Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5, 144-159
2024
Publisher: Learning Gate
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

Can firm profitability, firm sustainability, and firm size influence director remuneration in public listed companies?

Erlane K Ghani[1], Kamaruzzaman Muhammad[2*], Wan Saidatul Shahnaz Mohsin[3], Arie Pratama[4]
[1,2]Faculty of Accountancy, Universiti Teknologi MARA Cawangan Selangor, Selangor; kamaruzzaman@uitm.edu.my (K.M)
[3]Tricor Axcelasia Sdn Bhd, Malaysia
[4]Faculty of Economics and Business, Universitas Padjadjaran, Bandung, Indonesia.

Abstract: A director of a company shall exercise reasonable care, skill, and diligence with the knowledge, skill, and experience that may reasonably be expected of a director and which the director in fact has. In view of this, there is a need to find a balance between remunerating directors for their challenging responsibilities and attracting and retaining them, while also justifying the pay package to shareholders, which remains difficult for many listed companies. Therefore, it is important to understand the factors that influence directors' remuneration in public listed companies. This study aims to address this issue by choosing three firm characteristics namely, firm profitability, firm sustainability, and firm size. This study relied on content analysis on public listed companies in Malaysia. This study utilised 291 observations over a period of 3 years, from 2019 to 2021. The statistical analysis was performed using panel data analysis. This study shows that firm sustainability positively and significantly influences director remuneration in public listed companies. On the other hand, this study shows that firm profitability and firm size negatively influence director remuneration, although the relationship is not significant. The findings of this study implicate that firm sustainability is an important factor in determining director remuneration in public listed companies. The findings of this study contribute to the literature on the factors that contribute to director remuneration in public listed companies and are able to justify why these directors are remunerated differently.

Keywords: *Director remuneration, Firm profitability, Firm size, Firm sustainability, Public listed companies.*

1. Introduction

For many listed companies, it remains difficult to find a balance between compensating a board member for demanding tasks and attracting talent while justifying the salary package to shareholders (Jacob, 2019). The difficulty for shareholders is whether directors should be paid high fees when the company is experiencing financial losses. The company and shareholders face the challenge of remunerating directors appropriately, sufficiently, and attractively so that they can properly manage the company's business and help revitalise the company when the company suffers financial losses (Jacob, 2019). Difficulties also arise as to whether director remuneration should be maintained if the company suffers financial losses or whether it should remain the same. The main belief in director remuneration stems from the principal-agent theory, according to which a well-designed remuneration package would inspire and incentivize directors to run the company well, which in turn would benefit shareholders through their returns (Jensen & Murphy, 1990; Murphy, 1990).

The Malaysian Code on Corporate Governance (MCCG) principles on director remuneration emphasise the need for an attractive remuneration package for experienced and qualified directors to attract and retain them for their diligent service to the company. The remuneration package should be linked to their own performance and that of the company. It is also added that remuneration should be

© 2024 by the authors; licensee Learning Gate
* Correspondence: kamaruzzaman@uitm.edu.my

fair in order to attract, retain, and motivate directors, while not forgetting the complexity of the nature of the company and its business. It would not be fair if remuneration did not reflect the complexity of the company, because the more complex the business, the greater the responsibility that directors must bear (MCCG, 2001). In the context of agency theory, the MCCG 2021 states that shareholders and companies should consider not only the background and qualifications of directors but also their ability to be independent of management. This is because if directors are too familiar with how management operates, they may not be objective enough in their decision-making and instead tend to run the company based on material benefits and attractive compensation packages (Al-Sayani & Al-Matari, 2023). Furthermore, companies need to compensate their directors in a way that motivates and inspires them to realise the company's goals, not just pay them to get through the month or year without being enthusiastic about the company's strategic objectives (Talha, Sallehuddin, & Masuod, 2009). In order to reward directors efficiently and effectively, the company should establish a remuneration committee that is at least predominantly made up of non-executive directors. The non-executive directors play an independent role in the remuneration of directors by reviewing the directors' ability to lead the company and recommending to the board the right remuneration package for each director.

The aim of this study is to analyse the impact of firm characteristics on director remuneration in public listed companies. Specifically, this study examines whether firm profitability, firm sustainability, and firm size can influence director remuneration in public listed companies. The results of this study provide understanding to relevant parties such as compensation policymakers, shareholders, stakeholders, and company management on which firm characteristics can influence director compensation in public listed companies. The next section, Section 2, provides a comprehensive literature review. Section 3 provides the research framework for this study, and Section 4 explains the research design used in this study. Section 5 presents the results and discussion, while the last section, Section 6, concludes this study.

2. Literature Review

Director remuneration is the payment for the services or employment of directors on the board of a company or organisation. Director remuneration may be in the form of a fee, salary, or the use of the company's property as agreed between them and the company (Razak, 2014). Reports on corporate governance, such as the Cadbury Committee Report (1992) and the Greenbury Committee Report (1995), published and produced by the Committee on the Financial Aspects of Corporate Governance and the United Kingdom Confederation of British Industry, respectively, state that companies should put together a remuneration package that can attract and retain capable and talented directors. However, the reports did not examine what exactly the remuneration should be, as it is left to companies to decide how to justify it so that it is appropriate for directors and accountable to their shareholders.

According to KPMG's report on the director remuneration survey (2006), the remuneration paid by Malaysian listed companies to their directors consists of three components: fixed remuneration based on position, variable remuneration, and benefits in kind (KPMG, 2006). The fixed remuneration component comprises the annual salary and other fixed fees, allowances, and additional fees for directors. The variable remuneration component consists of salary or fee increases, cash bonuses, and the Employee's Shares Options Scheme. However, this variable component only applies to executive directors and not to non-executive directors. The same applies to benefits in kind, which mainly apply to executive directors. Telephone costs, employee discounts, pension schemes, loans, insurance cover, holidays, provision of accommodation, company cars, club membership, and annual leave are examples of common benefits in kind. The proportion of benefits in kind paid to executive directors can be between 10 percent and 20 percent of their base salary.

The MCCG has asked companies to disclose their detailed remuneration plans for directors and senior executives. Similar to the Bursa Securities Listing Requirements, listed issuers are required to disclose the remuneration of their directors in great detail on a name-by-name basis. Under the Companies Act 2016, which requires shareholder approval of director remuneration and bonuses at a

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

general meeting, the level of remuneration can no longer be hidden from the public. The disclosure of director remuneration at Bursa Malaysia has provided this study with the information for its analysis. The level of director remuneration package should be sufficient to attract and retain competent directors (Razali, Yee, Hwang, Tak, & Kadri, 2018).

A group of studies has analysed the relationship between firm profitability and director remuneration. Firm profitability is a measure of an organisation's profit relative to its expenses. Organisations that are more efficient achieve a higher profit in relation to their expenditure than a less efficient organisation that has to spend more to achieve the same profit. Studies that have investigated the relationship between organisational performance and board remuneration. Lee and Isa (2014), for example, found that director compensation is positively associated with bank performance. Their study used panel data from nine domestic and twelve foreign banks for the nine-year period from 2003 to 2011, suggesting that adequate director remuneration leads directors to monitor the bank's management more effectively so that it acts in the best interest of the bank's owners, i.e., shareholders. Their study found that the effective monitoring of bank management by directors depends on the firm size and the number of independent directors on the board. Both Main, Bruce, and Buck (1996) and Benito and Conyon (1998) discovered a correlation between director pay and firm performance as measured by profitability. O'Neil and Iob (1999) analysed the factors determining director remuneration in Australia and found a correlation between director remuneration and firm performance. However, in the Malaysian market, Dogan and Smyth (2002) found no significant correlation between director remuneration and firm profitability. Instead, excessive remuneration packages for directors pose a significant risk of minority shareholder wealth appropriation (Hassan, Christopher, & Evans, 2003).

In Firth, Tam, and Tang (1999), they discovered that chief executive officer (CEO) and managing director pay are strongly and positively correlated with performance. According to a study by Hassan et al. (2003), a higher CEO salary has a negative impact on organisational performance. They measured firm performance using the return on equity, which decreased between 1997 and 1998, even though executive salaries increased steadily during that time. Ozkan (2007) has also demonstrated a negative relationship. As the remuneration of directors, particularly executive directors, is based on their personal and professional performance, linking their remuneration to company performance should be considered fair to shareholders. Several studies have been conducted in the UK to determine whether there is a link between director remuneration and company performance (Gregg, Machin & Szymanski, 1993; Conyon & Leech, 1994; Conyon & Gregg, 1994; Conyon, Gregg & Machin, 1995). Their data shows that company growth plays an important role in determining the compensation of top directors. According to Main et al. (1996), there is a significant and positive correlation between company performance and the total remuneration of the board of directors.

Miyienda, Oirere, and Miyogo (2013) claim that there is a positive correlation between director remuneration and company performance. According to a study conducted by Haron and Akhtaruddin (2013) on 120 Malaysian companies at Bursa, there is a favourable correlation between company performance and director remuneration. This study provides convincing evidence of the positive relationship between director remuneration and company performance. Although a large sample of 120 companies from Bursa Malaysia was used, the data was only collected for one year, 2005; therefore, the results may not be reliable enough to draw a firm conclusion. Other studies, such as Talha et al. (2009), also found a favourable correlation between directors' total remuneration and company performance. According to Jensen and Murphy (1990), a good compensation package linked to performance will encourage directors to make extra efforts to increase their compensation and will attract the best qualified directors with the most sought-after specialisation.

According to Main et al. (1996), Conyon and Peck (1998), Firth et al. (1999), Ozkan (2007), and Hassan et al. (2003), there is a relationship between director compensation and performance. However, Abdullah (2006) also found no correlation between director remuneration and corporate profitability as measured by the return on assets of distressed companies. His study used publicly available data from a sample of 172 companies, including 86 distressed and non-distressed companies, in the financial year

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

2001. Due to the inconsistent findings, this study would like to re-examine the link between firm profitability and director remuneration. Therefore, the following hypothesis is developed:

H_1: There is a significant relationship between firm profitability and director remuneration in public listed companies.

According to Phillippa, Harris, and Gosling (2021), performance in the area of sustainability is now regularly recognised alongside traditional key performance indicators. Hartikainen, Marko, and Antti (2021) define sustainability remuneration as remuneration based on long-term economic, social, and environmental objectives. Their study focused on the executive compensation and sustainability reporting of 43 listed companies in Finland, based on readily available reports from 2016. The results show that the majority of Finnish corporate reporting gives only a shaky picture of the essentially non-existent relationship between firm sustainability and remuneration. The Dow Jones Sustainability Index lists a significant number of Finnish companies, a sign of their commitment to sustainability goals. However, this commitment does not seem to translate into rewards for sustainability. For example, although Nokia was ranked as the 18th most sustainable company in the world by Corporate Knights in 2017, the company's remuneration strategy is said to be focused almost exclusively on maximising shareholder returns. It can be argued that this is due to the requirements of Finnish law. In addition, boards and compensation committees are encouraged to familiarise themselves with the company's environmental, social, and governance (ESG) objectives and understand how to link them to executive compensation. They must explain the rationale for such linkage during the process. According to Spierings (2022), based on a survey of roundtable participants, the main reasons why companies incorporate ESG measures into executive compensation are to signal that ESG is a priority and to respond to investors while meeting the ESG commitments the company has made.

Studies have shown that remuneration policies and procedures should be designed to support the organisation's strategies and long-term vision. They should be designed to incentivize directors to work towards the company's long-term growth objectives (Journeault, Levant, & Picard, 2021). Considering that the current business environment is becoming increasingly complex due to rising stakeholder expectations, globalisation, technological advancements, and innovation in business models, remuneration policies and procedures should be fair and transparent. This requires that remuneration packages be in line with the long-term business sustainability of the company. Mahoney and Thorn (2006) note that executive compensation and firm sustainability are still rarely linked, even though the majority of large companies report on their sustainability. One of the causes of this problem is that it is challenging to develop a transparent system for sustainability compensation, as sustainability goals are difficult to measure. According to Keatinge and Eaton (2014), the use of sustainability pay is expected to increase and incentivize companies and society as a whole to become more sustainable. Developments in the area of sustainability compensation and reporting are slow, and there is a lack of comprehensive academic research. While executive compensation is a focus of research in corporate governance and responsibility, there is little information on the links between sustainability, transparency, and compensation. Therefore, the following hypothesis is proposed to further investigate the impact of sustainability on executive compensation.

H_2: There is a positive relationship between firm sustainability and director remuneration in public listed companies.

Studies have also analysed the relationship between firm size and director remuneration. Firm size is a quantifiable measure of the size and operating capacity of a company. There are various ways to measure firm size, such as the number of employees, total revenue, and market share. Amin, Ismaail, Kamarudin, and Sarman (2014), in their study of factors influencing director remuneration in Malaysia, found that firm size has a significant positive relationship with director remuneration. According to their study, directors are likely to receive higher remuneration the larger and more profitable their company is. The study is based on a sample of 845 companies and covers the years 2009 to 2011. The study includes companies from various industries such as industrial products, consumer goods and services, technology, property, construction, and others, with the sample representing 88 percent of the total

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

population, leaving little room for misrepresentation and external validity issues. Usman (2010) found in his study that companies with a larger firm size pay higher compensation. His study, which used data from 2004 to 2008, found that while larger companies pay more, their performance is also indirectly positively influenced by their larger size. It was also found that an increase in board size does not always lead to an increase in remuneration.

According to Zhou (2000), it is logical and justified that top managers receive a high salary because a larger organisation carries greater responsibility. This study was conducted in Canada and covered 755 Canadian companies from 1991 to 1995. In this study, compensation and firm size are also indirectly related to company performance. Furthermore, Rosen (1992) added that the costs and effects of business decisions, whether right or wrong, are felt much more frequently and strongly in larger companies than in smaller companies. Abdullah (2006) notes that the key element that influences executive compensation in Malaysia is firm size. Ibrahim, Ibrahim, Ismal, Adibah, and Kamarudin (2015) found further Malaysian evidence that the board members of larger companies are paid better than the board members of smaller companies. Based on their study of 537 companies listed on Bursa Malaysia between 2007 and 2009, Jaafar and James (2013) found that firm size has a favourable influence on board remuneration, which is consistent with previous Malaysian findings. Accordingly, greater responsibility should be rewarded with a higher salary, depending on firm size. In fact, the board of a large company has more duties, expertise, knowledge, and time to oversee the business, as their efforts should be rewarded with higher compensation.

Amin et al. (2014) note that firm size has the greatest influence on executive compensation. Considering the complexity of decision-making, high responsibility, and high expectations, they recommend that directors leading larger organisations also expect high compensation packages. While Girma, Thompson, and Wright (2007) and Eichholtz, Kok, and Otten (2008) found in their studies that there was a positive relationship between executive pay and organisational performance, this was not as strong as the relationship between pay and firm size. The findings of Eichholtz et al. (2008) show that firm size is more important for executive pay in the UK property sector than company performance. This is consistent with the findings of Tee and Hooy (2009), who identified firm size as the most important determinant of executive remuneration based on their sample of Malaysian government-linked companies from 2001 to 2006. Therefore, the following hypotheses are put forward in this study to determine the relationship between these variables:

H_3: There is a positive relationship between firm size and director remuneration in public listed companies.

3. Study Framework

Agency theory is used as the basis for this study. According to Hillman and Dalziel (2003), agency theory is one of the various approaches taken by researchers looking for evidence of links between supervisory boards and corporate performance. According to agency theory (Jensen & Meckling, 1976), it is about the relationship between the headmaster of a company, also known as the owner, and its manager, also known as the agent. According to the agency theory of Smith and Watts (1992), the performance of a company can be improved by increasing the remuneration of the directors. To make sure that the interests of the directors and the shareholders are in line, the principal uses a control mechanism known as agency costs to monitor the performance of its agents, the directors. The costs spent on monitoring the work of management are used to improve the corporate governance structure of the company, e.g., by appointing additional independent non-executive directors and consulting experts or engaging competent external or internal auditors to help improve the company's internal control.

Agency theory is also about the managers or agents not misappropriating the company's assets for their own interests or those of third parties but using the company's assets only for the interests of the company itself. Furthermore, the representative should not derive greater private benefit for himself at the expense of the company, which could reduce the value of the company and also impair the shareholders' return. The proxy must act in the interests of the company and the shareholders and maximise the shareholders' return. In addition, the shareholders must provide adequate remuneration to

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

the representatives (managers and directors) so that they can manage the company properly within a sound corporate structure. Directors must keep shareholders properly informed, as shareholders are not involved in the running of the business. As a result, good compensation will be an incentive for directors to disclose more information as part of their governance responsibilities.

Nagar, Nanda, and Wysocki (2003) suggest that compensation should be explicitly correlated with disclosure activity. In addition to disclosure as part of strengthening corporate governance, achieving corporate objectives is one of the activities that managers must undertake to align their interests with those of shareholders. In order to get managers to align their interests with the achievement of corporate goals, which in turn increase shareholder value, managers or directors must be compensated fairly and attractively enough to motivate them to work harder for the company and shareholders. Thus, agency theory is related to this study, which is about examining the characteristics of the company in terms of profitability, sustainability, and size in terms of director remuneration in public listed companies.

Figure 1 presents the research framework of this study that explains the relationship between the independent variables and the dependent variable. The independent variables are a firm's characteristics, which are firm profitability, firm sustainability, and firm size, whereas the dependent variable is the director remuneration. The framework shows that the firm profitability, firm sustainability, and firm size can influence director remuneration in public listed companies in Malaysia.

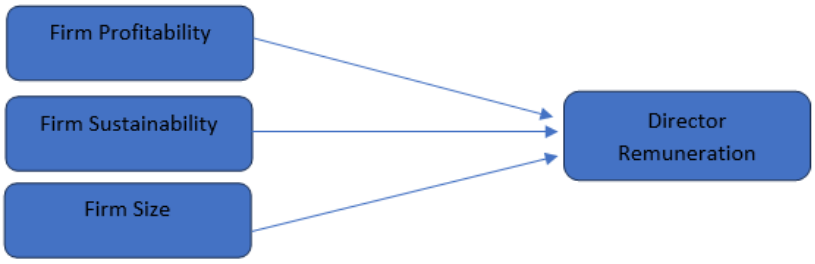

Figure 1.
Study framework.

4. Research Design

4.1. Sample Selection

The entire population of the 100 companies in the FTSE Top 100 Index forms the sample frame for this study. The samples were selected from the 100 public listed companies in the FTSE Top 100 Index as they play a key role in the respective sector markets and operate in major industries in Malaysia. The rationale behind this was that large companies tend to disclose and be more transparent about director remuneration. Although the MCCG requires disclosure of director remuneration by name, there are still a few public listed companies that do not comply with this requirement and choose to disclose director remuneration only on the basis of amounts and not by name. By selecting large and leading public limited companies, the survey can reduce the possibility of non-disclosure of board remuneration.

The sample was reduced from one hundred public companies to ninety-seven public companies, as three public companies each have different justifications that result in incomplete data, making the panel data unbalanced. A data set is unbalanced if at least one panel member was not observed in a single period. It is a data set in which the variables have been observed a different number of times, which means an unequal number of observations (Searle, 2006). The reasons for this are as follows: one public listed company was delisted from the official list of Bursa Malaysia Securities Berhad with effect from December 16, 2021; one public listed company was not yet listed on Bursa Malaysia in 2019 but was listed in 2020; and one public listed company was delisted from Bursa Malaysia due to a change of financial year, which was previously from December 1, 2019 to December 31, 2019. This selection resulted in 291 observations over three years, from 2019 to 2021. A summary of the sample selection can

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

be found in Table 1.

Table 1.
Sample selection.

Description of the sample	Total sample units
Initial numbers of public listed companies listed under FTSE Bursa Malaysia top 100 index	100
(-) Exclude: public listed companies with incomplete data	(3)
Total number of public listed companies included in this study	97
Total observations of panel data (97 public listed companies x 3 years)	291

4.2. Research Instrument and Data Collection

This study utilised content analysis. The directors' salaries for financial years 2019, 2020, and 2021 have been extracted from the annual reports of each public listed company published on the Bursa Malaysia website. It is one of the requirements of the MCCG under Section 8.1 that specific information on the remuneration of individual directors must be disclosed in detail and by name. The breakdown of individual director remuneration includes fees, salaries, bonuses, benefits in kind, and other emoluments. The disclosure enables stakeholders to assess and determine whether the remuneration of directors is appropriate in terms of their individual performance and that of the company. The data on firm characteristics were taken from the Thomson Reuters Eikon database and analysed accordingly. Thomson Reuters Eikon is one of the leading providers of financial and non-financial data. It is a powerful and user-friendly open-platform solution for ingesting current and historical data (Thomson Reuters, 2018).

Firm profitability is extracted from the return on assets, which is given for each company in Thomson Reuters Eikon under the financial ratios (key ratios) category. Return on assets is a measure of a company's profitability in relation to its total assets. It is calculated by dividing a company's operating income by the value of all its assets. Firm sustainability is also extracted from Eikon in the ESG category, where the data comes from the combined ESG score. The Thomson Reuters ESG scores were created to quantify a company's relative ESG performance in ten areas (emissions, environmental product innovation, human rights, shareholders, and others) based on information that the company has publicly disclosed. The categories of each pillar are as follows: Resource use, emissions, and innovation fall under the environmental pillar; employees, human rights, community, and product stewardship fall under the social pillar; and management, shareholders, and corporate social responsibility strategy fall under the governance pillar. More than 400 data points were used to generate 70 key performance indicators, which were then categorised into ten categories within the three pillars using a standard, equally weighted framework.

Firm size is represented by market capitalization, which is taken from Eikon under the overview category, where it shows the total information of listed companies. The market capitalization of a company is calculated by dividing the price of each share by the total number of shares outstanding. Market capitalization can give an indication of firm size. In addition to annual and five-year averages for growth, profitability, liquidity, leverage, EV ratios, and asset utilisation, Thomson Reuters offers a wide range of pre-calculated financial parameters. Thomson Reuters offers the flexibility to use both standardised and as-reported forms. Thomson Reuters is also able to find a range of companies based on specific criteria such as market capitalization, industry, location, and others.

4.3. Variable Measurements

Director remuneration is the dependent variable in this study. Director remuneration in this study is based on the total remuneration of executive and non-executive directors, comprising salary, bonus, fees, and perquisites, excluding share options. As the reporting formats used by the companies in the sample and the specifics of these reports vary from company to company, it was not possible to collect data on

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

share options or market-based incentives for this study. In order to avoid missing and incorrect data, market-based incentives are not included in the study.

The independent variables of this study are firm characteristics in terms of firm profitability, firm sustainability, and firm size. Firm profitability, also referred to as firm performance, measures the efficiency and effectiveness of the firm's operations, management, and the ability of the firm to generate profit from its business. Hagel III, Brown, and Davison (2010) assert that return on assets clearly takes into account the assets used to support business operations. Rather than focusing only on the company's high return on sales, it assesses whether the company can generate a sufficient return on these assets. Return on assets measures the effectiveness of a company's management in generating profits from all assets as recognised on the balance sheet. The return on equity is expressed as a percentage. The higher the value, the more efficiently the company's management is managing the company's assets to generate profits. Return on Assets to be calculated as per formula below:

$$\text{Return on Assets} = \frac{\textit{Net income}}{\textit{Average Total Assets}} \times 100\%$$

The second independent variable is firm sustainability. This study uses the three main pillars of ESG: environmental, social, and governance disclosures. These pillars are measured using the score index. To ensure up-to-date, unbiased, and thorough reporting, Thomson Reuters employs more than 150 analysts trained in ESG data collection. There are more than 400 ESG metrics in the Thomson Reuters ESG universe that Thomson Reuters analysts manually process for each company.

Table 2.
Indicators assigned to respective categories.

Pillars	Categories	Indicators	Percent
Environment	Resources use	20	11
	Emissions	22	12
	Innovation	19	11
Social	Workforce	29	16
	Human rights	8	4.5
	Community	14	8
	Product responsibilities	12	7
Governance	Management	34	19
	Shareholders	12	7
	CSR strategies	8	4.5
Total		178	100

Each metric is carefully processed to standardise the data and ensure it is comparable across the spectrum of companies. The data collected is based on the materiality, data availability, and importance of the area (Thomson Reuters, 2018). The three pillar scores and the final ESG score are derived from a combination of the 10 categories, weighted proportionally to the number of measures within each category. The ESG score reflects the company's ESG performance, engagement, and effectiveness based on publicly available information and is expressed as a percentage.

The third independent variable is firm size. Firm size is measured by its market capitalization. The market capitalization of a listed company is calculated by dividing the total number of shares outstanding by the price at which they are traded. In other words, market capitalization calculates the total value of a company by dividing the share price by the number of shares outstanding. This indicator is crucial because it provides information about firm size and how it has changed over time. The formula for market capitalization is as follows:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

Market capitalization = number of shares outstanding x price

5. Results and Discussion

Table 3 contains the descriptive statistics of the mean, median, maximum, minimum, and standard deviation of the variables for the 291 observations for the 97 cross-sectional data and the 3-year series data from 2019 to 2021. There are values for the Jarque-Bera tests, which can also be used to determine whether the data is normally distributed.

Table 3.
Descriptive statistics

	Director remuneration (RM'000,000/ mil) y	**Firm profitability x1**	**Firm sustainability x2**	**Firm size (RM'000,000/ mil) x3**
Mean	20.842	0.0943	38.48	12,900.00
Median	7.186	0.0570	46.01	6,130.00
Maximum	2,370	1.0850	90.52	98,600.00
Minimum	0.452	0.241	-	810.00
Std. dev.	140.000	00.1386	29.19	17,700.00
Jarque-bera	916,441.40	4,403.035	6.55	1,019.26
Probability	-	-	0.00	-
Sum	6,070.00	27.449	11,197.57	3,740,000.00
Sum sq. Dev.	5,660,000	5.5272	247,013.10	90,900,000 00.00

Based on the fixed effects model (FEM) regression model test performed, the data is normal as the probability of the Jarque-Bera values is higher than the cut-off significance value (i.e., $p > 0.05$).

To determine the best regression model, several assessments can be performed, including the Chow test, the Hausman test, and the Lagrange multiplier test. In this study, the Chow test was performed first to determine the better model between the common effects model (CEM) and the FEM. The results of the Chow test can be found in Table 4. The significance value of the Chow test is 0.0047, which is below the significance threshold of 0.05. This result indicates that the FEM model should be used in this study.

Table 4.
Chow test.

Effects test	**Statistics**	**d.f.**	**Sig.**
Cross-section F	1.183	-96,191	0.1641
Cross-section Chi-square	135.819	6	0.0047

After the Chow test was determined, the Hausman test was performed to determine whether the FEM or the random effect model (REM) was the better model. The result of the Hausman test is shown in Table 5. The significance value of the Hausman test is 0.0179, which is less than 0.05. This indicates that the FEM should also be implicated. As both the Chow test and the Hausman test are in favour of the FEM, the FEM model was used as the best regression model for the panel data in this study.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

Table 5.
Hausman test.

Test summary	Chi-sq. statistic	Chi-Sq. d.f.	Sig.
Cross-section random	10.081874	3	0.0179

The Jarque-Bera test was used to assess the degree of normal distribution of the data and to check the reliability of the results. As shown in Figure 2, the shape of the residual distribution is leptokurtic, and the residuals have a normal distribution if the significance of the Jarque-Bera probability exceeds the significance level of 5 percent.

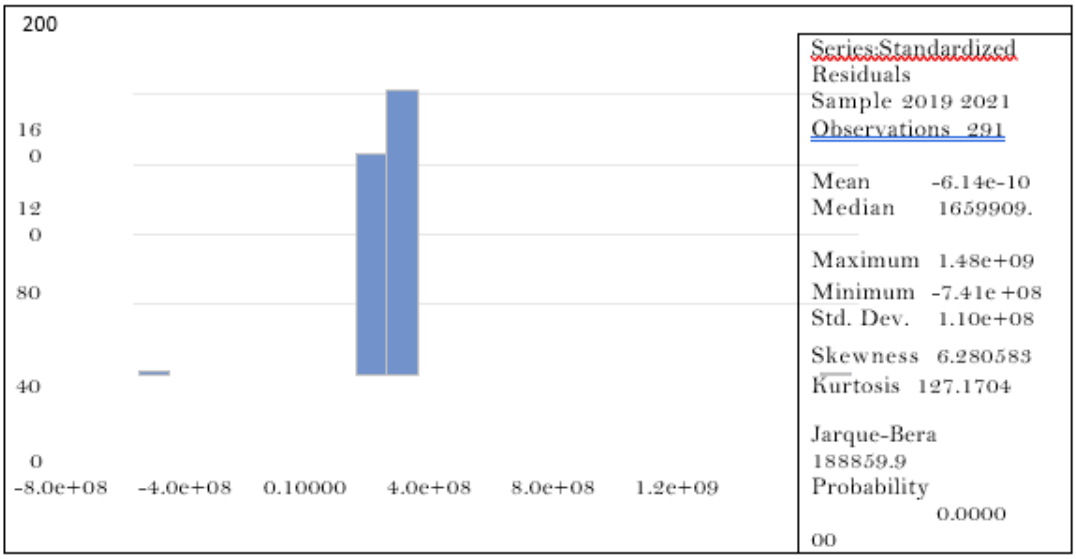

Figure 2.
Data normality for the fixed effect model.

Table 6 shows the results of multicollinearity based on the correlation matrix for the variables used in this study. The threshold value for the correlation value is 0.85, and a multicollinearity problem can be recognised according to Fauzan and Matoati (2021) and Widarjono (2016) if the correlation value is higher than 0.85. As shown in Table 6, all correlation values between the individual variables are below 0.85. Therefore, there were no problems with multicollinearity in the panel data of this study.

Table 6.
Multicollinearity of variables.

	Firm profitability	Firm sustainability	Firm size
Firm profitability	1.000	0.024	-0.032
Firm sustainability	0.024	1.000	0.418
Firm size	-0.031	0.418	1.000

The possibility of heteroscedasticity was tested in this study using the Glejser test. This test examines the hypothesis that the error variance is constant. When heteroscedasticity occurs in a regression model, it becomes difficult to rely on the results. The test results are shown in Table 7. It was found that heteroscedasticity is not a problem in the model as the probability for all variables is above the significance value of 5 percent. With a robust regression model, the results documented in this study are therefore reliable.

© 2024 by the authors; licensee Learning Gate

Table 7.
Heteroskedasticity.

Variable	Coefficient	Std. error	t-Statistic	Prob.
Director remuneration	39,674,553.00	11,134,172.00	3.56	0.0004
Firm profitability	41,998,420.00	45,081,502.00	0.93	0.3523
Firm sustainability	23,967.63	234,640.00	0.10	0.9187
Firm size	0.00	0.00	1.28	0.2013

The Durbin-Watson (DW) test was used in this study to look for signs of serial correlation. A rule of thumb from previous studies, such as Zamil and Hassan (2019), states that a statistical DW value between 1.5 and 2.5 indicates that there is no collinearity with the residuals, that they are relatively normal, and that there is no autocorrelation. From the result shown in Table 8, it can be concluded that there was no autocorrelation problem in the study as the Durbin-Watson statistic of 2.24 is within the acceptable range.

Table 8.
Autocorrelation - durbin-watson statistics.

Root MSE	110,000,000.00	R-squared	0.379624
Mean dependent var	20,842,340.00	Adjusted R-squared	0.058068
S.D. dependent var	140,000,000.00	S.E. of regression	136000000
Akaike info criterion	40.55	Sum squared resid	3,510,000,000,000
Schwarz criterion	41.82	Log likelihood	-5800.665
Hannan-Quinncriter.	41.06	F-statistic	1.180585
Durbin-Watson stat	2.24	Prob(F-statistic)	0.165382

The correlation results are shown in Table 9. The results show that the correlation between the company characteristics, i.e., profitability, and executive board remuneration is low, negative, and not significant (r = -0.06, p-value = 0.33). The correlation between sustainability and director remuneration is low, positive, and non-significant (r = 0.079, p-value = 0.1795), and finally, the correlation between firm size and director remuneration is low, positive, and non-significant (r = 0.007763, p-value = 0.8951). Overall, the results show that while all variables have a low correlation with director remuneration, only firm sustainability and firm size have a positive correlation, while firm profitability is negative.

Table 9.
Pearson correlation.

Correlationprobability	Director remuneration	Firm profitability	Firm sustainability	Firm size
Directors' remuneration	1.000			
Firm profitability	-0.057	1.000		
Firm sustainability	0.079	0.024	1.000	
Firm size	0.008	-0.032	0.418	0.001

A panel data regression was used to evaluate the hypotheses in this study. Table 11 summarises the results of the relationships between the dependent variable and each independent variable. The FEM was selected as the best regression model for this study. This model assumes that individual differences can be accounted for by using different intercepts (Zulfikar, 2018) and is used when researchers want to analyse the effects of variables over time. Since each variable is unique, its error term and constant are not associated with others.

The regression results are in Table 10. The R2 in the goodness-of-fit test determines how well the

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

regression line represents the data. Table 10 demonstrates that the independent variables can account for a percentage of the variation in directors' pay (R2 = 0.379624) and that other variables account for the remaining 62.20 percent of the variation in directors' pay. Taking into account the fixed effect model's degree of freedom, the results for the adjusted R2 show that the variables used in this study can explain 5.81 percent of the change in directors' pay from 2019 to 2021.

Based on the analyses of this study, there is an insignificant negative relationship between company profitability and director remuneration, as shown in Table 10 (B = - 61,240,988.00, t = -0.59, p > 0.05). This result is consistent with the earlier literature by Abdullah (2006) and Ozhan (2007), which showed a negative relationship between director remuneration and firm performance. According to a study by Abdullah (2006), using distressed and non-distressed firms for the years 2001 and 2022, return on assets is not correlated with director remuneration. Hassan et al. came to a similar conclusion in their 2003 study, which demonstrated that the company's performance as measured by return on equity decreased during the same time period in which the level of director compensation steadily increased from 1997 to 1998. According to a study by Tee and Hooy (2009) on a sample of state-controlled businesses from 2001 to 2006, there is a negative correlation between director compensation and lagged return on equity measures of company performance. Therefore, H1 is rejected due to the non-significant negative relationship.

Table 10.
Panel data regression.

Variable	Coefficient	Std. error	t-Statistic	Prob.
C	- 40,380,027.00	35,406,862.00	- 1.14	0.2555
Firm Profitability	-61,240,988.00	103,000,000.00	- 0.59	0.5543
Firm Sustainability	1,993,234.00	567,297.30	3.51	0.0006
Firm size	-0.000754	0.002286	- 0.33	0.7418

Root MSE	110,000,000.00	R-squared	0.379624
Mean dependent var	20,842,340.00	Adjusted R-squared	0.058068
S.D. dependent var	140,000,000.00	S.E. of regression	136000000
Akaike info criterion	40.55	Sum squared resid (RM'mil)	3,510,000,000,000
Schwarz criterion	41.82	Log likelihood	-5800.665
Hannan-Quinncriter.	41.06	F-statistic	1.180585
Durbin-Watson stat	2.24	Prob(F-statistic)	0.165382

Secondly, there is a significant positive correlation between the sustainability of the company and executive board remuneration (B = 1,993,234.00, t = 3.51, p < 0.05). Keatinge and Eaton (2014), who predict that the use of sustainability remuneration will rise and serve as a catalyst for the promotion of sustainability in businesses and society, confirm this. According to Chan, Watson, and Woodlift (2014), the efforts of business leaders to report on corporate social responsibility would be rewarded with better compensation to motivate them to perform well. According to Heron (2016), there is a favourable correlation between director remuneration and corporate social responsibility. Therefore, H2 is accepted due to the significant positive relationship.

Third, there is an insignificant negative relationship between firm size and director remuneration (B = -0.000754, t = 0.002286, p > 0.05). This result is consistent with Usman (2010), who found in his study that the larger the company, the higher the director remuneration. Such a finding is in contrast to Abdullah (2006), who found in his study that firm size in Malaysia is positively associated with director remuneration. Therefore, H3 is rejected due to the insignificant negative relationship. A summary of the results of the regression analysis is presented in Table 11.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

Table 11.
Summary findings from panel data regression.

Hypotheses	Findings
H1: There is a significant relationship between firm profitability and director remuneration in public listed companies	Rejected
H2: There is positive relationship between firm sustainability and director remuneration in public listed companies	Accepted
H3: There is positive relationship between firm size and director remuneration in public listed companies	Rejected

5. Conclusion

This study was conducted to analyse the impact of company characteristics, i.e., firm profitability, firm sustainability, and firm size, on the director remuneration of public listed companies. This study covers a period of 3 years, from 2019 to 2021, and uses data regression, specifically the FEM. Firstly, this study concluded that the relationship between company profitability and director remuneration is insignificantly negative. This finding is consistent with Abdullah (2006), Ozhan (2007), Hassan et al. (2003), and Tee and Hooy (2009). Abdullah (2006) notes that the negative relationship could be due to the fact that the samples in this period from 2019 to 2021, when the COVID-19 pandemic occurred, resulted in the companies being in distress. The reason why his result was negative was due to the fact that the samples were taken from distressed companies that were recovering from the crisis. In addition, the reason for the negative result could also be that the profitability of the company in the form of ROA is not an important and decisive indicator for director remuneration. Nurani and Sakan's 2003 study, which shows that Malaysian companies still have a long way to go before they can link director remuneration to the company's performance, supports this conclusion. Furthermore, it seems to be the wrong decision by the company to compensate directors less when the return on equity is lower, even though the directors could work extra hard to turn the company around and grow. Remuneration based on return on assets rather than the efforts made by the directors in managing the company seems unfair and lacks understanding of a director's responsibilities.

Secondly, this study concluded that firm sustainability has a significant positive relationship with director remuneration in public listed companies. This finding is consistent with previous studies, such as the study by Keatinge and Eaton (2014), in which more sustainable remuneration is expected, while the study by Heron (2016) found a positive relationship between director remuneration and corporate social responsibility. Carina et al. (2014) pointed out that directors' efforts in corporate social responsibility disclosure are rewarded with better remuneration as a form of encouragement for objective performance.

Third, this study concluded that firm characteristics related to firm size have an insignificant negative relationship with director compensation. This result is in contrast to an earlier literature review where Abdullah (2006) found in his study that firm size is positively related to director remuneration in Malaysia. This unexpected result could be due to the fact that the panel data covers the period from 2019 to 2021, where companies are in difficulty due to the COVID-19 pandemic and are slowly recovering in 2021. According to the findings, the pandemic has an impact on even the executive salaries of the companies in the FTSE Bursa Malaysia Top 100 Index. For this reason, firm size does not establish a positive relationship.

This study is subject to several limitations. Firstly, the study used samples of executive salaries from the FTSE Bursa Malaysia Top 100 Index. The results might be different if the samples included companies other than the top 100, e.g., small and medium-sized companies that are also listed on the stock exchange. The finding of this study that director remuneration and firm size are insignificantly negatively related could change if the study includes companies with a different market capitalization. Secondly, the study covers three years, from 2019 to 2021. The global COVID-19 pandemic starts at the end of 2019, worsens in 2020, and recovers towards the end of 2021. If the study were extended to the

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate

period before the pandemic, i.e., another 2 years, from 2017 to 2021, and thus covered 5 annual series, the results could be different. Thirdly, the study refers to public listed companies in Malaysia. Therefore, the results are limited only to the characteristics of Malaysian companies, i.e., firm profitability, firm sustainability, and firm size. Other countries may have better and more comprehensive sustainability efforts and reports than a developing country like Malaysia. Therefore, one of the variables in the study might yield different results if the study includes companies from other countries.

In sum, the findings of this study enhance the existing body of knowledge on the determinants of director remuneration in public listed companies and provide a rationale for the variations in remuneration among the directors.

Copyright:
© 2024 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

References

[1] Abdullah, S. N. (2006). Directors' remuneration, firm's performance and corporate governance in Malaysia among distressed companies. *Corporate Governance*, 6(2), 162-175.
[2] Al-Sayani, Y.M. and Al-Matari, E.M. (2023), Corporate governance characteristics and impression management in financial statements. A further analysis. Malaysian evidence, *Cogent Social Sciences*, 9(1), 2191431.
[3] Amin, J.M., Ismail, W. A. W., Kamarudin, K. A. and Sarman, S. R. (2014). *What determines directors' remuneration in Malaysia?* Research Trends in Social and Behavioural Science, 469-475.
[4] Benito, A. and M. Conyon (1999) The Governance of Directors' Pay from UK Companies, *Journal of Management and Governance*, 3(1), 117-136.
[5] Chan, C. M.C., Watson, J. and Woodlift, D. (2014). Corporate governance quality and corporate social responsibility disclosure. *Journal of Business Ethics*, 125(1), 59-73.
[6] Conyon, M.J. and Leech, D. (1994). Top pay, firm performance and corporate governance.
[7] *Oxford Bulletin of Economics and Statistics*, 56(3), 229-247.
[8] Conyon, M. J. and Gregg, P. (1994). Pay at the top: Research of the sensitivity of top director remuneration to firm specific shocks. *National Institute Economic Review*, 149(August), 83-92.
[9] Conyon, M.J., Gregg, P. and Machin, S. (1995). Taking care of business: executive compensation in the United Kingdom. *The Economic Journal*, 105(430), 704-13.
[10] Dogan, E. and Smyth, R. (2002). Board remuneration, firm performance, and ownership concentration: evidence from publicly listed Malaysian companies. *ASEAN Economic Bulletin*, 19(3), 319-347.
[11] Eichholtz, P., Kok, N. and Otten, R. (2008). Executive Compensation in UK Property Companies. *The Journal of Real Estate Finance and Economics*, 36, 405-426.
[12] Fauzan, A. and Matoati, R. (2021). Financial ratios and share prices of JII70 indexed companies for the 2018-2020 period. *The Management Journal of Binaniaga*, 6(23), 23-39
[13] Firth, M., Tam, M. and Tang, M. (1999). The determinants of top management pay. *Omega*, 27 (6), 617-635
[14] Greenbury Committee Report. (1995). *Directors' remuneration – Report of a research group chaired by Sir Richard Greenbury*. London: Gee
[15] Cadbury Committee Report. (1992). *Committee on the financial aspects of corporate governance*. London: Gee
[16] Girma, S., Thompson, S. and Wright, P. W. (2007). Corporate Governance Reforms and Executive Compensation Determination: Evidence from the UK. *Manchester School*, 75(1), 65-81.
[17] Gregg, P., Machin, S. and Szymanski, S. (1993). The disappearing relationship between directors' pay and corporate performance. *British Journal of Industrial Relations*, 31(1),1-10.
[18] Haron, H. and Akhtaruddin, M. (2013). Determinants of director remuneration in Malaysian public listed companies. *Indian Journal of Corporate Governance*, 6(2), 17-42.
[19] Hartikainen, H, Marko, J. and Antti, R. (2021). Sustainability in executive remuneration- A missing link towards more sustainable firms? *Journal of Cleaner Production*. 324, 129224
[20] Hagel, III, Brown, J.S. and Davison, L. (2010). The best way to measure firm performance. *Harvard Business Review*. Available from hbr.org/2010/03/the-best-way-to-measure-firm-performance.
[21] Hassan, S., Christopher, T. and Evans, R. (2003). Directors' remuneration and firm performance: Malaysian evidence. *Malaysian Accounting Review*, 2(1), 57-67.
[22] Heron, N. M. (2016). *An analysis of the relationship between CEO compensation and corporate social responsibility disclosure type and quality*. Dissertation, City University of New York.
[23] Hillman, A.J. and Dalziel, T. (2003). Boards of directors and firm performance: integrating agency and resource

dependence perspectives. *The Academy of Management Review*, 28 (3), 383-396
[24] Ibrahim, M. K, Ibrahim, N., Ismal, W., Adibah, W. and Kamarudin, K. A. (2005) Determinants of directors' remuneration: Malaysian evidence 1998-2001. *Social and Management Research Journal* 2(1), 48-60.
[25] Jaafar, S. B. and James, K. (2014). Director remuneration pay: Trends during and after the financial crisis of 2007 to 2009. *Australasian Accounting, Business and Finance Journal*, 8(3), 56-69.
[26] Jacob, S. (2019). *Finding the balance on directors' pay.* The Edge Market.
[27] Jensen, M.C. and Murphy, K.J. (1990). Performance pay and top-management incentives.
[28] *Journal of Political Economy*, 98(2), 225-264.
[29] Jensen, M.C. and Meckling, W.H. (1976). Theory of the firm: managerial behaviour, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305-360.
[30] Journeault, M., Levant, Y. and Picard, C.F., (2021). Sustainability performance reporting: a technocratic shadowing and silencing. *Critical Perspective on Accounting*. 74, 102145.
[31] Keatinge, C. and Eaton, D. (2014), Greening the green: Linking executive compensation to sustainability, https://www.glasslewis.com/wp-content/uploads/2015/10/Greening_the_Green_2013_FINAL.pdf
[32] KPMG (2006). KPMG directors' remuneration survey 2006. *KPMG Business Advisory Sdn Bhd*, 1-20.
[33] Lee, S. P. and Isa, M. (2014). Directors' remuneration, governance and performance: The case of Malaysian banks. *Managerial Finance*, 41(1), 26-44.
[34] Main, B. G. M, Bruce, A. and Buck, T. (1996). Total board remuneration and firm performance. *The Economic Journal*, 106(439), 1627-1644.
[35] Mahoney, L. and Thorn, L., (2006). An examination of the structure of executive compensation and corporate social responsibility: a Canadian Investigation. Journal of Business Ethics. 69(2), 149-162.
[36] MCCG (2001), Malaysian Code on Corporate Governance, https://www.sc.com.my/api/documentms/download.ashx?id=239e5ea1-a258-4db8-a9e2-41c215bdb776
[37] Miyienda, B., Oirere, C.O. and Miyogo, J., (2013). The relationship between director remuneration and performance of firms listed in the Nairobi securities exchange. *International Journal of Social Sciences*, 15(1), 1-17.
[38] Murphy, K. (1999). *Executive compensation.* In Ashenfelter, O. & Cards, Y.D. (ED), Handbook of Labour Economics, 3, North Holland, Amsterdam
[39] Nagar, V., Nanda, D. and Wysocki, P. (2003). Discretionary disclosure and stock-based incentives. *Journal of Accounting and Economics*, 34(1), 283-309.
[40] Nurani, N. and Sakan, S. (2003). Pay that matters - companies are not giving enough emphasis on the variable components of remuneration. *Malaysian Business.* August 16, 58- 64.
[41] O'Neil, G.L. and Iob, M. (1999). Determinants of executive remuneration in Australian organizations: Exploratory research. *Asia Pacific Journal of Human Resources*, 37(1), 35-75.
[42] Ozkan, N. (2007). Do corporate governance mechanisms influence CEO compensation? An empirical investigation of UK companies. *Journal of Multinational Financial Management*, 17(5), 349-364
[43] Phillippa, O., Harris, L. and Gosling, T. (2021). Linking Executive Pay to ESG goals. *Strategy Business PWC.* Available from www.pwc.com/exec-pay-and-esg
[44] Razak, N.H.A, (2014), Director remuneration, corporate governance and performance: A comparison between government linked companies vs Non-government linked companies, Corporate Board: Role, Duties & Composition, 10(2), 46-63
[45] Razali, M. W. M., Yee, N. S., Hwang, J. Y. T., Tak, A. H. B. and Kadri, N. (2018). Directors' remuneration and firm's performance: A study on Malaysian listed firm under Consumer Product industry. *International Business Research*, 11(5), 102-109.
[46] Rosen, S. (1992). Contracts and the Market for Executives. *Contact Economics*, 181-217
[47] Searle, S. R. (2006). *Linear models for unbalanced data.* John Wiley & Sons.
[48] Spierings, M. (2022). Linking Executive Compensation to ESG Performance. *Harvard Law Schoo lForum on Corporate Governance.* Available from corpgov.law.harvard.edu/2022/11/27/linking-executive-compensation-to-esg- performance/
[49] Smith, C.W. and Watts, R.L. (1992). The investment opportunity set and corporate financing, dividend, and compensation policies. *Journal of Financial Economics*, 32(3), 263-292.
[50] Talha, M., Sallehuddin, A. and Masoud, S., (2009). Directors' remuneration, firm performance and board committee relationship in Malaysia. *Corporate Ownership & Control.*6(3), 553-561.
[51] Tee, C.M. and Hooy, C.W. (2009). *Directors' pay performance: a research on Malaysian government linked Companies. CenPRIS Working Paper* No. 110/09, Universiti SainsMalaysia, Penang, 1-19
[52] Thomson Reuters (2018), Annual report 2017, https://archive.annual-report.thomsonreuters.com/2017/downloads/annual-report-2017-thomson-reuters.pdf
[53] Usman, T. (2010). *CEO compensation: Relationship with performance and influence of boardof directors*, Gotland University
[54] Widarjono, A. (2016). Analisis Penerapan Multivariat: Dengan Program SPSS, AMOS dan Smart PLS. *UPP STIM YKPM.*
[55] Zamil, G. S. and Hassan, Z. (2019). Impact of environmental reporting on financial performance: Research of global Fortune 500 companies. *Indonesian Journal of Sustainability Accounting and Management*, 3(2), 109-118.

© 2024 by the authors; licensee Learning Gate

[56] Zhou, X. (2000). CEO pay, firm size, and corporate performance: evidence from Canada.
[57] *Canadian Journal Economics*, *33*(1), 213-251.
[58] Zulfikar, R. (2018). Estimation model and selection method of panel data regression: an overview of common effect, fixed effect, and random effect model. 10.31227/osf.io/0qe2b

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 144-159, 2024
DOI: 10.55214/25768484.v8i5.1677
© 2024 by the authors; licensee Learning Gate