Efficiency in Giving Back to the Masses: Insights from ESG and Non-ESG Firms in Selected East Asian Countries

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ABSTRACT

Increasing awareness for sustainability has led more firms to incorporate environmental, social, and governance (ESG) reporting into their establishments. However, firms' ESG information are beset with issues of information asymmetry. Hence, this study was set to provide a more uniformed statistical method of measuring firm's social performance (SP); named ESG efficiency. The Data Envelopment Analysis (DEA) model was used to measure the ESG efficiency of firms in giving back to the masses by means of ESG contribution. Malaysia, Thailand, Singapore, and Indonesia were selected for the study from the year 2010 to 2019. The findings were relatively consistent for all selected countries. The study found that ESG efficiency of both ESG and non-ESG firms had fluctuated, with ESG firms' ESG efficiency fluctuating on an increasing trend. ESG firms were found to be more efficient in giving back to the masses, with higher mean technical efficiency (TE), compared to non-ESG firms. Furthermore, Pure Technical Inefficiency (PTIE) was identified as a significant factor in influencing a firm's TE, indicating that the firms were purely managerial inefficient in directing their financial returns toward ESG contribution. Subsequently, this study provides a simpler method in SP measurement, and was able to identify the significant factor that affected firms' ESG efficiency, and extends the literature on East Asia's ESG development.

Keywords: ESG, data envelopment analysis, efficiency

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INTRODUCTION

Corporate mishaps initiated by poor business practices (e.g., Enron, WorldCom, & Parmalat) have been the main catalyst towards firms' increased awareness towards social and environmental issues. The Stakeholder Theory (ST) contends that in order to have a sustainable long-term growth, firm should focus on not only its shareholders, but its stakeholders too (Freeman, 1983). To date, there are increasing numbers of firms that incorporate ESG reporting into their establishments (Starks, Venkat, & Zhu, 2017). ESG reporting disclosures by firms signals firms' transparency and awareness about ESG issues, further indicating that firms are adamant in achieving wholesome objective for the firm, its stakeholders, and the economies, which would have significant financial impact on firm in the long run.

In addition, information on firm's environmental, social, and governance (ESG) performance is communicated to investors in two ways; (1) ESG voluntary disclosures by the firm itself and (2) ESG scores produced by independent information intermediaries. However, these firms' ESG information are not without issues. Firstly, firm's voluntary disclosure of its ESG performance depends on the nature of transparency of the firm. Even though Clarkson et al. (2008) demonstrated a positive relationship between corporate social responsibility (CSR) performance and information transparency, Cho, Lee, and Pfeiffer (2013) stated that there exists a possibility that firm is being selective in disclosing its ESG information. Withholding information is not an uncommon practice among firms. Firms may intentionally withhold information from its stakeholders depending on which is more opportunistic to the firm (Kulkarni, 2000). The aforesaid predicaments present high chances of information asymmetry, where firm's ESG disclosures are potentially erroneous.

Secondly, ESG scores are produced by independent information intermediaries, such as Morgan Stanley Capital International (MSCI), Kinder, Lydenberg, and Domini Research and Analytics (KLD), Bloomberg, Dow Jones, Morningstar, just to name a few. ESG scores serve to provide incremental information advantages to investors. Firm's voluntary ESG disclosures are still used as the main source of information in producing the ESG scores, despite firm's information distortion possibility (Cho,

Lee, & Pfeiffer, 2013). It is argued that ESG scores are produced by office-based, non-technical individuals, that lacks understanding of the issue (Siew, Balatbat, & Carmichael, 2016). Siew, Balatbat, and Carmichael (2011) contend the methodology in deriving ESG scores are subjective in nature which is difficult to quantify, as there are many dimensions to ESG performance. These ESG dimensions are over-whelming to articulate into simple scores, hence resulting in a possibility of inaccuracy and information asymmetry. Therefore, investors are inadequate to handle these over-whelming loads of information on firms' social performance (SP) (Perez-Gladish & M'Zali, 2010; Perez-Gladish et al., 2013) and it is burdensome for investors to meticulously review each firm's SP information (Hollingworth, 1998).

ESG factors are non-financial and qualitative in nature making them hard to measure (ASEAN-Japan Centre (AJC), 2019). Furthermore, ESG scores are not a true SP metric. In addition, Jensen (2001) contended that in the absence of firms' SP measures, socially responsible firms' internal control systems would be impaired. While from an investor's perspective, Hollingworth (1998) claim that the lack of SP measures would burden investors to meticulously inspect each funds' prospectus to meet their personal values dimensions. Moreover, practitioners argue that there is no uniformity in measuring firm's SP. Current SP indicators, such as certifications, codes of conduct, and social notations are often differed and exclusive to each industry (Perez-Gladish et al., 2013). According to Jeong et al. (2013) due to the nature of ESG factors, a universal statistical method of SP measurement is needed and of utmost importance.

Based on the aforementioned problems, this study focused on investigating the true objective of being socially responsible (SR), which is sustainability. This study asks a more vital question; whether SR firms actually uphold their stakeholders' wellbeing? This leads to the issue of measuring firms' SP. Thus, this study introduced a more uniformed statistical method of measuring firm's SP; named ESG efficiency by using the Data Envelopment Analysis (DEA). The objective of this study was to analyze the efficiency level of firms (both ESG and non-ESG) in giving back to the masses by means of ESG contributions. By using the DEA model, the study was able to measure firms' ESG efficiency. Furthermore, the DEA model was also able to identify the factors that may influence a firm's ESG efficiency, by performing both parametric and non-parametric robustness tests.

Scope of the Study

The economies of Malaysia, Thailand, Singapore, and Indonesia were selected in order to investigate the set objectives. These economies suited the study objectives based on three central reasons. First, these countries lead the ESG development in the East Asian region (refer Table 1). As at 2019, ESG investment amounted to nearing half of total investment in the ASEAN-4 economies at 44.5% (AJC, 2019). Second, they are characterized with high information asymmetry. The problem of information asymmetry is more substantial in the emerging markets of Asian, as they are said to possess high information asymmetry due to weak investor protection (La Porta et al., 2000), high family ownership concentrations (Claessens, Djankov, & Lang, 2000), and inadequate corporate controls (La Porta et al., 2000). Third, the issue of firm inefficiency is prevalent in the few regions of the Asia Pacific (Kinda, Plane, & Veganzones-Veroudakis, 2014; See, 2015). Jarboui, Pascal, and Younes (2013) highlighted that firm efficiency level in different economies might vary due to institutional differences.

Table 1: ASEAN-4 ESG-related Development

Country	Exchange Name	*Global Disclosure Ranking	Require ESG Reporting	Written Guidance on ESG Reporting	ESG Related Training	Sustainability Indices	ESG Investment (%)
Malaysia	Bursa Malaysia	15	Yes	Yes	Yes	Yes	35
Thailand	SET	10	Yes	Yes	Yes	Yes	59
Singapore	SGX	16	Yes	Yes	Yes	Yes	70
Indonesia	IDX	25	Yes	No	No	Yes	14

**ranking as at 2017, among 55 economies globally*
Source: AJC (2019)

LITERATURE REVIEW

The good management theory (Waddock & Graves, 1997) suggests that firms with high SP creates a sustainable long-term relationship with its stakeholders, which consequently increases financial performance (FP). The Good management theory encompasses good conduct by firm in relation to various stakeholders, as such its employees, customers, local government, and local communities. Moreover, the slack resources theory (Waddock & Graves, 1997) suggests that a firm with high FP has excess resources (slack resources) to be invested in various dimensions of SR,

as such employee, customer, and community relations, environmental protections, and philanthropy programs. The possibility of firms to engage in SR activities is determined by the availability of slack resources. Firms would achieve high SP through efficient allocation of slack resources, where high FP is the main catalyst.

The empirical literature on firm's SP measurement is open to debate and is uncertain. Measuring SP is not a straightforward process and is complex in nature (Wood, 2010). The many dimensions and definitions of a firm's SR, blur the link between SP and FP of a firm (Ullman, 1985). Firm's SP is a multi-dimensional construct that encompasses multiple sources of inputs (Waddock & Graves, 1997). Adding to the existing complexity, the ESG dimensions differ for each industry and are highly qualitative in nature, making it hard to quantify. Empirical evidence supports both the good management theory and the slack resources theory, claiming the relationship between SP and FP as a "virtuous cycle" (Waddock & Graves, 1997).

To date, various information intermediaries provide information on firm's SP, in the form of CSR or ESG scores. These scores are materialized by assessing firms' multi-dimensional commitment to SR. These scores have gained acceptance by practitioners and scholars alike as proxies for firm's SP (Cormier et al., 2009; Cohen et al., 2011; Cho, Lee, & Pfeiffer, 2013; Siew, Balatbat, & Carmichael, 2016). However, these scores do not directly measure firms' SP and the underlying theoretical and methodological aspect in materializing these scores are suspect (Wartick & Mahon, 2009).

This study did not completely reject these scores as measures of firm's SP. This study acknowledged the significant relevance of these scores in embodying firm's SP to a certain extent. This study did not exclusively rely on information intermediary's ESG scores as proxy for SP, but used the scores as elements in measuring SP. Furthermore, the measurement of SP in this study was grounded on the slack resource theory, as firm's SP is a derivative of firm's excess resources from high FP. Investment in SR is costly to a firm, thus a firm needs to obtain high FP in order to become highly SR and consequently achieve a high SP.

Einolf (2007) sampled 978 US firms and used the output-input DEA in measuring firms' SP efficiency. The study used Value Line projected the

alpha and the Morning Star Rating as its output variables, while IW Financial ESG scores as its inputs. Belu (2009) also used the output-input DEA, where the output variables were sustainability scores calculated from questionnaire of CSR dimensions. For its input, firm's measures of FP were used, such as return on assets, return on equity, and annual average stock returns. Chen and Delmas (2011) used the DEA model to address the ordinal nature of SP, based on SP ratings from the KLD database. The model's SP was calculated by the weighted sum of the category scores. The assigned weights were derived from three methods, based on; (1) equal weights, (2) Waddock and Graves (1997), and (3) Ruf, Muralidhar, and Paul (1998). Jeong et al. (2013) used the ESG scores of Korean publicly listed firms and converted them into ESG costs as output. FP measures of firms such as; return on asset, return on equity, and operating profit percentage were used as its set of input. In investigating the relationship between operational productivity, SP, FP, and risk of 476 US manufacturing firms, Jacobs, Kraude, and Narayanan (2016) used the KLD database ratings. Similar to Chen and Delmas (2011), the study took into account the ordinal nature of KLD ratings' strengths and concerns. However, the study employed the input-oriented DEA model. The model ranked each output and input by assigning a certain value to them. The study claimed that firms with the most efficient SP have maximum strengths and minimum concerns. Ramanathan, Ramanathan, and Bentley (2018) investigated the influence of regulations flexibility on firms' innovation and FP relationship of 125 UK manufacturing firms. It used the DEA to measure environmental regulations flexibility. The model output variables were e measures of regulations flexibility, while its inputs were measures of regulations inflexibility. These measures were obtained through distribution of questionnaires to firms. Whereas, the factor analysis method was used to measure FP, which were proxied by sales growth and increase in market share.

Collectively, based on the slack resources theory and a plethora of aforementioned empirical findings, a firm's SP is a consequence of a firm's FP. Furthermore, despite various methodological approaches, empirical findings have shown that a firm's SP is able to be measured by a firm's FP variables related to equity returns.

METHODOLOGY

Data Collection

The Economies of Malaysia, Thailand, Singapore, and Indonesia were selected for investigation based on reasons stated earlier. The data was collected from multiple databases. Firstly, in measuring the TE of firms, the data for inputs and outputs were obtained from two different databases. A firms' ESG scores as outputs were obtained from the Thomson Reuters ASSET4 ESG database. Whereas, the financial data for inputs were a firm's financial data, obtained from the Worldscope database. The data spanned over a period of 10 years, between 2010 to 2019. The time period was selected for this study as it was the aftermath of the 2008 global financial crisis and before the effect of the Covid-19 global pandemic.

This study started with a sample population of 2,721 listed firms of various sectors from the four economies. Later, the study focused only on "active" firms and "dead" firms were omitted from the population. Out of these 2.721 firms, 178 firms were labelled as ESG firms in ASSET4 with 58 firms from Malaysia, 41 from Thailand, 42 from Singapore, and 37 from Indonesia.

This study compared firms' ESG efficiency by measuring technical efficiency (TE) between ESG firms and non-ESG firms through the DEA. Therefore, the sample of ESG firms was matched with a sample of non-ESG firm. In matching the ESG and non-ESG firm samples, this study adopted the Nofsinger and Varma (2014) method. ESG firms were matched with a non-ESG counterpart from the same sector of economies and with a similar total asset value. The study relaxed the total assets criteria and matched the ESG firms with a non-ESG firms that had the closest total asset value. The ESG firm was omitted from the sample if it is the sole firm in its respective sector with no available match of a non-ESG counterpart.

This study final sample included 298 firms, where 149 were ESG firms and another 149 non-ESG firms. There were 94 firms from Malaysia, 66 from Thailand, 66 from Singapore, and 72 from Indonesia.

Data Envelopment Analysis (DEA)

The Non-parametric frontier model was used to examine a firm's ESG efficiency. Efficiency relates to the concept of economies of scale, where a firm achieves maximum output production through cost savings and efficient usage of inputs (Farrell, 1957). Cummins and Weiss (2013) stated that the non-parametric frontier model, such as DEA is a superior method in examining efficiency of firms (Charoenrat, Harvie, & Amornkitvikai, 2013; Cummins, & Weiss, 2013). The DEA makes no appropriate functional form assumption on its distributions, inputs and outputs selection, and efficiency frontier. The DEA is capable of processing multiple inputs and outputs through a decision-making unit (DMU). The DEA measures the efficiency of the DMU in comparison other firms in the industry operating near or on the efficient frontier, through a maximum of ratio of weighted outputs and weighted inputs.

This study used the Banker, Charnes, and Cooper (BCC) model under the variable returns to scale (VRS) assumption in assessing the efficiency of each DMU. Under the VRS, not all DMU are assumed to operate at an optimum level (Banker, Charnes, & Cooper, 1984). The DEA measures firm's TE in producing output near or on the efficient production frontier. The TE is further divided into two measurements of pure technical efficiency (PTE) and scale efficiency (SE). The VRS assumption provides measurement of PTE and SE. Furthermore, firm's inefficiency as such pure technical inefficiency (PTIE) and scale inefficiency (SIE) can be identified. The PTIE measures firm's managerial inefficiency and the SIE measures firm's size inefficiency. Hence, the TE scores in this study were measured on both ESG and non-ESG firm's SP efficiency. The efficiency scores (TE, PTE, and SE) range between 0 to 1, a score closer to 1 is considered higher efficiency.

DEA Input and Output Selection

Since there are many dimensions to ESG performance, the methodology in deriving ESG scores is subjective in nature which is difficult to quantify (Siew, Balatbat, & Carmichael, 2011) and over-whelming to articulate into simple scores. Hence, this study put forth the ESG efficiency using the DEA model, as a new SP measurement.

This study employed DEA's input-output framework by linking a firm's financial performance (FP) and firm's sustainability performance (SP) as inputs and outputs respectively. It used firm's FP measures of ROA, ROE, and operating profit margin (OPM) as inputs. Whereas, the specific Environmental Score (ES), Social Score (SS), and Governance Score (GS) of firms were used as outputs, that denoted the dimensions of ESG.

Furthermore, the DEA's production approach was used in translating firm's FP into ESG achievements to serve the end-users, grounded by the slack resources theory, relating to the Farrell (1957) production approach, a firm's economic performance is converted to firm's social achievements relating to the ESG. It defines a firm's commitment towards reinvestment of its wealth into the ESG values for the masses.

The selection of inputs and outputs for the DEA model were based on various past reputable empirical literature, as such Belu (2009), Jeong et al. (2013), and Belu and Manescu (2013). Belu (2009) used output-input DEA in measuring a firm's SP. The study used a firm's measures of FP as inputs, such as the ROA, ROE, and annual stock returns average. While for its output, the study used the sustainability scores of 0 to 100, calculated from the questionnaire on CSR dimensions. Jeong et al. (2013) used the ROA, ROE, and percentage of operating profit as inputs in the DEA model. For its outputs, the study used the ESG costs, which were calculated from ESG scores of Korean public listed firms. In the Belu and Manescu (2013) DEA model, ROA and Tobin's Q were used as its inputs. While for its outputs, CSR scores of 0 to 100 obtained from the Sustainable Asset Management (SAM); an asset management company in Switzerland.

The DEA model in this study had a combination of three inputs and outputs respectively. It satisfied the rule of thumb as described by Cooper, Seiford, and Tone (2000), which is:

$$N \geq max\ \{m \times s,\ 3\ (m + s)\} \quad \text{..... (1)}$$

Where, N is the number of DMU or sample, m is the number of inputs, and s is the number of outputs. Table 2 summarizes these outputs and inputs variables.

Table 2: DEA's Inputs and Outputs Variables

Variables	Name of Variable	Acronym	Definition / Measurement	Source
Inputs	Return on Asset	ROA	(Net Income – Bottom Line – ((Interest Expense on Debt-Interest Capitalized) * (1 – Tax Rate))) / Total Asset Last 2 Years Average * 100	Worldscope
	Return on Equity	ROE	(Net Income – Bottom Line – Preferred Dividend) / Common Equity's Last 2 Years Average * 100	Worldscope
	Operating Profit Margin	OPM	(Operating Income / Net Revenues) * 100	Worldscope
Outputs	Environmental Score	ES	Calculated from data points related to firm's environmental performance, such as resource reduction, emission reduction, product innovation.	ASSET4
	Social Score	SS	Calculated from data points related to firm's social performance, such as employment quality, health and safety, training and development, diversity, human rights, community, product responsibility	ASSET4
	Governance Score	GS	Calculated from data points related to firm's corporate governance, such as board structure, compensation policy, board functions, shareholders rights, vision and strategy	ASSET4

Source: Worldscope (2020) and Thomson Reuters ASSET4 ESG Database (2020)

RESULTS AND DISCUSSION

Descriptive Statistics of Inputs and Outputs Variable

The inputs and outputs of the study's DEA model are described in Table 3. Via the production approach, the study's DEA model consisted of three inputs and three outputs. A firm's financial ratio of return on asset (ROA),

return on equity (ROE), and operating profit margin (OPM) were selected as inputs. Whereas, a firm's SP of environmental score (ES), social score (SS), and governance score (GS) were selected as outputs.

Table 3 summarizes the descriptive statistics of both ESG and non-ESG firms. Panel A, Panel B, Panel C, and Panel D display the descriptive statistics for Malaysia, Thailand, Singapore, and Indonesia respectively. The data showed that the ESG firms had higher average value of inputs compared to non-ESG firms from the period 2010 to 2019 for all countries. Note that for all countries, non-ESG firms recorded a 0.000 mean output value for ES, SS, and GS, indicating that non-ESG firms made no involvement in ESG contributions.

Table 3: Summary Statistics of Input and Output Variables in DEA Model for Malaysia, Thailand, Singapore, and Indonesia (2010-2019)

	ESG				Non-ESG			
Variables	**Mean**	**Min**	**Max**	**Std. Dev**	**Mean**	**Min**	**Max**	**Std. Dev**
Panel A: Malaysia								
Inputs								
ROA	9.087	-10.400	51.160	8.675	4.560	-46.440	38.610	8.189
ROE	21.226	-51.980	369.910	39.563	6.916	-182.780	88.150	20.525
OPM	17.369	-27.800	58.880	13.190	2.678	-664.800	76.840	55.004
Outputs								
ES	23.758	0.000	91.070	22.723	0.000	0.000	0.000	0.000
SS	33.461	0.000	97.020	25.372	0.000	0.000	0.000	0.000
GS	36.517	0.000	91.760	26.011	0.000	0.000	0.000	0.000
Panel B: Thailand								
Inputs Inputs								
ROA	8.780	-3.150	40.610	6.455	6.164	-26.180	88.890	8.482
ROE	20.197	-75.290	134.040	18.332	11.105	-62.250	170.850	14.877
OPM	15.962	-23.450	52.900	13.617	-3.999	-3692.090	64.490	207.933
Outputs								
ES	29.637	0.000	96.920	29.462	0.000	0.000	0.000	0.000
SS	41.415	0.000	96.540	32.373	0.000	0.000	0.000	0.000
GS	35.970	0.000	89.430	29.772	0.000	0.000	0.000	0.000

Panel C: Singapore								
Inputs								
ROA	7.480	-14.570	38.130	5.966	6.387	-17.860	92.070	9.575
ROE	24.935	-80.560	1087.140	85.499	10.573	-106.470	136.380	19.056
OPM	19.174	-37.740	63.360	16.436	13.779	-179.000	97.470	29.866
Outputs								
ES	32.188	0.000	92.980	26.911	0.000	0.000	0.000	0.000
SS	37.061	0.000	97.360	25.445	0.000	0.000	0.000	0.000
GS	40.038	0.000	90.860	26.032	0.000	0.000	0.000	0.000
Panel D: Indonesia								
Inputs								
ROA	10.149	-39.060	52.090	10.523	5.193	-25.910	51.790	7.263
ROE	21.690	-136.510	281.460	31.295	2.703	-549.750	115.980	57.143
OPM	20.698	-121.330	80.240	17.092	11.147	-410.120	81.210	36.904
Outputs								
ES	23.193	0.000	89.940	24.679	0.000	0.000	0.000	0.000
SS	39.238	0.000	97.250	30.134	0.000	0.000	0.000	0.000
GS	38.777	0.000	95.670	29.200	0.000	0.000	0.000	0.000

Findings of Firm ESG Efficiency of ESG and Non-ESG Firms

Prior to the discussion of the DEA model findings, this study tested the rule of thumb on the combination of inputs and outputs (Cooper, Seiford, & Tone, 2000). The study consisted of balanced DMUs for both ESG and non-ESG firms, with 94 DMUs for Malaysia (ESG: 47, non-ESG: 47), 66 DMUs for Thailand (ESG: 33, non-ESG: 33), 66 DMUs for Singapore (ESG: 33, non-ESG: 33), and 72 DMUs for Indonesia (ESG: 36, non-ESG: 36). Thus, satisfying the rule of thumb, since the total number of DMUs for each country is more than the number of inputs and outputs variables (3 inputs × 3 outputs or 3 [3 inputs + 3 outputs]). Therefore, the selection of variables was valid and permitted the measurement of DMU efficiencies.

The next section discusses the TE change of ESG and non-ESG firms in the selected East Asian countries from 2010 to 2019.The DEA method was used to measure the TE change and was divided into two components of (1) PTE and (2) SE. This study further provided evidence on the nature of the returns to scale of each ESG and non-ESG firms, if SIE existed.

This study constructed separate annual efficiency frontier for each year, in order to observe ESG and non-ESG firms' efficiencies. The advantage of this type of efficiency frontier is that each firm can be observed more than once over a period of time, since a firm might be efficient in one period of time and inefficient in another (Isik & Hassan, 2002). Thus, assuming that the errors or data problems are not consistent over time. Allowing the aforementioned assumption, reduces the lack of random error issue in the DEA (Isik & Hassan, 2002; Sufian, Mohamad, & Muhamed-Zulkhibri, 2008). Therefore, constructing a separate annual efficiency frontier for each year is more flexible and preferable for the study objectives. Consequently, ten separate frontiers (2010–2019) were constructed for both ESG and non-ESG firms in the selected East Asian countries.

Table 4 to Table 7 illustrate the mean efficiency scores of both ESG and non-ESG firms in Malaysia, Thailand, Singapore, and Indonesia from 2010 to 2019. The mean efficiency scores are presented by each year, in Panel A (2010) to Panel J (2019). While, Panel K (All Years) presents the efficiency scores for all ESG and non-ESG firms for all years.

Malaysia

The results as in Table 4 suggested that Malaysia's ESG firms' ESG efficiency had been on an increasing trend, with mean TE scores increasing from 40.7% in 2010 to 75.5% in 2019. While for Malaysia's non-ESG firms, the results displayed a fluctuating trend with very low mean TE scores; from 7.5% in 2010 to 5.2% in 2019. Based on Panel K (All Years), Malaysia's ESG firms exhibited a higher mean TE (75.5% vs. 5.2%), PTE (77.5% vs. 8.3%), and SE (97.5% vs. 93.6%) relative to the non-ESG firms. First, ESG firms were overall more managerial efficient in channeling their financial returns towards ESG contribution or SP, with lower input waste (TIE: 24.5% vs 94.8%) compared to non-ESG firms. Second, from the pure managerial efficiency standpoint, ESG firms displayed a considerably higher pure managerial efficiency than non-ESG firms, with lower wastage of inputs (PTIE: 22.5% vs 91.7%) to produce the same level of outputs. Third, both the ESG and non-ESG firms were considerably scale efficient, with ESG firms having slightly more optimal scale of operation and lower wasted inputs (SIE: 2.5% vs. 6.4%) compared to non-ESG firms.

Table 4: Summary Statistics of Efficiency Scores for ESG and Non-ESG Firms in Malaysia (2010-2019)

	ESG		Non-ESG	
Efficiency Measures	**No. of DMUs**	**Mean**	**No. of DMUs**	**Mean**
Panel A: Year 2010				
TE	47	0.407	47	0.075
PTE	47	0.416	47	0.095
SE	47	0.974	47	0.937
Panel B: Year 2011				
TE	47	0.442	47	0.065
PTE	47	0.465	47	0.067
SE	47	0.957	47	0.950
Panel C: Year 2012				
TE	47	0.487	47	0.045
PTE	47	0.490	47	0.059
SE	47	0.983	47	0.971
Panel D: Year 2013				
TE	47	0.516	47	0.065
PTE	47	0.521	47	0.065
SE	47	0.988	47	0.990
Panel E: Year 2014				

TE	47	0.548	47	0.064
PTE	47	0.551	47	0.064
SE	47	0.994	47	0.993
Panel F: Year 2015				
TE	47	0.607	47	0.065
PTE	47	0.625	47	0.082
SE	47	0.973	47	0.962
Panel G: Year 2016				
TE	47	0.639	47	0.050
PTE	47	0.651	47	0.080
SE	47	0.981	47	0.951
Panel H: Year 2017				
TE	47	0.735	47	0.063
PTE	47	0.745	47	0.080
SE	47	0.984	47	0.972
Panel I: Year 2018				
TE	47	0.724	47	0.038
PTE	47	0.733	47	0.058
SE	47	0.985	47	0.969
Panel J: Year 2019				
TE	47	0.755	47	0.052
PTE	47	0.775	47	0.083
SE	47	0.975	47	0.936
Panel K: All Years				
TE	470	0.755	470	0.052
PTE	470	0.775	470	0.083
SE	470	0.975	470	0.936

Thailand

The findings as in Table 5 showed that Thailand's ESG firms' ESG efficiency hadbeen on an increasing trend, with mean TE scores increased from 29.7% (2010) to 70.7% (2019). For Thailand's non-ESG firms, the results demonstrated a decreasing trend of a low mean TE scores, from 7.3% (2010) to 4.3% (2019). Comparatively based on Panel K (All Years), Thailand's ESG firms revealed a higher mean TE (53.9% vs. 4.9%), PTE (58.9% vs. 7.5%), and SE (90.8% vs. 90.0%) relative to non-ESG firms. Firstly, non-ESG firms had a very high input waste (TIE: 95.1%) indicating that non-ESG firms were managerial inefficient in directing their financial returns toward ESG contribution or SP, compared to ESG firms (TIE:

46.1%). Secondly, based on the pure managerial efficiency perspective (PTE: 58.9% vs. 7.5%), non-ESG firms also had very high input waste with a PTIE of 92.5%, compared to the ESG firms' PTIE of 41.1%. Lastly, both ESG and non-ESG firms were in the same way scale efficient (SE: 90.8% vs. 90.0%) with a very low input waste of 9.2% (ESG) and 10.0% (non-ESG).

Table 5: Summary Statistics of Efficiency Scores for ESG and Non-ESG Firms in Thailand (2010-2019)

	ESG		Non-ESG	
Efficiency Measures	**No. of DMUs**	**Mean**	**No. of DMUs**	**Mean**
Panel A: Year 2010				
TE	33	0.297	33	0.073
PTE	33	0.299	33	0.087
SE	33	0.989	33	0.974
Panel B: Year 2011				
TE	33	0.343	33	0.081
PTE	33	0.345	33	0.081
SE	33	0.997	33	0.997
Panel C: Year 2012				
TE	33	0.408	33	0.057
PTE	33	0.416	33	0.080
SE	33	0.979	33	0.955
Panel D: Year 2013				
TE	33	0.454	33	0.039
PTE	33	0.490	33	0.080
SE	33	0.898	33	0.877
Panel E: Year 2014				
TE	33	0.385	33	0.014
PTE	33	0.596	33	0.045
SE	33	0.599	33	0.701
Panel F: Year 2015				
TE	33	0.605	33	0.047
PTE	33	0.636	33	0.076
SE	33	0.931	33	0.916
Panel G: Year 2016				
TE	33	0.695	33	0.055
PTE	33	0.715	33	0.075
SE	33	0.956	33	0.942
Panel H: Year 2017				
TE	33	0.722	33	0.040
PTE	33	0.791	33	0.111
SE	33	0.900	33	0.809

Panel I: Year 2018				
TE	33	0.775	33	0.042
PTE	33	0.824	33	0.043
SE	33	0.932	33	0.945
Panel J: Year 2019				
TE	33	0.707	33	0.043
PTE	33	0.779	33	0.073
SE	33	0.904	33	0.886
Panel K: All Years				
TE	330	0.539	330	0.049
PTE	330	0.589	330	0.075
SE	330	0.908	330	0.900

Singapore

The findings as in Table 6 specified that Singapore's ESG firms' ESG efficiency had been on a fluctuating trend, between 49.7% and 68.3% from 2010 to 2019. Singapore's non-ESG firms also displayed a fluctuating trend with a very low mean TE score, between 3.7% and 6.0% in the span of 10 years (2010-2019). To compare the findings in Panel K (All Years), Singapore's ESG firms showed a higher mean TE (60.1% vs. 4.7%), PTE (63.2% vs. 6.3%), and SE (94.4% vs. 93.5%) relative to the non-ESG firms. Firstly, mean TE scores (60.1% vs. 4.7%) illustrated that both ESG and non-ESG firms were managerial inefficient in utilizing their financial returns toward ESG contribution or SP, with non-ESG firms being more managerial inefficient than ESG firms (TIE: 39.9% vs. 95.3%). Secondly, based on the PTE scores comparison (PTE: 63.2% vs. 6.3%), non-ESG firms were more purely managerial inefficient with high output loss of PTIE of 93.7%, compared to ESG firms' PTIE of 36.8%. Lastly, based on SE scores comparison (SE: 94.4% vs. 93.5%), both ESG and non-ESG firms were closely scale efficient with very low output loss of 5.6% and 6.5% for ESG and non-ESG firms respectively.

Table 6: Summary Statistics of Efficiency Scores for ESG and Non-ESG Firms in Singapore (2010-2019)

	ESG		Non-ESG	
Efficiency Measures	**No. of DMUs**	**Mean**	**No. of DMUs**	**Mean**
Panel A: Year 2010				
TE	33	0.557	33	0.059
PTE	33	0.581	33	0.106
SE	33	0.949	33	0.913
Panel B: Year 2011				
TE	33	0.609	33	0.060
PTE	33	0.630	33	0.079
SE	33	0.949	33	0.941
Panel C: Year 2012				
TE	33	0.497	33	0.043
PTE	33	0.531	33	0.043
SE	33	0.925	33	0.947
Panel D: Year 2013				
TE	33	0.518	33	0.038
PTE	33	0.583	33	0.073
SE	33	0.881	33	0.868
Panel E: Year 2014				
TE	33	0.637	33	0.045
PTE	33	0.648	33	0.045
SE	33	0.983	33	0.965
Panel F: Year 2015				
TE	33	0.601	33	0.048
PTE	33	0.615	33	0.075
SE	33	0.972	33	0.920
Panel G: Year 2016				
TE	33	0.585	33	0.043
PTE	33	0.606	33	0.044
SE	33	0.968	33	0.978
Panel H: Year 2017				
TE	33	0.657	33	0.044
PTE	33	0.680	33	0.045
SE	33	0.961	33	0.963
Panel I: Year 2018				
TE	33	0.683	33	0.037
PTE	33	0.717	33	0.045
SE	33	0.947	33	0.949
Panel J: Year 2019				
TE	33	0.664	33	0.056

PTE	33	0.730	33	0.074
SE	33	0.905	33	0.903
Panel K: All Years				
TE	330	0.601	330	0.047
PTE	330	0.632	330	0.063
SE	330	0.944	330	0.935

Indonesia

The findings as in Table 7 illustrated that Indonesia's ESG firms' ESG efficiency had been fluctuating on an increasing trend, with a mean TE score of 47.5% in 2010 to 52.2% in 2019. For Indonesia's non-ESG firms, the findings also demonstrated a fluctuating trend, ranging from lowest of 4.2% (2015) to highest of 7.7% (2016). From Panel K (All Years), in comparison, Indonesia's ESG firms revealed a higher mean TE (55.4% vs. 5.2%), PTE (57.2% vs. 6.1%), and SE (96.8% vs. 97.6%) relative to the non-ESG firms. Firstly, the output losses (TIE) experienced by ESG and non-ESG firms of Indonesia were 44.6% and 94.8% respectively. These findings specified that both ESG and non-ESG firms were managerial inefficient in exploiting their financial returns toward ESG contribution or SP, where non-ESG firms were more managerial inefficient than ESG firms. Secondly, the output losses from pure managerial efficiency perspective showed PTIE of 42.8% for ESG firms and 93.9% for non-ESG firms. Lastly, the output losses from the scale efficiency perspective showed very low SIE of 3.2% for ESG firms and 2.4% for non-ESG firms.

Table 7: Summary Statistics of Efficiency Scores for ESG and Non-ESG Firms in Indonesia (2010-2019)

	ESG		Non-ESG	
Efficiency Measures	**No. of DMUs**	**Mean**	**No. of DMUs**	**Mean**
Panel A: Year 2010				
TE	36	0.475	36	0.045
PTE	36	0.484	36	0.045
SE	36	0.985	36	0.996
Panel B: Year 2011				
TE	36	0.442	36	0.044
PTE	36	0.463	36	0.044
SE	36	0.958	36	0.980
Panel C: Year 2012				

TE	36	0.497	36	0.045
PTE	36	0.503	36	0.045
SE	36	0.983	36	0.987
Panel D: Year 2013				
TE	36	0.523	36	0.048
PTE	36	0.534	36	0.048
SE	36	0.981	36	0.995
Panel E: Year 2014				
TE	36	0.572	36	0.053
PTE	36	0.586	36	0.072
SE	36	0.975	36	0.964
Panel F: Year 2015				
TE	36	0.599	36	0.042
PTE	36	0.621	36	0.042
SE	36	0.963	36	0.986
Panel G: Year 2016				
TE	36	0.608	36	0.077
PTE	36	0.653	36	0.099
SE	36	0.927	36	0.932
Panel H: Year 2017				
TE	36	0.646	36	0.053
PTE	36	0.664	36	0.070
SE	36	0.971	36	0.975
Panel I: Year 2018				
TE	36	0.651	36	0.070
PTE	36	0.656	36	0.070
SE	36	0.992	36	0.988
Panel J: Year 2019				
TE	36	0.522	36	0.045
PTE	36	0.554	36	0.070
SE	36	0.947	36	0.955
Panel K: All Years				
TE	360	0.554	360	0.052
PTE	360	0.572	360	0.061
SE	360	0.968	360	0.976

Robustness Tests

Next, it was imperative to test the significance of the aforementioned findings of the DEA model. Robustness checks were done in order to test the correctness of the efficiency scores that were obtained earlier. To see

whether, the difference in the TE, PTE and SE of the ESG and non-ESG firms in the selected East Asian countries were statistically significant. To test the significance difference, Sufian and Kamarudin (2015) and Kamarudin et al. (2017) suggest to perform both parametric (t-test) and non-parametric tests (Mann-Whitney & Kruskall-Wallis). Performing both parametric and non-parametric tests enabled the study to attain more robust resultsthe reason being that the data might violate the assumption of a parametric t-test, hence a non-parametric test is also required (Coakes & Steed, 2003; Kamarudin et al., 2017).

Table 8 illustrates the robustness tests for the DEA model's efficiency scores of both ESG and non-ESG firms. Panel A, Panel B, Panel C, and Panel D present the results for Malaysia, Thailand, Singapore and Indonesia respectively. The results from the parametric t-test showed that ESG firms had a higher level of mean TE and PTE compared to non-ESG firms for all four selected East Asian countries. All of these findings were significantly different at the 1% level. These findings were further confirmed by the non-parametric tests of Mann-Whitney (Wilcoxon) and Kruskall-Wallis.

Furthermore, Malaysia, Thailand, and Singapore reported a higher mean SE for ESG firms relative to non-ESG firms. Only Indonesia reported a higher mean SE for non-ESG firms relative to ESG firms. However, the findings for SE were verified not significant based on all three robustness tests. These were true for all selected East Asian countries, except Malaysia.

Table 8: Robustness Tests for Efficiency Scores of ESG and Non-ESG Firms of Malaysia, Thailand, Singapore, and Indonesia (2010-2019)

Test Statistics	Parametric Test		Non-Parametric Test			
	t-test		Mann-Whitney test		Kruskall-Wallis test	
	T (Prb > t)		z (Prb > z)		χ^2 (Prb > χ^2)	
	Mean	T	Mean rank	Z	Mean rank	χ^2
Panel A: Malaysia						
Technical Efficiency						
ESG	0.586	13.251***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.058		5.50		5.50	
Pure Technical Efficiency						
ESG	0.597	12.977***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.073		5.50		5.50	
Scale Efficiency						
ESG	0.979	2.308**	13.30	-2.117**	13.30	4.480**
Non-ESG	0.963		7.70		7.70	
Panel B: Thailand						
Technical Efficiency						
ESG	0.539	8.573***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.049		5.50		5.50	
Pure Technical Efficiency						
ESG	0.589	8.392***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.075		5.50		5.50	

Scale Efficiency						
ESG	0.908	0.177	11.30	-0.605	11.30	0.366
Non-ESG	0.900		9.70		9.70	
Panel C: Singapore						
Technical Efficiency						
ESG	0.601	27.769***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.047		5.50		5.50	
Pure Technical Efficiency						
ESG	0.632	27.088***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.063		5.50		5.50	
Scale Efficiency						
ESG	0.944	0.636	11.50	-0.756	11.50	0.571
Non-ESG	0.935		9.50		9.50	
Panel D: Indonesia						
Technical Efficiency						
ESG	0.554	21.606***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.052		5.50		5.50	
Pure Technical Efficiency						
ESG	0.572	20.928***	15.50	-3.780***	15.50	14.286***
Non-ESG	0.061		5.50		5.50	
Scale Efficiency						
ESG	0.968	-0.828	8.90	-1.209	8.90	1.463
Non-ESG	0.976		12.10		12.10	

Note: ***, ** and * indicate significance at the 1%, 5%, and 10% level respectively

CONCLUSION

To date, there are increasing numbers of firms that incorporate ESG reporting into their establishments (Starks, Venkat, & Zhu, 2017). ESG reporting disclosures and ESG scores of firms signal firms' transparency and awareness about ESG issues, hence portraying a strong corporate image to stakeholders and investors alikewhich consequently, is argued to have significant financial impact on firms in the long run (Starks, Venkat, & Zhu, 2017).

However, these ESG reporting disclosures and ESG scores of firms are not without issues. Firstly, firms' voluntary ESG reporting disclosures present the possibility of deliberate information withholding (Kulkarni, 2000; Cho, Lee, & Pfeiffer, 2013). Secondly, ESG scores produced by independent information intermediaries are contended to be theoretically and methodologically unreliable (Wartick & Mahon, 2009; Siew, Balatbat, & Carmichael, 2016) and plagued with information asymmetry possibilities (Kulkarni, 2000; Cho, Lee, & Pfeiffer, 2013). ESG factors are non-financial and qualitative in nature making them hard to measure (AJC, 2019). Furthermore, ESG scores are not a true SP metric; there is no uniformity in measuring a firm's SP and a universal statistical method of measurement is highly needed (Jeong et al., 2013; Perez-Gladish et al., 2013). It is imperative to investigate whether ESG firms are actually keeping their end of the bargain, which is upholding their stakeholders' wellbeing.

Thus, this study introduced a more uniformed statistical method of measuring firm's SP, which is named ESG efficiency. By using the DEA model, the study was able to measure the efficiency of firms in giving back to the masses by means of ESG contribution, through ESG efficiency. Furthermore, the DEA model was also able to identify the factors that may influence the firm's TE in relation to SP.

The findings highlighted that the ESG efficiency of both ESG and non-ESG firms have been fluctuating for all countries, with ESG firms' ESG efficiency fluctuating on an increasing trend. Collectively, the findings were consistent on all four selected economies. ESG firms of all countries were found to be far more efficient in giving back to the masses by means of ESG contribution, compared to non-ESG firms. This can be seen from

the higher level of mean TE scores in comparison to non-ESG firms. Furthermore, the study also identified that the factor that significantly influenced firm's ESG efficiency and the factor was consistent across all four selected countries. Through the robustness tests, it was identified that firm's ESG inefficiency was significantly influenced by PTE rather than SE; where PTIE dominated SIE for both ESG and non-ESG firms which means that firm's ESG inefficiency is attributed by firm's managerial inefficiency in directing their financial returns toward ESG contribution for the masses.

Consequently, first, this study provides fellow investors with a simpler SP measurement, that is methodologically transparent and theoretically sound. It is able to identify the efficiency of firms in giving back to the masses through the ESG spectrum, thus assisting investors to make informed decisions on SR investment selection. Second, the measurement also helps to identify the significant factor that taints firms' SP for investors and firms alike. By identifying the factor, this study calls for ESG firms to do required adjustment to better their FP resources' management, hence improving their SP's efficiency. While, non-ESG firms can reevaluate their stance on ESG since they are identified to be managerially inefficient in managing their financial returns. Third, the study edifies academicians with empirical evidence on SR and ESG development in East Asia. Moreover, it adds to the body of literature related to ESG, especially the scarce literature area of SP measurement since past scholarly literature have a relatively narrow research focus on the effect of SP on firm's FP, especially in the western economies (Renneboog, Ter Horst, & Zhang, 2008; Perez-Gladish & M'Zali, 2010).

Finally, for future research purposes, it would be interesting to extend this study by investigating thoroughly on potential determinants that might influence ESG and non-ESG firms' SP efficiency. Particularly on scant literature on how country characteristics may influence firms' SP efficiency. Furthermore, it would be compelling to test the influence of this study's SP measurement on capital market information asymmetry whether the study's proposed SP measurement is able to mitigate the capital market's information asymmetry.

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