standard errors of the model are not constant over time.

The model was also tested for the presence of autocorrelation, among the residuals and the coefficients of the model, using Wooldridge test for autocorrelation in panel data. The null hypothesis for the test states that there is no first order autocorrelation. The result of the test showed a *P-value* of 0.000 which is less than 5% level of significance adopted for this study. The result suggested the rejection of the null hypothesis and the acceptance of the alternate hypothesis that showed the presence of autocorrelation.

All the diagnostics test conducted for the model, without the effect of moderating variables, showed the presence of cross sectional dependence, heteroscedasticity, and autocorrelation therefore such OLS, fixed effect model, and random effect model would not be appropriate estimators for the model. In order to correct this problem, the Linear Regression (PCSEs) was used to estimate the effect of environmental disclosure practice and volatility of stock market return of companies quoted on the Nigerian stock market.

The results of the model adopted to test the hypothesis, without the effect of moderating variables, is shown on table 4.1 and is interpreted as follows:

The results showed that while environmental pollution and control policy (EPC) (with *coefficient* = -0.062 and *p-value* = 0.000), energy policy (ENP) (with *coefficient* = -0.62 and *p-value* = 0.015), and impact on biodiversity (IB) (with *coefficient* -0.091 and *p-value* = 0.000)

value = 0.000) have negative and significant influence on volatility of stock market return, Waste management cost (WMC) (with *coefficient* = -0.030 and *p-value* = 0.241), have negative and insignificant influence on the volatility of stock market return. Environmental research and development cost (ERD) (with *coefficient* = 0.040 and *p-value* = 0.015) has a positive and significant influence on the volatility of stock market return; and cost of compliance with environmental laws (CCEL) (with *coefficient* 0.021 and *p-value* = 0.294) has a positive and insignificant influence on the volatility of stock market returns.

The coefficient of the regression result measures the magnitude and the direction of relationship between the dependent and the independent variables. Environmental pollution and control policy (EPC) with coefficient of -0.062, energy policy (ENP) with a coefficient of -0.62, impact on biodiversity (IB) with a coefficient of -0.091, and Waste management cost (WMC) with a coefficient of -0.030 implies that a unit increase in EPC, ENP, IB, and WMC could result in 6.2%, 62%, 9.1%, and 3% decrease in the volatility of stock market returns in the shares of companies quoted in the Nigerian stock market respectively. A unit increase in the disclosure of environmental research and development (ERD), and cost of compliance to environmental laws (CCEL) could induce an increase of 4% and 2.1% in the volatility of stock market return respectively.

The explanatory power of environmental pollution and control policy (EPC), energy policy (ENP), impact on biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), and cost of compliance to environmental laws (CCEL) combined on the volatility of stock market return in the Nigerian Stock Market is 0.069 which implies that only 6.9% of volatility in volume of transaction is caused by the combined influence of the explanatory variables while the remaining 93.1% is caused by other variables not considered in this study. The *F-stats* with a *coefficient* and *p-value* of 4.12 (0.001) which is less than 5% level of significance adopted for this study is an indication that all explanatory variables (EPC, ENP, IB, WMC, ERD, AND CCEL) jointly and significantly influence the dependent variable (VSMR).

The parameter estimates obtained from the Linear Regression (PCSEs) are given in the equation for model three without the effect of moderating variables is shown as follows:

$$\mathbf{VSMR_{it} = 0.392 - 0.062EPC_{it} + 0.62ENP_{it} - 0.091IB_{it} - 0.030WMC_{it} + 0.40ERD_{it} + 0.021CCEL_{it} + \mu_{it} \text{-----Model 3}}$$

The study also considered the effect of firm size and firm age on environmental disclosure and volatility of volume of transactions. This is functionally presented as follows:

$$\mathbf{VSMR_{it} = \beta_0 + \beta_1EPC_{it} + \beta_2ENP_{it} + \beta_3IB_{it} + \beta_4WMC_{it} + \beta_5ERD_{it} + \beta_6CCEL_{it} + \beta_7FSZ_{it} + \beta_8FAG_{it} + \mu_{it} \text{-----Model 3}}$$

In order to select the most appropriate model for hypothesis with the effect of moderating variables, hausman test was conducted to determine whether the unique errors (error term) are correlated with the regressors. The null hypothesis for the test suggested the appropriateness of random effect model (REM) while the alternative hypothesis suggested fixed effect model (FEM). The result of the hausman test showed a *p-value* of 0.969, that is 96.9 % percent which is greater than 5% level of significance adopted for this study. The results suggested random effect model as the most appropriate for hypothesis three with the effect of moderating variables. To confirm the result of the husman test, Lagrangian multiplier (LM) tests was conducted. The test was conducted to determine the most appropriate model between the random effect model and the pooled ordinary least squares (OLS) regression. The null hypotheses of this test is that OLS is an appropriate model while the alternate hypothesis suggested random effect model as the most appropriate model. The result of the LM tests showed a coefficient and *p-value* of 895.31 (0.000), which is less than the 5% level of significance adopted by this study. The result also suggested random effect model as the most appropriate model for hypothesis three when considering the effect of moderating variables.

To determine the robustness of the model, diagnostics test for cross sectional dependence, heteroscedasticity, and auto correlation was carried out as in the model without the effects of moderating variables.

All the diagnostics tests conducted for model with the effect of moderating variables, showed the presence of heteroscedasticity, and autocorrelation; as such OLS, fixed effect model, and random effect model would not be appropriate estimators for the model. In order to correct this problem, the random effect model with cluster was used to estimate the effect of environmental disclosure practices on the volatility of stock market return in the Nigerian stock market taking into consideration the effect of moderating variables. The result is also shown on table 4.1 in appendix I and interpreted as follows:

The results showed that environmental pollution and control policy (EPC) (with *coefficient* = -0.026 and *p-value* = 0.526), energy policy (ENP) (with *coefficient* = -0.042 and *p-value* = 0.503), have impact on biodiversity (IB) (with *coefficient* -0.025 and *p-value* = 0.523), environmental research and development cost (ERD) (with *coefficient* = -0.000 and *p-value* = 0.993), and cost of compliance with environmental laws (CCEL) (with *coefficient* -0.007 and *p-value* = 0.853) have negative and insignificant influence on the volatility of stock market returns in the Nigerian stock market; while waste management cost (WMC), (with *coefficient* = 0.005 and *p-value* = 0.928), and firm size (FSZ) (with *coefficient* = 0.011 and *p-value* = 0.482) have a positive and insignificant influence on the volatility of stock market returns. Firm age (FAG) (with *coefficient* = -0.011 and *p-value* = 0.000) has negative and significant influence on the volatility of stock market returns in the Nigerian stock market.

The coefficient of the regression result measures the magnitude and the direction of relationship between the dependent and the independent variables. Environmental pollution and control policy (EPC) with coefficient of -0.026, energy policy (ENP) with a coefficient of -0.042, impact on biodiversity (IB) with a coefficient of -0.025, environmental research and development cost (ERD) with a coefficient of -0.000, cost of compliance to environmental laws (CCEL) with a coefficient of -0.007, and firm age (FAG) with a coefficient of -0.011 implies that a unit increase in EPC, ENP, IB, ERD, CCEL, and FAG could result in 2.6%, 4.2%, 2.5%, 0%, 0.7%, and 1.1% decrease in the volatility stock market return in the Nigerian Stock Market. On the other hand, waste management cost (WMC) with a coefficient of 0.005, and firm size (FSZ) with a coefficient of 0.011 implies that a unit increase in WMC, and FSZ could result in 0.05%, and 1.1% increase in the volatility stock market return of shares.

The explanatory power of environmental pollution and control policy (EPC), energy policy (ENP), impact on biodiversity (IB), waste management cost (WMC), environmental research and development cost (ERD), cost of compliance to environmental laws (CCEL), firm size (FSZ), and firm age (FAG) combined on the volatility of stock market return of shares in the Nigerian Stock Market is 0.168 which implies that 16.8% of volatility of stock market return of shares in the Nigerian stock market is caused by the combined influence of the explanatory variables while the remaining 83.2% is caused by other variables not considered in this study. The *wald-test* with *p-value* = 0.000 which is less than 5% level of significance adopted for this study is an indication that all explanatory variables (EPC, ENP, IB, WMC, ERD, CCEL, FSZ, and FAG) jointly and significantly influence the dependent variable (VSMR).

The parameter estimates obtained from the random effect model with cluster are given in the equation for model two with the effect of moderating variables shown as follows:

$$\text{VSMR}_{it} = 0.694 - 0.026\text{EPC}_{it} - 0.042\text{ENP}_{it} - 0.025\text{IB}_{it} + 0.0005\text{WMC}_{it} - 0.000\text{ERD}_{it} - 0.007\text{CCEL}_{it} + 0.011\text{FSZ}_{it} - 0.011\text{FAG}_{it} + \mu_{it}$$

Comparing the models of hypothesis, with and without the influence of moderating variables, it is shown by the result that the model with the influence of moderating variable explained more appropriately the relationship between environmental disclosure practices

and volatility of stock market return of shares in the Nigerian stock market. The explanatory power of the independent variables in the model with moderating variables is 16.8 % which is greater than that of the model without moderating variables (6.9%). The *wald-test* (31.75(0.000)) and (62.34(0.034)) of the models, with and without the moderating variables respectively, confirmed the superiority of the model with the moderating variables.

4.3. Discussion of Findings

The regression result in Table 4.1 showed that environmental disclosure indices (EDI) had a negative and significant influence on Stock Market Return Volatility (SMRV) as shown by *wald-test* = 62.34, *Adj. R²* =16.8, and *P-value* = 0.000. The significance of the *P-value* at 5% level of significance adopted for this study supported the acceptance of the alternate hypothesis that suggested that volatility of stock market return is significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange. As a result, the study concluded that Volatility of stock market return is significantly influenced by environmental disclosure of companies quoted in the Nigerian Stock Exchange. This result is in line with the *A priori* expectation of the study and also aligned with a similar study.

A similar study conducted by Zhang, Djajadikerta, and Zhang (2018) to check if sustainability engagement affects stock return volatility in Chinese financial market and concluded that sustainability news release was found to affect positively stock return volatility. Saleh, Zulkifli, and Muhamad (2011) also found a positive relationship between corporate social responsibility and stock market return. On the contrary, Nwangi and Mwit (2015) found no relationship between voluntary disclosure and stock returns of companies quoted in the Nairobi stock exchange.

Considering individual effect of environmental disclosure indices on stock market return, the result showed that environmental pollution and control policy (EPC), energy policy (ENP), impact on biodiversity (IB), environmental research and development cost (ERD), and cost of compliance with environmental laws (CCEL) had negative and insignificant influence on stock market return volatility. While waste management cost (WMC), and firm size (FSZ) had positive and insignificant influence on stock market return volatility, firm age (FAG) had negative and significant influence on stock market return. Investors in stock market are not only concerned with the returns on their investment but majorly concerned with the certainty of such return. A volatile financial market could make financial planning, based on investment in the stock market, to be difficult as providers of funds may find it difficult to determine the state of their investment with some degree of certainty. Where the stock market returns become highly volatile, providers of fund may ask for higher return to compensate for the high risk or divest their fund to less risk venture. The stability of the market increases the confidence of the investing public, and as such it is important for management to provide all necessary information to assist investors to make informed decision with regard to investment in the company's shares.

5. Conclusion and Recommendation

5.1. Conclusion

The main objective of this study was to determine the impact of environmental disclosure on the volatility of stock market return in the Nigerian stock market and the results showed that environmental disclosure indices jointly and significantly affect volatility of stock market return in Nigeria.

5.2. Recommendation

To ensure that companies consistently disclose environmental information, adequate laws and penalties must be created and enforced by policy makers. Managers should be aware of the impact of their operation on the environmental and design operational strategies to minimize externalities generated by its operations. Financial analysts should also consider environmental factors in reviewing financial statements and advising the investing public. Researchers and scholars should explore the subject of environmental disclosure, especially in the developing nations with aim of proffering solutions to the ever growing impact of companies' activities on the environment.

5.3. Suggestion for Further Studies

This study focused on the impact of environmental disclosure on volatility of stock market return in Nigerian stock market using data from the consumer and industrial sector of the Nigerian economy for a period of 15 years covering 2002 to 2016. It is suggested that future studies should extend the research to include quoted firms in other sectors of the economy whose operations have significant impact on the environment using a larger time frame.

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Appendix I

Table 4.1: Result of Regression Analysis

| SMRV | WITHOUT CONTROL VARIABLES | | | | WITH CONTROL VARIABLES | | | |
|---------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| | Pooled OLS | Fixed Effect | Random Effect | Linear Reg. (PCSEs) | Pooled OLS | Fixed Effects | Random Effects | Random Effects (Cluster) |
| EPC | -0.062 (-0.98) {0.327} | -0.049 (-1.15) {0.252} | -0.050 (-1.19) {0.235} | -0.062 (-3.50) {0.000} | 0.021 (0.33) {0.739} | -0.024 (-0.58) {0.563} | -0.026 (-0.63) {0.526} | -0.026 (-0.63) {0.526} |
| ENP | -0.062 (-0.60) {0.547} | -0.045 (-0.68) {0.500} | -0.045 (-0.69) {0.493} | -0.62 (-2.44) {0.015} | -0.053 (-0.56) {0.576} | -0.041 (-0.65) {0.519} | -0.042 (-0.67) {0.503} | -0.042 (-0.67) {0.503} |
| IB | -0.091 (-1.48) {0.141} | -0.065 (-1.60) {0.111} | -0.065 (-1.64) {0.102} | -0.091 (-5.85) {0.000} | -0.131 (-2.30) {0.022} | -0.015 (-0.37) {0.709} | -0.025 (-0.64) {0.523} | -0.025 (-0.64) {0.523} |
| WMC | -0.030 (-0.27) {0.784} | -0.020 (-0.32) {0.749} | -0.021 (-0.34) {0.737} | -0.030 (-1.17) {0.241} | 0.113 (1.09) {0.276} | -0.001 (-0.02) {0.985} | 0.005 (0.09) {0.928} | 0.005 (0.09) {0.928} |
| ERD | 0.040 (0.51) {0.612} | 0.004 (0.07) {0.944} | 0.006 (0.10) {0.921} | 0.040 (2.43) {0.015} | -0.013 (-0.18) {0.859} | 0.003 (0.06) {0.951} | -0.000 (-0.01) {0.993} | -0.000 (-0.01) {0.993} |
| CCEL | 0.021 (0.27) {0.791} | 0.006 (0.14) {0.889} | 0.006 (0.15) {0.884} | 0.021 (1.05) {0.294} | 0.018 (0.25) {0.806} | -0.007 (-0.19) {0.851} | -0.007 (-0.19) {0.853} | -0.007 (-0.19) {0.853} |
| FSZ | - - - | - - - | - - - | - - - | -0.026 (-2.25) {0.026} | 0.024 (1.32) {0.187} | 0.011 (0.70) {0.482} | 0.011 (0.70) {0.482} |
| FAG | - - - | - - - | - - - | - - - | -0.006 (-4.89) {0.000} | -0.013 (-3.85) {0.000} | -0.011 (-3.73) {0.000} | -0.011 (-3.73) {0.000} |
| Constant | 0.393 (22.53) {0.000} | 0.385 (34.86) {0.000} | 0.386 (6.12) {0.000} | 0.392 (22.53) {0.000} | 1.110 (6.43) {0.000} | 0.605 (3.20) {0.002} | 0.694 (3.73) {0.000} | 0.694 (3.73) {0.000} |
| Adj. R ² / Overall R | | 0.088 | 0.087 | 0.069 | 0.211 | 0.142 | 0.168 | 0.168 |
| F-stat (Prob) | | 5.03 (0.000) | - | 4.12 (0.001) | 0.000 (0.236) | 7.57 (0.000) | - | - |
| Wald-test (Prob) | | - | 31.75 (0.000) | | - | - | 62.34 (0.000) | 62.34 (0.000) |
| Hausman Test | | | 0.05 (1.000) | | | | 2.34 (0.9688) | |
| Testparm (rho)/LM test | | | 992.29 (0.000) | | | | 895.31 (0.000) | |

| | | | | | | |
|-------------------------|--|--|-----------------|--|--|-----------------|
| Heteroscedasticity Test | | | 40.05 (0.000) | | | 157.6 (0.000) |
| Cross-Sect. Dependence | | | 0.000 | | | 0.000 |
| Auto-correlation Test | | | 359.965 (0.000) | | | 1869.39 (0.000) |

Source: Authors Computation, 2019 using STATA 15.

