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# The Impact of Environmental, Social, and Corporate Governance Performance on Implied Cost of Capital : Oil and Natural Gas Companies in Asian Countries


**Proposed by :**

Rucita R. Ramadhiani – 7732283

< r.rucitarahmahramadhiani@students.uu.nl>

**Supervised by :**

Derwall, J.M.M. (Jeroen)

j.m.m.derwall@uu.nl

**Co-reader :**

Catalina A. Papari

c.a.papari@uu.nl

# Abstract

This study investigates the interaction between ESG (environmental, social, and governance) performance and implied cost of capital for a sample of Asian Oil and Natural Companies. The implied cost of capital calculation is generated to forecast firms' earnings with reliable proxies and less bias. ICC also enable ESG risk to be differentiated from systematic risk calculation. Overall, the *Social* ratings from overall ESG disclosure suggest a more significant impact on the cost of capital compared to other disclosures. The findings also support previous research indicating that investors view `sin` industry enterprises as riskier, thus increasing the firms' cost of capital.

***Keywords:*** *Implied Cost of Capital, ESG, Asian Oil and Gas Market, Panel Data*

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# Introduction

"*The exact concept of sustainable finance will evolve (over time), responding to experiences gained and global developments.*" (Gelder, 2012)

The growth of the economy and environmental awareness nowadays is so strenuous that the private sector must quickly adopt the changes experienced by societies in their ethical and moral codes to remain competitive. After the financial crisis, many global stakeholders expect corporations to identify and manage significant environmental, social, and corporate challenges. Since then, environmental, social, and governance (ESG) disclosures have emerged. Traditional financial reporting has become insufficient for stakeholders' information needed to make dependable financial decisions (Cheng, The international integrated reporting framework: Key issues and future research opportunities, 2014). Non-financial data has the potential to grow its importance and be a reliable firm performance measurement (Maas, 2020). According to recent statistics, global sustainable investment grew by more than 67 per cent between 2014 and 2018 (GSIR, 2020). Numerous research highlight the advantages of environmental, social, and corporate governance measures (Chava, 2014) (El Ghoul, 2011) (Dhaliwal, Li, Tsang, & Yang, 2011). These include the possibility of increasing the company's value, operational and financial performance, attractiveness, share liquidity, volatility minimisation, cost of capital (both stock and debt), and convenient access to funding (Viehs & Gordon, 2014).

Several new methods have been developed to find the best way to calculate the ESG effect on the company's capital valuation. Generally, the traditional economic calculation (e.g. CAPM) is based on realised expected return. However, that calculation might count ESG as a systematic risk. In contrast, newer calculations like the ICC estimate the cost of capital by combining current and future internal rates of return through a cross-section statistical approach. ICC constructs a reliable measurement using more vital variables with less bias (Hou, 2011). Proper risk valuation is essential because ESG policies and development impacts are more severe in a few industries and regions (Blommestein). For example, compared to Europe, most Asian countries have lower

significancy with the ESG developments and a region with a lot LDCs with the most vulnerability to climate change (Country classification - UN, 2016). Moreover, several industries with a high dependency on fossil-fuel energy have a more significant impact from carbon pricing risk. The occurrence has caused disproportional risk valuation, and the firm's equity cost is overvalued (Bolton, 2020). In contrast, (Hong & Kacperczyk, 2009) literature presents evidence that investors' aversiveness to invest in `sinful stocks`(e.g. alcohol, tobacco, and gaming companies) induced a risk-sharing market situation. Prior research also suggests that CSR affects a firm's perceived riskiness while various disclosure and ESG standards create information asymmetry problems (El Ghoul, 2011).

Asia is a resource-rich region with energy reserves such as iron, petroleum, lumber, oil (mainly oil, coal, and natural gas), and many others. Simultaneously, Asian countries produce around 82 per cent of the world's crude rubber and 56 per cent of the world's tin. In addition, Asian countries have economic advantages due to their 5.2 per cent growth rate and aggregate GDP of around 2.6 trillion USD (Nasir et al., 2019). In short, a large part of the Asian market is sustainable sensitive and thus has high financial consequences (Gracia & Siregar, 2020). However, despite the large size of the corporate debt market and its global significance, there is a scarcity of studies assessing the impact of sustainability practices on the cost of debt and equity capital (Hoepner,2016). On behalf of decades of Trans-ASEAN Gas Pipeline project and the ongoing gas crisis resulting from the Russia-Ukraine war, it is attractive to see how sustainable governance affects the capital risk and valuation in this particular business sector and region (Sovacool, 2009).

Beyond the similar objection to the previous research examining ESG disclosures and the cost of capital, this paper attempts to offer supporting evidence and understanding for the occurring debate on the impact of ESG-related issues and the risk development cost of capital in Asia. Furthermore, this research will focus on the following main questions. First, to what extent does ESG affect Asian oil and gas firms` cost of capital? Second, which ESG derivatives (Environment, Social, or Governance) have a more significant effect on the firms` cost of capital?

Finally, this research utilises the ESG rating disclosure by Thomson Reuters ASSET4 dataset, now called Refinitive, financial data report from Factset, and Wold Bank data report. Previous researchers' most frequently-used databases for sustainability data are CSR, the KLD STATS Database and Bloomberg ESG Database. This research utilised environmental, social and corporate governance (ESG) scores and the company's implied cost of capital in 50 oil and gas Asian companies from 2010-2021 data. The model will include various variables that simulate the primary causes of ESG scores in those companies and financial incentive policies for renewable energy sources on their ICC.

# Literature Review

## 2.1 The firm's perceived risk

Finance is crucial to developing a low, climate-resilient sustainable economic environment. Therefore, according to Paris Agreement, financial flows must be aligned toward low greenhouse gas emissions and climate-resilient development policies (GSIR, 2020). Overall, policy effectiveness within firms also depends on various factors that substantially impact economic growth. For example, firms with a favourable reputation in sustainability will manage to negotiate better with stakeholders, suppliers, and customers (Robinson, 2008). Numerous examples of sustainable finance institutions trying to enhance these factors by accepting cooperative partnerships with other financial institutions and labour organisations contributing sustainably to generate more capital (Godfrey, 2009). Employees who consciously work in good reputation firms will generally have better work efficiency and may contribute to lowering the firm's costs (Roberts & Dowling, 2002). In many cases, these mainstream institutions see these collaborations as part of their efforts on ESG initiatives. These various policies among ESG method, cost of equity calculation, and country's sustainable regulation increase concerns on assessing an integrated firm's risk calculation (Cheng, 2014).

Few empirical studies show that businesses in developing countries prioritise SDGs and implement ESG scores. Previous literature suggests that proactive environmental firms significantly reduce investors' perceived riskiness (Feldman, 1997). Later, other studies

underlined how socially irresponsible firms possess a higher risk and might endure uncertain futures (Robinson, 2008). For example, firms that sell harmful and unsafe products (`sin` industries) expect a high risk of lawsuits and fine payments (Hong & Kacperczyk, 2009). The question is whether the higher perceived risks of low CSR firms can be diversified away in an investor's portfolio and thus not priced in the traditional cost of capital calculation. A prior study also implied that as investors prefer higher ESG score firms, the risk becomes an idiosyncratic risk and thus cannot be calculated by beta as a systematic risk in CAPM (El Ghoul, 2011). Considering the risk valuation arguments mentioned above, this research will compute the cost of capital by the ICC calculation. ICC Calculation focus will be explained in the later section.

## 2.2 Environmental, Social, Corporate Governance (ESG)

The prior literature had found a robust association between CSR, ESG and a company's cost of equity (Elili, 2020) (El Ghoul, 2011). On the contrary, the neoclassical economic paradigm saw sustainability as unnecessary and incompatible with profit maximisation (Friedman, 1970). The growing correlation between CSR measures in firms across controversial industries is adversely connected with the equity costs discrepancy between controversial and non-controversial business sectors (Hong & Kacperczyk, 2009). The similarities between CSR and ESG stated in various journals have been made to analyse the distinction for a deeper evaluation of the manners. Sustainable finances can affect several firm operations, such as a company's cash flows (Fama & French, 1997) or firm government performance. On that behalf, ESG ratings can affect the overall firm's cost of equity (Richardson, 2001).

ESG criteria and investing have received much attention during the last few years. The financial industry generates more products and services connected to ESG ratings, indexes, and funds. Nevertheless, the amount of disclosed non-financial information in such reports is frequently overwhelming (Cheng, 2014). In addition, various ESG indexes, stocks and fixed-income income funds, and ETFs are currently growing in line with their valuation risk. Growing awareness within the industry that ESG investing practices will evolve to meet its users' expectations and establish trust with more integrated reports (Hou, 2011).

While ESG approaches are improving and becoming more transparent, scoring remains in a state of development; some rating agencies are still refining their methodology by incorporating variables such as materiality. Subjective evaluation is challenging, especially regarding absolute and relative ratings within and between industries (Bolton, 2020). A lack of standardisation for investors contributes to the ongoing uncertainty within ESG methods and calculations. Purchasing those shares would result in ESG-indifferent investors' portfolios no longer being optimally diversified (Heinkel, 2001). Business financing decisions showed a societal rule against investing in unsustainable firms, called "sin stocks". Several investors, notably institutions specific to principles, suffer expenses by refraining from investing in these stocks. Moreover, the profitability of sin stocks outside the United States also suggests that norms affect firm stock prices and returns (Hong & Kacperczyk, 2009). The ESG score can also be a proxy for evaluating these social norms to avoid systematic risks, but avoidance from few investors can shift ESG risk to business-specific risk.

The institutional investor industry also contains various distinct stakeholders with potentially distributed parameters. For example, each institution can choose ESG providers with the most similar firm values (Cheng, 2013). Insurance companies, investment advisers, and pension funds are more likely to encounter investor pressure and avoid high-emission enterprises. At the same time, mutual funds and hedge funds are natural high-risk takers in the market who will do otherwise. The growth of a broad range of investing terminology and accounting systems results in metric discrepancies. Therefore, growing awareness among firms is concerned about including ESG in their valuation to compensate for that added risk (OECD, 2020).

The general outcome from ESG corporate governments' implications on the cost of equity literature has a negative impact (Hong & Kacperczyk, 2009) (Chava, 2014) (El Ghoul, 2011). However, some other findings appear contrary due to dependency on a systematic risk business environment connected to the effectiveness of countries' national and local governance (Breuer, 2018). According to prior reports, several large, publicly-traded banks worldwide have begun to include climate change issues in their lending choices. (Chava, 2014) There has been a significant increase in environmentally sensitive lending, which aims to include the environmental impact

of borrowers in the loan decision. Therefore, the degree to which the ESG methodology combines forward-looking financially crucial data into expectations of returns and risks and the following expectation to which it potentially contributes to the company shareholders' long-term returns (Ratajzak, 2021).

## 2.3 Assets VS. Goodwill, A Trade Off

Previous research argues that Goodwill and other intangible assets are hard to be separated (Eeftink, Knoops, & Vergoossen, 2002). New regulations recognise other intangible assets separately from goodwill if they meet the required definitions. For companies that develop through acquisition, the transaction may contain a significant asset of internally generated Goodwill (King, 2001). The generated Goodwill then subconsciously adds the firm asset impairments. Thus, the direct or indirect effects of an ESG issue could result in an impairment indicator, especially in an industry with high regulation like oil and natural gas. When, for instance, the issue materially affects the estimates used to determine the fair value of the reporting unit associated with goodwill or the fair value of the indefinite-lived intangible asset, ESG factors may also impact the calculation of an impairment loss (Deloitte, 2008).

The unexpected future impairments might lead the company to overestimate its Goodwill. When an overestimate occurs, the leaders in the industry have trouble generating growth in their massively diversified portfolio. Consumer preferences push big companies to shift faster than ever (Francis & Hoefel, 2018). However, if companies are not critical in analysing their potential investment, they may overestimate the business valuation in transactions and lead to future problems. Companies KPMG (2010) has observed the potential issue such as overestimating estimated Goodwill; a relatively high percentage allocation of the purchase price to Goodwill may imply overly optimistic expectations for synergies or significant bid premiums paid as part of the procurement price. The lack of identifiability is the essence of the definition of Goodwill, therefore associated with the risk on the firm's valuation. Companies may engage in excessive bid premiums, which eventually generate high levels of Goodwill and a significant risk of future impairment. Also, the percentage allocation of a purchase price to other intangible assets is less than that allocated to Goodwill across all industries (KPMG Advisory, 2010). These cases may

be driven by an attempt to avoid significant future negative earnings resulting from the amortisation of other intangible assets.

## 2.4 Carbon Footprint Consumption in the Oil and Gas Industry

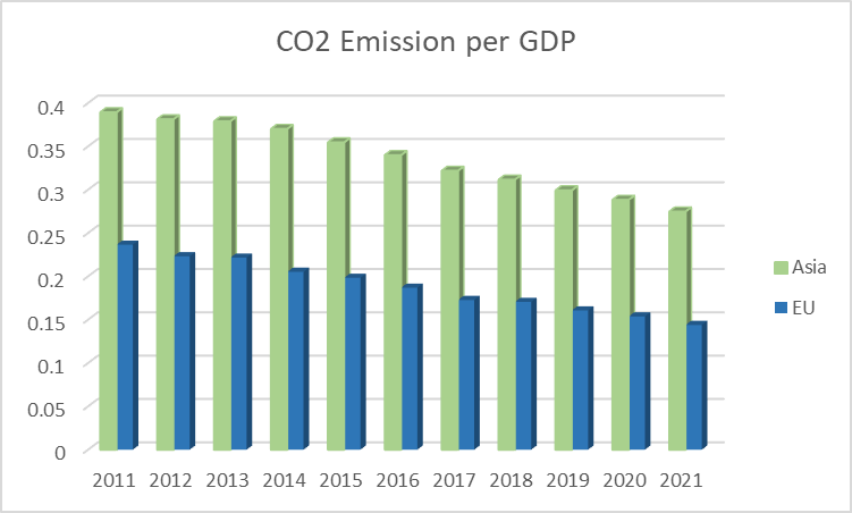
The escalating need for electricity and the climate change challenges connected with conventional energy has increased the demand for renewable sources. However, it has been discovered that a lack of formal institutional set-up, a domestic bond economy, growing stages of the capital bond market with limited private participation, and a lack of international certification will restrict the growth of the renewable energy sector. (Ding, 2019) Most investors may not fully integrate with carbon risk because they are inclined to or habitually look at future cash-flow projections, ignoring unaccountable awareness about global climatic change and its significant risks.

One of the Sustainable Development Goals of the United Nations targets is to improve worldwide resource efficiency in consumption and production and initiatives to detach economic growth from environmental devastation led by developing countries. The goal can be measured by material footprint per GDP and domestic material consumption per GDP. Carbon footprint severity can impact stock returns in a variety of ways. First, because carbon dioxide emissions are linked to fossil-fuel energy, including oil and gas, returns are influenced by fossil-fuel energy prices and commodity price risk. Second, firms with a substantial CO2 footprint could become subject to carbon price risk and other governmental interventions to reduce pollutants. Lastly, fossil fuel firms will also be more vulnerable to the technological risk presented by limited options for renewable energy (Bernardelli, 2022).

These solid and unavoidable adjustments covering the oil and gas industry make it intriguing to analyse this sector. According to the data available in Refinitive, the EU firms are already advancing their industry towards sustainability. Asia's escalating energy consumption and the country's reliance on fossil fuels lead to Asia`s carbon-intensive growth (Sovacool, 2009). However, world bank data on the carbon emissions per GDP trend shown on the graph below shows that Asian countries are currently following the trend to decrease their carbon footprint.

The growing sustainable occurrence makes the oil and gas industry prone to the sustainability effect and investor boycott. Correspondingly, research conducted in south America developed substantial ESG effects on the cost of capital in sensitive environmental industries such as the oil and gas industry. (Martínez-Ferrero, 2015)

**Graph a. Carbon Dioxide Emission per GDP Graph**




*Source: https://data.worldbank.org/indicator/*

The primary energy sector of conventional fuel is also the highest carbon dioxide producer. While it will be hard to separate carbon footprints from economic growth, a positive relationship between economic growth and sustainable energy sources from the world bank data shows growing evidence. To worsen the situation, energy supply in the leading reserves of conventional fuels like coal, oil, and natural gas, is disproportionately spread and significant distances away from major city centres where energy infrastructure is most needed.

There are also few previous data to assess the potential demand for sustainable energy options. Instead, natural gas prospects are based on Net Present Value analyses of its benefits at the level of production processes (Groenendaal, 1994). These assessments are integrated with subsectoral economic growth forecasts to anticipate Asia's future gas consumption. Due to high capital investment costs, a lack of financial resources, and insufficient knowledge transfer, renewable energy generating power across Asia is limited (Handayani,2022). Consequently, imbalanced economic development curtails the growth of renewable energy-based generation.

Moreover, it will be fascinating to find out whether carbon emissions and material footprint should be perceived as systematic risk factors as if the risk premium has links to the risk factor. The theory could be seen by looking at projected governmental measures to reduce emissions that were implemented evenly to all emissions so that carbon emissions might become a systematic risk factor (Bolton, 2020). In contrast, most regulatory actions could be implemented gradually at the state, industry, and municipal levels. In addition, technological advancements in the usage of renewable energy could disproportionately benefit specific activities or industries. Thus, the material footprint would not be expected to represent a systematic risk factor in this research among Asian countries.

## 2.5 Hypothesis Development

The previous studies have shown various findings towards EGS association with forms cost of capital. At the same time, few measures are highly related to limited industries and regions. Compared to the United States and Europe, Asian countries have endured the most significant economic loss and high casualties due to global warming (NOAA, 2021). Notably, 219 million people in the region do not have access to electricity, and another 100 million have only intermittent access to electricity and essential energy services. (Ding, 2019). Correspondingly, trade aid engages to help developing countries accomplish sustainability objectives by adapting to climate change and benefiting from comparative advantages in low-carbon production (OECD, 2020). However, the knowledge and economics gap will result in the pressure for legislation on broad developing countries rising as renewable energy industrialisation grows faster in developed regions.

The knowledge gap is partly the result of a lack of research involving the value of the ESGs through trade, especially in Asian countries. It underlines the importance of climate-friendly standards for long-term economic health in the natural energy sector. Due to the development, company asset decisions will need to constantly adjust and develop as the ESG risk calculation expands indefinitely. The variety of risk perceptions ESG encounters will ultimately impact companies' valuation on their cost of debt and equity (AIC, 2021). Undoubtedly, it is

essential to see the ESG disclosure impact on the firms` valuation. Based on the arguments mentioned, the following hypothesis are:

*H1 : There is a positive association between ESG disclosure and the Asian oil and gas industry firm's implied cost of capital*

*H1a. : There is a positive association between Environment disclosure and the Asian oil and gas industry firm's implied cost of capital*

*H1a. : There is a positive) association between Social disclosure and the Asian oil and gas industry firm's m implied cost of capital*

*H1a. : There is a positive association between Governance disclosure and the Asian oil and gas industry firm's implied cost of capital*

# Data and Methodology

## 3.1 Sample Variables

This analysis utilised various control variables to account for environmental and individual impacts to identify the potential effects of the ESG Score on the cost of capital of the listed Asian oil and gas companies. The data utilised for this research was obtained from FactSet and Refinitive Eikon annual data from the end of the fiscal year of observation. Supposedly, 245 listed oil and gas companies are operating on the whole Asian continent. Due to the limitation of ESG score availabilities in Asian oil and gas industries, this research will include statistics from 50 listed companies from 2010 – 2022, distributed in the table below.

**Table 3.1.a** Countries and Companies

| | **Countries** | **Number of Companies** |
|---|---|---|
| **1** | The Philipines | 1 |
| **2** | Thailand | 9 |
| **3** | India | 8 |
| **4** | Sinapore | 2 |
| **5** | China | 13 |
| **6** | Hong Kong | 3 |
| **7** | Japan | 6 |
| **8** | Taiwan | 1 |
| **9** | Indonesia | 4 |
| **10** | South Korea | 2 |
| **11** | Pakistan | 1 |
| | **Total** | **50** |

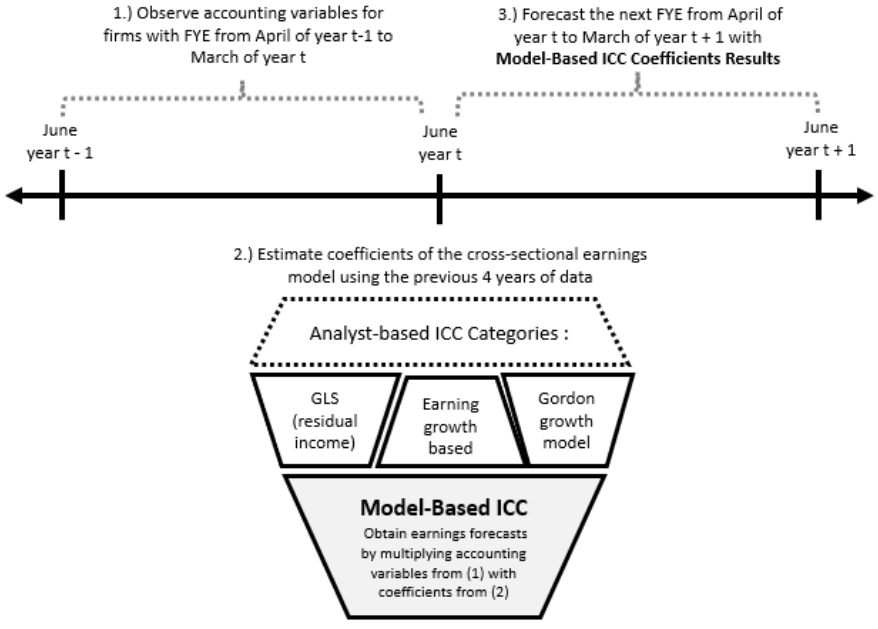
Furthermore, the variables are divided into three computation groups: implemented cost of capital analysis, ESG disclosure computations, and control variables. Cross-sectional panel data was used to evaluate the research hypotheses. Finally, the variable classification prospect to better understand the trend of each section of analysis.

## 3.2 Data Selection

### 3.2.1 Implied Cost of Capital Analysis (ICC)

This study will begin with computing the estimated firms' cost of capital. As mentioned in the literature, this research utilised the new approach of the ICC estimation consists of computing a cross-sectional model of the forecasted earnings of the companies. The significant benefit of the model-based method is that it calculates earnings projections using a broad cross-section of individual companies, generating statistical power while demanding minor forecast constraints.

The model-based ICC correlates the current stock price to the present value of predicted future cash flows. In addition, the method allows us to approximate earnings forecasts and ICC for any company that has publicly traded equity and information on a limited amount of accounting indicators. Following the lead of prior studies and set individual ICC estimations that range to composite the values. Model-based ICC data and forecast development progress are shown in the diagram below:




*Source: New Approach Implied ICC Diagram* (Hou, 2011) *with adjustments*

Another consideration of old ICC computation is the limitation and availability of the variables and data necessary for the valuation. However, in contrast to traditional measures of firm value (like Tobin's Q and WACC), ICC enables one to vary significantly in growth rates and expected future cash flows when forecasting firms' cost of equity. (El Ghoul, 2011) The WACC calculations contain a beta variable that proved uncorrelated to either ESG or CSR, which will decrease the accuracy of model regression if included in the calculation. Compared to realised returns, the implied cost of equity capital is more dependent on cross-sectional variance among enterprises and hence serves as a better proxy for expected return (Botosan, 2011).

Considering the sustainability movement on financial decisions will shift the understanding of portfolio valuation. Early on, the capital asset pricing model (CAPM) depicted how financial markets price assets and, as a result, calculate predicted returns on capital investments. This model provides a way for evaluating risk and converting it into estimates of expected return on equity within its company beta and stock price valuation. Beta plays a supporting role in the market's evaluation of a stock's systematic risk (Gebhardt, Lee, & & Swaminathan, 2001). Another asset-pricing theory based on aggregate risk variables such as size and book-to-market ratios or firm-specific risk connected to observable business characteristics has not incorporated environmental, social, and governance (ESG) considerations into the investment process. In contrast, according to AIC research, two-thirds (65%) of private investors prefer a lesser return to invest in a company with enhanced ESG influence (AIC, 2021). As a result, risks and opportunities affiliated with a portfolio alignment with the SDGs externalities can be undervalued and might not be identified in existing valuations. Therefore, improved studies have constructed a better way to count the ICC from the previous analyst-based to model-based computing, performing refine results on the forecast after comparing it to the actual data from the companies in real-time. (Hou, 2011)

This particular ICC calculation builds on three main categories: pooled cross-sectional GLS regression, earning-growth based, and Gordon growth model. The residual valuation income (GLS) computes each firm's implied cost-of-capital as the internal rate of return, making the net present value of expected future cash flows to the current stock price. The model is

mathematically parallel to the well-known dividend discount model, but it provides a more intuitive insight into the role of economic profitability in stock valuation (Gebhardt, 2001). In additional, price-earnings (PE) ratio valuation is a PE ratio divided by short-term earnings growth. This analyst valuation is shown to be helpful in particular cases of abnormal growth in the earnings valuation model (Easton, 2009).

The last category is the Gordon growth model, which forecasts abnormal performance with a finite horizon according to a new method for estimating the expected return on a share. Purposely as investors expect a corporation to earn a return on equity investment equal to the expected return on its shares for the rest of its life. The analysis uses the expected return on a share as the discount indicator that reflects the share's current price with a dividend expectation. Thus, the dividend in each period from N + 1 to infinity is equal to the forecast for normalised earnings in Period N + 1. This model upgrades the traditional CAPM as the expected return on a share varies with beta and dividend yield using previous empirical tests of the CAPM for estimating expected return failed (Gordon & Gordon, 1997).

Composite all the calculations additionally will rise the ICC estimates at the 1st and 99th percentiles yearly to reduce the impact of outliers. Finally, we establish a minimum reporting concurrency of three months to ensure that the model-based earnings estimates are based on publicly available information at the time of ICC computation. The model-based ICC calculation evaluates data with better precision and broader coverage than the old individual analyst model. As the ICC forecast is calculated, the following step is to see the implication with the ESG.

#### 3.2.2.1 ICC Model and Variables

Following prior literature on ICC calculation, this research adopted several vital variables. As this calculation focuses on the firm's expected earnings, the EBITDA and net income (accruals) variables adjust the forecast (Gebhardt, Lee, & Swaminathan, 2001). The model also add dummy variable scores of 1 for firms with annual negative earnings and 0 otherwise. A closer examination of the individual environmental protection reveals that banks appear to be concerned about both existing regulated environmental issues (e.g. hazardous waste and

substantial emissions footprint.) (Chava, 2014). On that grounds, firms that generate significant profit from environment-friendly products or services appear to experience lower interest rates on their bank loans (Fischer-Vanden & Thornburn, 2013). Prior literature suggests that ESG disclosure decreases systematic risks, thus boosting firms` value. This ICC model uses the annual percentage of dividend payment and a dummy dividend that equals 1 for dividend payer firms and 0 otherwise. The last proxy on the model is *size*, the firm's total asset's log value. *Size* variable adds to its significance on the firms' earnings, and more prominent companies generally face more public attention and financial resources regarding ESG disclosure (Wang, 2021).

**Table 1 – Variables on GLS used on ICC model-based**

| Name | Proxy |
|---|---|
| Expected Earnings | forecasted earning data for each firm model estimation |
| Size | (log) total asset owned by each company |
| Dividend Payment | percentage of annual dividend paid by the firm |
| Dummy on Dividend | dummy variable consists of 1 for dividend payer firms and 0 for otherwise |
| EBITDA | earnings before tax, depreciation and amortisation |
| Dummy Earnings | dummy variable with 1 for the firm with negative earnings and otherwise |
| Accrual | (log) revenues or expenses stated as the company's net income reported on the income statement |
| Country | Dummy of category company's domicile |

GLS or xtgls uses feasible generalised least squares to fit panel-data linear models. This prompt facilitates estimation in the presence of autocorrelation within panels as well as cross-sectional correlation and heteroskedasticity between panels (Wooldridge, 2015). The GLS approach is primarily used because the researcher might want to collect from GLS by specifying a good, reason across-sectional error structure while still obtaining valid asymptotic inference if this matrix is incorrectly specified. Secondly, the researcher may wish to perform panel data GLS and compute the robust to conditional heteroskedasticity variance matrix. The reasons are deemed desirable and appealing. Lastly, by cause of the various levels of measurement used in each variable (e.g. percentage, ratio, and interval), the logarithmic scale is used to measure significant

or highly skewed variables (Hou, 2011). In this analysis, 10 years of financial data available from 50 companies will be used. While the GLS model for the new approach of implied ICC model-based calculation in 2011 used the pooled regression with the model below:

$$Expected\ Earnings\ (Forecast\ ICC)_{t+n} = \beta_0 + \beta_1(Size)i,t + \beta_2\ (Divident\ Payment)i,t + \beta_3\ (Dummy\ Dividend)i.t + \beta_4\ (EBITDA)\mathrm{i.t} + \beta_5\ (Dummy\ Earnings\ )i.t + \beta_6\ (Accruals)i.t + \mathcal{E}i.\mathrm{t}$$

In theory, the equity cost of capital is the projected rate of return on shares requested by stock market investors. In contrast, the debt cost of capital is the crucial assumption underlying the cost of borrowing that reflects the default risk premium demanded by the company's creditors. As a result, a firm's ICC is the projected necessary return that a company must achieve on an equity placement to fulfil its capital providers.

The accuracy of the PEG ratio is determined by the inputs used. When analysing a company's PEG ratio from a published source, it is critical to determine which growth rate was used in the calculation. If future growth rates are forecasted to depart from a company's historical growth, using chronological growth rates may result in an inaccurate PEG ratio. The extent to which a PEG ratio result indicates an overpriced or undervalued stock diverges by industry and firm type. Some investors consider that a PEG ratio less than one is desirable as a general guideline. (Oricchio, 2012) The Gordon Growth Model has a key flaw in its premise that a corporation grows at a constant rate. In actuality, it is exceedingly unlikely that corporations' dividends will increase at a steady rate. Another concern is the model's extreme sensitivity to the growth rate and discount factor utilised. (Corporate Finance Institute, 2018) If the needed rate of return is less than the growth rate, the model can produce a negative number. Furthermore, if the needed rate of return and growth rate have the same value, the value per share approaches infinity, which is theoretically unreliable.

#### 3.2.2.2 ICC Result

**Table a. Descriptive Statistics on GLS ICC Calculation**

| Variable | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|
| **Exp.earn** | 6.43 | 1.86 | -0.38 | 10.16 |
| **Size** | 8.61566 | 1.650788 | 3.960318 | 12.10463 |
| **Divpaid** | 0.16 | 0.61 | 0.00 | 7.09 |
| **Ebitda** | 1758.03 | 3501.69 | -7390.27 | 25894.80 |
| **Accruals** | 5.82922 | 2.125323 | -1.117489 | 16.40659 |
| **Dumdiv** | 0.71 | 0.46 | 0.00 | 1.00 |
| **Dumear** | 0.12 | 0.33 | 0.00 | 1.00 |
| **Country** | 5.02 | 2.52 | 1.00 | 11.00 |

The table above presents the summary statistics of the variables computed in ICC GLS regression. The calculation still shows reasonable data, even with some missing values. The next step is the result of the first step of ICC analysis, the GLS calculation.

**Table b. Pooled GLS ICC Regression Result (Average)**

| | **Exp.earnings** | |
|---|---|---|
| Size | 0.0001 | *** |
| | (0.0001) | |
| Divpaid | 0.0681 | |
| | (0.0930) | |
| Dumdiv | 0.8735 | *** |
| | (0.1337) | |
| Ebitda | 0.0001 | ** |
| | (0.0000) | |
| Dumear | -0.7670 | *** |
| | (0.2533) | |
| Accruals | 0.0001 | |
| | (0.0001) | |
| Country | 0.0559 | ** |
| | (0.0230) | |
| _Cons | 4.7825 | *** |
| | (0.1616) | |
| | ****** P<0.01, ** P<0.05, * P<0.1*** | |

Most of the variables used in the cross-sectional earnings model have high significance towards the expected future earnings calculation, alternatively to each firm *i* and each year *t* in

our samples. The analysis computes earnings growth forecast into the future by multiplying the independent variables as of year t with the coefficients from the pooled regression estimated using the previous ten years of data. The table also shows the coefficients from the pooled regressions estimated each year from 2010-2021 implies a stable average. Future earnings are also significantly positively related to the firm's total assets, whereas companies with higher accruals tend to affect a firm's higher future earnings.

As from the other two calculations on building ICC shows a similar result of calculation with limited anomaly prior to the differences in the variable used. Potential measurement issues and bias from estimation will be lowered as we composite all the variables for each company annually. Lastly, the average composite ICC calculation result below will be used to analyse the correlation between firms' ESG scores.

**Table c. ICC Model-Based Result**

| | 2021 | 2020 | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ICC** | 3.214 | 4.073 | 5.013 | 4.162 | 3.419 | 2.058 | 3.551 | 2.456 | 2.706 | 4.001 | -0.674 | 7.265 |
| | (5.492) | (0.742) | (0.603) | (0.439) | (0.361) | (0.317) | (0.487) | (0.812) | (0.702) | (0.297) | (0.720) | (0.001) |

### 3.2.2 ESG Score Variables

This research utilised 4 ESG variables: overall ESG Scores and, in addition, separate environmental, social, and governance scores. The scores are accessible from the Thomas Reuters Refinitive data collection range between 0-100. Refinive obtained the data by annual reports, websites, and corporate sustainability or CSR reports disclosed publicly by the companies. Shown below each of variables data coverages and annotation.

**Table d. ESG Scores Annotations**

| Variables | Notation | Data Coverage |
|---|---|---|
| ESG Score | ESG | The accumulated score of companies' environmental, social and governance valuations |
| Environmental Score | ENV | Carbon emission, climate change effect, pollution, water use, energy consumption, innovation, and renewable energy resource use |
| Social Score | SOC | Community relations, human rights, employee turnover, workforce management, human rights, and product responsibility |
| Governance Score | GOV | Board size, board duality, independent directors, CSR strategy, management, and shareholders meeting percentage |

### 3.2.3 Control Variables

The practical implications of control variables were based on the methods utilised in studies examining the effect between CSR and the cost of capital covered in the literature review. The dataset is obtained annually from FactSet and the world bank dataset. The following control variables proven to eliminate statistical bias in the research based on previous studies (El Ghoul, 2011) (Dhaliwal, Li, Tsang, & Yang, 2011) used in this findings are firm *size, market-to-book ratio, leverage, return on asset and carbon footprint*. The firm size variable is associated significantly with the cost of capital. More prominent companies are more inclined to interact in ESG management because they generate more stakeholder attention and are considered to have better prospects to conduct sustainable practices. The following variable demonstrates how big firms are likely to have lower risks for the investors (Gebhardt, 2001).

The second control variable is the market-to-book ratio. This proxy is expected to impact the cost of capital positively. The higher the ratio, the company expected to gain also more returns. The variable shows that the firms have more possibilities for growth (Goss, 2011). In comparison, leverage is a proxy for a company's long-term financial plans. When the firm chooses to raise its debt, its risk will also increase. At the same time, it is implied to have a negative association with the cost of capital, identical to the effect constructed by the return on assets variable (Wenxia Ge, 2015). Firms with advanced Returns of Assets usually easily access a loan with lower interest. For that reason, firms might choose to take on more debt, increasing the risk to the company. The return on assets is computed by dividing net income by the average of total assets (Ellili, 2020).

National government regulation on sustainable financing also affects the companies' corporate decision-making arrangement. Although restrictive capital controls in Asia are high, the quality of its financial institutions varies substantially between administrations ranging from authoritarian to democratic, limiting capital flow in the region. Thus, each company can interpret the power asymmetry between the countries or areas differently. The issues can be resolved by choosing the correct variables that minimise each country's error subjectivities and valuation (Hou, 2011).

The last variable added is the country's carbon footprint per GDP, part of UN SDGs indicators. The particular intermediary points to how sufficient each Asian countries' government regulation is to achieve sustainable targets.

**Table e. Control Variables on ESG effect on ICC model**

| Name | Proxy |
|---|---|
| **Size** | The (log) value of total assets |
| **ROA** | Return on assets growth percentages of net profit and average assets from the end and beginning of the annual reporting period |
| **Leverage** | Debt weight is calculated as the quotient of total interest-bearing debt outstanding and the sum of total interest-bearing debt outstanding and total equity |
| **MTB** | The ratio of market to book value |
| **Goodwill** | The (log) goodwill rate from the end of the fiscal year of observations |
| **CO Footprint/GDP** | consumption reports carbon footprint per GDP calculation on each firm's domicile country |
| **Country** | Dummy of each company's headquarter domicile |

## 3.3 Methodology

Therefore, all the variables are included in the regression models to compensate for all extraneous variables that may influence the research findings. Analysis and data computation was conducted using statistical software Stata. The study's primary determinant was the frequency of their use, followed by the quality of practical implementation. Finally, the panel data regression calculates using the following general formula, whereas the ESG variable will be modified with each derivative simultaneously.

$$ICC_{i.t} = \beta_0 + \beta_1(\boldsymbol{ESG})_{\boldsymbol{i.t}} + \beta_2\,(Firm\,Size)_{i.t} + \beta_3\,(Market - to - Book\,ratio)_{i.t} + \beta_4\,(Leverage)_{i.t} + \beta_5\,(Return\,on\,Asset)_{i.t} + \beta_6\,(Goodwill)_{i.t} + \beta_7\left(\frac{Footprint}{GDP}\right)_{i.t} + \beta_8\,(Country)_{i.t} + \mathcal{E}i.t$$

# Empirical Results

This segment specified the pooled regression results of the 50 oil and gas companies dataset, focusing on listed companies that completed the overall ESG valuation. The dataset consists of financial data, prices, and each country's economic estimation in Asia. In addition, this section will have several steps for calculation results. First, the calculation begins with the correlation matrix, then multicollinearity test results, descriptive summary statistics, and the hypothesis test with pooled Random effect regression results.

## 4.1 Correlation Matrix

**Table f. Pairwise Correlation Matrix**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **ICC** | **ESG** | **ENV** | **SOC** | **GOV** | **Size** | **MTB** | **Leverage** | **ROA** | **Goodwill** | **Carbon** | **Country** |
| **(1)** | 1.0000 | | | | | | | | | | | |
| **(2)** | 0.1489 | 1.0000 | | | | | | | | | | |
| **(3)** | 0.1549 | 0.9340 | 1.0000 | | | | | | | | | |
| **(4)** | 0.1671 | 0.9156 | 0.9052 | 1.0000 | | | | | | | | |
| **(5)** | 0.0894* | 0.7859 | 0.6919 | 0.6350 | 1.000 | | | | | | | |
| **(6)** | 0.1363 | 0.1585 | 0.1733 | 0.1647 | 0.139 | 1.0000 | | | | | | |
| **(7)** | 0.0069*** | 0.0744* | 0.1536 | 0.1002 | 0.243 | 0.1428 | 1.0000 | | | | | |
| **(8)** | 0.0677 | 0.0228** | 0.1035 | 0.0811 | 0.141 | 0.0216** | -0.0478** | 1.0000 | | | | |
| **(9)** | 0.0567 | 0.0146** | 0.0029*** | 0.0168** | 0.080* | 0.1738 | 0.1718 | -0.1380 | 1.000 | | | |
| **(10)** | 0.0216** | 0.0021*** | 0.0400** | 0.0086*** | 0.056 | 0.0637 | -0.1834 | 0.0363 | -0.051 | 1.0000 | | |
| **(11)** | 0.1673 | 0.3968 | 0.3672 | 0.4521 | 0.180 | 0.1073 | -0.0437** | -0.1393** | 0.048** | 0.0152** | 1.000 | |
| **(12)** | 0.1057 | 0.0953* | 0.0852* | 0.0733* | 0.256 | 0.1275 | -0.1700 | 0.0102 | 0.082* | -0.0441** | 0.063* | 1.000 |

***** p<0.01, ** p<0.05, * p<0.1***

As seen in the correlation matrix table above, there is a significant influence on ESG score and its derivatives to the companies' cost of capital. The goodwill valuation rate in corporations has also shown a prominent effect through the ICC. Nevertheless, the return on asset variable also displays a fair association with our essential ESG score derivatives.

## 4.2 Multicollinearity Test

Furthermore, considering several correlations in the correlation matrix table before, multicollinearity problems must be considered and checked. This problem can be assessed with the Stata variance inflation factor test. The result of the test is shown in the table below:

**Table g. Variance Inflation factor**

| | ICC | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | VIF | 1/VIF | VIF | 1/VIF | VIF | 1/VIF | VIF | 1/VIF |
| **ESG** | 1.220 | 0.816 | | | | | | |
| **ENV** | | | 1.220 | 0.819 | | | | |
| **SOC** | | | | | 1.290 | 0.773 | | |
| **GOV** | | | | | | | 1.200 | 0.833 |
| **Carbon** | 1.220 | 0.818 | 1.180 | 0.848 | 1.280 | 0.779 | 1.080 | 0.928 |
| **ROA** | 1.140 | 0.874 | 1.140 | 0.874 | 1.140 | 0.874 | 1.150 | 0.869 |
| **MTB** | 1.110 | 0.897 | 1.130 | 0.885 | 1.120 | 0.896 | 1.140 | 0.877 |
| **Size** | 1.110 | 0.901 | 1.120 | 0.897 | 1.110 | 0.899 | 1.100 | 0.908 |
| **Country** | 1.100 | 0.910 | 1.100 | 0.913 | 1.090 | 0.913 | 1.160 | 0.865 |
| **Leverage** | 1.060 | 0.946 | 1.060 | 0.943 | 1.060 | 0.947 | 1.090 | 0.919 |
| **Goodwill** | 1.040 | 0.960 | 1.050 | 0.954 | 1.040 | 0.959 | 1.040 | 0.964 |
| **Mean VIF** | 1.130 | | 1.120 | | 1.140 | | 1.120 | |

*Multicollinearity Test Result on Stata*

The value produced by VIF for each explanatory variable ranges from one to unlimited. The values can be interpreted in three absolute indications of multicollinearity problems within variables used in the regression. First, if the VIF score is given one, there is no multicollinearity within the variables. The second category includes a VIF range value of 1-5, which display a reasonable possibility of multicollinearity problems. When the values are above five, it is assumed that variables have multicollinearity problems, whereas coefficient estimates and p-values from the regression output are unreliable (Wooldridge, 2015). This research VIF scores result consistently in the first category, meaning the result analysis has no multicollinearity problems.

## 4.3 Descriptive Statistics

**Table h. Summary Statistics**

| Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| **ICC** | 3.636 | 2.994 | -11.061 | 17.606 |
| **ESG** | 41.068 | 28.745 | 0.000 | 87.647 |
| **ENV** | 40.762 | 31.779 | 0.000 | 94.291 |
| **SOC** | 40.429 | 32.230 | 0.000 | 93.778 |
| **Gov** | 38.697 | 30.170 | 0.000 | 92.275 |
| **Size** | 5.107 | 0.176 | 0.207 | 19.251 |
| **MTB** | 1.444 | 1.418 | 0.000 | 11.954 |
| **Leverage** | 9.663 | 21.133 | 0.000 | 29.473 |
| **ROA** | 5.108 | 10.078 | -68.971 | 91.103 |
| **Goodwill** | -45.009 | 32.320 | -10.000 | 24.158 |
| **Carbon** | -0.013 | 0.012 | -0.036 | 0.013 |

*Summary Statistic compute on Stata*

Overall, the data used on the calculation sample contain a fairly diverse size and various debt and equity ratios. However, there are several missing values, regression with the dataset of 10 years' financial reports remained considerably adequate. The calculation also includes significant firms` measurements, computed statistical robustness and meaningful results.

## 4.4 Hypothesis Testing

Table k. below shows the empirical results of the impact of ESG score and derivatives on the company's cost of capital. Model (1) includes the overall ESG score, while model (2), (3) and (4) have each of the environment, social, and governance disclosures.

**Table i. Impact of ESG score and derivatives on Implied Cost of Capital (ICC)**

| | Cost of Capital | | | |
|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** |
| **ESG** | 0.01961 | | | |
| | (0.01407) | | | |
| **ENV** | | 0.01791 | | |
| | | (0.01106) | | |
| **SOC** | | | 0.01853* | |
| | | | (0.01142) | |
| **GOV** | | | | 0.01340 |
| | | | | (0.01504) |
| **Size** | -4.10791*** | -4.04473*** | -4.00844*** | -4.28917*** |
| | (1.53107) | (1.48716) | (1.53298) | (1.55422) |
| **MTB** | 0.29219 | 0.32348 | 0.28445 | 0.31776 |
| | (0.22094) | (0.22435) | (0.21446) | (0.23615) |
| **Leverage** | -0.00123** | -0.00100** | -0.00112** | -0.00144** |
| | (0.00050) | (0.00048) | (0.00049) | (0.00063) |
| **ROA** | 0.04519 | 0.04339 | 0.04219 | 0.04712 |
| | (0.05306) | (0.05230) | (0.05216) | (0.05491) |
| **Goodwill** | -0.00014 | -0.00001 | -0.00004 | -0.00035 |
| | (0.00012) | (0.00011) | (0.00025) | (0.00001) |
| **Carbon** | 5.63953** | 6.44872*** | 5.91917** | 7.21826 |
| | (2.04178) | (2.74001) | (2.65442 | (2.20782) |
| **Country** | 0.35711* | 0.36337* | 0.36491* | 0.33447* |
| | (0.19600) | (0.19858) | (0.20025) | (0.18418 |
| **_cons** | 1.97702 | 1.98290 | 1.95122 | 2.53466** |
| | (1.31283) | (1.21705) | (1.19770) | (1.20551) |
| *R-Squared (within)* | 0.0265 | 0.0289 | 0.0289 | 0.0216 |
| | | | | ****** p<0.01, ** p<0.05, * p<0.1*** |

*Regression Result compute on Stata*

The regressions reveal that all ESG components positively affect the cost of capital. The test result can conclude that the oil and gas sector is, in a way, part of `sin stocks` due to its high dependency on fossil fuels and sustainable vulnerability. In overall models, *Size* has significant adverse impacts on to cost of capital. Considering the more asset the company has increased the chance of information asymmetry and risk diversification, hence avert by investors and lowering

the firm's valuation (Heinkel, 2001). Furthermore, the *Leverage* variable has a negative coefficient but significantly impact the cost of capital on all model with a 5% significancy level. These findings suggest that ESG disclosure, as well as a high level of leverage, are essential determinants in impacting the company's cost of capital. The country's carbon emissions also have a significant positive effect on three of the models. Although the carbon footprint significancy level is only 1%, it shows how each country's sustainable regulation adequately impacts the firms` capital valuation.

Moreover, the calculation also shows that the ESG *Social* score has the most significant impact compared to other derivatives. Furthermore, it indicates that within Asian oil and gas companies, human and community relations are essential for a firm's valuation; in contrast with more developed markets like the United States or Europe, Asian economies and businesses are characterised by ownership concentration. On that behalf, the research findings differ from previous studies conducted in the US market, such as those (El Ghoul, 2011) and (Dhaliwal, Li, Tsang, & Yang, 2011) who claimed ESG has adverse effects on the corporate cost of capital. The centralisation of family members in management and leadership roles can also explain the social score's significance. The Asian country's weak investor protection highlights the importance of public policy implications (Breuer, 2018). However, the significance level of the social score is only 10%.

To conclude, the table displays the positive effect of ESG ratings on companies' cost of capital. This finding is consistent with Chava's literature (Chava, 2014), whereas institutional investors avert investing in a firm with high contributions to waste and climate change. Another study from Breuer (Breuer, 2018) also suggests that a firm's ESG activities have a beneficial capacity to boost the firm's cost of capital.

# Conclusion

*(Implications and Limitation)*

The dataset utilised in this study comprises strongly balanced panel data of 50 companies from 2010-2021. Initially, 245 companies' annual data would be utilised for this research. Differences in computation arose due to the missing observations within the limited data available from Refinitive and FactSet. The result of this study contributes to the international research and arguments on the ESG rating disclosure to the firm value. In the interest of the findings, it demonstrates that within Asian oil and gas industries, the significant need for fossil-fuel energy and lack of sustainable development cause ESG rating disclosure will not increase firms' market value. The different operational regions from most prior studies as base literature also contribute to the result discrepancy.

The outcome of this research hopefully can assist managers in understanding the impact of ESG investment on firms' forecasted financing costs in sustainable-sensitive industries (`sin stock` industries), which has profound implications for future corporate strategic planning. The findings suggest that various ESG disclosures in different industries and regions have different impacts. On the whole, recent cost of capital studies is used to improve the variety of ways and better calculation methods. In addition, added country-based variables associated with ESG contributed to better financial decision-making in multinational corporations. Lastly, not many known studies empirically examine Asia's environmental growth performance.

The findings might be helpful for upcoming decisions on future practice, especially regarding Asian electricity scenarios. For example, geographically distributed renewable energy development can be encouraged by integrating the Asian energy market to accommodate cross-border trade and the free movement of sustainable energy sectors within regions. The movement might also include sustainable energy transmission expansion guidelines. Due to the limited amount of statistical data on the country's accomplishments, this can also provide a milestone to analyse Asia's progress in fulfilling critical development of future demands of the oil and natural gas industry as well as the United Nations' Sustainable Development Goals.

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