

ESG Investment and Risks: Conceptualise the Unexpected

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ABSTRACT

Investors are integrating ESG factors into their decision-making processes to invest sustainably and gain competitive returns. The presence of risks from the recent past and the near future and the occurrence of a rare, unforeseeable, and economically significant event, known as a black swan event, hinder their ability to make sound investment decisions. In light of this, our study aims to develop a conceptual framework for the risk-return issue in ESG investments. The Southeast Asia region will be emphasised more due to its potential for future ESG investment growth and higher returns. Consequently, our investigation provides two possible frameworks to measure the relationship between ESG risks and ESG firms' stock returns in Southeast Asia. In the absence of ESG indices in the region, local ESG companies listed on stock markets have been suggested as a viable alternative.

Keywords: *ESG Investment, ESG-Related Risks, Black Swan, Markowitz Portfolio Theory, Southeast Asian*

1.0 INTRODUCTION

Environmental, social, and governance (ESG) investing has been practised for many years, originating from the eighteenth century's socially responsible investing (SRI)¹. Since then, excluding entire industries or specific companies that engage in unethical or harmful business practices from investment portfolios has become common practice. In addition to social (S) issues, current investors are also paying more attention to environmental (E) and governance (G) issues. In the early 2000s, ESG investing was still in its infancy and not widely available to investors. However, in recent years, the demand for financial services

¹ During the early phases of SRI, investors avoided making investments in companies or industries that had a negative impact on society, such as alcohol, gambling, and any forms of the sin business, such as human trafficking and slavery.

and investment products that take ESG issues into account has grown significantly among market participants and investors (Aich et al., 2021; Khan, 2019; Khemir et al., 2019; Singh, 2020; Zhou & Zhou, 2022). The COVID-19² pandemic, on the other hand, has brought a significant turning point in the evolution of ESG investing (Cornell, 2021; Demers et al., 2021; Ferriani & Natoli, 2021; Omura et al., 2021; Pedersen et al., 2021).

1.1.1 Global ESG Investment

Investors have been forced to re-evaluate their investment strategies due to unexpected events that have had significant impacts in recent years. One such event was the COVID-19 pandemic crisis, which JPMorgan (2020) characterised as a "sustainability" crisis. This is because it not only led to a severe economic downturn but also brought attention to the issue of climate change, causing decision-makers to prioritise sustainability in their investment decisions. Additionally, 2022 saw a series of severe and interconnected disruptions that impacted the global economy. These included the aftermath of the COVID-19 crisis, the Ukraine-Russia conflict, and the U.S.-China trade war, which resulted in climate, food, and energy crises. Inflation and debt tightening also occurred as a result of these events. Consequently, global output growth is expected to slow down from 3.0 per cent in 2022 to 1.9 per cent in 2023, which represents one of the most lower growth rates observed in recent times (United Nations, 2023).

In conventional economic theory, it is assumed that investors who are rational and limited by their risk tolerance and financial resources opt for investment portfolios that maximise their expected returns. Thus, Whelan et al. (2021) assert that investing in various ESG strategies could result in substantial benefits, particularly during social or economic crises, as a precautionary measure. Their assertion is supported by the visual comparison in Figure 1, which analyses the price performance of the MSCI World Index and the MSCI ESG Leaders Index from 2012 to 2022. The MSCI World Index and the MSCI ESG Leaders Index have exhibited an upward trend since 2012, with two brief periods of decline in early 2019 and mid-2020. However, since then, the prices of both indexes have experienced a substantial increase. The MSCI ESG Leaders Index rose by approximately USD 22 or more than 50 per cent in 2021, followed by a stable fluctuation from USD 18 to USD 22 afterwards.

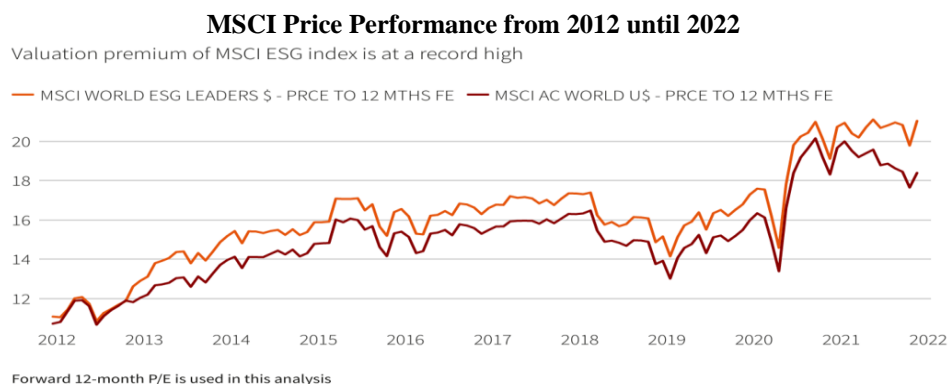


Figure 1: MSCI World versus MSCI ESG Leaders Index
(Source: Figure was extracted from Refinitive Datastream)

Furthermore, Murugaboopathy (2021) states that the cumulative index performance of the MSCI World ESG Leaders has risen since 2019, with a notably substantial increase from October 2020 to December 2021, as depicted in Figure 2. This positive trend is expected to boost investor confidence, particularly among those who may have previously harboured doubts regarding the future performance of ESG stocks. Also, Beloskar and Rao (2022) found that during the COVID-19 pandemic in India, ESG information could signal future stock performance, with ESG performance providing downside protection in times of crisis and reducing stock return volatility while not proving to be harmful to investment performance during regular times.

² COVID-19 is defined by the World Health Organization (WHO) as an infectious disease caused by the SARS-CoV-2 virus.

Gross Returns (in U.S. Dollars) from September 2007 until December 2021

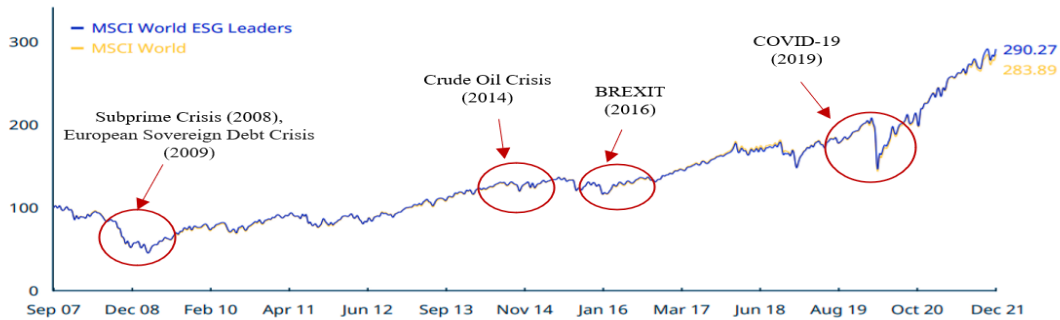


Figure 2: MSCI World and Leaders' ESG Cumulative Index Performance with Black Swan Events
(Source: Figure was extracted from MSCI.com)

1.1.2 ESG Investment in Southeast Asia

In the years leading up to the COVID-19 pandemic, Southeast Asia was a notable economic powerhouse with considerable growth potential. According to Figure 3, most of the region's countries experienced substantial annual gross domestic product (GDP) growth from 2015 to 2019, excluding Brunei and Timor. However, GDP growth in the ASEAN-5 nations and Cambodia decreased significantly during the pandemic. Despite this setback, the International Monetary Fund (IMF) has projected continued economic growth in Southeast Asia for the foreseeable future, as illustrated in Figure 4.

Investor interest in ESG investing has recently increased in Southeast Asia, particularly during the pandemic, as investors seek to achieve sustainable results while maximising their risk-adjusted returns. This trend is reflected in the Schroders' Global Investor Study (SGIS) 2021, which shows that more than 60 per cent of Southeast Asian investors, particularly in Singapore, Malaysia, Thailand, and Indonesia, now prioritise social and environmental concerns, surpassing the global average. In Malaysia, for instance, the Twelfth Malaysian Plan, 2021-2025, emphasises a nationwide transition to more sustainable economic and lifestyle practices that value natural resources and environmental health. The plan seeks to promote sustainable and resilient green growth while promoting a more equitable distribution of benefits from using natural resources. However, the lack of reliable ESG metrics in this region remains a significant barrier to the development of sustainable investing (PRI, 2022).

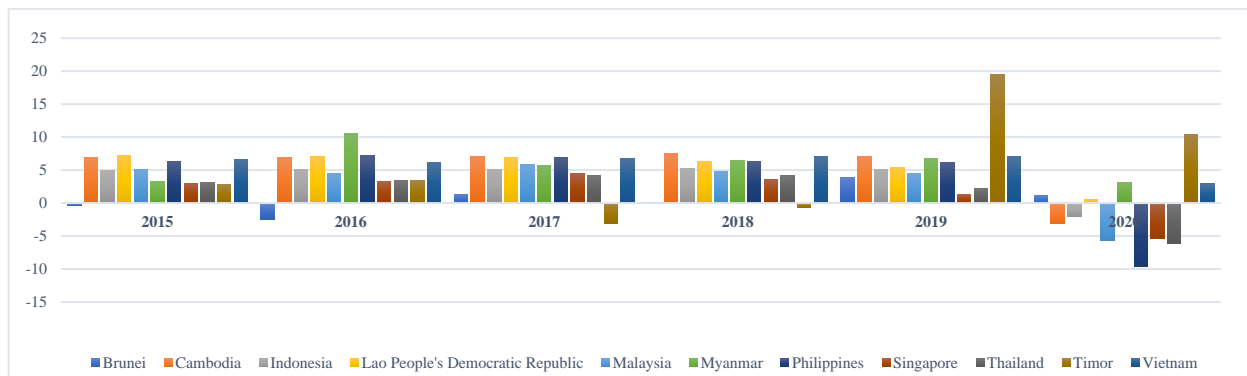


Figure 3: Southeast Asia GDP Growth (in Annual Percentage)
(Source: Data was gathered from the Eikon Refinitiv and visualised by the authors)

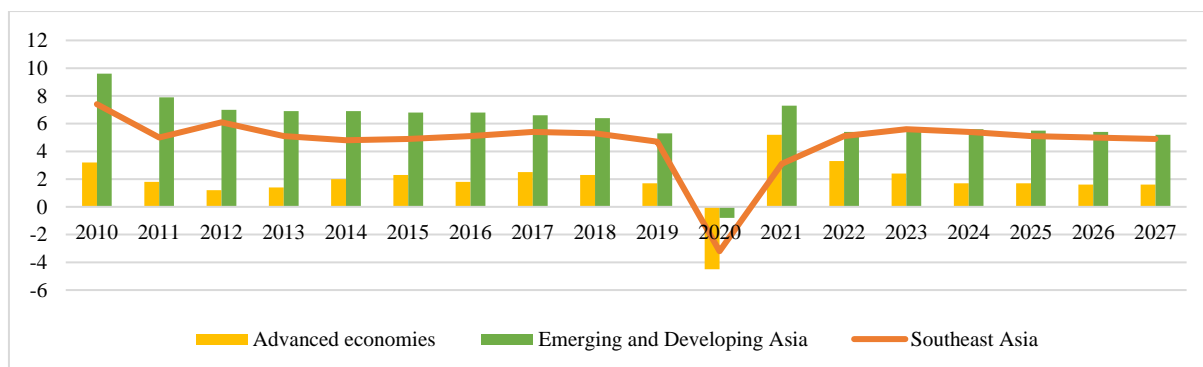


Figure 4: Real GDP Growth (in Annual Percentage)
 (Source: Data was gathered from the IMF and visualised by the authors)

On the other hand, the Government Actuary's Department (2019) notes that the relationship between investment in the stock market and economic growth often diverges, and its exact nature remains unknown. The potential for stock market returns to rise or fall depends on the presence or absence of positive or negative GDP growth. However, although there is a direct link between ESG and GDP per capita in the long run, no such connection exists in the short run (Diaye et al., 2022). The shift towards sustainable investing by many countries in response to global trends has resulted in the recognition that ESG investing can generate a broad range of results, similar to SRI. Thus, different investment strategies that factor in risks and opportunities to generate long-term value have been adopted (OECD, 2021).

Given the region's growing focus on sustainable investing, it can also be inferred that ESG investment in Southeast Asia may require careful consideration of risks and opportunities to yield optimal outcomes. Despite the substantial amount of empirical research that has explored the effect of socially responsible investments (ESG) on corporate financial performance, as demonstrated in studies by Heijningen (2019) and Kumar et al. (2016), there is often a lack of consideration for the risk factor. Previous research has not adequately assessed risk, and return analyses, leading to insufficient evaluation of the positive and negative correlations between variables (Friede et al., 2015).

Daily market fluctuations can be attributed to various economic and other events that affect markets, countries, businesses, or governments (Heugh et al., 2021). Known-to-unknown events, such as the "black swan", influenced investor behaviour (Estrada, 2008) and their initial passive or active investment strategy (Ali et al., 2019; Estrada, 2008). Anticipating potential risks is crucial, especially given the complexity of predicting them prior to their occurrence. It can be even more challenging than assessing the damage's extent once they have occurred. Like other forms of risk, the negative consequences of these risks could negatively impact a company's assets, financial and economic standing, and reputation.

To our knowledge, no empirical studies have been conducted on the risks and return trade-offs associated with cryptocurrency and ESG investment portfolios. Nevertheless, cryptocurrency's issue in ESG investments has been a subject of discussion, with varying perspectives among investors and companies on its potential to support or compromise ESG objectives. For instance, a particular discourse posits that to uphold their professed mission, ESG investment funds must refrain from investing in corporations with cryptocurrency exposure (Conklin & Malone, 2023). Neglecting to do so would be inconsistent with the primary purpose of ESG investment funds. On the other hand, proof of work systems necessitates crypto miners to purchase and maintain their mining equipment indefinitely, incurring more energy costs. Like all other monetary systems and investments, cryptocurrency is imperfect and continuously needs improvement. Therefore, the argument that they should not be included in an investment portfolio is unfounded (Green, 2022).

In light of the abovementioned issues, we will develop a conceptual framework for ESG investments in Southeast Asia that accounts for the impact of black swans. This research contributes in two ways. First, it will aid future investors by developing a framework for ESG-related risks in Southeast Asia, considering ESG risk factors, black swan risks, and ESG-near-future risks associated with ESG firms' stock returns. By broadening the risk factors used to calculate the return of ESG stocks, future researchers and investors can

gain a more accurate understanding of the performance of these stocks. In the subsequent sections, we will discuss further the literature reviews, methodology, and conclusion of this study.

2.0 LITERATURE REVIEW

Investors have always been interested in the relationship between investment risks and expected returns. One of the most notable theories on this topic is the Modern Portfolio Theory (MPT), developed by Harry Markowitz in 1952. The MPT defines risk as the variance of individual assets and portfolio returns. The variance is a crucial measure of portfolio risk and an essential indicator of adequate diversification. The theory also defines risk as volatility, which can be measured using various statistical methods, such as the standard deviation of returns and the financial risk model. As the level of risk increases, investment returns become more volatile, which means investors need to be aware of the frequency and magnitude of an investment's price fluctuations and their relationship with volatility. High volatility refers to investments that experience significant fluctuations in value over a short period, while low volatility describes the opposite behaviour. The Capital Asset Pricing Model (CAPM), which was developed by Sharpe (1964) and Lintner (1965), and its equilibrium were also derived as an extension of MPT by Mossin (1966).

In actual investment, the term 'risk' denotes a circumstance in which the decision-maker possesses knowledge of the feasible outcomes of a given decision and the respective probabilities of occurrence for each outcome. Whereas uncertainty refers to a circumstance in which the decision-maker does not have sufficient information. Although numerous studies have argued that risk is distinct from uncertainty (Knight, 1921; Rueter, 2013; Tomaa et al., 2012), the terms are frequently used interchangeably. Risk reflects the uncertainty surrounding the return on investment. The more uncertain the return on an investment, the higher the risk (Smart et al., 2017). In another context, Head (1967) defined risk not as uncertainty but as the objective probability that an event's actual outcome will differ significantly from its expected outcome.

Most previous research has employed the concept of risk as a substitute for volatility (Engle, 2004; Huang et al., 2018; Mohamed Yousop et al., 2021). The presence of extreme volatility in financial time series can complicate the analysis of ESG firms leading to unfavourable outcomes for the ESG market and investment. Seneviratne et al. (2012) explain that heightened volatility implies a greater probability of market decline. In contrast, reduced volatility suggests a greater likelihood of market growth, both of which have implications for the overall performance of firms (Kumar et al., 2016). Therefore, conducting a comprehensive risk assessment is necessary to assist investors in minimising the impact of possible risks by devising appropriate strategies.

ESG funds exhibit lower risk or volatility. Morelly and D'Ecclesia (2021) discovered that the environment score (E score) significantly impacts portfolio volatility across all sectors examined. During the entire period under investigation, portfolios with high E scores display lower volatility than their low-E equivalents. Moreover, ESG performs better in volatile markets due to their lower exposure to systematic risks (Pedersen et al., 2021). During economic turmoil, companies with higher ESG scores are found to be less risky and more stable (Omura et al., 2021; Singh, 2020), particularly for ESG leaders, who usually have lower market beta and volatility (Bruno et al., 2021).

Also, compared to conventional investments, ESG investments typically demonstrate a higher return and performance. Research indicates that ESG investing may lead to superior performance without posing significant risks, as evidenced by the robust performance of the ESG India Index since its establishment (Chelawat & Trivedi, 2015). Furthermore, a recent study conducted by Omura et al. (2021) found that, with the exception for Japan, MSCI SRI Indices generate higher average returns when compared to MSCI Indices. On the other hand, the risk-return trade-off of ESG investments provides a potential for higher performance and returns with lower risk (Kumar et al., 2016), particularly firms with strong ESG performance have lower stock price volatility and more extensive stability (Zhou & Zhou, 2022).

2.1.1 ESG Risks Factor

"ESG Risks Factors" are identified not only as "ESG-related risks" but also as sustainability, non-financial, or extra-financial risks, given the absence of a universally recognised definition. This is because each

entity's definition will be based on its definition, including the business model, internal and external environment, product or service, goal and vision statement, and fundamental values statement (COSO & WBCSD, 2018). According to the U.S. Securities and Exchange Commission (2021), the lack of standardisation and precision in ESG definitions and the rapid increase in demand for ESG products and services also contribute to ESG risks. The ambiguity associated with ESG ratings provided by many organisations causes confusion and affects the analysis of the relationship between risk, return, and ESG ratings (Cornell, 2021; European Banking Authority, 2021)

Since the COVID-19 outbreaks, each country requires integrated strategies for identifying and mitigating risks and adverse consequences. ESG risks are broadly defined as environmental, social, and governance risks. Environmental risks include the physical impact of climate change, which may lead specific geographies areas at greater risk and transitional risk. These risks include carbon emissions, harmful chemical usage, biodiversity loss, and deforestation. Social risks are associated with health, inequalities and human rights, while governance risks are associated with board composition, bribery, and corruption. Both social risks and governance risks will eventually have a negative financial impact on the firm (European Banking Authority, 2021).

2.1.2 The Black Swan

One of the most critical factors in establishing ESG-related risks is considering the possibility of something completely unexpected happening, sometimes called the "black swan" risk. A black swan is a metaphor for a highly implausible event that has a significant impact (Bodie et al., 2014). The theory of black swan events was first introduced by Taleb (2007). He outlines three main features of a black swan event: its outlier status, significant impact, and retrospectively explainable and predictable nature. The black swan is a potentially catastrophic event that is highly negative, difficult to predict, and goes above and beyond what is typically expected of a scenario. There have been numerous worldwide black swan events, including World War I, the 2008 Global Financial Crisis, the September 11, 2001, terrorist attack, the birth of the internet, and many others. However, not all these events impacted the financial sector.

Understanding the concept of a black swan event for a country requires distinguishing between actual black swan events and situations that do not qualify as such. Identifying a "black swan" for a country requires an understanding that not every crisis or situation denoted by the term "black swan" is, in fact, a black swan. For example, the tsunami that hit Fukushima Daiichi in March 2011 with 14-meter waves was not a black swan since prior disasters of equal scale struck the region between the 9th and 17th centuries with almost the same magnitude. Terrorist attacks are virtually daily or monthly occurrences in several Middle Eastern nations, yet the terrorist attacks of September 11, 2001, were unexpected and hence qualified as a black swan event. In Malaysia, a series of black swans have been seen recently, notably in the last three years. Malaysian investors have been struck by a barrage of shocks, including one of the worst contractions in economic activity, a dramatic drop in asset values, and a change in government with an uncertain policy stance.

In a risk and safety context, the term "black swan" is frequently used, and its existence cannot be ignored (Aven, 2013). According to Aven (2014), there are three distinct categories of black swan events: unknown unknowns (an event that was utterly unknown to the scientific environment), unknown knowns (event not on the list of known events from the perspective of those who carried out risk analysis), and events with a negligible probability of occurrence and thus are not believed to occur. He also examines the possible method for addressing black swans (subjective and objective – based on probability and frequency). He concludes that current risk concepts and treatment frameworks must be expanded to include black swan risk (Aven, 2015). Even though his research is more scientifically oriented, most of his claims apply to investors.

Regarding ESG, Piserà and Chiappini (2022) show that ESG and thematic indexes have risk hedging properties during the COVID-19 crisis and perform better than cryptocurrency, but none have safe-haven properties. Furthermore, Hang Seng Indexed (2022) indicates that the Hang Seng Index with ESG initiatives (HSIESGS) generally outperformed the Hang Seng Index (HIS) in most "black swan" or disruptive events, but the HSI performed better during the first and fifth waves of COVID-19 in Hong Kong and current geopolitical tension in Eastern Europe. Despite some minor underperformance, the outperformance of the HSIESGS was typically greater than the underperformance.

2.1.3 Cryptocurrency as ESG Near-Future Risk

The development of crypto assets in ESG investments will determine future threats to ESG. Cryptocurrencies are currently among the most popular global investment trends. As of 2020, emerging markets and developing economies were the top five countries using or owning crypto assets, while advanced economies were the least likely (Buchholz, 2021). A recent study by Schroders' Global Investor Study 2021 found that most people will allocate more to savings or low-risk investments, with only one-third allocating more to high-risk investments. However, older and younger generations of investors are more interested in cryptocurrency. The study also showed that in low-interest-rate environments (often due to recession), more than half of Asian investors were most likely to invest in high-risk investments, with 22 per cent of those investors investing in cryptocurrency. The role of cryptocurrency in shaping the future of payment systems cannot be understated, given recent financial developments and inclusions. Nevertheless, the conflicts arising from electronic waste, carbon emissions, and social and governance factors directly conflict with ESG investing principles, despite its emphasis on sustainable and responsible investment practices.

For many years, concerns have been raised about the amount of energy used in mining cryptocurrencies, particularly those that use a proof of work consensus model such as Bitcoin and Ethereum (also known as Ether). Bitcoin and Ether are designed to be energy intensive and "mined" by millions of powerful computers worldwide. According to Cho (2021), because the entire network has invested millions of dollars in hardware and infrastructure, transitioning to a more energy-efficient system would be difficult, especially since there is no central oversight body. However, several projects are attempting to reduce cryptocurrency's overall carbon footprint. For instance, Ether's consensus model has shifted from "proof of work" to "proof-of-stake," which relies on "stakes" that already own some Ether to process new transactions (Browne, 2021). Validators only need to buy tokens to win blocks to participate in the proof of stake model.

Research on the relationship between ESG investment and cryptocurrency risk is not extensively discussed, with most of the discussion surrounding this topic being based on industry reports and statements—to date, no empirical evidence of the relationship between the two. However, recent studies have highlighted the importance of evaluating the ESG credentials of cryptocurrency companies for financial institutions prioritising ESG and developing a comprehensive plan for bitcoin hedging for corporate treasuries (Rabbani et al., 2021). Additionally, future research should focus on improving the effectiveness of chain code operations for an ESG-based carbon market (Golding et al., 2022). While a study by Ciaian et al. (2022) found a strong relationship between investor preferences and crypto-investment exposure, it did not examine the associated investment risks and returns, only comparing the effect of ESG preferences on investment decisions between crypto-assets and traditional financial assets.

2.1.4 The Measurements

Initially proposed by Louise Bachelier in 1900, the random walk theory suggests that share prices are random and unpredictable. Supporting Bachelier's theory, Malkiel (1973) also argued that past prices could not accurately predict future prices, particularly in the short term. Fama's earlier research in 1970, which employed a related theory called the Efficient Market Hypothesis (EMH), asserted that investors in an efficient market act rationally and that no one can outperform the market since stock prices constantly adjust to relevant information. Therefore, neither technical nor fundamental analysis can lead to success in the market because security prices are always adjusted to their equilibrium levels. However, the EMH's assumption of the rationality of market participants in making investment decisions has been criticised in recent times.

In reality, unexpected events, anomalies, behavioural tendencies, and mood can cause investors to act irrationally. Thus, according to Bodie et al. (2014), there is no definitive theory about the level of risk an investor should be exposed to in the market. Even for long-term investments, such as ESG investments, events like "black swan" and the development of future investment direction, such as cryptocurrency adoption, do not guarantee investment performance. As for the investigation, past experiences, such as historical prices or returns, best indicate future risk.

In this regard, numerous methods have been proposed to investigate the relationship between ESG risk and stock return and the measurement of risks. The Ordinary Least Square Regression has extensively measured

the relationship between returns or risks or any other interested variables (Demers et al., 2021; Dorfleitner et al., 2016). Other methods as Autoregressive Conditional Heteroscedasticity (ARCH) and Generalized Autoregressive Conditional Heteroscedasticity (GARCH), are used to determine the presence of volatility in the stock market (Huang et al., 2018; Lin & Tsai, 2019; Zhou & Zhou, 2022). The utilisation of these models can be primarily attributed to heteroscedasticity being typically present in time series data and is difficult to circumvent. As a result, the application of these models is favoured as they facilitate the modelling of conditional heteroscedasticity, which encompasses the dynamic nature of volatility in financial markets (Mohamed Yousop et al., 2021; Morelli & D'Ecclesia, 2021).

Since the nature of a "black swan" is unexpected, a few techniques have been identified to simplify its measurement. For instance, by examining pertinent news or articles published by various sources, one can ascertain the probability of each risk occurring in Southeast Asia – dummy variables. Alternatively, according to (Estrada, 2007), one can determine the existence of the black swan by quantifying outliers of daily returns greater than three standard deviations or $|\sigma \geq \pm 3\%|$ in stock returns or portfolio performance. His study discovered sizeable daily return swings in 15 international equity markets, demonstrating that black swans significantly impact long-term performance. This will be discussed later in this study concerning sustainability risk. Besides, according to (Estrada & Vargas, 2012), Taleb's (2007) definition of a black swan can be simplified into rarity, extreme impact, and retrospective predictability. Thus, by focusing on outliers or large market fluctuations, a monthly return on the global stock market greater than or equal to 5 per cent in absolute value or $|\pm 5\%|$ also can be used to identify a black swan. Later, (Ali et al., 2019) applied the exact measurement to describe a black swan in Shanghai Stock Exchange (SSE Composite Index) and Pakistan Stock Exchange PSX (KSE-100) Index.

3.0 WAY FORWARD

This study aims to develop a conceptual framework for ESG investments in Southeast Asia that considers the impact of black swans. Our discussion will begin with data availability, followed by a suggested framework and method for future research.

3.1.1 *Sample and Data Collection*

The daily closing index prices of ESG companies' stocks in Southeast Asia are suggested to be used in this study. These prices span from 2009, which was the year when the first cryptocurrency was traded, to the most recent investment year. Three steps will be taken into consideration for the data screening process:

To begin with, to identify the stocks for this study, the selection process will involve referring to the ESG criteria. The latest classification will be considered to ensure that the stocks selected are current and relevant. The data will be collated from various sources, including Bloomberg, Yahoo Finance, and Refinitiv Datastream. It is worth noting that many global ESG stocks indices are available. These indices measure the performance of companies based on their ESG practices. Some of the most well-known ESG indices include the MSCI World ESG Leaders Index, FTSE4Good Index Series, and Dow Jones Sustainability Indices. These ESG indices, which financial data providers or rating agencies usually compile, can assist investors in selecting stocks that align with their values and preferences while providing insight into a company's sustainability performance. Consequently, investors can use ESG indices to create diversified portfolios that meet their financial goals while supporting sustainability efforts. The following are indexes available in the stock market:

- The Dow Jones Sustainability Indices (DJSI) from S&P Global is a group of float-adjusted market capitalisation-weighted indices that evaluate the performance of companies around the world according to ESG criteria.
- FTSE Russell's FTSE4Good Index Series is a group of indices that measures the stock price movement of companies based on their commitment to ESG best practices. Multiple market participants can utilise FTSE4Good indexes to develop and evaluate sustainable investment products.
- MSCI has developed the MSCI ESG Leaders Indexes to track how well companies with high Environmental, Social, and Governance (ESG) ratings perform relative to their competitors. The MSCI ESG Leaders Index should comprise fifty per cent of the MSCI Parent Index.

- The NSE Nifty 100 ESG Index on the NSE India stock exchange is a stock market index that tracks the performance of companies with high ESG ratings in India. Each component's weight in the index is determined by its free-float market capitalisation and modified ESG risk score.
- The S&P Global 1200 ESG Shariah Index tracks the Shariah-compliant components of the S&P Global 1200 ESG Index.
- Solactive's Solactive Social Media Index is a global equity index that follows companies with strong ESG practises in social media, such as social networking providers, file sharing, and other web-based media applications.
- The STOXX ESG Leaders Indices are a family of benchmarks constructed from the STOXX Global ESG Leaders Index, which follows the 50 most significant components worldwide by market capitalisation.

To date, no stock indices in Southeast Asia are specific to ESG. However, several regional stock exchanges have begun implementing sustainability reporting requirements and encouraging ESG reporting and disclosure by listed companies. Thus, data from ESG firms can be gathered by focusing on a specific aspect of the ESG firms, such as types of ESG business and their stock prices (as of February 17, 2023: 11.59 am), as shown in Table 1.

Table 1. Examples of ESG companies in Singapore, Malaysia, Indonesia, and Thailand

Country	Companies	Types of ESG Business	Stock Price
Singapore	DBS Group Holdings Ltd <ul style="list-style-type: none"> • Market Cap: SGD 90.18 billion • EPS: 3.15 	Sustainable finance, green bonds, renewable energy investments	SGD 35.04
	CapitaLand Limited <ul style="list-style-type: none"> • Market Cap: SGD 19.56 billion • EPS: SGD 0.2100 	Sustainable buildings, green financing, community development	SGD 3.82
	ComfortDelGro Corporation Limited <ul style="list-style-type: none"> • Market Cap: SGD 2.6 billion • EPS: SGD 0.0700 	Electric vehicles, green initiatives, community engagement	SGD 1.19
	Wilmar International Limited <ul style="list-style-type: none"> • Market Cap: SGD 24.84 billion • EPS: SGD 0.4800 	Sustainable palm oil, zero deforestation, renewable energy investments	SGD 3.98
Malaysia	Petronas Chemicals Group Berhad <ul style="list-style-type: none"> • Market Cap: MYR 19.36 billion • EPS: MYR 0.2300 	Sustainable chemicals, energy efficiency, renewable energy investments	MYR 4.42
	Dialog Group Berhad <ul style="list-style-type: none"> • Market Cap: MYR 12.797 billion • EPS: Not available 	Sustainable oil and gas, renewable energy investments, community development	MYR 2.43
	Top Glove Corporation Bhd <ul style="list-style-type: none"> • Market Cap: MYR 1.51 billion • EPS: MYR 0.0200 	Sustainable production practices, community development, health and safety	MYR 0.7196
	Public Bank Berhad <ul style="list-style-type: none"> • Market Cap: MYR 18.625 billion • EPS: MYR 0.0700 	Sustainable finance, green bonds, community development	MYR 0.9308
Indonesia	PT Bank Rakyat Indonesia (Persero) Tbk	Sustainable finance, microfinance, financial inclusion	IDR 4,840

	<ul style="list-style-type: none"> Market Cap: IDR 731.184 trillion EPS: IDR 338.00 		
	PT Bank Mandiri (Persero) Tbk <ul style="list-style-type: none"> Market Cap: IDR 298.1 trillion EPS: 882.52 	Sustainable finance, green financing, financial inclusion	IDR 10,175
	PT Astra International Tbk <ul style="list-style-type: none"> Market Cap: IDR 232.8 trillion EPS: IDR 705.00 	Sustainable mobility, green financing, community development	IDR 5,625
	PT Bank Rakyat Indonesia (Persero) Tbk <ul style="list-style-type: none"> Market Cap: IDR 731.184 trillion EPS: IDR 338.00 	Sustainable finance, microfinance, financial inclusion	IDR 4,840
Thailand	PTT Public Company Limited <ul style="list-style-type: none"> Market Cap: THB 950.169 billion EPS: THB 3.54 	Renewable energy, energy efficiency, sustainable mobility	THB 33.25
	Advanced Info Service Public Company Limited <ul style="list-style-type: none"> Market Cap: THB 621.566 billion EPS: THB 8.75 	Sustainable telecommunications, digital inclusion, community development	THB 209
	Siam Cement Public Company Limited <ul style="list-style-type: none"> Market Cap: THB 406.8 billion EPS: THB 24.61 	Sustainable construction materials, circular economy, renewable energy	THB 339

Note: Information was gathered from Yahoo Finance

The next step is determining each risk and its associated characteristics in each component. Developing and categorising E, S, and G for ESG risks tends to be intricate since specific issues are challenging to identify due to their uniqueness to each organisation and country. However, even though categorising ESG risks might be challenging, Hayat et al. (2015) suggest that the E, S, and G can be generally classified as Figure 5 shows.

Given the complexity of ESG-related risks, this study will employ the "random forest method" to determine which factors should be included in each E, S and G component. In addition, issues with data classification and regression can be resolved by "training" random forest algorithms with bagging or bootstrap aggregation. Rather than relying on a single decision tree, the random forest takes the prediction from each tree. It bases its final prediction on the majority vote of predictions, thereby enhancing the predictive accuracy of the entire dataset. The algorithm bases its conclusion on the data and predictions from the decision trees. As the number of trees employed increases, enhanced precision can be anticipated. However, our focus in this study did not require us to demonstrate simulations for these techniques.

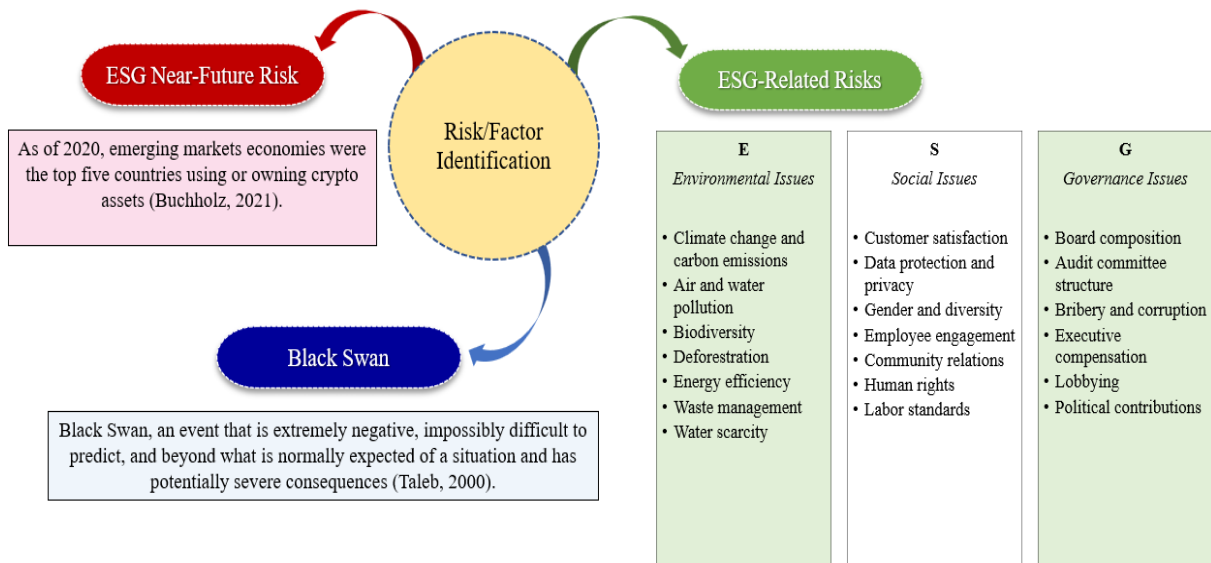


Figure 5: Risk or Factor (Variables) Identification

(Measurement method: Random Forest Method for Sustainability Risks)

This study will then employ a multi-quantitative approach to test hypotheses developed based on the framework that has been established. Several tests that will be conducted are performed using the following procedures.

3.1.2 Return Measurement

In order to measure the return performance, the determination of return will be calculated using the following formula:

$$R_t = \frac{\text{Closing } P_t - \text{Opening } P_t}{\text{Opening } P_t} \times 100 \quad \text{Eq. (1)}$$

R_t represents the continuously compounded return at time t , Closing P_t represents the security price at the end of the t trading day (current price), and Opening P_t represents the security price at the end of the $t-1$ trading day (past price). This study will use five weekly observations, excluding weekends and public holidays.

The study will commence by utilising fundamental descriptive statistical measures, which include mean, standard deviation, minimum, maximum, and outcomes on Jarque-Berra. These measures will be employed to scrutinise the behaviour of index returns. Subsequently, the study will estimate the effect on the return equation by employing the Panel Least Square method as follows:

$$R_{it} = \alpha_i + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \beta_3 X_{3,it} + e_{it} \quad \text{Eq. (2)}$$

where R_{it} is derived from Eq (1), α_i is a constant variable for the regression equation, β_1, β_2 , and β_3 are the coefficient for X_1 (ESG Risk Factors), X_2 (ESG Near-Future Risk) and X_3 (Black Swan), e_{it} is the error term i represents the Southeast Asian country, and t represents the time-series component.

3.1.3 Volatility or Risk Measurement

Autoregressive Conditional Heteroscedasticity (ARCH) and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models are widely used to model and forecast financial data volatility in time series analysis. However, these traditional models are unsuitable for panel data, as they need to account for the cross-sectional dependence between different entities in the panel. To address this issue, panel ARCH and GARCH models are used, which extend the traditional models to incorporate cross-sectional dependencies.

The panel ARCH model accounts for heteroscedasticity in the error terms of a panel data set by considering that the variance of the error term is a function of the lagged error terms and other explanatory variables.

On the other hand, the panel GARCH model extends the panel ARCH model by allowing for time-varying volatility. This model assumes that the conditional variance of the error term is a function of its past values, the past values of the error terms of other entities in the panel, and other explanatory variables. Panel ARCH and GARCH models consider cross-sectional dependencies, making them suitable for predicting financial data volatility in panel settings. These models expand the traditional ARCH and GARCH models and provide a more accurate representation of financial data in panel data analysis.

4.0 CONCLUSION

ESG investing has emerged as a promising long-term alternative to sustainable investing, as short-term investments are no longer favoured due to their higher risk. When ESG factors are incorporated into the decision-making process, investors can sustainably invest while achieving comparable financial returns to conventional investment strategies. The incorporation procedure begins with identifying investment objectives, continues with evaluating and selecting the most sustainable companies, and concludes with monitoring the entire procedure. By examining a company's business practises and the factors affecting its operations, long-term investors are typically better informed, with ESG factors constituting a significant portion of the information available (Korwatanasakul, 2020).

Nevertheless, unexpected events have prompted many investors to re-assess and re-evaluate their investment strategies for the near future. Alongside stock selection, ESG-related risks can directly or indirectly influence investor preferences. Risks such as black swan events, deteriorating social cohesion, and a lack of board diversity are only a few of the risks that have the potential to negatively impact the performance and returns of a vast majority of businesses worldwide. As a result, investors are increasingly evaluating ESG-related risks when making investment decisions. For instance, the COVID-19 pandemic has led to a renewed focus on sustainability and social responsibility in investments. This global event has significantly impacted the economy, and investors are now more likely to prioritise long-term sustainability and social responsibility in their investments. In this context, ESG factors can help mitigate risk over time and improve long-term financial performance.

A complex and multifaceted relationship exists between cryptocurrency, ESG investment, and black swan events. On the one hand, cryptocurrency has been associated with environmental concerns due to the enormous energy consumption required for mining and transaction processing. As a result, ESG investors may view cryptocurrency as an unsustainable investment that conflicts with their values. On the other hand, some cryptocurrency proponents argue that it can be a more socially and economically inclusive investment than traditional financial systems. Additionally, cryptocurrency may be viewed as a potential hedge against black swan events, unpredictable and rare events that can significantly impact financial markets. By empirically investigating, the relationship between them will be crystallised.

Furthermore, ESG analysis can provide investors with valuable information about companies' environmental impact, social responsibility, and governance practices. This information can be used to make more informed investment decisions, ultimately resulting in higher long-term returns. Future researchers are also encouraged to use the methodology suggested in this study to discover results based on empirical findings. In conclusion, while ESG investing is a promising alternative to traditional investment strategies, investors must also consider ESG risk factors and ESG near-future risk when making investment decisions. By prioritising sustainability and social responsibility, investors can mitigate risk and achieve better long-term financial performance while promoting positive social and environmental outcomes.

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