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Does ESG Efficiency Moderates the Asymmetric Information of Malaysian and Singaporean Capital Markets

(*Adakah Kecekapan ESG Memoderasi Maklumat Asimetri dalam Pasaran Modal Malaysia dan Singapura*)

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ABSTRACT

There exists a practicality issue with firms' Social Performance (SP), where there is no uniformity in measuring a firm's Environment, Social, and Governance (ESG) performance. This issue creates an Information Asymmetry (IA) problem for fellow stakeholders in the capital market. Hence, this study's objectives are (1) to develop a new and uniform firm's SP measurement, ESG efficiency (Technical Efficiency (TE)), and (2) to assess the practicality of TE by examining the moderation effect on the relationship between Country Characteristics (CC) and IA in capital markets. This study focuses on ESG firms of Malaysia and Singapore between the years 2010 and 2019. Notably, Malaysia and Singapore were selected as they are ASEAN leaders in ESG development, yet still face firm inefficiency and high IA in their capital markets. TE is developed using Data Envelopment Analysis (DEA), and its moderation effect is investigated using stepwise regression analysis. For the first objective, DEA findings reveal that Malaysia's ESG firms are slightly more ESG efficient compared to Singapore's. Moreover, it reveals that firms in both countries are purely inefficient in managing their financial returns for stakeholders' ESG contributions. For the second objective, findings on TE moderation effects are mixed and exclusive to each country. Malaysia records both weakening and strengthening moderation effects, while Singapore records only a strengthening moderation effect towards the CC-IA association. The study contributes to the scant areas of ESG literature, such as SP measurement. The study uses an efficient production function in relation to a firm's ESG performance measurement, TE. The study presents evidence that TE demonstrates the ability to mitigate the capital market's IA. It calls for policymakers to regulate new laws that accentuate compulsory ESG commitment from listed firms, which would result in increased capital market transparency and investor protection.

Keywords: ESG performance measurement; *data envelopment analysis*; *information asymmetry*; *moderation effect*; *Malaysia and Singapore*

ABSTRAK

Terdapat satu isu praktikal berkenaan prestasi sosial firma kerana tiada keseragaman dalam pengukuran prestasi ESG firma. Isu ini menimbulkan masalah maklumat tidak simetri bagi pihak berkepentingan dalam pasaran modal. Justeru itu, objektif kajian ini adalah (1) membangunkan pengukuran baharu bagi prestasi sosial firma yang lebih seragam iaitu ESG Efficiency (TE), dan (2) mengaji sama ada TE berperanan sebagai pemboleh ubah penyederhana dalam hubungan antara ciri negara dengan maklumat tidak simetri dalam pasaran modal. Kajian ini menumpukan perhatian kepada firma ESG di Malaysia dan Singapura antara tahun 2010 hingga 2019. Malaysia dan Singapura dipilih kerana kedua-dua negara tersebut merupakan peneraju pembangunan ESG di rantau ASEAN, namun masih berdepan masalah ketidakcekapan dan maklumat tidak simetri yang tinggi dalam pasaran modal. Tahap kecekapan teknikal (TE) dibangunkan menggunakan Data Envelopment Analysis (DEA), manakala kesan penyederhanaan dikaji dengan stepwise regression analysis. Untuk objektif pertama, penemuan kajian DEA menunjukkan bahawa firma ESG di Malaysia lebih cekap ESG berbanding dengan Singapura. Selain itu, penemuan tersebut turut menunjukkan bahawa firma di kedua-dua negara kurang cekap dalam mengurus penggunaan pulangan kewangan bagi menyumbang kepada ESG kepada pihak berkepentingan. Untuk objektif kedua, penemuan menunjukkan kesan penyederhanaan TE berbeza bagi setiap negara. Malaysia merekodkan kesan

penyederhanaan yang lemah dan pengukuhan, manakala Singapura pula merekodkan hanya kesan penyederhanaan berbentuk pengukuhan terhadap hubungan ciri-ciri negara dengan maklumat tidak simetri. Kajian ini menyumbang kepada bidang kajian ESG yang masih terhad, khususnya dalam pengukuran prestasi sosial firma. Kajian ini menggunakan teori fungsi pengeluaran cekap bagi menghasilkan pengukuran prestasi ESG firma, khususnya kecekapan teknikal (TE). Kajian ini membentangkan bukti bahawa TE mampu mengurangkan maklumat tidak simetri dalam pasaran modal. Oleh itu, kajian menyeru penggubal dasar negara supaya menggubal undang-undang baharu yang menekankan komitmen wajib terhadap ESG oleh firma-firma tersenarai awam. Langkah ini dijangka meningkatkan ketelusan maklumat dalam pasaran modal serta memberi perlindungan kepada para pelabur.

Kata kunci: Pengukur prestasi ESG; *data envelopment analysis*; *maklumat tidak simetri*; *kesan penyederhanaan; Malaysia dan Singapore*

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INTRODUCTION

Corporate mishaps (e.g., British Petroleum Deepwater Horizon, Volkswagen Dieselgate, and Rana Plaza factory) have helped open the eyes of the global financial community, increasing awareness of social and environmental issues. To date, globally, more firms are adopting social responsibility into their establishments. A socially responsible firm incorporates Environment, Social, and Governance (ESG) dimensions into its business practices. Sustainable investments amount to US$103 trillion of total assets under management in 2020 (Principles for Responsible Investment (PRI), 2020), signifying that more firms are integrating ESG into their business practices.

Furthermore, the exponential demand for socially responsible investment has called for firms to communicate their Social Performance (SP) to the public. ESG firms release their SP to the stakeholders in two ways: either through (1) firms' voluntary ESG disclosure or (2) from ESG scores published by independent information intermediaries.

However, the problem lies within these methods of firms' ESG disclosures. These ESG disclosures and scores produced by independent information intermediaries are argued to be theoretically and methodologically unreliable (Siew et al. 2016; Avramov et al. 2021; Billio et al. 2021) and beset with Information Asymmetry (IA) issues (Cho et al. 2013). In real-world practicality, Tricks (2022) highlighted that the issue of ESG disclosures has recently become unreasonably political, complicating efforts towards standardized ESG disclosure. Additionally, securities regulators from America, the European Union, Asia, and other international standard-setting bodies are independently waging a battle on the issue, which impedes global standardization efforts. The same issue has been discussed by a few past academic literatures (Jeong et al. 2013; Avramov et al. 2021; Billio et al. 2021; Hafiz Ali et al. 2022a; 2022b). As a result, (1) ESG firms are burdened with various ESG reporting requirements and (2) stakeholders are overwhelmed with various ESG information from numerous sources. These create unequal informational positions and an imbalanced investment opportunity for stakeholders, bringing forth the IA problem in the capital markets.

Hence, to address the issue, this study proposes a uniform SP measurement grounded in sound theory and methodology, compared to ESG scores produced by independent information intermediaries. This study proposed that SP measurement is referred to as ESG efficiency. In essence, ESG efficiency is developed based on an efficient production function (Farrell, 1957). It employs the Technical Efficiency (TE) score of the Data Envelopment Analysis (DEA) input-output model via the production approach (Farrell 1957). Accordingly, ESG efficiency measures firms' efficiency in responding to their stakeholders' ESG dimensions.

At the same time, the usefulness of ESG efficiency is being assessed. The study evaluates whether ESG efficiency affects the strength and direction of the relationship between Country Characteristics (CC) and IA in the capital market. Notably, firms' engagement in social responsibility is contended to create competitive advantage (Porter & Van der Linde 1995). Therefore, it is interesting to investigate the moderation effect of ESG efficiency; whether the results agree with past empirical findings of a negative association between a firm's Corporate Social Responsibility (CSR) performance and IA (Cho et al. 2013; Cai et al. 2015). Consequently, providing further evidence of significant benefits that ESG practices bring to firms in mitigating IA problems (Verrecchia 2001; Utz 2017). Moreover, studies on the moderation effect of a firm's SP are scarce.

Therefore, this study utilizes two-stage analyses. In particular, the study's first objective is to analyze a firm's ESG efficiency level. It questions whether there is any difference in ESG efficiency between ESG firms in Malaysia and Singapore. In addition, this study hypothesizes that there is a significant difference in ESG efficiency between Malaysia's and Singapore's ESG firms.

Meanwhile, the second objective of this study is to examine whether ESG firms' efficiency moderates the relationship between CC and capital market IA in Malaysia and Singapore. Accordingly, this objective raises the following research question: Does ESG efficiency significantly influence the strength and direction of the relationship between CC and IA in the capital markets? Based on this, the study hypothesizes that ESG efficiency significantly moderates the relationship between CC and capital market IA in both Malaysia and Singapore.

This study focuses on firms' ESG efficiency in Malaysia and Singapore. These developing economies are selected for reasons: (1) they are leaders in Southeast Asian's ESG development, (2) they possess issues of firm inefficiency, and (3) they are characterized by high IA (Kinda et al. 2014; ASEAN-Japan Center (AJC) 2019; Hafiz Ali et al. 2022a; 2022b).

Essentially, this study seeks to contribute towards developing a uniform SP measurement that is grounded in sound theory and methodology. First, ESG efficiency is able to identify the source of a firm's ESG inefficiency, whether it is a result of (1) Pure Managerial Inefficiency (PTIE) or (2) size inefficiency. Accordingly, by identifying inefficient areas, the study could assist ESG firms to become more technically efficient in contributing to their stakeholders.

Secondly, this study benefits policymakers in developing economies. ESG efficiency could influence policymakers to regulate a better ESG disclosure framework. This, ultimately, results in improved capital market transparency and investor protection.

LITERATURE REVIEW

SOCIAL PERFORMANCE-FINANCIAL PERFORMANCE NEXUS IN DEVELOPING ESG EFFICIENCY

In developing ESG efficiency as the new firm's SP measurement, this study links the firm's SP with its Financial Performance (FP), grounded in slack resources theory (Waddock & Graves 1997). The theory states that a firm with high FP has surplus resources (slack resources) to reinvest in the many dimensions of social responsibility. Additionally, the likelihood of a firm participating in socially responsible activities is conditioned by the availability of slack resources. Therefore, a firm's efficient apportionment of slack resources (high FP) would result in the firm's high SP.

Notably, a firm's commitment towards the ESG dimension is costly. Thus, confirming the SP-FP nexus, that firm's FP produces the firm's SP. This nexus is the foundation for selecting the study's inputs and outputs for the DEA model. Relatedly, a firm's FP acts as an input in producing outputs; that is, the firm's SP.

In the same breath, Hafiz Ali et al. (2022a) employed DEA to measure the ESG efficiency of ESG and non-ESG firms in selected Southeast Asian countries from the year 2010 to 2019. The study used inputs of a firm's FP measures, which are: Return on Assets (ROA), Return on Equity (ROE), and Operating Profit Margin (OPM). At the same time, Thomson Reuters' ASSET4 firm's Environmental Score (ES), Social Score (SS), and Governance Score (GS) were used as outputs of firms. Collectively, the study noted that ESG firms are more efficient than non-ESG firms in distributing their financial returns toward ESG contributions. Moreover, both firms' inefficiencies are contributed to by purely managerial inefficiency.

This approach follows prior studies that employed similar DEA-based frameworks to assess ESG or CSR efficiency. For example, Belu (2009) and Belu and Manescu (2013) utilized ASSET4 ESG dimensions as outputs to evaluate firms' sustainability efficiency. Likewise, Lo and Sheu (2007), Zhu (2014), and Zhou et al. (2018) applied DEA models to measure environmental and social efficiency using comparable ESG indicators. More recent applications, such as Hafiz Ali et al. (2022a; 2022b) and Halkos and Petrou (2019), reaffirmed that ESG scores from ASSET4 are reliable and widely adopted proxies for corporate SP in DEA efficiency analyses.

INFLUENCE OF FIRM AND COUNTRY CHARACTERISTICS ON ESG EFFICIENCY

Consequently, the SP-FP nexus of slack resources theory (Waddock & Graves 1997) is also used as a basis in determining the Firm Characteristics (FC) that could influence a firm's ESG efficiency. Hence, the proxies for FC should be cautiously selected for their practical consequences on the firm's SP, especially characteristics related to the firm's risk.

Furthermore, this study also argues that variation in a firm's SP can be influenced by the country's characteristics. Notably, each country has a national system and jurisdiction that explains a firm's social responsibility differently. As such, firms' practices differ among countries due to differences in their national systems' framework of social responsibility, especially in relation to labor rights, environmental protection, and education. Thus, it is plausible to infer that diversity in countries' characteristics influences a firm's ESG efficiency.

Consequently, this study is adamant that a well-founded institutional theory should be used as a foundation in determining the proxies of CC, such as the National Business System (NBS) (Whitley 1999). In essence, NBS institutional theory is widely used to illuminate a firm's behavior in relation to cross-country differences. It suggests that a country's institutional dimensions may influence a firm's performance. These institutional dimensions relate to a firm's access to resources, its stakeholders' sustainability welfare, which are (1) the financial system, (2) the educational system, (3) the political system, and (4) the cultural system.

Similarly, Hafiz Ali et al. (2022b) investigated the predictors of SP efficiency for both ESG and non-ESG firms in Malaysia and Singapore from 2010 to 2019. The study observed that both internal characteristics (e.g., firm) and external characteristics (e.g., country) are significant predictors of SP for Malaysia's ESG firms. Meanwhile, only external characteristics were significant for Singapore. As for the non-ESG firms, only internal characteristics were significant for both countries.

INFORMATIONAL ROLE OF ESG EFFICIENCY AND INFORMATION ASYMMETRY

Efficient Market Hypothesis (EMH) (Fama 1965) suggested that in an ideal capital market, securities will be priced appropriately and reflect all available information in the market. Considering that the ideal capital market is a frictionless market with well-informed, active investors, where financing and investment programs are fixed. However, Malkiel (2003) contended the impossibility of an efficient market, as capital markets of the real world are inefficient, volatile, and influenced by various determinants. Therefore, the existence of various independent information intermediaries provides stakeholders with valuable information to assist in making informed and sound investment decisions.

Nevertheless, scores published by independent information intermediaries are argued to lack a theoretical structure, be methodologically unreliable (Siew et al. 2016; Avramov et al. 2021; Billio et al. 2021), and be beset with possibilities of IA problems (Cho et al. 2013). A plethora of past literature has discussed the value of a firm's SP information. Does a firm's SP information carry any informational advantage to fellow stakeholders?

Additionally, past literature related to CSR has empirically proven the informational role of a firm's SP. It signals stakeholders regarding a firm's reputation, credibility, quality, and honesty (Brekke & Nyborg 2005; Fisman et al. 2006). Moreover, socially responsible firms have higher corporate value, which attracts quality, competent labor (Brekke & Nyborg 2005). For instance, Renneboog et al. (2008) stated that CSR reduces the number of firms' competitors.

Accordingly, this study extends the argument by asking whether a firm's SP information can reduce the capital market's IA. Past literature from areas of CSR (Kanagaretnam et al. 2007; Clarkson et al. 2008; Cho et al. 2013; Cai et al. 2015) and ESG (Dhaliwal et al. 2014; Siew et al. 2016; Utz 2017) both provide empirical evidence of a negative association between a firm's SP and IA. Concurrently, these empirical findings support the claim that a firm's socially responsible practices bring information transparency that mitigates IA (Verrecchia 2001; Cho et al. 2013; Siew et al. 2016; Utz 2017; Aik et al. 2020).

Correspondingly, this study extends the work of Hafiz Ali et al. (2022a; 2022b) by investigating the practicality of ESG efficiency as a firm's SP measure. In addition, this study investigates whether the ESG efficiency can moderate the relationship between CC and IA in the capital market. Does ESG efficiency affect the strength and direction of the relationship between CC and IA in the capital market?

RESEARCH GAP

Despite the growing body of research linking ESG performance, firm efficiency, and IA, several gaps remain unaddressed. From a stakeholder perspective, most prior studies focus predominantly on investors' or shareholders' responses to ESG disclosures (e.g., Cho et al. 2013; Dhaliwal et al. 2014), while overlooking how ESG efficiency reflects a firm's accountability toward stakeholders who depend on transparent and comparable ESG information. From a theoretical standpoint, existing literature has yet to integrate the efficient production function and slack resources theory into the assessment of SP measurement, nor to link these frameworks with the EMH and NBS theory to explain the informational role of ESG practices across institutional contexts. Empirically, prior research has concentrated on Western or single-country settings, with limited evidence from Southeast Asia. This is particularly true when comparing Malaysia and Singapore, two economies that are regional ESG leaders yet are characterized by differing institutional environments and persistent IA. Moreover, the moderating role of ESG efficiency on the relationship between CC and capital market IA remains largely unexplored. This study addresses these gaps by developing and assessing ESG efficiency within a cross-country ASEAN context, bridging stakeholder, theoretical, and empirical deficiencies in the current ESG literature.

METHODOLOGY

DATA SELECTION

This study focuses on firms' ESG efficiency in Malaysia and Singapore. These countries are selected for reasons: (1) they are leaders in Southeast Asian's ESG development, (2) they possess issues of firm inefficiency, and (3) they are characterized by high IA (Kinda et al. 2014; AJC 2019; Hafiz Ali et al. 2022a; 2022b). In the Southeast Asian region, Malaysia is viewed as a developing nation, while Singapore is a developed nation. Therefore, it is significantly beneficial to investigate a firm's ESG efficiency in a setting that is riddled with IA issues (Lu et al. 2014; Ali et al. 2017).

The data collected spanned a period of ten years, from 2010 to 2019. The time period is to control the effect of the 2008 global financial crisis and the COVID-19 global pandemic on firms' and countries' data. At the beginning, a sample population of listed firms from all sectors in Malaysia (861 firms) and Singapore (534 firms) is collected. However, only 100 firms are labeled as ESG firms in Thomson Reuters ASSET4 ESG database (ASSET4), where Malaysia (58 firms) and Singapore (42 firms) are represented.

Several firms are omitted due to the unavailability of data. Moreover, the study focuses only on "active" firms, while "dead" firms are omitted. "Dead" firms are firms that have ceased operations or are no longer operational, nor listed in the stock exchange, within the timeline of the research. Ultimately, the study's final sample includes a total of 80 ESG firms from 41 sectors of the economy, with Malaysia (47 firms) and Singapore (33 firms).

This study pools firms' data across various sectors due to sample size constraints (Li et al. 2019). DEA requires an adequate sample size relative to the number of Decision-Making Units (DMUs), inputs, and outputs. Note that an overly small sample size leads to overfitting and poor discriminatory power (Charnes et al. 1978).

RESEARCH DESIGN

This study employs two stages of analysis: DEA and Panel Regression Analysis. In the first stage analysis, the study developed ESG efficiency as a new firm's SP measurement using DEA. In the second stage analysis, stepwise regression analysis is employed to examine the moderation effect of ESG firms' ESG efficiency on the relationship between CC and IA in capital markets.

FIRST STAGE ANALYSIS: DEA AND ITS INPUTS OUTPUTS SELECTION

DEA is a non-parametric frontier model that makes no appropriate functional form assumption on its distributions, inputs, outputs selection, and efficiency frontier. It is developed based on the efficient production function by Farrell (1957). Furthermore, it can thwart functional form's misspecification and yield more accurate efficiency estimates (Cummins & Weiss 2013). It also measures the TE of each DMU through the maximum ratio of weighted outputs and weighted inputs. Using the Variable Return to Scale (VRS) assumption, TE is divided into (1) Pure Technical Efficiency (PTE) and (2) Scale Efficiency (SE). Here, the firm's inefficiency can be identified (i.e., Pure Technical Inefficiency (PTIE) and Scale Inefficiency (SIE)), where they measure a firm's managerial inefficiency and size inefficiency, respectively. These efficiency scores (TE, PTE, and SE) range between 0 (low efficiency) and 1 (high efficiency).

This study's DEA model is made under the VRS assumption that not all DMUs operate at an optimum level (e.g., Banker-Charnes-Clooper (BCC)). Therefore, this study's DEA model is Output-Oriented (OO), which uses multiple inputs to produce multiple outputs. In particular, the OO-DEA model intends to maximize output levels at the expense of its given set of inputs. For this reason, this study employs the BCC-OO-DEA model via the production approach.

Therefore, in developing ESG efficiency as a new measurement of a firm's SP, this study infers that a firm's SP is a byproduct of firm's FP, where a firm's FP acts as input and a firm's SP acts as output (Jeong et al. 2013; Belu & Manescu 2013; Hafiz Ali et al. 2022a; 2022b). Specifically, this study's DEA model has three inputs and outputs, satisfying the rule of thumb (Cooper et al. 2000).

Thus, ESG efficiency measures firms' efficiency in responding to their stakeholders' ESG dimensions, represented by TE scores. It relates to the firm's maximum TE in utilizing its financial returns (inputs) toward stakeholders' ESG dimensions (outputs). Accordingly, ESG efficiency (*TE*) represents the maximum TE measurement, while the inputs are the firm's measures of FP (*ROA*, *ROE*, *OPM*), and the outputs are the firm's SP measures (*ES*, *SS*, *GS*). Table 1 summarizes these input and output variables.

TABLE 1. ESG efficiency's inputs and outputs measurements

Variable	Name of Variable	Acronym	Definition/Measurement	Source
Inputs	Return on Asset	*ROA*	Calculated by dividing the firm's net income by the average of its total assets over the last 2 years. It is expressed in percentage.	Worldscope
	Return on Equity	*ROE*	Calculated by dividing the firm's net income by the average of its common equity over the last 2 years. It is expressed in percentage.	Worldscope
	Operating Profit Margin	*OPM*	Calculated by dividing the firm's operating income by its net revenues. It is expressed in percentage.	Worldscope
Outputs	Environmental Score	*ES*	Calculated based on the firm's environmental performance data points, as described by ASSET4 ESG Database.	ASSET4
	Social Score	*SS*	Calculated based on the firm's SP data points, as described by ASSET4 ESG Database.	ASSET4
	Governance Score	*GS*	Calculated based on the firm's corporate governance data points, as described by ASSET4 ESG Database.	ASSET4

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

SECOND STAGE ANALYSIS: STEPWISE REGRESSION ANALYSIS AND PROXIES SELECTION

The second objective of this study is to examine the moderation effect of ESG firms' ESG efficiency on the relationship between CC and IA in capital markets. The main independent variables include FC (*SIZE*, *BETA*, *HHI*) and CC (*MCap*, *DEBT*, *LP*, *CompI*, *CorrI*, *GovtO*). In contrast, the dependent variable is the measure of the capital market's IA (*BAS*), while ESG efficiency is used as the moderating variable (*TE*). Therefore, the baseline model (Equation 1.0) examines the direct relationship between *FC*, *CC*, and capital market *IA*:

$$IA_{i,t} = \alpha + \beta_{i,t}\left(\Sigma\, FC_{i,t}\right) + \beta_{i,t}\left(\Sigma\, CC_{i,t}\right) + n_{i,t} + \varepsilon_{i,t}. \quad \ldots\ldots\ldots\ldots\ldots (1.0)$$

Following this, the extended model (Equation 2.0) introduces the moderating effect of ESG efficiency (*TE*) through interaction terms between *TE* and *CC*. Stepwise regression analysis is utilized to investigate the set objective, serving as an automatic variable selection algorithm that instinctively selects the most significant variables to be included in a regression model. In particular, it selects variables in a step-by-step manner. Accordingly, the procedure identifies one

independent variable at a time and repeats the process until a single, optimum regression model with satisfactory explanatory power is achieved (Williford & Depaolis 2016). Moreover, the procedure includes independent variables with the most statistical significance and excludes those with the least significance. It is a robust parameter estimate as it uses a maximum likelihood estimator, corrects the degrees of freedom of standard errors (Meyers et al. 2013), and avoids the acute multicollinearity problems (Sufian & Kamarudin 2015). Therefore, this study implements the forward selection method of stepwise regression analysis. The models are developed as follows:

$$IA_{i,t} = \alpha + \beta_{i,t}\left(\Sigma\, FC_{i,t}\right) + \beta_{i,t}\left(TE_{i,t}\right) + \beta_{i,t}\left(\Sigma\, CC_{i,t}\right) + \beta_{i,t}\left(\Sigma\, CC_{i,t} * TE_{i,t}\right) + n_{i,t} + \varepsilon_{i,t}, \quad \ldots\ldots\ldots\ldots\ldots (2.0)$$

where *i* is the individual observation, *t* is the time period, α is the constant term, β is the vector of coefficients, *n* is an unobserved effect, and ε is the error term. Meanwhile, *IA* is a proxy for the capital market's IA, *TE* is the ESG efficiency of ESG firms, *FC* is various proxies for FC, and *CC* is various proxies for CC. Furthermore, *CC*TE* is the interaction between ESG efficiency and various proxies of CC. Accordingly, Equation 1.0 is employed to examine the moderation effect of ESG efficiency on the relationship between CC and the capital market's IA. Table 2 summarizes all the dependent and interaction variables used.

TABLE 2. Summary of variables for the second stage analysis

Name of Variable	Acronym	Definition / Measurement	Source	
Dependent Variables				
Bid-Ask Spread	*BAS*	Annual average of the difference between a firm's security's price and its ask price.	Worldscope	
Acronym		Description	Predicted Sign	Supporting Literature
Control Variables				
Firm Characteristics, *FC*				
SIZE		A negative relationship is expected, as a firm with a large size experiences a lower cost of capital, which in turn leads to lower IA.	(-)	Cormier et al. (2009)
BETA		A positive relationship is expected, as a firm with high systematic risk deters investors from appropriately valuing the firm, which consequently increases investors' information costs and IA.	(+)	Cormier et al. (2009)
HHI		A positive relationship is expected, since a high (low) *HHI* value indicates a less (more) competitive industry. High industrial competition encourages a firm to operate efficiently, thus reducing IA between insiders and external shareholders in the capital market.	(+)	Chu and Song (2010)
Interaction Variables				
Country Characteristics, *CC*				
Financial System Dimension				
*MCap*TE*		A positive relationship is expected, as the cost of issuing financial assets that are sensitive to information increases with IA. *TE* is expected to significantly moderate the *MCap-BAS* relationship.	(+)	Lambert, Leuz, and Verrecchia (2007)
*DEBT*TE*		A positive relationship is expected, as the cost of issuing financial assets that are sensitive to information increases with IA. *TE* is expected to significantly moderate the *DEBT-BAS* relationship.	(+)	Lambert, Leuz, and Verrecchia (2007)
Education and Labor System Dimension				
*LP*TE*		A negative relationship is expected, due to IA and capital markets' imperfections; firms may rely on labor productivity to signal efficiency and competitiveness in obtaining capital financing. A negative significant relationship is expected. *TE* is expected to significantly moderate the *LP-BAS* relationship.	(-)	Ganotakis and Love (2012)
Political System Dimension				
*CompI*TE*		A positive relationship is expected, as practices of bargaining, lobbying, and bribery to gain personal benefits by firms are common in a competitive market. *TE* is expected to significantly moderate the *CompI-BAS* relationship.	(+)	Ioannou and Serafeim (2012)
*CorrI*TE*		A negative relationship is expected, since a lower value of *CorrI* indicates a higher corruption level. Low corruption control precipitates a higher bid-ask spread. *TE* is expected to significantly moderate the *CorrI-BAS* relationship.	(-)	Hearn (2021)
Cultural System Dimension				
*GovtO*TE*		A negative relationship is expected, as high controlling shareholders will diligently monitor management's actions, restrict agency cost, and reduce IA. *TE* is expected to significantly moderate the *GovtO-BAS* relationship.	(-)	Hope, Thomas, and Vyas (2009)

Source: Worldscope Refinitiv DataStream (2020), and World Bank (2020)

RESULTS AND DISCUSSIONS

FIRST STAGE ANALYSIS: DEA

DESCRIPTIVE STATISTICS OF DEA'S INPUTS AND OUTPUTS VARIABLES OF MALAYSIA AND SINGAPORE

Table 3 summarizes the descriptive statistics for ESG firms in Malaysia and Singapore. Accordingly, Panel A presents Malaysia from the period of 2010 to 2019. Malaysia ESG firms record mean input value of *ROA*, *ROE*, and *OPM* of 9.087, 21.226, and 17.369, respectively. Meanwhile, the mean output value for ESG firms of *ES*, *SS*, and *GS* are 23.758, 33.461, and 36.517, respectively. Conversely, Panel B reports that the ESG firms of Singapore have a mean input value of *ROA*, *ROE*, and *OPM* of 7.480, 24.935, and 19.174, respectively. Additionally, the mean output value for ESG firms of *ES*, *SS*, and *GS* are 32.188, 37.061, and 40.038, respectively.

TABLE 3. Summary statistics of input and output variables in the DEA model for Malaysia and Singapore (2010-2019)

Variable	Mean	Min	Max	Std. Dev
Panel A: Malaysia				
Inputs				
ROA	9.087	-10.400	51.160	8.675
ROE	21.226	-51.980	369.910	39.563
OPM	17.369	-27.800	58.880	13.190
Outputs				
ES	23.758	0.000	91.070	22.723
SS	33.461	0.000	97.020	25.372
GS	36.517	0.000	91.760	26.011
Panel B: Singapore				
Inputs				
ROA	7.480	-14.570	38.130	5.966
ROE	24.935	-80.560	1087.140	85.499
OPM	19.174	-37.740	63.360	16.436
Outputs				
ES	32.188	0.000	92.980	26.911
SS	37.061	0.000	97.360	25.445
GS	40.038	0.000	90.860	26.032

RESULTS OF DEA'S ESG EFFICIENCY SCORES FOR MALAYSIA AND SINGAPORE

This study constructs ten separate annual efficiency frontiers (2010-2019) to observe ESG efficiency. The efficiency frontiers constructed assumed that the data problems are inconsistent over time, as a firm might be efficient and inefficient throughout the observed time period (Isik & Hassan 2002). The approach also helps reduce the issue of random error in DEA (Isik & Hassan 2002; Sufian et al. 2008). Table 4 outlines the mean ESG efficiency scores (*TE*) of all ESG firms for all years from 2010 to 2019.

TABLE 4. Summary statistics of ESG efficiency scores (*TE*) for Malaysia's and Singapore's ESG firms (2010-2019)

Efficiency Measures	No. of DMUs	Mean	Min	Max	Std. Dev
Panel A: All Years Malaysia					
TE	470	0.755	0.012	1.000	0.356
PTE	470	0.775	0.014	1.000	0.361
SE	470	0.975	0.609	1.000	0.037
Panel B: All Years Singapore					
TE	330	0.601	0.008	1.000	0.307
PTE	330	0.632	0.012	1.000	0.316
SE	330	0.944	0.543	1.000	0.077

The findings reveal consistent results for both Malaysia and Singapore. All ESG firms reported an increasing trend of ESG efficiency scores (*TE*) from 2010 to 2019, with Malaysia recording an increase from 40.7% to 75.5%, while Singapore fluctuated between 49.7% and 68.3%.

Table 4's Panel A (All Years Malaysia) reports the mean *TE* scores of Malaysia's ESG firms. It yields a mean *TE* of 75.5% with input waste of 24.5%, implying that ESG firms could have reduced their inputs by 24.5% and still produced the same amount of outputs (75.5%). In contrast, Panel B (All Years Singapore) indicates that ESG firms have a mean *TE* of 60.1% with input waste of 39.9%. This implies that ESG firms could have reduced their inputs by 39.9% and still produced the same amount of outputs (60.1%).

Furthermore, Panel A and Panel B of Table 4 also report PTE and SE scores, and the results are consistent for both countries. The mean *TE* scores are further broken down into their PTE and SE components. In Panel A, Malaysia's ESG firms report PTIE of 22.5% and SIE of 2.5%, while in Panel B, Singapore's ESG firms report PTIE of 36.8% and SIE of 5.6%. Note that PTIE and SIE scores explain the cause of ESG firms' inefficiencies. The results for both countries suggest that ESG firms' inefficiencies are credited by PTIE rather than SIE, indicating that ESG firms' inefficiencies are caused by PTIE or SIE. Furthermore, this suggests that both countries' ESG firms are inefficient in contributing to stakeholders' ESG dimensions. Moreover, both countries' ESG firms are purely managerial and inefficient in coordinating their financial returns with stakeholders' ESG contributions. Therefore, the study supports the first hypothesis, indicating a significant difference in ESG efficiency between Malaysia's and Singapore's ESG firms.

SECOND STAGE ANALYSIS: STEPWISE REGRESSION ANALYSIS

DESCRIPTIVE STATISTICS OF ESG EFFICIENCY, FIRM CHARACTERISTICS, COUNTRY CHARACTERISTICS, AND CAPITAL MARKET'S INFORMATION ASYMMETRY OF MALAYSIA AND SINGAPORE

Table 5 summarizes the descriptive statistics of Malaysia's and Singapore's ESG firms for the years 2010 to 2019. Panel A and Panel B present the descriptive statistics for Malaysia (47 firms) and Singapore (33 firms), respectively.

First, Panel A displays the descriptive statistics of ESG firms in Malaysia between 2010 and 2019. ESG firms in Malaysia record an average *BAS* of USD -0.0089, with a range between USD -0.1267 and USD -0.0003. Furthermore, Malaysia's ESG firms have an average *TE* (0.586). For firm-level characteristics, the average *SIZE* of Malaysia's ESG firms is USD 5.931 billion, with an average systematic risk (*BETA*) of 1.062 and an average industry competition level

(*HHI*) of 0.097. For country-level characteristics, Malaysia's market capitalization (*MCap*) and the country's debt ratio (*DEBT*) record an average value of 134.316 and 53.067, respectively. In addition, the country has an average labor productivity (*LP*) of 109.958. The country also records competitive (*CompI*) and corruption (*CorrI*) indices with average values of 25.750 and 48.400, respectively. As for the shareholding percentage of government bodies in the country's firms (*GovtO*), Malaysia's ESG firms record an average value of 0.117.

On the other hand, Panel B displays the descriptive statistics of ESG firms in Singapore between 2010 and 2019. ESG firms in Singapore record an average *BAS* of USD -0.0113, with a range between USD -0.1216 and USD 0.0012. Additionally, Singapore's ESG firms have an average *TE* (0.601). For firm-level characteristics, the average *SIZE* of Singapore's ESG firms is USD 9.154 billion, with an average systematic risk (*BETA*) of 1.011 and an average industry competition level (*HHI*) of 0.212. For country-level characteristics, Singapore's market capitalization (*MCap*) and the country's debt ratio (*DEBT*) record an average value of 223.505 and 106.760, respectively. Moreover, the country has an average labor productivity (*LP*) of 108.829. The country also records average values of 29.046 and 86.500 for competitive (*CompI*) and corruption (*CorrI*) indices, respectively. Interestingly, for the shareholding percentage of government bodies in the country's firms (*GovtO*), Singapore reports an average value of 0.000. This indicates that, based on the study's sample, government bodies in Singapore hold no shareholding percentage in the country's ESG firms.

TABLE 5. Descriptive statistics of Malaysia's and Singapore's ESG firms (2010-2019)

Variable	Mean	Min	Max	Std. Dev	Mean	Min	Max	Std. Dev
	Panel A: Malaysia				Panel B: Singapore			
BAS	-0.009	-0.127	-0.000	0.015	-0.011	-0.122	0.001	0.016
TE	0.586	0.012	1.000	0.356	0.601	0.008	1.000	0.307
Firm Characteristics								
SIZE (USD billion)	5.931	0.031	42.762	7.548	9.154	0.193	59.434	9.502
BETA	1.062	-1.091	4.032	0.631	1.011	0.217	1.921	0.417
HHI	0.097	0.000	1.000	0.207	0.212	0.000	0.931	0.326
Country Characteristics								
MCap	134.316	110.764	160.260	16.572	223.505	184.144	269.892	27.895
DEBT	53.067	50.700	54.700	1.193	106.760	97.000	126.300	8.320
LP	109.958	100.000	123.600	8.303	108.829	100.000	118.384	6.039
CompI	25.750	4.870	74.600	31.671	29.046	5.470	84.780	35.865
CorrI	48.400	43.000	53.000	3.043	86.500	84.000	93.000	3.143
GovtO	0.117	0.000	0.729	0.172	0.000	0.000	0.000	0.000

RESIDUAL ANALYSIS

Prior to employing the stepwise regression analysis, a normality test is conducted on the study's underlying distribution. The skewness and kurtosis *z*-values indicate that all explanatory variables are not normally distributed for both countries' data. Although parametric statistical methods entail data with normal distribution, Ordinary Least Squares (OLS) estimators are still Best-Linear-Unbiased-Estimator (BLUE) despite the error term not being normally distributed (Gujarati & Porter 2009). Therefore, the data remains non-normal. Following this, the study conducts a multicollinearity test using the Pearson correlation matrix. At the same time, the matrix identifies a few variables with correlation coefficients that are close to or greater than 0.80 (Gujarati & Porter 2009). Variables *LP* and *CompI* are noted to highly correlate with *MCap* and *DEBT*. In other words, these findings are true for both countries, thereby indicating a possibility of a multicollinearity problem in the proposed regression model for both countries later.

MODERATION EFFECT OF ESG EFFICIENCY ON THE RELATIONSHIP BETWEEN COUNTRY CHARACTERISTICS TO CAPITAL MARKET'S ASYMMETRIC INFORMATION OF MALAYSIA AND SINGAPORE

In examining the moderation effect of an ESG firm's ESG efficiency (*TE*) on the relationship between CC and IA in the capital markets of Malaysia and Singapore, the study adopts a stepwise regression model using the forward selection method to mitigate the issue of multicollinearity.

Capital market's IA (*BAS*) acts as the study's dependent variable. Variables of FC (*SIZE*, *BETA*, and *HHI*) are set as control variables. Meanwhile, variables of CC (*MCap*, *DEBT*, *LP*, *CompI*, *CorrI*, and *GovtO*) are set as independent variables. Simultaneously, the ESG firm's ESG efficiency (*TE*), which was obtained through the DEA method in the first stage analysis, is set as the study's moderating variable. Moreover, the baseline model, Model 1, is the regression model for the control variables. At the same time, the extended model, Models 2a, 2b, 2c, 2d, and 2d, examines the interaction between ESG efficiency (*TE*) and CC (2a: *MCap*TE*, 2b: *DEBT*TE*, 2c: *CompI*TE*, 2d: *CorrI*TE*, 2e: *GovtO*TE*).

The interaction between ESG efficiency (*TE*) and CC's *LP* variable is omitted from the study for several reasons. First, the variable *LP* is identified to have a high VIF value for both countries: Malaysia (VIF: 19.821) and Singapore (VIF: 208.198). High VIF values indicate that the regression models have a multicollinearity problem and must be addressed. Second, using the forward selection method of stepwise regression analysis, the study arrives at a final parsimonious model that excludes the variable *LP* for both countries.

Breusch-Pagan Lagrange Multiplier (BP-LM) test (Breusch and Pagan, 1980) is conducted for each regression model and renders chi-square (x^2) that is significant at a 1% level, signifying that GLS is appropriate for these regression models. Notably, GLS can oversee issues of sector-level heteroskedasticity, firm-specific autocorrelation, and cross-country

correlation in an ESG panel data study (Driscoll & Kraay 1998; Baltagi 2008; Wooldridge 2010). Subsequently, the Hausman test (Hausman 1978) is applied, where chi-square (x^2) is revealed to be non-significant, and that GLS under REM is selected for these countries' proposed regression models. In an ESG study, REM is a better estimate than FEM since it has lower variance, retains time-invariant regressors, and performs better with a small sample size (Arellano 2003; Scholtens & Sievänen 2013).

Table 6 presents the findings of the moderation effect of an ESG firm's ESG efficiency (*TE*) on the relationship between CC and IA of Malaysia's and Singapore's capital markets. Panel A presents the findings for Malaysia, while Panel B presents the findings for Singapore. The baseline model, Model 1, presents the results for the control variables, which are statistically significant for both countries. For Malaysia, five out of nine variables are noted to be statistically significant: *BETA*, *HHI*, *DEBT*, *CorrI*, and *GovtO*. However, for Singapore, only *TE* is identified as a significant predictor of *BAS* at a 5% level. Thus, the Model 1 findings indicate that *TE* is a significantly negative predictor of *BAS* only for Singaporean ESG firms, suggesting ESG efficiency is significant in reducing the Singaporean capital market's IA.

Note that the R-squared values for Malaysia (Model 1 and Model 2a to Model 2e) and Singapore (Model 1 to Model 2a to 2d) are within the range of 6% to 9%. These modest R-squared values are consistent with prior ESG literature (Eccles et al. 2014; Friede et al. 2015). This is expected given the multidimensional and qualitative nature of ESG constructs and the limited sample size. Despite this, the direction and statistical significance of coefficients remain robust and economically meaningful.

Furthermore, the findings of the extended model (Model 2a to 2e) are discussed. Model 2a assesses the moderation effect of an ESG firm's ESG efficiency (*TE*) on the country's market-based financial system-IA relationship. First, the findings in Panel A (Malaysia) indicate that *TE* is a significantly negative predictor of *BAS* at the 1% level, whereas *MCap* is non-significant. Nevertheless, when *MCap* interacts with *TE* (*MCap*TE*), the variable becomes negatively significant at the 1% level, revealing a strengthening moderation impact. Second, the findings in Panel B (Singapore) highlight that both *TE* and *MCap* are significantly negative predictors of *BAS* at the 5% level. The negative sign of *MCap* does not agree with the predicted positive sign. Additionally, when *MCap* interacts with *TE* (*MCap*TE*), the negative relationship is maintained with a strengthening moderation impact to a 1% level of significance. This finding contradicts Myers and Majluf's (1984) hypothesis. Therefore, the findings on the interaction variables infer that a firm's ESG efficiency eases the capital market's IA, especially with ESG firms that are in both countries' market-based financial system (Lambert et al. 2007).

Model 2b evaluates the moderation effect of an ESG firm's ESG efficiency (*TE*) on the country's credit-based financial system-IA relationship. First, the findings in Panel A (Malaysia) demonstrate that *TE* is non-significant, whereas *DEBT* is a significantly negative predictor of *BAS* at the 1% level. Notably, the significantly negative finding of *DEBT* does not agree with the predicted sign. Nonetheless, when *DEBT* interacts with *TE* (*DEBT*TE*), the variable becomes non-significant, revealing a weakening moderation impact. Second, the findings in Panel B (Singapore) highlight that both *TE* and *DEBT* are significant predictors of *BAS* and agree with their predicted signs, at 1% and 10% level, respectively. However, when *DEBT* interacts with *TE* (*DEBT*TE*), the variable becomes significantly negative at the 1% level, unveiling a strengthening moderation impact. This finding also contradicts Myers and Majluf's (1984) hypothesis. This implies that a firm's ESG efficiency alleviates the capital market's IA, especially for ESG firms that are in Singapore's credit-based financial system (Lambert et al. 2007).

On the other hand, Model 2c assesses the moderation effect of an ESG firm's ESG efficiency (*TE*) on the country's competitiveness in productivity and capitalizing its resources-IA relationship. First, the findings in Panel A (Malaysia) demonstrate that *TE* is a significantly negative predictor of *BAS* at the 1% level, whereas *CompI* is non-significant. However, when *CompI* interacts with *TE* (*CompI*TE*), the variable becomes negatively significant at the 5% level, suggesting a strengthening moderation impact. Second, the findings in Panel B (Singapore) highlight that both *TE* and *CompI* are significant predictors of *BAS* at a 1% level. Nevertheless, when *CompI* interacts with *TE* (*CompI*TE*), the variable becomes negatively significant at the 1% level, suggesting a strengthening moderation impact. Still, this finding contradicts that of Ioannou and Serafeim (2012). This signifies that a firm's ESG efficiency allays the capital market's IA, especially for ESG firms that are in both countries' competitive environments (Lambert et al. 2007).

Model 2d evaluates the moderation effect of an ESG firm's ESG efficiency (*TE*) on the country's corruption level-IA relationship. First, the findings in Panel A (Malaysia) record that *TE* is a significantly negative predictor of *BAS* at the 5% level, while *CorrI* is non-significant. Interestingly, when *CorrI* interacts with *TE* (*CorrI*TE*), the variable becomes positively significant at the 5% level, signifying a strengthening moderation impact. Second, the findings in Panel B (Singapore) record that both *TE* and *CorrI* are significantly negative predictors of BAS at the 1% level. Despite this, when *CorrI* interacts with *TE* (*CorrI*TE*), the variable becomes positively significant at the 1% level, signifying a strengthening moderation impact. This finding contradicts Hearn (2021). Concurrently, a firm's ESG efficiency mitigates the capital market's IA, especially for ESG firms operating in both countries' corruption-ridden environments (Lambert et al. 2007).

TABLE 6. Regression on the moderation effect of ESG firms' ESG efficiency (*TE*) on the relationship between country characteristics to asymmetric information of Malaysia's and Singapore's capital markets (2010-2019)

Panel A: Malaysia						
Model	1	2a	2b	2c	2d	2e
Est. Method	REM	REM	REM	REM	REM	REM
Constant	0.165***	0.193***	0.208***	0.167***	0.155***	0.169***
	(0.058)	(0.059)	(0.065)	(0.058)	(0.059)	(0.059)
TE	-0.000	-0.014***	0.040	-0.001***	-0.014**	-0.000*
	(0.000)	(0.005)	(0.027)	(0.000)	(0.007)	(0.000)
Control Variables:						
Firm Characteristics						
SIZE	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
BETA	0.001*	0.001*	0.001*	0.001*	0.001**	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HHI	-0.000*	-0.001	-0.001*	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country Characteristics						
MCap	0.001	-0.002	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DEBT	-0.040***	-0.043***	-0.051***	-0.041***	-0.042***	-0.040***
	(0.013)	(0.013)	(0.015)	(0.013)	(0.013)	(0.013)
LP						
CompI	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CorrI	-0.009***	-0.009***	-0.008***	-0.008***	-0.004	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
GovtO	0.008**	0.009**	0.008**	0.009**	0.008**	0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Interaction Variables:						
*MCap*TE*		-0.002***				
		(0.001)				
*DEBT*TE*			-0.010			
			(0.007)			
*CompI*TE*				-0.000**		
				(0.000)		
*CorrI*TE*					0.004**	
					(0.002)	
*GovtO*TE*						0.003
						(0.002)
R-squared	0.063	0.078	0.067	0.071	0.071	0.066
Adjusted R-squared	0.045	0.058	0.047	0.051	0.050	0.045
F-statistics	3.440***	3.870***	3.314***	3.529***	3.482***	3.225***
d statistics	1.642	1.684	1.654	1.663	1.654	1.653
BP-LM x^2	1621.800***	1615.119***	1577.785***	1581.686***	1624.014***	1578.970***
Hausman x^2	0.000	0.000	0.000	0.000	0.000	0.000
No. of Obs	470	470	470	470	470	470
Panel B: Singapore						
Constant	0.011	0.025	-0.028	0.005	0.087***	
	(0.022)	(0.022)	(0.027)	(0.022)	(0.032)	
TE	-0.006**	-0.027**	-0.060***	-0.010***	-0.124***	
	(0.003)	(0.013)	(0.022)	(0.003)	(0.041)	
Control Variables:						
Firm Characteristics						
SIZE	0.000	0.000	0.000	0.000	0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
BETA	0.002	0.003	0.003	0.003	0.003	
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	
HHI	-0.008	-0.009	-0.009	-0.009	-0.009	
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	
Country Characteristics						
MCap	-0.000	-0.000**	-0.000	-0.000	-0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
DEBT	-0.000	-0.000	0.000*	-0.000	-0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
LP						
CompI	0.000	0.000	0.000	0.000***	0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
CorrI	-0.000	-0.000	-0.000	-0.000	-0.001***	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
GovtO						
Interaction Variables:						
*MCap*TE*		-0.000***				
		(0.000)				
*DEBT*TE*			-0.000***			
			(0.000)			
*CompI*TE*				-0.000***		
				(0.000)		
*CorrI*TE*					0.002***	

*GovtO*TE*					(0.000)
R-squared	0.064	0.084	0.082	0.084	0.092
Adjusted R-squared	0.041	0.058	0.056	0.058	0.067
F-statistics	2.748***	3.2666***	3.156***	3.249***	3.607***
d statistics	1.592	1.643	1.629	1.611	1.622
BP-LM x^2	638.979***	648.884	647.189***	650.884***	654.407***
Hausman x^2	0.000	0.000	0.000	0.000	0.000
No. of Obs	330	330	330	330	330

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Figures in parentheses ( ) are the standard error. All regression models are based on GLS under the REM framework (Models 1, 2a, 2b, 2c, 2d, and 2e). Models 2a, 2b, 2c, 2d, and 2e examine the interaction between ESG firms' ESG efficiency (*TE*) and CC (2a: *MCap*TE*, 2b: *DEBT*TE*, 2c: *CompI*TE*, 2d: *CorrI*TE*, 2e: *GovtO*TE*). These regression models are controlled for FC variables (*SIZE*, *BETA*, and *HHI*) that are likely to influence the capital market's IA (*BAS*)

Model 2e examines the moderation effect of an ESG firm's ESG efficiency (*TE*) on the firm's government ownership-IA relationship. First, the findings in Panel A (Malaysia) demonstrate that both *TE* and *GovtO* are significant predictors of *BAS*, at 10% and 5% levels, respectively. *TE* is negatively significant, and *GovtO* is positively significant. This finding agrees with Choi et al. (2010), where high government ownership leads to possible bureaucratic inexorability and bias in political connections. However, when *GovtO* interacts with *TE* (*Govt*TE*), the variable becomes non-significant, even though the positive relationship is maintained, indicating a weakening moderation impact. Likewise, a firm's ESG efficiency is not relevant in influencing the capital market's IA, especially with Malaysia's ESG firms that have high government ownership. Second, Panel B (Singapore) does not present any findings of the variable *GovtO*, nor the interaction variable, *GovtO*TE*. This is attributed to the fact that the variable *GovtO* is omitted from the model as it is reported to be a constant. Thus, the interaction variable of *GovtO*TE* is not investigated.

Based on the findings, the study collectively accepts the second hypothesis that ESG firms' ESG efficiency significantly moderates the relationship between CC and the capital market's IA of Malaysia and Singapore. This is true for several proxies for certain dimensions of NBS.

ROBUSTNESS CHECKS

FIRST STAGE ANALYSIS: DEA

It is imperative to examine the significance of the DEA model findings through robustness checks. It investigates whether *TE*, PTE, and SE scores obtained from Malaysia's and Singapore's ESG firms are statistically significant. Accordingly, three robustness tests were conducted to attain more robust results, where one is a parametric test (t-test) and the other two are non-parametric tests (Mann-Whitney and Kruskal-Wallis).

Parametric t-test results display that Malaysia's ESG firms have a higher level of mean *TE* and PTE compared to Singapore's ESG firms (*TE*: 0.601 > 0.586; PTE: 0.632 > 0.597). Note that these findings significantly differ at a 1% level. However, the mean SE is non-significant by the parametric t-test, with both non-parametric tests (Mann-Whitney and Kruskal-Wallis) confirming these results.

This study concludes that from 2010 to 2019, Malaysia's ESG firms were slightly more ESG efficient than Singapore's ESG firms. In other words, Malaysia's ESG firms are more managerial and more efficient in managing their financial returns to contribute to stakeholders' ESG dimensions than Singapore's ESG firms.

SECOND STAGE ANALYSIS: STEPWISE REGRESSION ANALYSIS

Robustness checks are conducted to test the dependability of our findings. First, the study executes the BP-LM test to determine whether the Pooled Ordinary Least Squares (POLS) and Generalized Least Squares (GLS) are appropriate. Specifically, the tests' *d*-statistic values for most POLS regressions demonstrated autocorrelation problems for both countries.

Henceforth, the study performs the Hausman test (Hausman 1978). The tests' results reveal that the majority of regression models are Random Effect Models (REM) under the GLS method. This improves the Durbin-Watson test's *d*-statistic to around two for all regression models, signifying no first-order autocorrelation problem (Gujarati & Porter 2009).

Subsequently, the White test and likelihood test are conducted to examine the problem of heteroscedasticity. Both tests' results reveal that the majority of the regression models have F-statistics that are significant at 5% and 1% levels. This indicates that the models are beset with heteroscedasticity problems. Therefore, the study employs the GLS method to address the heteroscedasticity problem (Gujarati & Porter 2009).

CONCLUSION

Past ill-reputed corporate downfalls have awakened firms' consciousness on ESG issues, pushing firms to incorporate ESG reporting into their practices. Correspondingly, ESG reporting disclosures and ESG scores signal firms' transparency, hence illuminating a strong corporate image to stakeholders and ultimately, substantial FP for firms.

Nevertheless, these ESG reporting disclosures and ESG scores of firms are not without issues. These issues include (1)

possibility of deliberate information withholding by firms, (2) ESG scores produced by independent information intermediaries are argued to be undependable, (3) these scores are considered to be plagued with IA possibilities, (4) ESG factors are challenging to measure due to its non-financial, qualitative nature, (5) ESG scores are not a true SP metric, (6) practitioners argue that there is no standardization in firm's SP measurement and (7) a universal statistical method of measurement is highly required.

Hence, this study's objectives are twofold. First, the study seeks to measure firms' SP by proposing a new and uniform measurement called ESG efficiency. ESG efficiency refers to a firm's effectiveness in responding to its stakeholders' ESG dimensions. The development of ESG efficiency is grounded on the efficient production function and slack resources theory. By employing the DEA method, the study can measure a firm's ESG contributions and further identify the inefficient factors of firms.

Second, the study investigates the practicality of ESG efficiency by examining the moderating effect of an ESG firm's ESG efficiency on the relationship between CC and IA in capital markets. The selection of CC as an independent variable is grounded in NBS theory, and the informational role of a firm's SP is grounded in EMH hypotheses. As such, the second objective is investigated using the forward selection method of stepwise regression analysis. In particular, the study focuses on ESG firms in Malaysia and Singapore between 2010 and 2019.

For the first objective, findings reveal consistent results for both countries. ESG firms exhibit mean *TE* scores that are trending upward. The mean *TE* scores suggest that Singapore's ESG firms are slightly more ESG efficient compared to Malaysia's. Despite this, both countries' ESG firms are inefficient in utilizing their inputs to produce the same outputs, resulting in a high output loss of (TIE). Additionally, ESG firms' ESG inefficiencies are contributed to by PTIE, indicating that both countries' ESG firms are inefficient in managing their FP toward stakeholders' ESG dimensions. Thus, this study encourages ESG firms to enact new strategies to improve the allocation of their FP resource usage.

For the second objective, findings record two key takeaways from the results, which are consistent for both countries. First, ESG efficiency (*TE*) is significant in mitigating the capital market's IA (*BAS*). Second, CC are significant predictors of the capital market's IA (*BAS*). Moreover, the moderation effects' findings are mixed and exclusive to each country. For Malaysia, the moderation effect's findings record ESG efficiency both weakens and strengthens the CC-IA association. Strengthening moderation effects are true for *MCap*TE*, *CompI*TE*, and *CorrI*TE*, where the stand-alone, non-significant CC variables become significant from the interactions with the firm's ESG efficiency. In contrast, weakening moderation effects are true for *DEBT*TE* and *GovtO*TE*, where the stand-alone, significant CC variables become non-significant from the interactions. For Singapore, the findings record the most evidence that ESG efficiency strengthens the CC-IA association. ESG efficiency significantly moderates the link between CC and IA. This is true for *MCap*TE*, *DEBT*TE*, *CompI*TE*, and *CorrI*TE* interaction variables. Furthermore, the majority of these significant moderation effects record opposite signs from the interactions.

En masse, these immense findings present substantial evidence that ESG efficiency significantly moderates the link between CC and IA. More importantly, the study's proposed firm's SP measurement, ESG efficiency (*TE*), demonstrates the ability to mitigate the capital market's IA (Aik et al. 2020). The moderation effect findings further solidify that ESG practices by firms present transparency of information, which helps alleviate the capital market's IA (Verrecchia 2001; Lambert et al. 2007).

IMPLICATIONS OF THE STUDY

In addition, this study presents numerous contributions to various real-world practitioners. First, for ESG firms, this study calls for implementing new allocation policies for their FP resource usage to efficiently contribute to stakeholders' ESG well-being. This study also verifies that being ESG committed, firms present transparency of information, which helps alleviate the capital market's IA. Second, policymakers should regulate new laws that require compulsory ESG commitment from listed firms, rather than being voluntary. Accordingly, the state of capital markets in observed economies can be more transparent and less volatile, to attract more foreign investors' commitments. Third, for fellow stakeholders (e.g., investors), this study provides a new and uniform firm's SP measure (ESG efficiency) that is easily accessible to assist investors in making informed investment decisions. Lastly, for fellow academics, this study contributes to the scarce literature on SP measurement. Moreover, ESG efficiency's practicality is tested in a cross-country context, the Southeast Asian region. Above all, ESG efficiency demonstrates that a firm's ESG commitment provides informational transparency, facilitating the capital market's IA.

LIMITATIONS OF THE STUDY AND FUTURE RESEARCH SUGGESTIONS

This study is not without limitations. Each limitation provides an opportunity for improvement and future research. First, the final sample size is rather small, with 80 firms (Malaysia: 47 firms; Singapore: 33 firms), as there are not many ESG-committed firms in the Southeast Asian region. This is despite the fact that the countries selected in this study are leading in ESG development. Thus, it is interesting to further the study's objectives in larger Asian markets, such as India and China. Second, the sample period of the study is from 2010 to 2019, selected to reduce the possibility that the study's findings are influenced by the 2008 global financial crisis and the COVID-19 global pandemic. Therefore, for future study, it is worth

investigating the impact of these crises on ESG firms' FPs and whether being ESG committed provides any protection for firms during crises. Third, the ESG efficiency in this study is developed based on the DEA's production approach. The definition of inputs and outputs used for ESG efficiency is standardized for all firms to minimize results bias, even though firms operate in different industries or sectors of the economy. Hence, future studies could explore different approaches, such as intermediation and value-added, depending on the firm's economic sector. Similarly, defining the input and output variables with alternative approaches could help to further data dependability on a firm's ESG efficiency. Ergo, a more robust measurement of a firm's ESG efficiency could be achieved.

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