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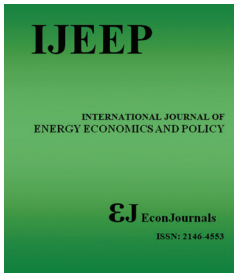

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Is Going Green Good for Profit? Empirical Evidence from Listed Manufacturing Firms in Indonesia

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ABSTRACT

This paper empirically analyses the effects of greenhouse gas (GHG) emissions on the financial performance (FP) of listed Indonesian manufacturing firms in 2011. The data of GHG emissions was obtained by personal interviews with relevant officials of sample firms as it is publicly unavailable. This research used four different measures of firm FP to understand how stakeholders respond to firms GHG emissions which were measured in CO_2e intensity. This study draws on the instrumental stakeholder theory and competitive advantage theory. The results showed that GHG emission has a positive significant effect on all measures of firm FP. As the cost of compliance exceeds the cost from non-compliance, and regulatory enforcement is lax, firms have little incentive to comply with GHG regulation.

Keywords: Greenhouse Gas Emissions, Financial Performance, Indonesian Manufacturing Firms
JEL Classifications: G3, L6, M1, Q5

1. INTRODUCTION

Climate change refers to "climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer." (IPCC, 2007). It is found that climate change occurs as the total stock of greenhouse gases (GHG) in the atmosphere increases. GHG emission has been attributed mainly to human activities. There are six such GHG that are measured by the accounting rules of the Kyoto Protocol. The level of these gases increased of 160 parts per million (ppm) from their pre-industrial levels (ABS, 2013) with its attendant effects such as storms and floods, melting of glaciers, heat waves, high incidence of droughts and others. Consequently, GHG emissions have become an important issue globally and efforts are being made to reduce GHG emissions by suitable policy interventions. The Australian government, for example, introduced a carbon tax. Similarly, the EU introduced a carbon trading scheme and Indonesia brought "energy management" regulations. Such regulations naturally impact the firm and its stakeholders (such as shareholders, creditors, customers and others) get concerned about the issue of climate change and its possible impact on the firm (Brinkman et al., 2008). Ignoring the interests of stakeholders would make it difficult for the firm to achieve its goals (Jensen, 2001). Consequently, there is growing interest in the association between the level of GHG emissions and firm financial performance (FP) (Busch and Hoffmann, 2011) which motivates this study.

This research focuses on Indonesia for several reasons. Indonesia experiences the problem of natural resource exploitation and environmental pollution in recent years (Gunardi et al., 2016). The extant empirical studies which are confined to developed countries have shown mixed results. Busch and Hoffmann (2011), Lee (2012) and Iwata and Okada (2010) found a negative association between GHG emissions and firm FP. On the other hand, Hatakeda et al. (2012), Wang et al. (2013) and Delmas and Nairn-Birch (2010) found a positive association. Unlike Indonesia, in developed countries, business attention to climate change has been high and regulations concerning climate change have been well established. Consequently, how do firms in a developing country such as Indonesia respond to GHG emission is an issue that has not been explored adequately in the literature to our knowledge. The recent Paris accord also recognizes that

issues that developing countries face are different from developed countries and "one size fits all" can't work in the matter of climate change. Furthermore, from a global climate change perspective Indonesia presents an interesting case. It is geographically unique with a number of islands, climate regimes and ocean conditions and as such has a key role in the global discourse on climate change (Mimura et al., 2007). Interestingly, the aspect of GHG emission and its effects on firm FP have received limited attention in academic studies as indicated later. This research focuses on manufacturing firms as they contribute significantly to GHG emissions, and as such are vulnerable to regulatory changes associated with climate change.

The study makes several important contributions. The extant studies, barring Iwata and Okada (2010), do not capture how stakeholders respond to GHG emission of the firm given its impact on firm FP while the present study specifically addresses this issue. The study, for example, uses pecking order theory (Myer and Majluf, 1984) to explain how owners response would be captured by the ROE while that of owners and creditors would be better reflected in ROI. ROS would capture customers' response and market response would be reflected by the Tobin's q. Furthermore, as prior studies were mostly confined to developed countries where published data of GHG measures is readily available, Indonesia present difficulties due to non-availability of published data. Consequently, this research collected the data by a primary survey of sample firms and used this unique data to assess the impact of GHG emissions on firm FP. Accordingly, this research shows a pathway for researchers in countries that do not have GHG emission data publicly available, how this difficulty can be overcome. Furthermore, as GHG emission regulation is not well established and enforced in Indonesia, firms pay little attention to this aspect (APEC, 2012). If GHG emission is adversary impacting firm FP, as some prior studies cited above have found, then these firms would do well in their own interest to control emission.

Academic studies on GHG emission and its effects on firm FP in Indonesia are limited. The studies that can be found are by Nishitani et al. (2012; 2013) and Nishitani et al. (2017) the former examined voluntary environmental management and its impact on firm FP. It found that firms that voluntarily embrace environmental management demonstrate positive impact on firm FP. the later found that the reduction of GHG emission to a greater extent has a positive and significant effect on firm profit. However, the former study is based on disclosures in annual reports and the later study is based on developed a questionnaire survey. This research directly measures the GHG emission of each of the sample firms and then examines the impact on firm FP and finds that these variables are positively associated.

On the conceptual front, the study would examine, the applicability or otherwise of the instrumental stakeholder theory (Jones, 1995) and competitive advantage theory (Porter and van der Linde, 1995a) in the Indonesian context. To advance the instrumental stakeholder theory, this study employs various measures of firm FP which will enable us to capture the response of different stakeholders to firms' GHG emissions (Iwata and Okada, 2010). The study also contributes to the least-cost strategy aspect of competitive advantage theory (Porter, 1980) by examining how GHG emissions impact firm costs and ultimately FP in Indonesia. Accordingly, we believe that the present study fills an important gap in the extant literature and we envisage that it would be of value to policy-makers, practitioners and researchers alike.

The paper proceeds as follows. Section 2 presents the theoretical underpinnings of the study and develops hypothesis. Section 3 describes the methodology and data. Section 4 presents results and analysis. The last section concludes.

2. THEORY AND HYPOTHESIS

GHG emissions by a firm are of concern to multiple stakeholders as it affects their interest. These concerns emanate from the likely cost the firm may have to face to comply with government regulations on one hand and the possibilities of penalties if the firm fails to comply. A firm will damage its reputation if it failed to control GHG emissions. Investors and creditors will lose confidence, thereby increasing the cost of equity and debt (Kapstein, 2001). Absenteeism and staff turnover may also increase because of unhealthy work environment (Hart and Ahuja, 1996). Local communities and NGOs may take legal action if firms do not comply with environmental regulations (Konar and Cohen, 1997), and the government may impose penalties (King and Lenox, 2001), adding to firm costs. Firms may also expose themselves to the risk of litigation (Berman et al., 1999). Accordingly, to achieve the goal of profit maximization and increasing the firm value, a firm needs to comply with the relevant regulations (Andriof and Waddock, 2002; Jensen, 2001; Muller and Sturm, 2001).

Another relevant issue in the context of examining the association between GHG emission and firm FP is the quality of enforcement of the government regulation (Porter and van der Linde, 1995b). Efficient regulations, they note, play a role in motivating firms to innovate. Innovations allow firms to reduce costs and improve their competitiveness. In contrast, under inefficient regulation, firms are slow in responding to carbon regulation (Porter and van der Linde, 1995b), as the possibilities of serious legal problems are unlikely.

In a country such as Indonesia where the government regulation on GHG emission is lax, there is little incentive for firms to comply as compliance has a cost which would lower profitability affecting stakeholder's interest. Firms are bound to weigh the cost of compliance vis-à-vis the cost of penalty due to noncompliance before they can consider complying with GHG regulations in Indonesia. Consequently, GHG emission by a firm may result in a positive relationship with firm FP if it is not complying with the regulation. On the other hand, a firm that complies with the regulation would incur additional costs lowering its profitability.

Porter and van de Linde (1995b) suggest that firms may earn benefits because the government imposes GHG emission regulations. Efficient regulations play a role in motivating firms to innovate. Innovation allows firms to reduce costs and improve their competitiveness. In contrast, under the inefficient regulation, firms

tend to delay their response to the low-carbon economy (Porter and van der Linde, 1995b), which may not result in serious legal problems. It can be concluded that with stakeholders' pressure and efficient environmental regulations, GHG emissions will have a negative effect on FP. Conversely, with a low level of stakeholders' pressure and inefficient environmental regulations, GHG emissions will have a positive effect on firm FP. GHG emissions in this research are operationaised as the intensity of CO_2 equivalent (CO_2e intensity).

Several firm specific factors besides GHG emission would impact firm FP and have been used in this paper as control variables. These are:

- Firm size: A firm with a large size can reap the economies of scale, make increased use of technology and reduce costs so as to improve profitability. Hall and Weiss (1967) using Fortune 500 firms found that firm size affects profitability significantly. Similar findings were reported by Majumdar (1997), Serrasqueiro and Nunes (2008), Lee (2009), and Sritharan (2015). Though, one would expect that large size would lead to economies of scale, if the firm becomes too large diseconomies of scale, could result to the detriment of the firm profitability. Some researchers have found such a negative relationship between size and profitability, such as Shepherd (1972); Becker-Blease et al. (2010), Banchuenvijit (2012).
- Leverage: Leverage refers to the debts raised by a firm. According to the agency cost theory, a positive relationship between financial leverage and firm performance is expected (Evgeny, 2015). A high debt ratio indicates extensive use of debt to finance firm assets. The higher the leverage ratio of a firm, the higher its financial risk (Berger and Bonaccorsi-di-Patti, 2006). Hence, the relationship between firm leverage and firm FP can be positive or negative, and this depends on the extent to which a firm's debt ratio reaches the optimum level.
- Capital intensity: Capital intensity is the amount of money invested in order to receive one dollar of output. It represents a firm's operating leverage (Lubatkin and Chatterjee, 1994). Martin (1983) and Harris (1988) found a negative association between capital intensity and firm performance. A high capital-intensive firm requires more capital to produce the same units of output as compared to a low capital-intensive firm. A capital-intensive firm is considered disadvantageous in terms of value-oriented environmental management (Schaltegger and Figge, 1998).
- Industry-type: This research use industry type as a dummy variable to assess the impact that industry type may have on firm performance. We classify industries in the sample in three groups (a) heavy industries including the cement, textile and garment, iron and steel, petrochemical and fertiliser, and porcelain and ceramic industries, (b) high GDP contributors, including motor vehicle parts and supplies, cooking oil, pulp and paper, and rubber, and (c) small firms, including the food and beverage industry and other industries that are not included in the group of heavy industries or the group of high GDP contributors. This classification is also used by Indonesian Government for industry analysis.

3. METHODOLOGY AND DATA

To provide information on how GHG emissions are measured, this study uses primary data. The primary data for this research were collected from the research samples via a face-to-face interview. The interview was conducted by interviewing a financial manager who had knowledge about the types and amounts of fossil fuels as well as the amount of electricity consumed by the firm in 2011. This research uses data year 2011 since regulation PP No. 70/2009 about energy conservation was introduced in 2009. Giving 2 year lag is considered to be enough time for forms to internalize the regulation in form's operation. These data were converted using the UK calculation system of Guidance on How to Measure and Report Your GHG Emissions (DEFRA, 2011) into kilograms of CO_2e produced by a firm. This is because Indonesia has not had an official guidance on how to measure GHG emissions produced by a firm.

3.1. Sample

There are 134 listed manufacturing firms on the Indonesian Stock Exchange (IDX) as on 31 December 2011. Out of this population, firms to be included in the sample were chosen by following procedure. Accordingly, a sample of 102 firms was finally available.

- All manufacturing firms that have financial reports for the year 2011 were initially included in the sampling frame. The 'energy management' regulation became applicable in Indonesia in 2009 so we focussed on financial reports of firms in the year 2011 so that enough time available to the firms to respond to the regulation.
- Of the firms at (a) above, those for which the 2011 annual report was not available at IDX website were excluded.
- Of the remaining firms, those that did not provide GHG data during survey were excluded.

3.2. Variables

3.2.1. Dependent variable: Firm FP

The dependent variable in this study is firm FP, which is measured by ROE, ROI, ROS, and Tobin's q. Four different measurements have been employed to represent firm FP because each one captures the behaviour and evaluation of various stakeholders who have different concerns (Iwata and Okada, 2010). Below is the measurement of used FP.

ROE captures the evaluation of shareholders (Iwata and Okada, 2010). Below is the measurement of ROE. ROE is return on equity; NI is net income; BVE is book value of equity.

$$ROE_{i,2011} = \frac{NI_{i,2011}}{\frac{BVE_{i,2011} + BVE_{i,2010}}{2}} \quad (1)$$

ROI indicates not only the evaluation from shareholders who contribute to the equity capital, but also the evaluation from creditors who provide borrowed capital (Iwata and Okada, 2010). Below is the measurement of ROI. ROI is return on investment; NI is net income; LTL is long-term liabilities; BVE is book value of equity.

$$ROI_{i,2011} = \frac{NI_{i,2011}}{\frac{\left(L\ TL_{i,2011} + BVE_{i,2011}\right) + \left(LTL_{i,2010} + BVE_{i,2010}\right)}{2}} \quad (2)$$

ROS reflects the evaluation from consumers and trading partners (Iwata and Okada, 2010). Below is the measurement of ROS. ROS is return on sales; NI is net income; NS is net sales and i is firm i.

$$ROS_{i,2011} = \frac{NI_{i,2011}}{\frac{NS_{2011} + NS_{2010}}{2}} \quad (3)$$

Tobin's q is interpreted as the firm's market value of intangible assets (Iwata and Okada, 2010). Below is the measurement of Tobin's q.

$$Tobin's\ q_{i,2011} = \left[\frac{MVE_{i,2011} + PS_{i,2011} + D_{i,2011}}{\left(\frac{TA_{i,2011} + TA_{i,2010}}{2} \right)} \right] \quad (4)$$

$$\text{Where, } MVE_{i,2011} = P_{i,2011} x CSO_{i,2011} \quad (5)$$

MVE is market value of equity; PS is liquidating value of the outstanding preferred stocks; D is total debt, including short- and long-term liabilities. TA is total assets; P is market price of common stock; CSO is number of common stocks outstanding and i is firm i.

3.2.2. Independent variables

GHG emission: Prior studies use secondary data of GHG emissions measured by carbon intensity which are readily available in those countries. Busch and Hoffmann (2011), for example, use data published by a Swiss-based independent asset management firm that develops sustainability ratings. They measure GHG emission by carbon intensity and compute it as a ratio of CO_2e emission (in tons) to sales. This ratio, however, suffers from a weakness, since goods produced by a firm may not get sold and there could be high level of unsold goods inventory. As the ratio does not account for unsold inventory it may give an erroneous picture of carbon intensity. A suitable measure would be CO_2e emission to units produced which is difficult to assess as a firm may produce multiple products. To overcome these difficulties in the present study carbon intensity has been computed as the ratio of kilogram CO_2e to net assets. This ratio measures the efficiency of every unit currency of net assets in producing GHG emissions; the higher the carbon intensity, the lower the efficiency. Carbon intensity equal to 0.004 means that every unit currency of net assets produces 0.004 kg of CO_2e:

$$CO_2e\ Intensity_{i,2011} = \frac{Kilograms\ of\ CO_2e_{i,2011}}{\left(\frac{NA_{i,2011} + NA_{i,2010}}{2} \right)} \quad (6)$$

Where,

CO_2e is carbon dioxide equivalent; NA is net assets measured as total asset - net working capital;

Net working capital is measured as current assets - current liabilities; i is firm i; t end of year t.

We obtained GHG emission information by face-to-face interviews with relevant officials of the sample company who had knowledge about the types and amounts of fossil fuels as well as the amount of electricity consumed by the firm in 2011. These data were converted into kilograms of CO_2e produced by a firm, using the calculation method described in the Guidance on How to Measure and Report Your GHG Emissions (DEFRA, 2011). We used these UK guidelines as Indonesia doesn't have similar guidelines on how to measure GHG emissions produced by a firm. The DEFRA calculates the kilogram of CO_2e of a firm by aggregating gross annual GHG emissions produced from the activities in scope 1, scope 2 and scope 3, as defined by the Carbon Development Project (CDP). Scope 1 emissions include direct GHG emissions produced from (i) the generation of electricity, heat, or steam from stationary sources, (ii) physical or chemical processing, (iii) emissions from the combustion of fuels in firm owned/controlled mobile combustion sources, and (iv) emissions that result from intentional or unintentional releases during business operations (CDM, 2008. p. 112). Scope 2 emissions include indirect GHG emissions from the purchase of electricity. Scope 3 covers indirect emissions that are not under the control of the firm, such as the activities of product distribution and activities of vehicles used in waste control. These activities are associated with outsourced or contracted activities. This research omits the emissions from scope 3 because it includes indirect emissions from activities associated with outsourced or contracted activities that are not under the control of the firms.

This research includes firm size, leverage, capital intensity, and industry type as control variables.

Firm size: It is obtained from the data of net sales in monetary units (Indonesian Rupiah) and is measured as the log natural (Ln) of a firm's sales in 2011. Similar to Iwata and Okada (2010), we measure firm size by following equation. Where, Ln is log natural; NS is donated net sales$_i$; i is for firm i; t is end of year 2011; t−1 is end of year 2010.

$$Firm\ Size_{i,t} = \frac{Ln\ (NS_{it}) + Ln\ (NS_{i\ t-1})}{2} \quad (7)$$

Leverage: Following from Graves and Waddock (1994) and Waddock and Graves (1997), we use leverage ratio as a proxy for firm risk and calculate it as below. Where, D is total debt; TA is total assets; i is firm i; t end of year 2011; t−1 is end of year 2010.

$$Leverage_{it} = \frac{D_{it}}{\left(\frac{TA_{it} + TA_{it-1}}{2} \right)} \quad (8)$$

Capital intensity: Capital intensity refers to the amount of capital invested to produce one dollar of output and measure it as the ratio of assets to sales (Pedersen and Thomsen, 1999; Russo and Fouts, 1997). Capital intensity is computed as follows. Where, TA is total assets; NS is net sales; i is firm i; t is end of year t; t−1 is end of year t−1.

$$\text{Capital Intensity}_{i,t} = \frac{TA_{it}}{\frac{NS_{it} + NS_{it-1}}{2}} \quad (9)$$

Industry type: Industry type is a dummy variable. We classify industries in two types only by following the industrial grouping conducted by Dewan National Perubahan Iklim (2009), that is, heavy industries and others as per the classification of industry type already indicated above.

The main purpose of this study is to examine the effects of GHG emissions on firm FP. Following previous research studies, some other factors that may have effects on FP are also included in the estimation equation as explanatory variables in addition to environmental performance. Our basic specification is expressed as follows:

$$\text{Financial performance}_{i,t} = \beta_0 + \beta_1 CO_2\text{eIntensity}_{i,t} + \beta_2 \text{Firm size}_{i,t} + \beta_3 \text{Firm leverage}_{i,t} + \beta_4 \text{Capital intensity}_{i,t} + \beta_5 \text{Dummy of Heavy Industry}_{i,t} + \varepsilon_i \quad (10)$$

Where, β_0 indicates constant variable, β_1, β_2, β_3, β_4, β_5 donates as regression coefficients, i donates as firm name, t represents time, and ε donates as error term. Four hypotheses are used to analyses the effects. The proposed hypotheses are non-directional since prior studies have found mixed results.

H_1: CO_2e intensity of firms has a significant effect on ROE

H_2: CO_2e intensity of firms has a significant effect on ROI

H_3: CO_2e intensity of firms has a significant effect on ROS

H_4: CO_2e intensity of firms has a significant effect on Tobin's q.

The multiple regressions conducted to test the proposed hypotheses are to perform the goodness-of-fit test, the F-test and the t test. Before analysing the model, a series of tests for normality of residuals, multicollinearity, heteroscedasticity and linearity will be conducted to fulfil the classical assumptions of multiple regression analysis (Ghozali, 2011; Gupta, 1999). The regression model that meets the classical assumption will be assigned for the purpose of analysis in this research.

4. RESULTS AND ANALYSIS

4.1. Descriptive Statistics

Descriptive statistics of each variable are reported in Table 1. The data provided in Table 1 are data included in each regression that already tested from the classical assumption. The sample size is not 102 because there are some cases omitted due to outliers. However, the rest samples are still big enough as Kline (2005) recommends that a realistic target of a sample size is considered to have at lease a ratio 10: 1 of independent variables. If a model includes 5 independent variables, then the sample size should be minimum 50 cases.

4.2. Does GHG Emission Impact Firm FP

Tables 2-5 presents the estimation results of regression model. Before running the model, regression assumptions were checked for violation. No such violation was noticed except in few cases which were omitted from the analysis.

As could be seen the variable of interest GHG emission has a statistically significant positive association with ROE, ROI, ROS, and Tobin's q at 5% level of significance. It means that the increase in GHG emissions increases ROE, ROI, ROS, and Tobin's q significantly. This result is not in line with the results of Busch and Hoffmann (2011), who find that there is no impact of GHG emission on ROA and ROE. However they find a negative relationship between GHG emission and in Tobin's q. They claim that the market appreciates any activities conducted by firms to deal with carbon issues. Firms with high carbon performance can generate a 'carbon premium' (Busch and Hoffmann, 2011). The results of the present study are not in line with the findings of Iwata and Okada (2010) either, who found that GHG emission has a significant negative effect on ROA, ROI, ROIC and Tobin's q.

However, our findings are similar to those of Hatakeda et al. (2012), who found that GHG emissions have a positive significant effect on profitability. They claim that the effect is positive because the marginal costs of reducing GHG emissions exceed the marginal benefits of reducing GHG emissions. Moreover, this result is in line with the result of Wang et al. (2013), who conducted a study in Australia and found that GHG emissions have a positive significant correlation with Tobin's q. This result is surprising because Australia has enforced a carbon tax on business practices. They argue that GHG emissions have a positive effect on Tobin's q because Australia's economy strongly relies on the resource industry, which is responsible for 89% of the total emissions under Scopes 1 and 2. Further, this industry shows strong FP and high growth because there is an increase in the exports of Australia's mining products as international demand increases (Wang et al., 2013). The strong FP and high growth of this industry may be appreciated by the market, so the market price of stocks in this industry increases. This factor may increase the Tobin's q.

This research is also in line with the result of Delmas and Nairn-Birch (2010), who suggested that firms with lower carbon footprints record lower ROA and firms with higher carbon footprints have higher ROA. They argue that carbon regulation is not enforced in the US, so firms with high GHG emissions can still generate more profit (Delmas and Nairn-Birch, 2010). In such conditions, firms will increase their revenue if they increase their GHG emissions because they have not internalised the costs associated with carbon. Further, to date, no financial incentives have been provided for firms to reduce their GHG emissions (Delmas and Nairn-Birch, 2010).

Table 1: Descriptive statistics of each variable used in the research

	N	Minimum	Maximum	Mean±SD
Descriptive statistics: ROE as dependent variable				
ROE	92	−0.17249	0.44277	0.1294048±0.11009365
lnCO_2e intensity	92	−12.97796	−4.60690	−9.2331724±1.56916303
Size	92	23.8974	32.7221	28.0780348±1.64863456
LNLeverage	92	−1.93564	0.87574	−0.7379947±0.47285741
LNCapitalIntensity	92	−1.26833	1.22043	−0.0182627±0.50550986
HeavyIndustry	92	0	1	0.26±0.442
Valid N (listwise)	92			
Descriptive statistics: ROI as dependent variable				
ROI	93	−0.14848	0.2734	0.0879526±0.07900843
lnCO_2e intensity	93	−12.97796	−4.60690	−9.2176463±1.51648624
Size	93	23.8974	32.7221	28.0339828±1.66714985
LNLeverage	93	−6.25561	1.13932	−0.7597516±0.76953246
LNCapitalIntensity	93	−1.26833	1.21464	−0.0239434±0.49771913
HeavyIndustry	93	0	1	0.30±0.461
Valid N (listwise)	93			
Descriptive statistics: ROS as dependent variable				
ROS	97	−0.23173	0.28783	0.0640863±0.08148417
lnCO_2e intensity	97	−12.97796	−4.60690	−9.2411431±1.50464768
Size	97	23.8974	32.7221	28.073467±1.6734195
LNLeverage	97	−6.25561	1.13932	−0.7692042±0.76025473
LNCapitalIntensity	97	−1.26833	1.21464	−0.0499608±0.50613983
HeavyIndustry	97	0	1	0.29±0.455
Valid N (listwise)	97			
Descriptive statistics: Tobin's q as dependent variable				
TOBINSQ	101	−1.68642	2.20148	0.3188781±0.64729551
lnCO_2e intensity	101	−12.97796	−4.60690	−9.2896931±1.52510804
Size	101	21.6664	32.7221	27.911480±1.8692112
LNLeverage	101	−6.25561	1.13932	−0.7465007±0.76885925
LNCapitalIntensity	101	−1.26833	1.74431	0.0110165±0.56524057
HeavyIndustry	101	0	1	0.30±0.459
Valid N (listwise)	101			

Source: Computed data

Table 2: Effect of independent variables on ROI

Coefficients[a]					
Model	Unstandardized coefficients		Standardized coefficients	t	Significant
	B	Standard error	Beta		
1					
Constant	−0.142	0.123		−1.150	0.253
lnCO_2intensity	0.016	0.005	0.298	3.207	0.002
SIZE	0.013	0.004	0.276	3.018	0.003
LNLAVERAGE	−0.008	0.009	−0.082	−0.899	0.371
LNCAPITAL	−0.059	0.014	−0.370	−4.109	0
Heavy industry	−0.005	0.016	−0.027	−0.292	0.771

[a]Dependent variable: ROI. R^2=0.311, adjusted R^2=0.271, F=7.856, Sig=0.000

Table 3: Effect of independent variables on ROE

Coefficients[a]					
Model	Unstandardized coefficients		Standardized coefficients	t	Significant
	B	Standard error	Beta		
1					
Constant	−0.230	0.178		−1.296	0.199
lnCO_2intensity	0.021	0.007	0.308	2.98	0.004
SIZE	0.02	0.006	0.309	3.214	0.002
LNLAVERAGE	0	0.022	−0.002	−0.021	0.983
LNCAPITAL	−0.064	0.02	−0.296	−3.136	0.002
Heavy industry	0.005	0.023	0.019	0.196	0.845

[a]Dependent variable: ROE. R^2=0. 276, adjusted R^2=0.232, F=6.316, Sig=0.000

The reasons for the positive significant effect of GHG emissions on firm FP in Indonesia are: Firstly, although the Indonesian government established Regulation No. 70/2009 regarding "energy management," calls for industrial sectors to reduce their GHG

Table 4: Effect of independent variables on ROS

Coefficients[a]					
Model	Unstandardized coefficients		Standardized coefficients	t	Significant
	B	Standard error	Beta		
1					
Constant	−0.249	0.128		−1.941	0.055
lnCO2intensity	0.021	0.005	0.384	4.079	0
SIZE	0.018	0.005	0.363	3.915	0
LNLAVERAGE	−0.020	0.01	−0.189	−2.056	0.043
LNCAPITAL	−0.002	0.015	−0.010	−0.108	0.914
Heavy industry	−0.024	0.017	−0.132	−1.430	0.156

[a]Dependent variable: ROS. R^2=0.265, adjusted R^2=0.224, F=6.546, Sig=0.000

Table 5: Effect of independent variables on LnTobin's q

Coefficients[a]					
Model	Unstandardized coefficients		Standardized coefficients	t	Significant
	B	Standard error	Beta		
1					
Constant	−1.629	0.95		−1.715	0.09
lnCO_2intensity	0.084	0.041	0.198	2.074	0.041
SIZE	0.106	0.033	0.307	3.2	0.002
LNLAVERAGE	0.229	0.079	0.272	2.913	0.004
LNCAPITAL	−0.002	0.11	−0.002	−0.022	0.983
Heavy industry	−0.236	0.132	−0.168	−1.788	0.077

[a]Dependent variable: LnTobin's q. R^2=0.200, adjusted R^2=0.158, F=4.749, Sig=0.001

emissions, the regulation appears to be ineffective in forcing firms to reduce their emissions. Many firms have ignored the regulation as the regulation seems no "teeth." According to the Indonesian Directorate of Energy Conservation, most participating firms in "energy management" are reluctant to comply because of the requirement of expensive investments (APEC, 2012). Indonesia does oblige a fine on firms who do not meet the regulation (Kementrian-Sumber-Daya-dan-Mineral, 2012) but the fine appears not high when compared to the benefits of non-compliance.

As per the extant Indonesian regulation, if a firm fails to comply with the first warning, it is issued a second warning and if it continues to ignore compliance then after 1 month of the serving of the notice, the firm will be imposed with a fine. The fine is set at twice the value of the wastage caused. The value of wastage refers to 5% of the energy costs consumed by the user for a 1-year (Kementrian-Sumber-Daya-dan-Mineral, 2012). According to Sitepu (2013), based on the 2010 data of Indonesian statistics, the contribution of fossil fuels and energy costs to the total cost of production is about 2.69% for fossil fuels and 2.70% for electricity. Hence, the contribution of fossil fuels and electricity costs to the total cost of production is about 5.39%. This condition will make firms weigh whether the benefit of non-compliance is more than the cost of non-compliance. Table 3 explains why there is actually an incentive to firms in Indonesia to avoid complying with the regulation. From Table 3, it could be seen that the penalty for non-compliance (i.e., US$0.539 in row D; column 4) is much lower than the benefit of non-compliance (i.e., US$1.67 in row H; column 4), resulting in net cash inflow of US$1.13. Consequently, there is little incentive for firms to comply (Table 6).

Secondly, the removal of subsidy for fossil fuels by Indonesian government have made their prices higher compared to coal making more use of coal cost effective for firms. But coal produces more GHG emissions than other types of fossil fuels (Kementrian-Sumber-Daya-dan-Mineral, 2012; Rubin, 2009). According to the World Bank (2009), coal produces around twice as much CO_2 than natural gas for every unit measurement. Moreover, many Indonesian firms continue to use machinery (old technologies) that are not environmental friendly (APEC, 2012). The above discussion helps explain our results which show a negative association between GHG emission and firm FP.

The coefficients of control variables have expected signs. Firm size has a positive significant effect on firm FP. The effect of firm leverage on firm FP is mixed. Furthermore, firm capital intensity affects firm FP negatively and significantly as found in other studies. The use of old technology adds to inefficiency raising cost and lowering profitability of Indonesian firms. We did not find that industry type dummy variable significant. It appears that both heavy industries and non-heavy industries are inefficient consumers of fossil fuels and electricity.

4.3. Conceptual Contribution: The Instrumental Stakeholder Theory

The instrumental stakeholder argument by Jones (1995), which has been used to reason the hypothesis for this study, suggests that a firm will succeed in the marketplace if it effectively manages its relationship with its key stakeholders. Consequently, it will increase firm FP (Brammer and Millington, 2008; Funk, 2003). Nevertheless, firms should be aware of stakeholder expectations differ, as different stakeholders assess firm FP differently (Wood and Jones, 1995). According to Iwata and Okada (2010), ROE, ROI, ROS and Tobin's q capture how various stakeholders with different interests respond to and value a firm's performance. Accordingly, the instrumental stakeholder argument of Jones

Table 6: Summary of incremental net cash flow after paying penalty

	1	2	3	4
	Description	**Source of data**	**Calculation**	**Result**
A	Total cost of production in US$	Hypothetical number		US$100.00
B	Total cost of energy	5.39% of total costs of production (Sitepu, 2013)	5.39% × US$100.00	US$5.39
C	The value of wastage	5% of energy costs consumed (Regulation No. 70/2009)	5% × US$5.39	US$0.2695
D	The fines paid in US$	Twice the value of wastage (Regulation No. 70/2009)	2×US$0.2695	US$0.539
E	Gross profit margin	25%* of sales		
F	Sales in US$	Total cost of production in US$†÷total cost of production in percentage‡	US$100 ÷ 0.75	US$133.33
G	Incremental sales	5%§ of sales (hypothetical number)	5% × US$133.33	US$6.67
H	Incremental profit	Gross profit margin x incremental sales	25% x US$6.67	US$1.67
I	Incremental cost of energy (same as B above)	5%** of total cost of energy (hypothetical number following the percentage increase in sales)	5% × US$5.39	US$0.2695
J	Incremental net cash flow (H-I) by NOT following GHG regulation	Incremental profit - incremental cost of energy	US$1.67 - US$0.2695	US$1.4005

*25% is the industrial average of gross profit margin in 2011. Calculated from gross profit margin in average of 102 firms included in the research. Gross profit margin is calculated $\frac{(\text{Sales-Total costs of production})}{\text{Sales}}$ as †as per * in raw A, column 4, ‡total cost of production is 75%. Calculated from the formula; sales=total cost of production+gross profit margin. Sales=100% (the exact figure), gross profit margin=25% (as presented in raw E, column 2) so that total cost of production is 75%, §A 5% increase in sales is a hypothetical number, **as rule of thumb, the cost of energy might increase at the same percentage with the increase of sales (5%)

(1995) can be evaluated by analyzing the relationship between GHG emissions and ROE, ROI, ROS and Tobin's q.

ROE as the reflection of shareholders' responses: ROE measures a firm's ability to provide income to existing stockholders (Carton and Hofer, 2006). It may capture how stockholders as equity providers respond to firms' environmental performance (Iwata and Okada, 2010). The proportion between equity and debts used to finance firms' assets may reflect the response of stockholders to firms. Based on pecking order theory (Myer and Majluf, 1984), firms may prefer to utilize 100% of their internal equity (such as retained earnings) to finance their assets if unlimited internal equity is available as this source of fund is generally considered to be cheaper than borrowing from external sources. The positive effect of GHG emissions on firm FP in this study implies that existing stockholders are less concerned about GHG emissions. They would like the firm to generate more profits by meeting the minimum requirements of energy management regulation. Accordingly, stockholders are happy if firms are run as business as usual (BAU).

ROI as the reflection of shareholders' and creditors' responses: According to Carton and Hofer (2006), ROI reflects the ability of a firm to utilize its long-term capital both equity and debt to produce net profit (Carton and Hofer, 2006). Iwata and Okada (2010) argue that ROI may capture how stockholders as equity contributors together with creditors as the providers of borrowed capital simultaneously respond to how the firm responds to emission regulation. The results reveal that GHG emissions significantly and positively affect ROI. It can be interpreted that stockholders and creditors together appear to pay little attention to GHG emissions. Under the current Indonesian conditions described above, firms tend to postpone the implementation of the low-carbon economy. They appear to anticipate no problem in producing high GHG emissions to generate profits for stockholders and creditors, as long as the firms avoid serious penalties/legal problems. Stockholders and creditors may be concerned about how firms generate incomes as the practice of BAU. Firms may start to respond to the issue of GHG emissions if the costs associated with GHG emissions really occur.

ROS as the reflection of consumers' and trading partners' responses: ROS indicates the efficiency of a firm to achieve optimum sales while simultaneously minimizing costs (Brealey et al., 2001; Pendlebury and Groves, 1999). According to Iwata and Okada (2010), ROS indicates the expectations of consumers and trading partners. When they respond positively to the firm, they buy its products more often and for more amounts resulting in increased sales. The positive significant effect of GHG emissions on ROS can be interpreted as consumers (particularly Indonesian consumers) having a preference for price rather than the environment. Consequently, there is little incentive for firms to control GHG emission which would add to production cost and ultimately the price to the consumer. When the benefit from compliance is not exceeding the cost of compliance, firms would naturally prefer to run BAU. From the instrumental stakeholder point of view, the positive significant effect of GHG emissions on ROS can be interpreted as follows. As consumers and trading partners are not concerned about GHG emissions produced by firms, the firms try to satisfy their consumers and trading partners by providing products with competitive prices. Hence, firms pay more attention to how they can produce products with a low price rather than pay attention to how they should reduce their GHG emissions that require large amount of investment.

Tobin's q as the reflection of market responses: Tobin's q is the ratio of the market value of a firm's assets to the replacement value of the firm's tangible assets (Lindberg and Ross, 1981). Tobin's q reflects the value of intangible assets (Konar and Cohen, 2001), and it captures how the market responds to a firm's performance associated with the environment (Iwata and Okada, 2010). Given the positive association found between GHG emission and firm performance measured by Tobin's q, it appears that market participants in Indonesia seem to be more concerned about profit performance of the firm rather than its climate-related performance. The market does not seem to consider

GHG emissions as an important issue while assessing the value of intangible assets. Under the current Indonesian conditions, it appears that market considers that significant investments for GHG reductions could possibly jeopardize firm competitiveness.

In brief, based on instrumental stakeholder theory (Jones, 1995), this study reveals that stakeholders (creditors, investors, stockholders, customers, trading partners and markets) do not seem to have any serious concerns about GHG emissions in Indonesia. Hence, firms maintain their relationship with stakeholders by BAU practice and by meeting the regulation minimally without jeopardizing their financial bottom line.

4.4. Conceptual Contribution: The Least-cost Strategy of Porter

Porter (1980) suggested that to achieve a competitive advantage, firms could adopt the least-cost strategy. Costs will increase when a firm performs an activity. Nevertheless, the increase in costs should be followed by a larger increase in profitability. Further, Porter and van der Linde (1995b) suggested that the government has a role to play in reducing uncertainty through regulation. Efficient regulation and strong law enforcement will ensure certainty for firms because such regulation enforces penalties for those not complying with regulation and providing reasonable financial incentives for those that comply. Such regulation helps firms to determine their strategies.

In the context of GHG-related regulation, when firms do not reduce their GHG emissions, they will be penalized and incur costs. In contrast, when firms succeed in reducing GHG emissions, they receive direct financial benefits, such as tax reductions on carbon and other financial incentives. Consequently, such firms can reduce their costs significantly so that they can implement the least-cost strategy (Porter and van der Linde, 1995b). In the context of Indonesia, there is a regulation to reduce GHG emissions; however, the regulation has not been enforced and the penalty appears to be affordable for those who do not comply. Further, although there are incentives for firms that try to reduce their GHG emissions consistently, the incentives appear to be unattractive to motivate firms to reduce their GHG emissions.

Under the "toothless" regulation and deprived law enforcement of Indonesia, the least-cost strategy of Porter (1980), seem to have little relevance for manufacturing firms. The results provide evidence that a firm financially benefits from increasing its GHG emissions. This confirms that where there is poor enforcement of GHG emission regulation, firms are disinclined to internalize costs associated with GHG emissions. Further, financial incentives provided by the government are not found attractive enough by firms to reduce their GHG emission. This result toughens the statement of the Indonesian Directorate of Energy Conservation, that most participating firms in 'energy management' are hesitant to complete energy audit recommendations because the recommendations require expensive investments (APEC, 2012).

The results of this research appear to support Friedman's (1970) view that firms are concerned with meeting the minimum law requirements in order to maximize profits. In brief, Friedman (1970) seems to suggest that firms should maximize profits by meeting the minimum law requirements, but not jeopardizing their financial bottom line. Indonesian manufacturing firms seem to be doing exactly that.

5. CONCLUSION

The objective of the study was to assess the impact on GHG emission on FP of manufacturing firms in Indonesia. The instrumental stakeholder theory underpinned the research. We used data for the year 2011 available from financial reports of listed manufacturing firms in Indonesia and collected the GHG emission data by personal interviews with firms in the sample given the difficulties in a developing country like Indonesia to find such data which are not publicly available.

This research found a positive relationship between GHG emission and firm FP measured in four different ways. The positive relationship indicates that there is little incentive for Indonesian firm for control GHG emission as the cost of compliance (additional investment required or penalties for non-compliance) appears to exceed the benefits non-compliance. Consequently, the firm stakeholders also appear to ignore the serious of GHG emissions and are focused on maximizing their own value.

Besides the conceptual contribution to the instrumental stakeholder theory and the least-cost-strategy theory our findings have important policy implications. The Indonesian government needs to seriously consider whether the energy management regulations need a relook in as much as the penalties for non-compliance need to be substantially high compared to the benefits of non-compliance. Currently that is not the case and requires a rethink. The government may also like to develop a system of collection of GHG emission information and publishing it or mandate companies to publish such data in annual report and the information should be subject to annual audit. This will make data available for government to monitor the GHG performance of manufacturing firms and also help researchers.

Future studies may like to use longitudinal data to examine this issue in the Indonesian context as well as in the context of other developing countries. A limitation of our study was it was confined to data for 1 year only given resources constraint in collecting the data through personal interviews.

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APPENDIX

Appendix: Operational definition and data sources

Variable	Operational definition	Notes	Data sources
ROE	$ROE_{i,2011}=\frac{NI_{i,2011}}{\frac{BVE_{i,2011}+BVE_{i,2010}}{2}}$	ROE is return on equity; NI is net income; BVE is book value of equity	Balance sheet and income statement from 2010 and 2011 available at www.idx.co.id
ROI	$ROI_{i,2011}=\frac{NI_{i,2011}}{\left(L\,TL_{i,2011}+BVE_{i,2011}\right)+\frac{\left(LTL_{i,2010}+BVE_{i,2010}\right)}{2}}$	ROI is return on investment; NI is net income; LTL is long-term liabilities; BVE is book value of equity	Balance sheet and income statement from 2010 and 2011 available at www.idx.co.id
ROS	$ROS_{i,2011}=\frac{NI_{i,2011}}{\frac{NS_{2011}+NS_{2010}}{2}}$	ROS is return on sales; NI is net income; NS is net sales and i is firm i	Income statement from 2010 and 2011 available at www.idx.co.id
Tobin's *q*	$Tobin's\ q_{i,2011}=\left[\frac{MVE_{i,2011}+PS_{i,2011}+D_{i,2011}}{\left(\frac{TA_{i,2011}+TA_{i,2010}}{2}\right)}\right]$ Where, $MVE_{i,2011}=P_{i,2011}\ xCSO_{i,2011}$	MVE is market value of equity; PS is liquidating value of the outstanding preferred stocks; D is total debt, including short- and long-term liabilities. TA is total assets; P is market price of common stock; CSO is number of common stocks outstanding and i is firm i	Balance sheet and income statement from 2010 and 2011 available at www.idx.co.id, IDX at the closing price of 31 December 2011
CO_2e intensity	$CO_2e\ Intensity_{i,2011}=\frac{Kilograms\ of\ CO_2e_{i,2011}}{\left(\frac{NA_{i,2011}+NA_{i,2010}}{2}\right)}$	CO_2e is carbon dioxide equivalent; NA is net assets measured as total asset - net working capital; net working capital is measured as current assets - current liabilities; and i is firm i	Face-to-face interview
Firm size	$Firm\ Size_{i,2011}=\frac{Ln\,(NS_{i,2011})+Ln\,(NS_{i,2010})}{2}$	Ln is logarithm natural; NS is net sales	Income statement from 2010 and 2011 available at www.idx.co.id

(*Contd...*)

Appendix: (*Continued*)

Variable	Operational definition	Notes	Data sources
Firm risk	$\text{Firm Size}_{i,2011} = \frac{\text{Ln}(NS_{i,2011}) + \text{Ln}(NS_{i,2010})}{2}$	D is total debt; TA is total assets	Balance sheet from 2010 and 2011 available at www.idx.co.id
Capital intensity	$\text{Capital Intensity}_{i,2011} = \frac{TA_{i,2011}}{\frac{NS_{i,2011} + NS_{i,2010}}{2}}$	TA is total assets; NS is net sales; and i is firm i	Balance sheet and income statement from 2010 and 2011 available at www.idx.co.id
Dummy variable of heavy industry	The group of heavy industry takes the value of one and zero otherwise		Publication of Dewan Nasional Perubahan Iklim (2009).