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# The moderating effect of profitability and leverage on the relationship between eco-efficiency and firm value in publicly traded Malaysian firms

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## Abstract

**Purpose** – The purpose of this study is to examine the impact of profitability and leverage on the relationship between eco-efficiency and firm value.

**Design/methodology/approach** – The study extends the Ohlson's model on value relevance using the hierarchical regression analysis to establish the moderating effects of the firm-specific variables. The sample includes 667 non-financial firms from the Bursa Malaysia, as of 2013. The data for eco-efficiency were extracted from content analysis of the annual report, whereas the financial data were retrieved from the data stream.

**Findings** – The study provides support for the stakeholder theory that purports that managers must develop a relationship with stakeholders by embarking on environmental friendly practices to maintain a positive firm value. The study shows a positive association between eco-efficiency and the value of the firm and provides support for a positive moderating relationship for profitability in the relationship between eco-efficiency and firm value, whereas there was no significant effect for leverage in the relationship.

**Research limitations/implications** – It should be noted that, first, the data comprised exclusively Malaysian companies. Including firms from similar developing countries with varying institutional make-up and culture would enhance the understanding of the subject. Second, considering that the data for this study is cross-sectional, it may not be sufficient to draw strong causal influences. The study is the first to the best of the researcher's knowledge to provide evidence that profitability positively moderates the relationship between eco-efficiency and firm value.

**Practical implications** – The result shows the management and potential investors that an investment in eco-efficiency will lead to a higher firm value, irrespective of the debt profile of the firm and that profitable firms are more likely to embark on an eco-efficient policy.

**Originality/value** – This study contributes to the literature by providing evidence from a developing country's perspective, as well as extending prior studies that merely examined the direct relationship, to now explore the moderating relationship of profitability and leverage in the relationship between eco-efficiency and firm value using a large sample.

**Keywords** Accounting, Environment, Firm value, Policy, Eco-efficiency, Moderating

**Paper type** Research paper

## Introduction

There has been growing expectations by societies over the past two decades on the need for corporations to become more accountable for the environment (Akroot and Othman, 2013). As a fall out of these growing expectations, organisations are beginning to take the initiative and are beefing up their business processes to conform to this trend (Al-Najjar and Anfimiadou, 2012). The organisations have indeed added environmental performance to their previous concerns for quality, service and cost (Brady *et al.*, 1999). Environmental performance viewed from a general perspective means putting in place measures that ensure the sustainability of environmental attributes such as water, soil, air and

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eco-systems. The reduction of environmental impacts or restoring the ecosystem poses huge demand on the organisation's resources. This huge spending needs to be accounted for. Engaging in these processes of restoration leads to the emergence of eco-efficiency. The eco-efficiency concept is thus a midpoint between the economy and the environment.

International discussions on the environment such as the United Nations Conference on Environment and Development, held by the business council for sustainable development popularised the concept of eco-efficiency because it has now become a key strategy used by business to assess and enhance the environmental performance of their products and services ([World Business Council for Sustainable Development, 2002](#)). [Derwall et al. \(2005\)](#) define eco-efficiency as the economic value created by a company from its products and services delivered in relation to the waste generated.

In recent times, a large number of potential investors are beginning to consider the idea of socially responsible investing. Nevertheless, the debate whether value is added as a result of environmental consideration to the process of stock selection is still on. One side of the divide believes that any attempt to improve social or environmental performance will be met with reduced shareholder value. A common thought is that a company's cost of complying with such ethical standards will lead to higher product prices which will place such a company at a disadvantaged position in the industry, leading to lower profitability ([Walley and Whitehead, 1994](#)). The other groups are of the opinion that a strategy of improved social or environmental performance can boost a company's output efficiency or even create a niche in the market ([Porter and Van Der Linde, 1995](#)). They assert that an improved environmental performance will lead to a cost-efficient use of the organisation's resources such that businesses that are environmentally responsible will be able to report higher profits leading to an enhanced value than less-responsible companies.

Furthermore, the connection between environmental concerns and performance of the firms has been widely studied with evidence of mixed findings. Although studies have established the link between environmental activity and good financial performance (see for example [Al-Najjar and Anfimiadou, 2012](#); [Connelly and Limpaphayom, 2004](#); [Dowell et al., 2000](#); [Konar and Cohen, 2001](#); [Sinkin et al., 2008](#)), others have in contrast reported that such positive relation does not exist ([Ingram and Frazier, 1980](#); [Walley and Whitehead, 1994](#)); they assert that remedial actions on the environment require huge costs because the investment in the requisite technology is necessary to engineer green technologies and products to alleviate the dreadful effects on the immediate environment, as well as comply with eco-efficient requirement require huge outlay.

For a more detailed understanding of the impact of eco-efficiency on the value of the firm, we introduce two moderating variables into our model. We argue that firm characteristics interplay with environmental strategy of eco-efficiency, affecting the relationship between eco-efficiency and firm value. Thus, we examine the impact of firm-specific characteristics such as leverage and the return on assets on the relationship between eco-efficiency and firm value. In doing so, the current study would expand prior studies on the theoretical implications of corporate environmental policy, including eco-efficiency for enhancing firm value.

## Literature review

An insight into the literature on environmental policy and firm value reveal a number of studies from developed countries ([Al-Najjar and Anfimiadou, 2012](#); [Connelly and Limpaphayom, 2004](#); [Dowell et al., 2000](#); [Konar and Cohen, 2001](#); [Sinkin et al., 2008](#)). The results generally reveal mixed findings. The mixed findings could be explained by a number of elements originating from the size of the sample, the varying definitions of the concept of environmental policy, lack of well-grounded theories and different assessment measures for environmental performance ([Konar and Cohen, 2001](#)). The existing literature on the relationship that exists between the firm's financial and environmental performance can be categorised into two. The first group

analyses the impact of the environmental strategy on the market value of the listed companies, in the event that there is a shock such as oil spillage. Second, studies that evaluate the financial and environmental performance overtime.

Past studies that examined the resulting effects of environmental incidents on stock prices, for example [Klassen and McLaughlin \(1996\)](#), purports that such firms experience inverse return when the news of environmental damage breaks, such as oil spillage, whereas high returns are experienced when the firms get positive news such as environmental awards and good performance recognition. Also, [Konar and Cohen \(2001\)](#) highlight that a poor environmental performance is negatively associated with an intangible asset value of the firm.

Contrarily, investigating the association between environmental policy and the market value of the firm, [Sinkin et al. \(2008\)](#) examined the hypothesis that the engagement of eco-efficiency as a business strategy has a positive relationship with the value of the firm. The study purports that for firms that have adopted eco-efficiency as a way of operating, and as such have been able to maintain costs and have boosted their profits, are likely to experience a higher value than firms that fail to adopt such policy. The study comprised 401 firms and defined eco-efficiency as the existence of ISO 14,001 certification and the issuance of corporate environmental reports. Further, the study utilised the Ohlson's model, and the empirical testing provided support for the proposition.

In a later study, [Al-Najjar and Anfimiadou \(2012\)](#) investigated the connection between eco-efficiency as an environmental policy and firm value amongst 201 firms in the UK for a period of five years. The study captured eco-efficiency as ISO14001 certification, presence of corporate social responsibility (CSR) report, and firms recognised in the BIE and FTSE4 good indices. The result correlates with the earlier study showing a positive association between market price and eco-efficiency, indicating that eco-efficiency can increase future earnings. Also highlighting the relevance of an environmental policy, [Dowell et al. \(2000\)](#) studied the environmental standards adopted by a sample of US MNEs in relation with the stock prices. The study measured the value of the firm using Tobin's Q formula. It was discovered that the adoption of an environmental standard makes for a higher market value compared with firms operating with less rigid country standards.

In contrast, [Connelly and Limpaphayom \(2004\)](#) in their study tested the hypothesis developed by [Porter and Van Der Linde \(1995\)](#) on the prowess of an environmental standard in improving the firm's production capacity. The study relied on data retrieved from the Thailand institute of director's corporate governance bench marking survey. The result failed to favour the hypothesis. The result showed a significant association between environmental information reported and the accounting financial performance, which elucidates that profitability in the short term is not influenced by environmental policies; however, in the long-run, there appeared to be a non-linear relationship.

Further, [Jaggi and Freedman \(1992\)](#) provide evidence that good pollution performance is negatively associated with the economic performance over a short period of time. They assert that the indifference of the market to in-depth information on organisation's pollution performance provides evidence that it did not provide good information disclosures. Also, [Hassel et al. \(2005\)](#) investigated the relationship between market value and overall environmental performance of Swedish-listed companies. The study found a negative relationship indicating that firms rated highly in terms of their performance on the environment are not *ceteris paribus* highly valued by investors. The argument is supported by the cost-concerned school which purports that high environmental performance is costly, and this has a negative impact on the expected earnings and market value ([Jaggi and Freedman, 1992; Walley and Whitehead, 1994](#)).

In addition to the studies done on eco-efficiency and firm value, prior studies have also looked at the effect of eco-efficiency on the cost of equity capital. For instance, [Botosan \(1997\)](#) investigated the effect of disclosure on the cost of equity capital. The study found a negative association as a result of the reduced information asymmetry associated with

more disclosure. Also, [El Ghoul et al. \(2011\)](#) affirmed that the higher CSR value a firm has, the lower will be the cost of equity capital. As such, investments to improve employee relations, environmental policies and better positioning of the product of the organisations will shrink the cost of equity. The study based in the USA measured the cost of equity using the modified [Ohlson's \(1995\)](#) model, modified by [Botosan \(1997\)](#).

From the above discussion of the literature, eco-efficiency as an environmental policy and firm value have been discussed and examined mainly in the developed countries like the USA and the UK. Literatures regarding the issue in a developing country, like Malaysia, are not in existence to the best of our knowledge. Further the result highlight inconsistency in findings. This study aims to bridge this gap in the eco-efficiency literature. We therefore extend the prior research by looking at the scenario in Malaysia using a large sample and examining the effects of moderators in term of firm specifics, in an attempt to address these inconsistencies.

## Theory development and hypotheses

### *Stakeholder theory*

[Freeman \(1994, p. 416\)](#) defines stakeholders as including "employees, financiers, customers and communities". The study asserts that the idea of a moral community cannot be divorced from the value creation activity of business. The stakeholder theory is viewed as more inclined to management such that it shows and reveals how the managers operate rather than addressing theorists and economists ([Freeman et al., 2004](#)). [Freeman \(1994\)](#) attributes the purpose of stakeholder theory to be focussed on two core issues. First, trying to find out the purpose of the firm; this gets managers to assess themselves in terms of the value they create and what can keep the stakeholders together. This will lead to better performance of the firm. Second, it seeks to know the responsibility of management to stakeholders. This brings management to consider the kind of relationship they desire to create with their stakeholders. Managers must develop relationships, get stakeholders to be motivated and create communities where everyone gives their best to create value for the firm ([Freeman et al., 2004](#)). The instrumental role of the stakeholder theory in the organisation has been highlighted by [Donaldson and Preston \(1995\)](#) and [Freeman \(1999\)](#). They claim that the theory helps to identify the link or disconnection between the management of organisational stakeholders and the attainment of fundamental corporate objectives such as growth and profitability. The implications generated here is such that adherence to stakeholders' principles and practices leads to the achievement of conventional corporate performance goals better than other methods.

Further, the stakeholder theory posits that friction could arise between the external costs of the firm (i.e. payoffs to bondholders) and its internal costs (i.e. product quality costs, environmental costs) ([Waddock and Graves, 1997](#)). The theory purports that when a firm lowers its internal cost by not engaging in environmental responsible actions in the hope that it will improve its financial performance, it ends up incurring a higher explicit cost, resulting in competitive disadvantage amongst its peers. Based on this argument, there is a positive association between eco-efficiency and firm value. In addition, a number of research on eco-efficiency and its effects on firm have been carried out; most of the studies provide support for a positive relationship between eco-efficiency and firm value ([Al-Najjar and Anfimiadou, 2012](#); [Derwall et al., 2005](#); [Sinkin et al., 2008](#)). In line with the above studies and going by the theory we hypothesize that:

*H1. Eco-efficiency has a positive effect on the firm's value.*

### *Moderating effects*

It has been suggested from literature that where there are inconsistencies in findings, a moderator could address such a problem ([Baron and Kenny, 1986](#)). In the context of our study, we concentrate on the firm-specific characteristics of the firm and incorporate them

into our model to investigate the effects on firm value for the firms adopting eco-efficient business strategy. The specific question is how firm-specific characteristics moderate the relationship between eco-efficiency and firm value? Firm-specific characteristics considered in this research include the return on assets, as well as the leverage of the firm.

### *Leverage*

One of the most debated issues in finance is the role of leverage on investment policies. On one side of the divide are those that argue that the capital structure in place is essentially irrelevant such that a firm with good projects will thrive irrespective of the nature of the balance sheet ([Miller, 1991](#)). It has also been argued that leverage reduces the firm's ability to finance its activities such that the debt of the firm can prevent it from raising funds to embark on projects that could perhaps have high net present value. ([Lang et al., 1996](#)). On the other side of the divide, further theories of optimal capital structure that pinpoint manager's discretion suggests that the negative effect of leverage on the growth of the firm could increase the value of the firm by deterring managers from taking bad projects that would only result in loss ([Jensen, 1986](#)). [Watts and Zimmerman \(1990\)](#) further assert that the larger a firm's debt/equity ratio, the more the urge from the firm's management to embark on accounting policies that shift earnings from the future to the present, thereby increasing the firm value. [Cormier and Magnan \(2003\)](#) suggest that such policies will include suspending discretionary environmental reporting, thus suggesting a negative moderating role played by leverage in the relationship between environmental policy and value of the firm. On the other hand, [Roberts \(1992\)](#) and [Orij \(2007\)](#) assert that an increased dependence on debt would warrant that the company increases its environmental activities and presents more environmental information to meet creditors' expectation on environmental issues. This suggests that leverage could positively moderate the relationship between environmental policy and firm value. In line with the above argument, the hypothesis developed is as follows:

*H2. Leverage moderates the relationship between eco-efficiency and firm value.*

### *Profitability*

According to [Rappaport \(1987\)](#), the issue of profitability is an extremely important creator of value within the organisation. The study asserts that an organisation can attain profitability by taking advantage of economies of scale, exploring avenues of cost reduction from suppliers, exterminating all overheads that fail to add value to the product and rendering costs that do not enhance the buyers need. Also [Naceur and Goaied \(2002\)](#) provide support for this view. They find that the tendency for creating future value is positively and significantly related to the return on equity. A number of studies have showed profitability influencing environmental performance. [Bragdon and Marlin \(1972\)](#) provided evidence of a positive relationship between profitability proxy by earnings per share and return on equity, and the council on economic priorities (CEP) environmental performance ratings. [Al-Tuwairji et al. \(2004\)](#) further support this view. They argue that the novelty of solutions aimed at reducing the inefficiencies associated with pollution promotes both environmentalism and industrial competitiveness simultaneously. This suggests that profitability can alter the relationship between eco-efficiency and firm value. In line with the above argument the hypothesis developed is as follows:

*H3. Profitability positively moderates the relationship between eco-efficiency and firm value.*

### **Methods**

The study population comprises all non-financial firms in the Bursa Malaysia, as of 2013 financial year. [Sinkin et al. \(2008\)](#) assert that large firms which are largely found in this tier of the market are likely to adopt leading edge environmental processes and practices. Also, such companies' activities have been perceived to have a significant impact on the

environment (Haniffa and Cooke, 2005). Our sample selection begins with the 932 firms appearing in the Bursa Malaysia website. After excluding firms with missing data and financial firms, we arrive at a sample of 667 firms. The study adopts the international standardisation environmental certificate (ISO 14001) as a measure of the presence of eco-efficiency in the firms (Al-Najjar and Anfimiadou, 2012; Sinkin *et al.*, 2008). The presence of ISO 14001 assures all stakeholders that the firms have met their obligations to the environment.

The data for eco-efficiency were arrived at after carrying out a content analysis of the annual report, whereas the financial data were retrieved from data stream. The annual report is used taking into consideration the fact that it has been found to be reliable and credible (Haji, 2013). Also, the annual reports are generally accepted by a number of users (Deegan and Rankin, 1997).

### Research model

The study adopts the value relevance model (Ohlson, 1995) in investigating how value relevant the concept eco-efficiency is to the firm. Eco-efficiency is a variable that has two outcomes – it is measured using dummy of one for eco-efficient firms and zero otherwise and is interpreted as other value relevant information in the model. The model is expressed as follows:

$$P = a_0 + a_1X + a_2Y + \beta_0V + \mu$$

Where,

- $P$  = the market value or price of the firm's equity;
- $X$  = lag of the earnings per share ( $t - 1$ );
- $Y$  = (net) book value measured as the proportion of common equity divided by outstanding shares at the company's fiscal year end;
- $V$  = a vector variable representing other value relevant information that could be obtained;
- $a_0$  = the estimates of the parameter that relate book value and earnings to the market value of the firm;
- $\beta_0$  = the estimates of the parameter that relate other information to the market value of the firm; and
- $\mu$  = the error term.

Ohlson (1995) suggests that there could be other value-relevant information that could lead to an improvement of the firm's future earnings. In a situation where the information is positively related with the future earnings, then it will also be positively related with the firm's market value. This study therefore includes eco-efficiency in the model because it assists in providing information that could help explain the reduced costs, increased efficiency, potential increased profits that will result from the adoption of eco-efficient strategy in running the business. We also examine the moderating effect of firm characteristics which include leverage and return on assets on the relationship between eco-efficiency and firm value. The model for the study is thus regressed in steps to test the moderating effect (Kim *et al.*, 2009):

$$P = a_0 + a_1BV + a_2EPS + \mu \quad (\text{Model1})$$

$$P = a_0 + a_1BV + a_2EPS + \beta_1ECO + \mu \quad (\text{Model2})$$

$$P = a_0 + a_1BV + a_2EPS + \beta_1ECO + \beta_2LEV + \beta_3PROF + \mu \quad (\text{Model3})$$

$$P = a_0 + a_1BV + a_2EPS + \beta_1ECO + \beta_2LEV + \beta_3PROF + ECOLEV + ECOPROF + \mu \quad (\text{Model4})$$

Where,

- $P$  = the market value or price of the firm's equity;
- $BV$  = (net) book value measured as the proportioned common equity divided by outstanding shares at the company's fiscal year end;

EPS = lag of the earnings per share ( $t-1$ );  
 ECO = an indicator variable for eco-efficiency;  
 LEV = leverage measured by long term debt/equity; and  
 PROF = profitability measured as return on assets i.e. net operating income divided by total assets.

We log the dependent variable  $P$  (market price per share) to control for heteroskedasticity in the model.

## Results and analysis

### *Descriptive analysis*

We present below the descriptive statistics of the variable used in the study (Table I).

The table above highpoints the description of the variables examined in the course of this study. The average earnings per share (EPS) of the firm is 0.14, showing low earnings. The variable of focus – eco efficiency – has a mean of 0.16 per cent, indicating that about 16 per cent of the firms in the sample are eco-efficient firms. This provides evidence that in Malaysia most of the firms do not follow the practice of eco-efficiency. The average leverage for the firm is about 24 per cent, indicating a low debt level. This also reveals that Malaysian firms rely less frequently on debt. Further, the mean return on total assets of the selected firms is about 3.87 which show that most of the firms are profitable. Lastly, from the results of the standard deviation, we can see that most of the variables are stable and can be relied upon.

### Correlation analysis

The correlation analysis for the variables is presented below (Table II).

From the result of the correlation analysis, we can see there is absence of multicollinearity among the variables. This absence of multicollinearity is also confirmed when we run the variance inflation factor (VIF) for all models as the values are below the threshold value of ten.

$H_1$  predicts positive effects for eco-efficiency on firm value. Multiple ordinary least squares (OLS) regression analyses were used to test  $H_1$ . Table III presents the results. Model 1 (equation 1) includes the control variables which were adjusted for heteroskedasticity in Model 1 (equation 2) using the robust regression as the diagnostic tests revealed that the assumption of homoscedastic disturbance was violated. Models 1 (equation 1) and (2) each explain about 54 per cent of the changes in firm value. In Model 2 (equation 1), the eco-efficiency variable was introduced. Similar to Model (1), we observe the presence of heteroskedasticity and correct for the problem using robust regression in Model 2 (equation 2). Consistent with  $H_1$  prediction, results indicate a significant positive relationship between eco-efficiency and firm value ( $\beta = 0.30$ ,  $p < 0.01$ ,  $R^2 = 0.55$ ). The introduction of the eco-efficiency variable explained an additional 1 per cent of the variance in firm's value. The results reveal that an eco-efficient business policy leads to a higher firm value.

**Table I** Descriptive statistics

Variable	Mean	SD	Minimum	Maximum
PRICE	2.08	4.97	0.02	68.70
BV	1.54	1.57	-1.92	13.20
EPS	0.14	0.29	0	4.58
ECO	0.16	0.37	0	1
LEV	24.31	41.79	-162.28	906.45
PROF	3.87	13.45	-180.29	60.24

Note: Researcher's computation (2015)

**Table II** Correlation analysis

	<i>PRICE</i>	<i>BV</i>	<i>EPS</i>	<i>ECO</i>	<i>LEV</i>	<i>PROF</i>
PRICE	1.00					
BV	0.47	1.00				
EPS	0.68	0.44	1.00			
ECO	0.12	0.04	0.09	1.00		
LEV	-0.04	-0.08	-0.04	0.02	1.00	
PROF	0.27	0.19	0.23	0.04	-0.19	1.00

Note: Researcher's computation (2015)

**Table III** Multiple regression analysis

Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
<i>Control</i>						
BV	0.43*** (0.02)	0.43*** (0.05)	0.43*** (0.02)	0.43*** (0.05)	0.40*** (0.02)	0.41*** (0.02)
EPS	1.15*** (0.12)	1.15** (0.47)	1.11*** (0.12)	1.11** (0.45)	0.92*** (0.11)	0.88*** (0.11)
<i>Independent</i>						
ECO			0.30*** (0.09)	0.30*** (0.09)	0.28*** (0.08)	0.31*** (0.11)
<i>Moderators</i>						
LEV					-0.00 (0.00)	-0.00 (0.00)
PROF					0.02*** (0.00)	0.02*** (0.00)
<i>Interaction</i>						
ECO → LEV						-0.00(0.00)
ECO → PROF						0.01* (0.01)
<i>R</i> <sup>2</sup>	0.54	0.54	0.54	0.54	0.62	0.62
<i>F</i>	383.94	137.53	264.32	108.57	214.12	153.23
$\Delta R^2$					0.08	

Notes:  $N = 667$  for all models; unstandardised coefficients are reported; the figures in parentheses are standard errors; \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

Hierarchical ordinary least square regression (OLS) was used to test  $H_2$  and  $H_3$ . The control variables (book value of equity and lag of earnings), eco-efficiency and moderator variables (leverage and profitability) as the main effect predictors of corporate value were entered. Next, we created predictor terms by multiplying the moderators by eco-efficiency. When the interactive terms were entered into the regression equation in Model 4, **Table III**, there was a significant increase in the model fit for regressions equations.  $H_2$  predicts leverage to moderate the relationship between eco-efficiency and firm value. In Model 4, the interaction between eco-efficiency and leverage has a non-significant effect on firm value ( $\beta = -0.00$ ,  $p > 0.10$ ). This finding does not support  $H_2$ .  $H_3$  suggests profitability to positively moderate the relationship between eco-efficiency and firm value. The statistically significant and positive coefficient for the interaction between eco-efficiency and profitability (return on assets) ( $\beta = -0.01$ ,  $p < 0.10$ ) indicates support for  $H_3$ .

As shown in **Table III** above, the results of the OLS regression show that the  $R^2$  for all four models is similar to that of previous studies such as Al-Najjar and Anfimiadou (2012) with adjusted  $R^2$  values of (0.63, 0.62) and that of Sinkin *et al.* (2008) with values of (0.50, 0.56, 0.58). The F-statistic value for all the models indicates statistical significance.

### Discussion of findings and conclusion

Drawing on evidence from the stakeholder theory and prior literature, we argue that eco-efficient policy adopted by management could lead to an enhanced firm value. We also examine the interplay between some firm-specific characteristics and eco-efficiency in respect of their joint effect on firm value. Several crucial findings emerge. First, there is support for the stakeholder's theory argument that to create value for the firm, managers

must develop relationships, get stakeholders motivated and create an environment conducive for all (Freeman *et al.*, 2004). Also, as the shareholders play a major role in determining the firm value, there is support for the argument purporting that some investors actually have interests beside wealth maximization in making their investment decision. If the demand for socially responsible investment opportunities generated by these investors exceeds the supply of these investment opportunities, then such investments can increase the firm's economic value (Mackey *et al.*, 2007). Further, a reduction in internal costs like environmental cost will only lead to a higher external cost like bondholders payoff as such firms might be perceived to have higher risk which could dwindle the firm value (Waddock and Graves, 1997).

The findings are also consistent with Sinkin *et al.* (2008) and Al-Najjar and Anfimiadou (2012) who show a positive association between eco-efficiency and the value of the firm for a sample of the US and UK firms, respectively. Firms are therefore encouraged to employ new processes to adapt to an eco-efficient environment. In employing new processes, firms will be able to carry out their business within environmental acceptable norms which results to an enhanced firm value.

Also included in the model are two moderating firm-specific variables that reflect the financial make-up of the firms. For example, the result of this study shows that higher leverage has no effect on the relationship between eco-efficiency and firm value. This agrees with the findings of Miller (1991) that suggest that the capital structure in place is irrelevant and that a firm with eco-efficient business policy will have a higher firm value irrespective of the debt-equity ratio. Another major finding is the positive moderating effect for profitability on the relationship between eco-efficiency and firm value. This is so because as Heinze (1976) puts it, profitability allows management the freedom and flexibility to undertake and present to shareholders more social responsibility programmes. Further, considering the high cost of acquiring the ISO 14001 certification, the condition for eco-efficiency, it is indeed likely that only profitable firms might be justified in venturing into such. Similarly, Bowman and Haire (1976) share the lead that social responsiveness require similar managerial expertise to make a firm profitable.

In conclusion, the study sets out to investigate the impact of leverage and profitability on the relationship between eco-efficiency and firm value. Prior studies examined the direct relationship (Al-Najjar and Anfimiadou, 2012; Connelly and Limpaphayom, 2004; Guenster *et al.*, 2011; Sinkin *et al.*, 2008). This paper applied the Ohlson (1995) model. The main findings show eco-efficiency having a strong affirmative association with the value of the firm. Also the findings show a positive moderating relationship for profitability in the relationship between eco-efficiency and firm value, whereas leverage plays no significant moderating role. In the course of making inferences from this study, it should be noted that, first, the data comprised exclusively Malaysian companies. Including firms from similar developing countries with varying institutional make-up and culture would enhance the understanding of the subject. Second, considering that the data for this study is cross-sectional, it may not be sufficient to draw strong causal influences. Further studies might clarify the causal relationships by using a longitudinal research design.

### Implication for practice and research

The acceptance of the positive relationship between eco-efficiency and firm value mostly for profitable firms is an indicator to shareholders that eco-efficient firms can generate higher future returns. Such an investment can be seen to give the firm a competitive advantage (Porter and Van Der Linde, 1995). Further, such eco-efficient practices can also influence consumer behaviour in a positive way, attracting eco-friendly consumers, thereby enhancing firms' sales. In recent times, process management has become a core area in business. The adoption of ISO 14001 which involves firms aligning environmental standards with a firm's business process is one of the main business strategies of firms engaged in environmental strategies. By doing so, such firms enhance its efficiency and

effectiveness as their processes are in line with changing environmental conditions. Such businesses save time, cost and reduce risk, thereby increasing the firm value.

The findings are highly relevant to management, shareholders and potential investors. The study educates investors on the lucrative returns potential of an eco-efficient corporation. It also shows management that an investment in an eco-efficient policy does not affect the profitability potential of the firm. Further, it shows management and potential investors that an eco-efficient policy will lead to a higher firm value irrespective of the debt profile of the firms. Lastly, the result also provides evidence that profitability drives firm value and profitable firms have the impetus to pursue ISO 14001 which is an indication of eco-efficiency demanded by such sensitive investors.

Our findings also have implications for research. Although a number of studies on eco-efficiency and firm value have been conducted using data from developed countries, there is a dearth of studies from developing markets. Thus, this study confirms the results from developing markets that there exists a positive relationship between both variables despite the different regulatory structures that separates the markets as environmental disclosures are still largely voluntary in most developing countries like Malaysia. In addition, this study is the first to the best of the researcher's knowledge to provide evidence that profitability positively moderates the relationship between eco-efficiency and firm value.

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