



**VOLATILITY SPILLOVER, INTEGRATION, AND PERFORMANCE OF
ISLAMIC AND CONVENTIONAL EQUITY MARKETS**

By

FOO SIONG MIN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

March 2024

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of the requirement for the degree of Doctor of Philosophy

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March 2024

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This study, which utilises data spanning from August 1, 2007, through May 5, 2023, explores the ambiguous relationship between Islamic Equity Markets (IEM) and Conventional Equity Markets (CEM) across three subperiods: (i) during the Global Financial Crisis (GFC); (ii) post-GFC and (iv) during the COVID-19. It analyses aspects, namely volatility, spillovers, integration and performance. While some research suggests IEM's outperformance due to Shariah principles, consensus in the literature is still lacking. Portfolio diversification is crucial for risk management and performance enhancement, prompting this study to examine the IEM's potential for innovative portfolio diversification and risk reduction.

The study employs stratified random sampling with daily prices of 16 conventional and Islamic market indexes from ASEAN (Malaysia and Indonesia), GCC (Bahrain, Saudi Arabia and UAE), the USA, China and MSCI ACWI. Further, it engages ARIMA-EARCH, MGARCH-DCC, wavelet techniques, performance analysis of

Jensen, Sharpe, as well as Treynor ratios and efficient frontier to address each objective.

The study's key findings are as follows: (1) this study challenges the notion that IEM inherently has lower risk, as IEM and CEM were significantly impacted by the COVID-19 crisis; (2) dynamic integration between IEM and CEM, varying with investment horizons and market conditions; (3) inconsistent outperformance of IEM compared to CEM across countries and periods; (4) A mixed portfolio of IEM and CEM on the efficient frontier was found to offer higher returns with lower risk; (5) IEM exhibited slightly higher volatility compared to CEM, with Malaysian's IEM and CEM exhibiting reduced correlations to countries' indexes of Bahrain and the USA, thus recommending the exploitation of diversification benefits, emphasising a balanced approach that incorporates both short-term and long-term strategies aligned with individual financial goals.

This thesis acknowledges limitations, suggesting that a more extensive comparative analysis beyond the regional focus and an exploration of macroeconomic factors would enhance its findings. Future studies should encompass cross-country comparative analyses to comprehend economic and cultural influences on equity markets. The research findings hold practical implications for improving portfolio diversification for investors, analysts, policymakers and market participants.

Keywords: Integration; Islamic equity markets; Performance; Spillover, Volatility

SDG: GOAL 8: Decent work and economic growth

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**KEMERUAPAN LIMPAHAN, INTEGRASI, DAN PRESTASI PASARAN
EKUITI ISLAM DAN KONVENSIONAL**

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Kajian yang menggunakan data dari 1 Ogos 2007 hingga 5 Mei 2023 ini meneroka hubungan yang tidak jelas antara Pasaran Ekuiti Islam (IEM) dan Pasaran Ekuiti Konvensional (CEM) merangkumi tiga subtempoh: (i) semasa Krisis Kewangan Global (GFC); (iii) selepas GFC dan (iv) semasa COVID-19. Ia menganalisis aspek seperti kemeruapan, limpahan, integrasi dan prestasi. Walaupun beberapa penyelidikan mencadangkan prestasi IEM yang lebih baik berbanding CEM disebabkan prinsip Syariah, namun konsensus dalam kajian literatur didapati masih kurang. Kepentingan kepelbagaian portfolio dalam pengurusan risiko dan peningkatan prestasi telah mendorong kajian ini untuk mengkaji potensi IEM dalam isu yang disebutkan.

Kajian ini menggunakan pensampelan rawak berstrata menggunakan harga harian enam belas indeks pasaran konvensional dan Islam dari ASEAN (Malaysia dan Indonesia), GCC (Bahrain, Arab Saudi, dan UAE), AS, China dan MSCI ACWI. Selanjutnya, ia menggunakan ARIMA-EARCH, MGARCH-DCC, teknik wavelet,

analisis prestasi nisbah Jensen, Sharpe, Treynor dan *efficient frontier* untuk mencapai setiap objektif.

Penemuan utama kajian adalah seperti berikut: (1) kajian mempertikaikan tanggapan bahawa IEM sememangnya mempunyai risiko yang lebih rendah, kerana kedua-dua IEM dan CEM terjejas dengan ketara disebabkan krisis COVID-19; (2) integrasi dinamik antara IEM dan CEM berbeza-beza mengikut dimensi pelaburan dan keadaan pasaran; (3) prestasi IEM yang tidak konsisten berbanding CEM merentasi negara dan tempoh masa; (4) Portfolio campuran IEM dan CEM di *efficient frontier* didapati menawarkan pulangan yang lebih tinggi dengan risiko yang lebih rendah; (5) IEM mempamerkan kemeruapan lebih tinggi berbanding CEM, dengan indeks-indeks Malaysia menunjukkan korelasi yang berkurangan kepada indeks negara lain seperti Bahrain dan Amerika Syarikat, seterusnya mencadangkan kebaikan kepelbagaian portfolio, selain menekankan pendekatan yang seimbang dengan menggabungkan kedua-dua strategi jangka pendek dan jangka panjang yang sejajar dengan matlamat kewangan individu.

Tesis ini mengakui batasan dan mencadangkan bahawa analisa perbandingan yang lebih meluas merangkumi fokus serantau dan penerokaan faktor makroekonomi akan meningkatkan kualiti dapatan kajian. Kajian masa depan harus merangkumi analisis perbandingan merentas negara untuk memahami pengaruh ekonomi dan budaya ke atas pasaran ekuiti. Penemuan penyelidikan mempunyai implikasi praktikal untuk meningkatkan kepelbagaian portfolio untuk pelabur, penganalisis, penggubal dasar dan peserta pasaran.

Kata kunci: Integrasi; Kemeruapan; Limpahan; Pasaran Ekuiti Islam; Prestasi;

SDG: MATLAMAT 8: Pekerjaan Baik dan Kemajuan Ekonomi



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Your kindness is truly appreciated, and I wish you all the best of luck in your future endeavors. May you achieve all your goals and continue to find success in your respective fields.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

ACF	Autocorrelation Function
ADF	Augmented Dickey-Fuller
ARDL	Autoregressive Distributed Lag
ARIMA	Autoregressive Integrated Moving Average
ASEAN	Association of South East Asian
BHC	MSCI Bahrain Index
BHI	MSCI Bahrain Islamic Index
CAPM	Capital Asset Pricing Model
CEM	Conventional Equity Market
CHC	Shanghai Composite Index
CHI	FTSE Shariah Index, China
COVID-19	Coronavirus pandemic
CWT	Continuous Wavelet Transform
DCC	Dynamic conditional Correlation
DJIM	Dow Jones Islamic Market Index
DWT	Discrete Wavelet Transform
EGARCH	Exponential Generalized Autoregressive Conditional Heteroskedasticity
EMH	Efficient Market Hypothesis
FTSE	Financial Time Stock Exchange
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GCC	Gulf Cooperation Council
GFC	Global Financial Crisis
ICM	Islamic Capital Market

IDC	IDX Composite Index
IDI	Jakarta SE Islamic
IEM	Islamic Equity Market
IF	Islamic Finance
IFDI	Islamic Finance Development Indicator
IFSI	Islamic Financial Services Industry
JII	Jakarta Islamic Index
KLCI	Kuala Lumpur Composite Index
MENA	Middle East and North Africa
M-GARCH	Multivariate Generalized Autoregressive Conditional Heteroscedasticity
MODWT	Maximal Overlap Discrete Wavelet Transform
MPT	Modern Portfolio Theory
ACWI	MSCI All-Country World indexes
MYC	FTSE Bursa Malaysia KLCI Index
MYI	FTSE Bursa Malaysia Hijrah Shariah Index
PACF	Partial Autocorrelation Function
PP	Phillips-Perron
SAB	Shariah Advisory Board
SAC	Saudi Tadawul All Share Index
SAI	S&P Saudi Arabia Shariah Index
SR	Sharpe Ratio
TR	Treynor Ratio
TVP-VAR	Time-Varying Parameter Vector Autoregressions
UAC	MSCI UAE Index
UAE	United Arab Emirates

UAI	MSCI UAE Islamic Index
USC	US Dow Jones Composite Index
USI	Dow Jones Islamic Index, US
VAR	Vector Auto Regression
WCT	Wavelet Coherence Transform
WRC	MSCI All-Country World Conventional Index
WRI	MSCI All-Country World Islamic Index



CHAPTER 1

INTRODUCTION

This chapter is structured into eight sections, beginning with an overview of the research background. Following this, the problem statement is articulated. The third and fourth sections delineate the research objectives and corresponding research questions. Subsequently, the significance and scope of the research are examined. The chapter concludes with an outline of the research organisation and a summary of the chapter.

1.1 Background of study

The global financial markets, both conventional and Islamic, faced unprecedented challenges during the Coronavirus pandemic (COVID-19), leading to economic contraction, lifestyle changes, increased global interconnectedness and heightened market disturbances. Market circuit-breakers were triggered in the United States multiple times in March 2020, with global markets experiencing elevated volatility (Contessi & De Pace, 2021). The pandemic evolved into a financial and economic crisis comparable to the 2007 Global Financial Crisis (GFC) (Goodell, 2020). In response, many countries implemented urgent monetary and fiscal stimulus packages, including lockdowns and social isolation policies (Baig et al., 2021).

The Islamic equity markets (IEM) then gained popularity as a safe-haven during the GFC crisis (Kang et al., 2023), necessitating a comprehensive understanding of

volatility, spillover, cointegration and performance of conventional and Islamic indexes. Over the past three decades, Islamic Finance (IF) assets have dramatically increased, reaching \$4.00 trillion in 2021 and projected to reach \$5.90 trillion in 2026 (Islamic Financial Services Board, 2022). However, it remains essential to recognise the relatively small size of IF compared to Conventional Finance, which calls for caution in interpretation. While the growth rate is remarkable within Islamic finance, its market size remains relatively small compared to conventional financial markets (Islamic Financial Services Board, 2022). Yet, Islamic finance has gained favour among non-Muslim investors, emerging as a pivotal tool for portfolio diversification.

Islamic financial instruments follow Shariah law, incorporating moral and monetary constraints, such as the prohibition of gambling, interest-bearing and risky business dealings. The absence of risk transfer and emphasis on risk sharing has made Islamic financial products potentially resilient during financial crises (Hasan et al., 2021). However, studies on the dynamics of IEM and conventional equity markets (CEM) during crises provide inconclusive results, with some supporting the safe-haven hypothesis (Alahouel & Loukil, 2021; Alqaralleh & Abuhowmmous, 2021; Haroon et al., 2021; Mandaci & Cagli, 2021b; Shahzad & Naifar, 2022) while others contradicting it (Anas et al., 2020; Bugar et al., 2022; K. Hassan et al., 2020).

The unique causes of the COVID-19 pandemic, distinct from the 2007 GFC, may alter the response of equity markets to safe havens. While the GFC resulted from irresponsible lending practices, Islamic finance's adherence to Shariah principles may provide some protection during the GFC crisis (K. Hassan et al., 2020). Hence, the COVID-19 pandemic is presumed to have less impact on Islamic assets, which may

provide investors with some protection during the crisis. Nevertheless, the volatile shift in the economy by the COVID-19 pandemic has prompted concerns about the sustainability of Shariah assets. As a result, assessing the IEM and CEM's response to this unique COVID-19 exogenous crisis and comparing it to the GFC becomes crucial. Extant academic evidence attests to the popularity of IEM, particularly after the 2007 GFC, with studies suggesting its outperformance during crises (Bossman et al., 2022; Ng et al., 2020). However, the current status of IEM as a "safe haven" during the COVID-19 crisis remains inconclusive, prompting the need for further investigation.

Aligned with Malaysia's Capital Market Masterplan 3 (CMP3), the nation has demonstrated economic resilience, fostering substantial growth in debt and equity-based financing (Securities Commission, 2021). Despite the growth, Malaysia has seen a decline in initial public offerings (IPOs) in the past decade (Securities Commission, 2022), influenced by companies delaying public offerings to maintain private status. While Malaysia leads in the number of listed companies among ASEAN nations, its market capitalisation has declined since 2015, raising concerns about diversification and risk stability, as depicted in Figure 1.1 (CEID Data, 2023).

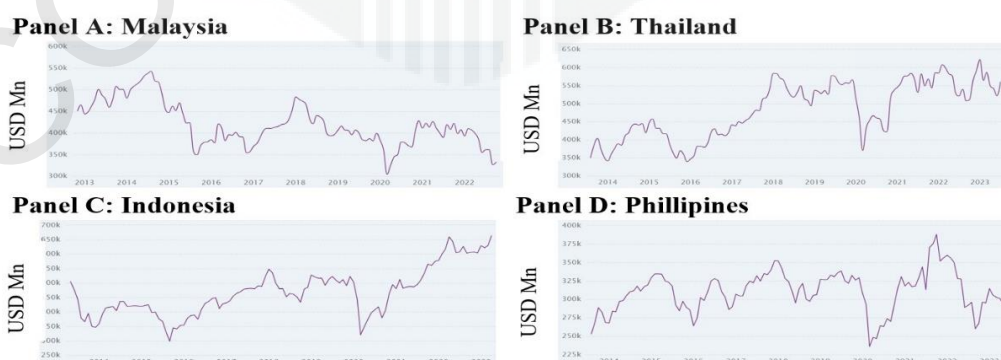


Figure 1.1: Market Capitalisation in Malaysia, Thailand, Indonesia and Philippines (USD Mn)
(Source: CEID Data, 2023)

The Malaysia Blueprint for Financial Sector 2022-2026 and the 12th Malaysia Plan outline strategies to position Malaysia as a regional financial hub (Bank Negara Malaysia, 2022; Ministry of Economy, 2021). These include increasing investor participation, attracting foreign investment, promoting innovation and supporting economic growth, with a focus on financing transformation, digitalisation, as well as green and Islamic finances (Ministry of Economy, 2021).

Investment decisions hinge on risk and returns, leading investors to adopt diversification strategies. International diversification is crucial for various market participants, while a comprehensive understanding of international volatility spillover, integration and asset performance is essential for effective risk management and portfolio allocation. This study extends several financial theories and employs various analytical tools to enhance investors' returns.

Given the increasing importance of Islamic finance and the need for a better understanding of its risk-return characteristics, the next section briefly introduces the concepts of volatility, spillover and contagion in CEM and IEM.

1.1.1 Volatility, spillover and contagion

Since the 1990s, financial liberalisation in developing nations has heightened globalisation and economic integration, making volatility spillover and contagion effects crucial for research (Bossman et al., 2022). During crises, investors' fear intensifies, triggering sell-offs, particularly in riskier assets affected by volatility shocks (Aloui et al., 2022). Volatility is a key measure for price discovery and financial

asset risk management, garnering significant attention in financial market research (Rusmita et al., 2020).

Preceding the GFC, excessive leverage in conventional markets amplified risk, leading to the GFC's aftermath with property bubbles, Lehman Brothers' bankruptcy, unemployment spikes and international trade reductions (Ng et al., 2020). Post-GFC, Islamic financial products were explored as alternatives, prompting an investigation into equity market volatility, a vital area for policymakers, academics, practitioners and investors. Stock price fluctuations are inherent, while markets experience volatility due to globalisation, economic integration and contagion, as apparent in the Lehman Brothers' insolvency in 2008 (K. Hassan et al., 2020).

The Efficient Market Hypothesis (EMH) underlies explanations of market volatility, suggesting that efficient markets incorporate all available information, making market prices unpredictable (Fama, 1970). Comprehension of the relationship between volatility and spillovers across markets with different characteristics aids resource allocation and assists investors in portfolio decision-making. Market volatility, while enabling speculators to profit, also contributes to market efficiency by eliminating short-term speculators. Speculators' behaviours enhance market efficiency by improving information and allocation dimensions in financial markets (S. Abdullahi, 2020).

Considering the controversy in previous studies on the decoupling hypothesis of IEM from CEM and the significance of IF, it becomes pertinent to examine volatility

transmission characteristics across IEM and CEM during a crisis to explore the phenomena of decoupling in the next sections.

1.1.2 Volatility spillover of the IEM and CEM

The concept of volatility spillover is intricately linked to the contagion and decoupling hypothesis, defined as the transmission of spillover shocks from one equity market to another, which influences changes in returns of the recipient market based on the returns of the origin market (Shabri et al., 2018). Notably, Shahzad and Naifar (2022) support the decoupling hypothesis, highlighting distinct behaviours of IEM and CEM during normal and crisis periods. Haroon et al. (2021) suggested that Islamic equities entail lower systematic risks, offering diversification benefits, while Alqaralleh and Abuhowmmous (2021) identified Islamic equities as safe havens for short-term investors seeking global portfolio diversification during crises.

Contrastingly, Bagan et al. (2022) found limited diversification benefits from IEM during turbulent periods, implying restricted performance improvement for portfolios incorporating Islamic assets. Furthermore, Hasan et al. (2021) rejected the decoupling hypothesis, asserting strong comovement between Islamic and conventional markets, thus challenging the notion of Shariah screening procedures providing a safe haven characteristic for Islamic assets during turbulence. Additionally, Jawadi et al. (2021) discovered that IEMs are not more resilient than CEMs during the COVID-19 crisis.

Given the conflicting findings, it is imperative to investigate volatility transmission characteristics between IEM and CEM during crises to comprehend the phenomena of

decoupling. Despite the debate on the decoupling hypothesis, the increasing integration of global financial markets prompts an examination of how it influences volatility transmission between IEM and CEM. The subsequent section delves into the market integration of IEM and CEM, exploring its implications for portfolio diversification and hedging strategies.

1.1.3 Market integration of IEM and CEM

Technological advancements, financial innovation and the removal of investment barriers contribute to the integration of global financial markets, impacting the portfolio diversification strategies of international market participants (Abdul Karim & Abdul-Rahman, 2020). Recent research by Adekoya et al. (2022) highlighted strong integration and high spillover between IEM and CEM in various sectors and countries, with IEM demonstrating greater stability and lower exposure to risks. Meanwhile, Sahabuddin et al. (2022) emphasised the robust long-term co-movement between IEM and CEM, which involved a lead-lag relationship in Bangladesh from 2014 to 2019.

While there are mixed findings on the performance of IEM relative to CEM, the increasing integration of global financial markets prompts inquiry into whether IEM can still offer diversification benefits and outperform CEM, particularly in turbulent periods. The next section investigates the performance of IEM and CEM during different market conditions.

1.1.4 Performance of IEM and CEM

Islamic equities, known for their unique characteristics, are considered by some researchers as an alternative for portfolio diversification owing to their lower leverage and asset-backed nature. During the GFC, Islamic equities demonstrated notable outperformance in risk-adjusted terms (Balli et al., 2019; S. Karim & Naeem, 2022; Shahzad et al., 2018), showcasing the resilience of Islamic finance principles during economic turmoil.

Controversial findings exist in this area, with studies supporting the outperformance of IEM over CEM. Mirza et al. (2022) found that IEM outperformed CEM even at the peak of COVID-19, with Islamic equities acting as safe havens. Shear and Ashraf (2022) observed milder reactions to shocks in Shariah-compliant equities, reinforcing their role as safe havens. In the same vein, Hassan et al. (2022) also indicated the general outperformance of Islamic markets, emphasising the resilience of IEM.

In contrast, Suryadi et al. (2021) concluded that IEM (JII) performed worse than CEM (IDX30) from 2017 to 2019. El Khamlichi et al. (2021) found that CEM outperformed IEM in emerging markets from 2002 to 2016. In another study, Abadi and Silva (2020) suggested that Islamic fundamental weighted portfolios do not shield against losses in turmoil crises in the Middle East and North Africa from 2005 to 2015. While the performance of IEM relative to CEM varies, non-financial factors, such as social environments and religion, may influence equity market participants and impact market performance.

1.1.5 Non-financial factors

Non-financial factors, including different social environments and religion, might be among the factors affecting the equity market's participants' behaviours, which eventually drive the equity market's behaviours. According to the Pew Research Centre (2017), Islam has the fastest rate of growth in the world and is projected to be the largest by 2075, overtaking Christianity. As of 2022, Muslims are projected at 24.9% (roughly 1.97 billion) of the world's population, with the Islamic population growing twice the rate of other populations and a majority (62%) of them living in the Asia Pacific (World Population Review & Review, 2022). This number clearly suggests the crucial role held by the Muslim population in the global economy.

The increase in the Muslim population and the growing significance of Islamic finance have spurred the creation of IEM, tailored to cater to the requirements of Shariah-compliant investors. Further exploration of Islamic finance and the growth of IF is presented in the subsequent section.

1.1.6 Islamic finance and the growth of IF

Islamic Finance (IF) involves the provision of financial services in accordance with Islamic law, ethics and regulations, prohibiting transactions related to interest ("riba"), games of chance or gambling ("maysir"), excessive risk and uncertainty ("gharar"), short sales and destructive financing activities (Yahya et al., 2021). Participants in IEM must adhere to Shariah-compliance criteria, excluding firms involved in indecent activities, such as alcoholic food and beverages, tobacco, non-Islamic insurance and

financial products/services, pork products, weapons and disallowed entertainment (Bugan et al., 2022). This distinctive approach to Islamic financial markets, based on a quantitative and qualitative ethical framework, differs fundamentally from conventional markets, impacting portfolio diversification benefits, integration and performance. The growth of IF has given rise to IEM, enabling investors to engage in Shariah-compliant investment practices.

The expansion of IF is evident in the Global Islamic Financial Services Industry (IFSI), where global Islamic financial assets reached \$4.00 trillion in 2021 and are projected to reach \$5.90 trillion by 2026 (ICD-Refinitiv, 2022). The Islamic banking segment accounts for 68.2%, while the Islamic capital market accounts for 30.9% of the global IFSI assets (Islamic Financial Services Board, 2022).

Figure 1.2 depicts the growth of Islamic finance assets from 2014 to 2021, reporting a steady annual growth rate of 11.38% since 2009, reaching nearly US\$3 trillion in 2020. However, the growth rate has slowed to 6.54% in the previous five years due to the impact of the pandemic (World Bank Group, 2021).

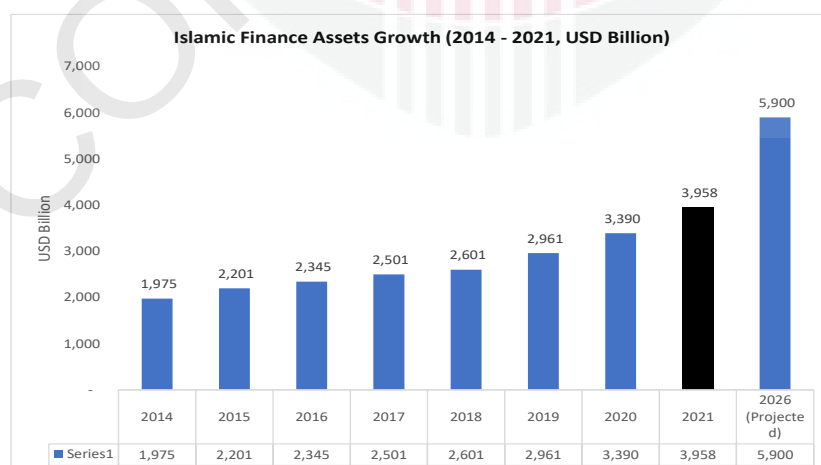


Figure 1.2: The Growth of Islamic Finance Assets (2014 -2021, USD Billion)
(Source: IFDI, 2022)

Therefore, the extraordinary growth of the durability and progress of the Islamic financial market has attracted investors around the globe (Bugan et al., 2022).

1.1.7 Shariah overview

From the Islamic point of view, Shariah or Islamic law is a guideline, path and permissible system guiding the Muslim day-to-day life in Islam to the right path, which is governed by Allah (Shinkafi et al., 2017). Shariah is also associated with “ad-din”, which means submission to the religion, trusting and pursuing rightness in accordance with Shariah. Hence, Shariah, as a way of life, incorporates all features of life, including personal, religious, ethical, political, commercial, financial and societal. The bases of Shariah are derivative of the Qur’an, Sunnah, Ijma, Qiyas and Ijtihad.

1.1.8 Islamic Capital Market

During the GFC, the Islamic Capital Market (ICM) experienced exponential expansion due to the rising demand from international market players for Shariah-compliant assets. Since then, ICM has become a successful parallel market along with conventional counterparts in many countries in mobilising and allocating capital funds efficiently. There are increasingly more non-Muslim market participants investing in Islamic assets, taking advantage of the unique Shariah screening, as well as the stability of Islamic instruments shown in the GFC (Bahloul et al., 2017).

Similar to the conventional capital market, ICM also acts as an intermediary in allocating capital funds from surplus entities to deficit entities. The difference between

them is in the perspective of ethics, morality and core values, whereby transactions must comply with the Shariah and Muslims' beliefs. Therefore, ICM plays an important role in capital mobilisation and allocation of Shariah-compliant financial assets.

1.1.9 Islamic capital market vs. conventional capital market

The Shariah framework was established by the Shariah Advisory Board (SAB) (Rusmita et al., 2020), prohibiting the engagement of “haram” (forbidden) transactions for ICM, while their elements of interest (“riba”), games of chance or gambling (“maysir”), or excessive risk and uncertainty (“gharar”) might exist in the transaction of the conventional capital market.

ICM is mainly divided into the Sukuk (debt) market, Shariah-compliant derivatives and the equity market. Sukuk is normally employed to finance long-term infrastructures, whereas the IEM is for capital raising exercises for Shariah-compliant assets. Sukuk differs from conventional bonds that are debt contract-based (Paltrinieri et al., 2019). Sukuk is supported by the real underlying assets based on a risk-sharing contract. The main objective of Sukuk is to create real assets and distributable incomes from businesses. IEMs are inclusive of Shariah-compliant indexes, Islamic securities and unit trusts, Islamic venture capital, Islamic EFT, Islamic REITs, Islamic fund management, Islamic structured products and Islamic stock broking.

1.1.10 The history of the global Islamic capital market

The origin of Islamic finance traces back to the early 1960s in Egypt, where a pioneering bank introduced the Islamic banking system. The Mit-Ghamr Islamic Saving Association spearheaded this initiative, organising the savings of Muslim depositors and generating revenues in alignment with Shariah principles (Orhan, 2018). Subsequently, in 1963, Malaysia established the Pilgrims Fund Corporation, Tabung Haji, dedicated to financing the Hajj pilgrimage to Mecca through Shariah-compliant investments. As of FY2022, Tabung Haji reported 8.77 million depositors and RM87.6 billion in investments (Tabung Haji, 2023).

Responding to the exponential growth of the Islamic finance industry, prominent global financial index service providers created indices tailored to meet the requirements of this specialised market. The DJIM index, inaugurated in 1999, stands out as the first global Shariah-compliant index provider (Asutay et al., 2021). Subsequently, financial giants, such as the Financial Times Stock Exchange (FTSE), Morgan Stanley Capital International (MSCI), as well as Standard and Poor's (S&P), among others, introduced indices comprising Shariah-compliant firms. Among various Islamic indices available, the DJIM index has become a widely used source of comprehensive time-series data for Shariah-compliant firms within academic circles (Asutay et al., 2021).

The robust expansion of the Islamic Capital Market is credited to its well-established legal, regulatory and Shariah framework, which encompasses a Shariah stock screening methodology to guarantee the Shariah compliance of investable stocks.

Details regarding the Shariah screening process of the researched variables are expounded upon in the subsequent section.

1.1.11 Shariah screening of FTSE Bursa Malaysia Hijrah Shariah Index

Malaysia has become a global Islamic finance leader through its robust legal, regulatory and Shariah framework, resulting in a strong ICM. Holding the world record, Malaysia has ranked first in the ICD-Refinitiv Islamic Finance Development Indicator (IFDI) Report 2022 for ten consecutive years (ICD-Refinitiv, 2022). The State of the Global Islamic Economy (SGIE) Report 2022 further underscored Malaysia's leadership in the overall Global Islamic Economic Indicator across various sectors (Institut Kefahaman Islam Malaysia, 2023). Additionally, Malaysia topped the 2023 Islamic Well-being Index for Muslim Countries, indicating its superior well-being compared to other Muslim-majority nations, particularly post-COVID (Institut Kefahaman Islam Malaysia, 2023).

Malaysia's financial landscape is marked by a substantial presence of leading Islamic fund management and stockbroking entities, offering Shariah-compliant financial products. The ICM has exhibited remarkable growth, consistently surpassing its conventional counterpart, as evidenced by double-digit increases in the market capitalisation of Shariah-compliant equities and the net asset value of unit trust funds (Islamic Financial Services Board, 2022). This growth is predominantly attributed to the confidence inspired by the ICM's robust Shariah governance measures.

The Shariah stock screening methodology, implemented since the mid-1990s and aligned with global standards, employs a comprehensive approach that combines quantitative and qualitative assessments. Shariah screening, rooted in surah al-Mukminun verse 51 of the Quran, is a systematic process that focuses on identifying Shariah-compliant stocks in adherence to Islamic law, principles and rules. This process delineates quantitative and qualitative criteria (Zainudin et al., 2016).

The qualitative screening criteria established by the Shariah Advisory Council of the Securities Commission for firms involved in mixed businesses encompass two essential aspects. Firstly, an emphasis is given on maintaining a reputable and righteous image. Secondly, the primary businesses of the firm are expected to contribute to the general welfare (maslahah) of the Muslim community. These qualitative benchmarks serve as integral elements in the assessment process, ensuring that firms engaging in mixed activities align with Shariah principles and objectives.

Quantitative screening criteria establish benchmarks in the Shariah quantitative screening process (Zainudin et al., 2016):

1. A 5% benchmark for obviously forbidden functions, such as investment in conventional banks, pork, liquor and gambling, with a cap on income from these functions not exceeding 5% of total revenue.

2. A 20% benchmark for revenue from rental expenses through non-compliant premises, where income comprising permissible and prohibited elements should not exceed 20% of total revenue.

The financial ratios subjected to scrutiny include the Cash-to-Total Assets Ratio, with a 33% threshold for compliance with riba-related elements, while the Debt-to-Total Assets Ratio, which should remain below 33%, considers only interest-bearing debt and excludes Islamic debt/financing or sukuk.

1.1.12 Shariah Screening of Jakarta SE Islamic Index

Governed by Law Number 8 Year 1995 on the Capital Market, the Indonesian Sharia Capital Market operates under the regulatory framework outlined in Bapepam-LK Rule Number IX.A.13 (Otoritas Jasa Keuangan, 2017), which specifically addresses the development of Sharia-compliant financial instruments with a primary focus on Sharia Securities, including Sharia Stocks, Sukuk and Sharia Mutual Funds. Adherence to Sharia principles in contractual arrangements and issuance methods is a fundamental requirement for these financial products.

Sharia Stocks, based on musyarakah or syirkah principles, represent ownership shares in a company, entitling holders to assets and earnings. However, not all stocks automatically meet Sharia compliance; stringent criteria detailed in Bapepam-LK Rule Number IX.A.13 must be met. Companies issuing Sharia Stocks must explicitly declare their commitment to Sharia principles in business activities and management, as stipulated in their articles of association. Additionally, Sharia Stocks must meet specific compliance criteria, including alignment with Islamic finance principles, maintaining a debt-to-asset ratio below 45% and ensuring that non-permissible contribution income to total revenue remains under 10% (Otoritas Jasa Keuangan, 2017).

1.1.13 Shariah screening for S&P Saudi Arabia Shariah Index

The S&P Saudi Arabia Shariah Index functions as a benchmark for Shariah-compliant investments, offering a transparent and systematic approach to screening and index construction (Standard & Poor's, 2007). This section outlines the screening procedures employed to guarantee adherence to Islamic principles, covering sector-based and accounting-based criteria. In the sector-based screening process, deliberate efforts are made to exclude businesses involved in non-Shariah compliant activities. Prohibited sectors include advertising and media, alcohol, embryonic or stem cell research, cloning, financials, gambling, pork, pornography, tobacco and deferred trading of gold and silver.

Following the removal of non-compliant businesses, the remaining companies undergo scrutiny based on financial ratios related to leverage, cash and revenue share from non-compliant activities. Leverage compliance is gauged by assessing the ratio of debt to the market value of equity over a 36-month period, with a predefined threshold set at less than 33%. Cash compliance involves evaluating ratios, such as accounts receivables to the market value of equity and the sum of cash and interest-bearing securities to the market value of equity over a 36-month period, with thresholds set at less than 49% and less than 33%, respectively. Permissible revenue share from non-compliant activities is determined by assessing the ratio of non-permissible income (excluding interest income) to total revenue, with a stipulated threshold of less than 5%. Investors are provided with a dividend purification ratio calculated as dividends multiplied by the ratio of non-permissible revenue to total revenue, serving purification purposes (Standard & Poor's, 2007).

1.1.14 Shariah screening for Dow Jones US Islamic Index

The Shariah Supervisory Board, tasked with aligning parameters in accordance with Shariah law, formulates guidelines to discern businesses incongruent with Islamic investment (S&P Dow Jones Indices, 2024). Within the framework of sector-based screening, enterprises involved in alcohol production, tobacco, recreational cannabis products, pork-related products, conventional financial services, weapons and defence, as well as entertainment, are deemed non-compliant. The Financial and Real Estate Categories encompass companies categorised under Financial (8000) and Real Estate (8600), which are deemed eligible if they function as Islamic Financial Institutions or operate in accordance with Shariah principles.

Following the exclusion of companies engaged in impermissible primary activities, the remaining equities undergo scrutiny based on the Accounting-Based Leverage Compliance Screen. This filter ensures that the ratio of total interest-bearing debt to the trailing 24-month average market capitalisation remains below 33%. The Dividend Purification Ratio computes dividends multiplied by the ratio of non-permissible revenue to total revenue, offering a metric for adherence to Shariah principles (S&P Dow Jones Indices, 2024).

1.1.15 Shariah screening for FTSE Shariah Index, China

The FTSE Global Equity Shariah Index Series is strategically formulated to serve as the foundational framework for Shariah-compliant investment products catering to the global Islamic investor community. It utilises Large and Mid-Cap stocks from the

FTSE Global Equity Index Series as its primary constituent pool (FTSE Russell, 2024). A meticulous screening process is subsequently applied, aligning with explicit Shariah principles. Yasaar Limited is entrusted with the responsibility of conducting the Shariah screening, thereby establishing a series of indices that adhere to Shariah principles.

The initial screening involves the exclusion of companies engaged in activities deemed non-Shariah-compliant, such as conventional finance (non-Islamic banking, finance, and insurance), alcohol, pork-related products, non-halal food production, packaging, and processing, as well as entertainment (casinos, gambling and pornography), tobacco, weapons, arms and defence manufacturing.

Following business activity screening, the remaining companies undergo a rigorous financial analysis based on predefined criteria for Shariah compliance. The financial ratios considered include debt constituting less than 33.333% of total assets, cash and interest-bearing items amounting to less than 33.333% of total assets, accounts receivable and cash comprising less than 50% of total assets, while the cumulative total of interest and non-compliant activities income not exceeding 5% of total revenue (FTSE Russell, 2024).

1.1.16 Shariah screening for MSCI Bahrain, UAE, ACWI Islamic Indexes

The financial ratio screening process is an integral component in aligning companies' financial health with Islamic principles. Three critical ratios are considered with predefined thresholds. Firstly, the total debt over total assets ratio should not exceed

33.33%, with a maximum limit set at 30.00%. Secondly, the sum of cash and interest-bearing securities over total assets is subject to a threshold of 33.33%, not surpassing 30.00%. Lastly, the sum of accounts receivables and cash over total assets should not go beyond 33.33%, with a maximum limit of 30.00% (MSCI Inc., 2024).

The final aspect of this process involves the purification of dividends, a crucial step in ensuring financial compliance. This purification process mandates that dividends distributed by companies undergo scrutiny, eliminating any income derived from prohibited activities and interest income from the overall earnings.

1.2 Problem statement

There have been a handful of studies that have researched the volatility, spillover, integration and performance of the IEM compared to CEM. Some of the studies' evidence in the literature concluded that IEM outperformed CEM during predicament periods (Asutay et al., 2021; Balli et al., 2019; S. Karim & Naeem, 2022; Shahzad et al., 2018). In one of the aforementioned studies, Asutay et al. (2021) documented the outperformance of Islamic indices over conventional indices across diverse regions during the GFC from 2007 to 2009. More specifically, within the challenging context of this period, Islamic indexes in the US market yielded an average return of -0.0034, coupled with a remarkably low standard deviation of 0.0381. Conversely, conventional indices demonstrated increased volatility alongside diminished average returns. The outperformance of IEM is induced by the fundamentals of Shariah laws. The law prohibited any elements of riba (usury), maisir (gambling), gharar (ambiguity), sharing of rewards and risks, as well as investing in prohibited immoral industries, which may

provide an alternative instrument for investors to manage the systematic risks (Hasan, Mahi, et al., 2021).

Global Islamic funds have seen substantial growth, reaching approximately USD 200 billion in asset management, with the rise of Environmental, Social and Governance (ESG) considerations (ICD-Refinitiv, 2022). Despite inconclusive findings on the interdependencies between IEM and CEM (Delle Foglie & Panetta, 2020), existing studies (Balli et al., 2019; S. Karim & Naeem, 2022; Shahzad et al., 2018) advocate for the benefits of IEM, serving as effective tools for risk mitigation and portfolio diversification.

In response to increased demand, institutional asset management bodies are integrating Islamic equities into their portfolios alongside conventional assets. This trend arises from concerns over excessive risks in conventional equities, heightened correlation among conventional assets, the growing Muslim population, as well as the perceived safety of Islamic instruments (Delle Foglie & Panetta, 2020; Hassan et al., 2020; Balli et al., 2019; Shahzad et al., 2018).

While existing research is delineated in the aforementioned references, predominantly focusing on the volatility, integration and performance of IEM in comparison to CEM, this study aims to identify the sources of decoupling and integration between IEM and CEM (Anas et al., 2020). By comparing and combining both markets, it seeks to provide comprehensive insights into portfolio optimisation decisions and enhance the completeness of financial markets.

The study includes countries with diverse religious backgrounds to address the practical gap in understanding international financial contagion, especially considering the impact of COVID-19. Existing evidence on the influence of COVID-19 remains inconclusive, with some studies reporting adverse effects (Ashraf, 2020; M. K. Hassan et al., 2022; Sharif et al., 2020; Yarovaya et al., 2021), while others yielding inconclusive results (Onali, 2020).

Besides, the decline in IPO activity and shrinking market capitalisation in the Malaysian equity market indicate a lack of diversification and stability for investors (Securities Commission, 2022). Despite having a large number of listed companies, the market's low fundraising activity raises concerns. In 2022, Southeast Asia saw a total of 137 IPOs, collectively raising \$6.5 billion. Among the standout performers in this region, Indonesia took the lead with 60 IPOs raising \$2.2 billion, followed by Thailand with 32 IPOs generating \$3.1 billion, and Malaysia contributing 29 IPOs that generated \$0.7 billion (EY Malaysia, 2023). Hence, the Malaysian government has outlined plans to develop the capital market and attract foreign investment (Bank Negara Malaysia, 2022; Ministry of Economy, 2021), which might require some time for these plans to come to fruition. In light of these challenges, investors are encouraged to explore international equity markets to enhance portfolio diversification, reduce risk and potentially improve returns.

The ongoing debate on portfolio optimisation and risk management originated in the 1950s prompts the need for effective strategies. Portfolio diversification is crucial for managing risk, yet constructing an optimal portfolio remains challenging. This study explores opportunities for diversification within the international equity market,

considering volatility, spillover, integration and performance in CEM and IEM. It uses efficient frontier analysis to optimise a mixed portfolio, offering a unique perspective by considering time and frequency domains encompassing over 16 years.

This research aims to address the practical gap in understanding international financial contagion, particularly amid the impact of COVID-19, emphasising the need for diversification in the Malaysian equity market and contributing valuable insights to the ongoing debate on portfolio optimisation and risk management for investors and asset managers navigating a dynamic financial landscape.

1.3 Research objectives

The main objective of this study is to investigate the volatility, spillover, integration and performance between Malaysia's IEM and CEM, compared to the Association of South East Asian (ASEAN) nation of Indonesia, Gulf Cooperation Council (GCC) countries, including Bahrain, Saudi Arabia and UAE, alongside international sample countries like the United States, China and MSCI All-Countries World indexes.

The specific objectives of this study are:

1. To explore the volatility behaviours of Malaysian IEM and CEM and their spillover behaviours with selected equity markets.
2. To investigate the dynamics of integrations between the Malaysian CEM and IEM with selected equity markets.
3. To appraise the performance between the Malaysian IEM and CEM with selected equity markets.

1.4 Research questions

Corresponded to the Research objective above, the following are the respective research questions:

1. What are the volatility behaviours of Malaysian IEM and CEM and their spillover behaviours with selected equity markets?
2. What are the dynamic integration behaviours of Malaysian IEM and CEM with selected equity markets?
3. What are the comparative performances of Malaysian IEM and CEM with selected equity markets?

1.5 Significance of the study

This study holds significance across three dimensions. Firstly, it enriches the academic and body of knowledge base, elevating ongoing scholarly discussions. Secondly, its practical relevance lies in providing valuable insights and solutions applicable to real-world situations. Lastly, the study bears importance in shaping policies, laying the groundwork for informed decision-making and policy formulation in pertinent domains.

1.5.1 Academic and body of knowledge significance

This study aims to contribute to the existing academic knowledge in finance by addressing theoretical gaps related to the volatility, spillover, integration and performance between IEM and CEM. Referencing the underpinning theories of EMH,

the decoupling hypothesis, MPT and CAPM, besides utilising univariate- and multivariate-GARCH models and innovative wavelet analyses, this study centres on understanding IEM's behaviours in diverse turmoil periods. Multi-resolution novel wavelet analyses, as recommended by Almansour (2021), are utilised to explore dynamic integration at various time scales. Drawing on the insights of Delle et al. (2020) and Shear & Ashraf (2022), this study combines IEM and CEM in Islamic countries and regions with diverse religious beliefs.

Furthermore, it investigates the sources of decoupling and integration following the suggestions of Anas et al. (2020). Beyond academic contributions, this study aspires to offer practical guidance to investors navigating volatile markets.

This research, propelled by the EMH, aims to furnish investors with actionable guidance for navigating turbulent markets. It endeavours to delve into strategic asset allocation strategies that are adaptable to volatile market environments and stable economic conditions. By leveraging insights from the EMH, this research seeks to equip investors with the tools and knowledge necessary to make informed decisions, thereby enhancing their ability to manage risk and capitalise on opportunities amidst market fluctuations. The ultimate goal is to empower academics, investors and policymakers with actionable knowledge that informs investment decisions and enhances risk management strategies.

1.5.2 Practical significance

The second major contribution of this research focuses on a broad array of stakeholders, particularly investors like portfolio managers, asset management companies and international investors. This study examines the response of conventional and Islamic equities to crises, providing valuable insights for portfolio managers responsible for investment decisions (Mandaci & Cagli, 2021b). These insights further empower portfolio managers to construct more resilient and diversified portfolios, effectively managing risks by understanding the reactions of different assets in times of crisis. Asset management companies tasked with optimising returns and navigating risk management complexities can significantly benefit from this research, enhancing their asset allocation strategies. By aiding clients in selecting investments resilient to market volatility, this study ultimately serves the interests of clients and stakeholders. International investors exploring opportunities across global markets, including Islamic finance, can gain distinctive insights into equity behaviours during crises to facilitate informed decisions on resource allocation.

The study emphasises the critical role of portfolio performance in investor profitability, advocating for comprehensive insights into investment decisions. Unlike previous studies with a time-domain approach, this research adopts a time-frequency domain analysis, considering various investment holding periods. The use of wavelet analysis across a heterogeneous time scale (4 to 1024 days) reveals dynamic co-movement relationships between different asset classes, hence aiding investors in maximising their capital market investments.

Furthermore, this research identifies suitable hedging mechanisms and safe-haven investments beneficial to all investor groups. Recognising assets likely to sustain or improve in value during crises becomes a crucial risk management tactic (Naeem et al., 2021). Armed with this information, investors can adeptly navigate turbulent market conditions to safeguard their investments.

1.5.3 Policy Significance

The third contribution involves supporting policymakers in fiscal and monetary decision-making, as well as predicting economic and financial stability while promptly addressing shocks. Given the accelerated occurrence of crises, an in-depth analysis of volatility, spillover, integration and performance in IEM and CEM aids regulatory bodies in risk management, hedging, as well as the development of Islamic products and strategies for financial stability.

Furthermore, the findings could assist policymakers in enhancing financial market completeness, fostering a conducive environment for IEM growth and fortifying resilience against crises. The ultimate contribution lies in promoting a nation's economic development and growth, recognising the pivotal roles played by equity markets in fund provisions and movements.

1.6 Scope of the study

This research investigates volatility spillover behaviours, integration and performance in ASEAN and GCC IEM and CEM compared to the USA, China and MSCI ACWI.

Sixteen major Islamic and conventional indexes were chosen for analysis owing to the prominence and activity of the selected countries. The diverse political, economic and legal contexts of these nations offer potential diversification benefits.

Strategically incorporating Malaysia into the study is imperative, thanks to its central role in Southeast Asia and its acknowledged status as a key hub for Asian markets. As a global leader in Islamic finance, Malaysia, which achieved the top position in the IFDI ranking in 2021 (ICD-Refinitiv, 2022), offers a distinctive vantage point for analysing Islamic securities. Malaysia's dynamic economy enhances overall research diversity, chosen not only for its economic significance but also for its strong financial market infrastructure.

This study spans from the GFC era to the COVID-19 period, covering notable events, including the introduction of the FTSE Bursa Malaysia Hijrah Shariah index in 2007. The dataset is structured for various analyses, with wavelet analysis employed owing to its ability to capture time and frequency domain properties without requiring segmentation, making it suitable for detecting structural breaks (Saiti et al., 2016).

1.7 Organisation of the research chapters

This study follows a structured framework, beginning with Chapter 1 introducing the research, laying the foundation and outlining the study's significance. Chapter 2 delves into a detailed literature review on volatility spillovers, market integration and IEM and CEM performance. In Chapter 3, the Research Methodology discusses variable selection, sample nation criteria and data-gathering procedures. The core of this study

resides in Chapter 4, presenting and analysing the results. Chapter 5 concludes the research, summarising key findings, emphasising their significance and underlining the study's contributions to the field.

1.8 Chapter Summary

This chapter has introduced the research topic, emphasising its importance and the need to explore risk diversification in international portfolios. It outlined the research problem, objectives, contributions and scope. The next chapter provides a comprehensive review of existing literature, covering foundational theories, research frameworks and hypotheses.

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