DIVERSIFICATION OF RISK IN MALAYSIAN CAPITAL MARKET ANALYSIS USING COMPOSITE AND SHARIAH MARKET INDEX PERFORMANCES

By

AMINAH BINTI SHARI

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

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August 2021

Chairman : **Associate Professor Fauziah binti Mahat, PhD**
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The study aims to achieve three objectives. Firstly, the study investigates the daily co-movement between risky assets (equity, bonds, commodity, and mutual funds) return and non-risky assets (treasury bills and money market funds) return towards composite and Shariah market indices for a capital market investment decision. Secondly, the study examines the dynamic co-movement trend between various risky assets and non-risky assets return towards composite and Shariah index to gain portfolio diversification benefits. Third, the study identifies the portfolio diversification benefits for risky and non-risky portfolios over different frequencies or investment horizons using analyses of Correlation-based, Multivariate-Generalized Autoregressive Conditional Heteroscedastic (MGARCH), Dynamic Conditional Correlations (DCCs), and Wavelet Coherence. The data was daily and spanned the period from 1 January 2007 to 6 February 2019. The study outcomes demonstrated that the co-movement between the risky and non-risky asset returns with composite and Shariah market indices varied timewise and was highly volatile. Additionally, the Maximal Overlap Discrete Wavelet Transform (MODWT) technique was implemented for study robustness.

The study findings revealed that, first, the results of Correlation analysis show a significant co-movement relationship between risky asset and non-risky asset returns and composite and Shariah market indices. Notably, the extent to which the elements were correlated differed based on duration and scale. The correlation coefficient showed that all sectoral equity indices were significantly and positively correlated with composite and Shariah index returns. A positive correlation was also perceived under the commodities and money market funds with composite and Shariah indices, whereas a negative connection was observed in bonds and treasury bills. Second, MGARCH-DCC results show that co-movement between risky and non-risky asset returns is time-varying and highly volatile. In terms of volatility, the result indicates that all non-risky assets are less volatile than risky assets investment. From the co-movement analysis, the Malaysian sukuk and money market funds denoted negative and unconditional relationships with the composite and Shariah market indices as a positive indicator of diversification advantages. Moreover, the conditional correlation trend of sectoral equities tends to comove with composite and Shariah market indices implying low diversification advantages. Third, the same outcomes measured with the wavelet coherence analysis also revealed that the co-movement between sectoral indices and Shariah market returns were positive under the time and frequency domains. Regardless, the coherence in the index pair of sectoral indices and market returns rose at a low-frequency scale (64 to 256 and 256 to 1024 days) from 2007 to 2019. All assets eventually attained correlation and revealed minimal portfolio diversification advantages. The bond and money market funds also indicated weak links for most frequency scales, recommending favorable diversification for fixed-income Malaysian investors (portfolio diversification) through bonds and money market fund investments. However, in the long run, both commodities and mutual funds markets are correlated, implying minimum portfolio diversification advantages. Lastly, the findings corresponded across various econometrics technique estimations. The results also potentially benefitted investors, portfolio managers, retailers, and institutional investors to improve portfolio diversification advantages.

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

KEPELBAGAIAN RISIKO DALAM ANALISIS PASARAN MODAL MALAYSIA DENGAN MENGGUNAKAN PRESTASI INDEKS PASARAN KOMPOSIT DAN SHARIAH

Oleh

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Kajian ini bertujuan untuk mencapai tiga objektif. Pertama, kajian ini mengkaji pergerakan harian antara pulangan harga aset berisiko (ekuiti, bon, komoditi, dan dana bersama) dan pulangan harga aset yang tidak berisiko (bil perbendaharaan dan dana pasaran wang) ke atas indeks pasaran komposit dan Syariah bagi menentukan pelaburan pasaran modal. Kedua, mengkaji aliran pergerakan dinamik antara pulangan harga aset berisiko dan aset yang tidak berisiko ke atas indeks pasaran komposit dan Syariah untuk mendapatkan faedah kepelbagaian portfolio. Ketiga, mengenal pasti faedah kepelbagaian portfolio untuk aset berisiko dan aset yang tidak berisiko berdasarkan kepada frekuensi yang berbeza atau cakerawala pelaburan dengan menggunakan analisis berdasarkan Korelasi, Generalisasi-Multivariat Autoregresif Heteroskedastik Bersyarat (MGARCH), Kolerasi Bersyarat Dinamik (DCCs), dan Koheren Gelombang. Data harian yang digunakan merangkumi jangka masa dari 1 Januari 2007 hingga 6 Februari 2019. Hasil kajian menunjukkan bahawa hubungan antara pulangan aset berisiko dan aset tidak berisiko dengan indeks pasaran komposit dan Syariah berbeza-beza mengikut masa dan sangat tidak menentu. Selain itu, teknik Transformasi Gelombang Diskrit Bertindih Maksimum (MODWT) dilaksanakan untuk memantapkan kajian.

Hasil kajian menunjukkan bahawa, pertama, hasil analisis Korelasi menunjukkan hubungan yang signifikan antara pulangan aset berisiko dan aset tidak berisiko dengan indeks pasaran komposit dan Syariah. Terutamanya, sejauh mana elemen yang dikorelasikan berbeza berdasarkan jangka masa dan skala. Pekali korelasi menunjukkan bahawa semua indeks sektor ekuiti berkorelasi secara signifikan dan positif dengan pulangan indeks komposit dan Syariah. Korelasi positif juga dikesan pada aset komoditi dan dana pasaran wang dengan indeks pasaran komposit dan Syariah, manakala hubungan negatif ditunjukkan oleh bon dan bil perbendaharaan. Kedua, hasil analisis MGARCH-DCC menunjukkan bahawa pergerakan antara pulangan aset berisiko dan aset tidak berisiko adalah berbeza-beza mengikut masa dan sangat tidak menentu. Dari sudut turun naik harga pasaran, hasil kajian menunjukkan bahawa semua pulangan aset tidak berisiko kurang stabil berbanding dengan pelaburan aset berisiko. Dari sudut analisis pergerakan, dana sukuk dan pasaran wang Malaysia menunjukkan hubungan negatif dan tanpa syarat dengan indeks pasaran komposit dan Syariah sekali gus memberi petunjuk positif tentang kelebihan kepelbagaian. Walau bagaimanapun, trend korelasi bersyarat bagi sektor ekuiti cenderung ke arah peningkatan seiring dengan kenaikan indeks pasaran komposit dan Syariah, justeru menunjukkan kelebihan kepelbagaian pada tahap yang rendah. Ketiga, hasil yang sama yang diukur dengan analisis Koheren Gelombang, menunjukkan bahawa korelasi antara indeks sektor dan pulangan pasaran Syariah adalah positif di bawah domain waktu dan frekuensi. Walau bagaimanapun, kesesuaian pasangan indeks sektor dan pulangan pasaran meningkat pada skala frekuensi rendah (64 hingga 256 dan 256 hingga 1024 hari) dari 2007 hingga 2019. Semua aset akhirnya mencapai korelasi dan menunjukkan kelebihan kepelbagaian portfolio pada tahap yang minimum. Hal ini juga menunjukkan bahawa bon dan dana pasaran wang mempunyai kaitan yang lemah untuk kebanyakan skala frekuensi, oleh itu kajian ini mengesyorkan kepelbagaian yang baik untuk pelabur Malaysia berpendapatan tetap (kepelbagaian portfolio) untuk mempelbagaikan portfolio pelaburan mereka melalui pelaburan bon dan dana pasaran wang. Walau bagaimanapun, dalam jangka panjang, kedua-dua aset iaitu komoditi dan pasaran dana bersama akhirnya berkorelasi sekali gus menunjukkan kelebihan kepelbagaian portfolio pada tahap yang minimum. Akhir sekali, dapatan ini sesuai dengan pelbagai anggaran teknik ekonometrik. Hasilnya juga berpotensi untuk menguntungkan pelabur, pengurus portfolio, peruncit, dan pelabur institusi dalam meningkatkan kelebihan kepelbagaian portfolio.

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LIST OF ABBREVIATIONS

MGARCH	Multivariate Generalized Autoregressive Conditional Heteroskedasticity
DCC	Dynamic Conditional Correlations
DWT	Discrete Wavelet Transform
MODWT	Maximal Overlap Discrete Wavelet Transform

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter provides a brief explanation of the study. Following the introduction, section 1.2 presents the study's background, while section 1.3 specifies the research problems. The subsequent sections of 1.4 and 1.5 outline the research questions and research objectives. Then, sections 1.6 and 1.7 describe the study's significance and scope; meanwhile, section 1.8 presents the study's overall structure. Finally, section 1.9 provides the chapter summary.

1.2 Background of the study

The capital market in the emerging market, particularly in Malaysia, has high global and international growth since the development of financial assets. Usually, retails and institutional investors will invest in various financial assets, namely equities, bonds, and real estate investment, to generate capital to accumulate wealth (Che & Liebenberg, 2017). There has been remarkable research development on diversification and performance, and risk and diversification during the last decade. Malaysia recorded the lowest risk-return profile in 2000 until 2010 compared to other selected markets, namely Tokyo, Shanghai, Mumbai, Jakarta, Korea, Philippines, New York, and Singapore (Securities Commission Malaysia, 2016). It shows that our neighboring countries, namely Indonesia, Singapore, and the Philippines, are more advanced in risk and return in the capital market. The analysis of the capital market has been a prominent issue for economic growth. On top of that, the fund raised from the Malaysian capital market is the largest allocation in respect to other Association of Southeast Asian Nations (ASEAN) countries, namely the Philippines, Vietnam, Thailand, Indonesia, and Singapore, during the Second Malaysia Capital Market Plan as of 31 December 2015 as shown in Figure 1.1.

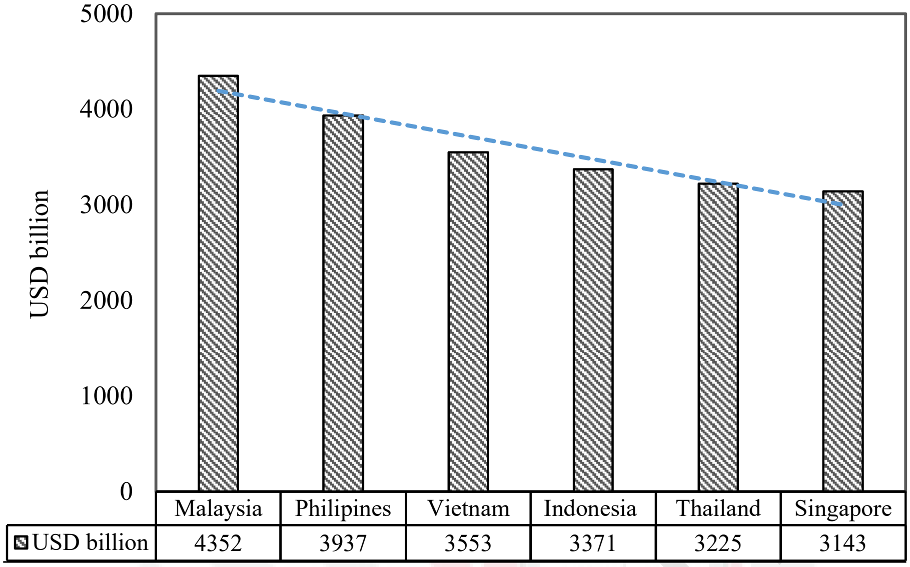

Figure 1.1 : Fund raised from secondary market in ASEAN
(Source : Capital Market Plan 2, Securities Commission Malaysia 2016)

In line with the equity market, Malaysia records the highest number of listed companies in ASEAN countries (Securities Commission Malaysia, 2016). It shows that the Malaysian capital market is the most favorable investment platform to investors than other ASEAN countries. Even though the equity market dominates the highest market share, it was not in line with the total fundraising from the equity market that accounted for only RM12.8 billion compared to RM85.7 billion through corporate bond investment in 2016 under the Second Malaysia Capital Market Plan as reported by the Securities Commission. As of 31 December 2015, the value of fundraising from the capital market decreased to a level considered unimpressive, as shown in Figure 1.2. It shows that the equity market investment could not provide better diversification and stable risk to investors. Otherwise, the investors could not shift their investment strategies toward the bond market. The weak equity market environment had caused some developed markets to decline IPOs and increase de-listings since 2005 (Securities Commission, 2016).

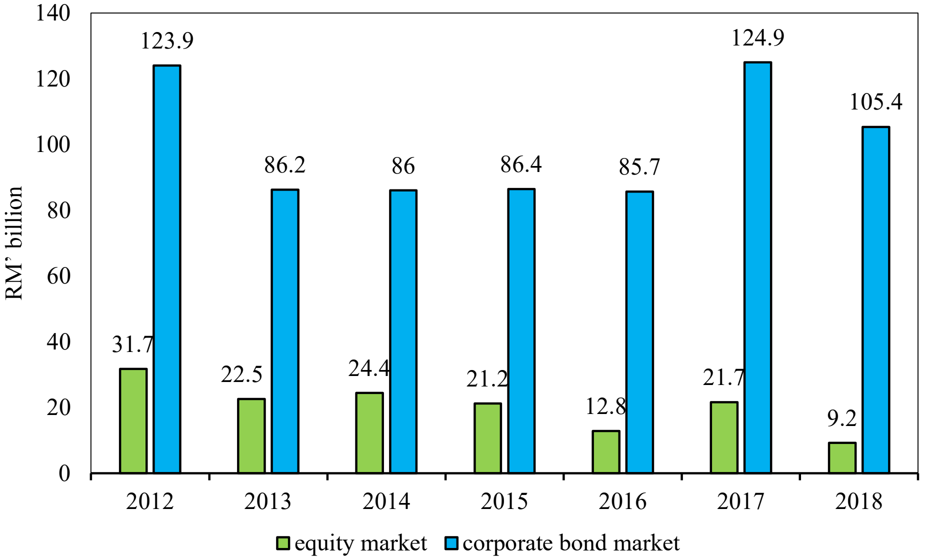

Figure 1.2 : Total fund raised via capital market in Malaysia
(Source : Capital Market Plan 2, Securities Commission Malaysia 2018, Bank Negara Malaysia)

In terms of growth in international investment, to date, RM235,819 million investments in equity portfolio and investment fund shares were recorded in the fourth quarter of 2017. Over the last five years, the allocation from international investment in equity portfolio and investment fund shares showed a gradual increase except in the first quarter of 2016, where the total value of such portfolio dropped to RM186,226 million from RM204,705 million in the previous quarter (Bank Negara Malaysia, 2017). This pattern was due to the stock market downturn that led to the equities' poor performance. This problem caused investors to lose their confidence to invest in the equity market. Investors would not benefit from the investment in the equity market unless the equity market could promise a stable risk and diversification benefit for a long-term investment.

The Malaysian capital market industry is ranked fifth most prominent in Asia (Securities Commission Malaysia, 2017). The industry was highlighted as crucial in the Financial Sector Blueprint 2. The Blueprint states, the government identifies the capital market industry as one of the eight service subsectors that should be focused on for further development during this plan period. According to the 11th Malaysia plan, the capital market industry was targeted to allocate financial resources efficiently to ensure financial stability. Among the different sectors of this industry, the finance, insurance, real estate, and business services contribute, on average, 6.8 percent of Gross Domestic Products (GDP) (Bank Negara Malaysia, 2011), which is the highlight of the contribution to the capital market industry's revenue.

On top of that, Malaysia's Capital market industry has shown remarkable growth in the last 27 years. In 1993, when the first financial asset debuted, the financial assets trading growth was slow due to a lack of organizational structure to support these financial assets' investment trading in the capital market. Upon establishing the Securities Commission on 1 March 1993, the industry started to pick up, from only RM699.5 billion in 1993, the size increased to RM3.1 trillion in December 2018. As of 31 December 2018, the Gross Domestic Products' market capitalization (GDP) percentage was 2.2 times (Securities Commission Malaysia, 2018). This development indicates that the Malaysian capital market has consistently outpaced the Malaysian economy. Given the large size of the Malaysian capital market, there is a possibility that the capital market industry could offer financial wealth and contribute to Malaysian economic growth significantly, as shown in Figure 1.3.

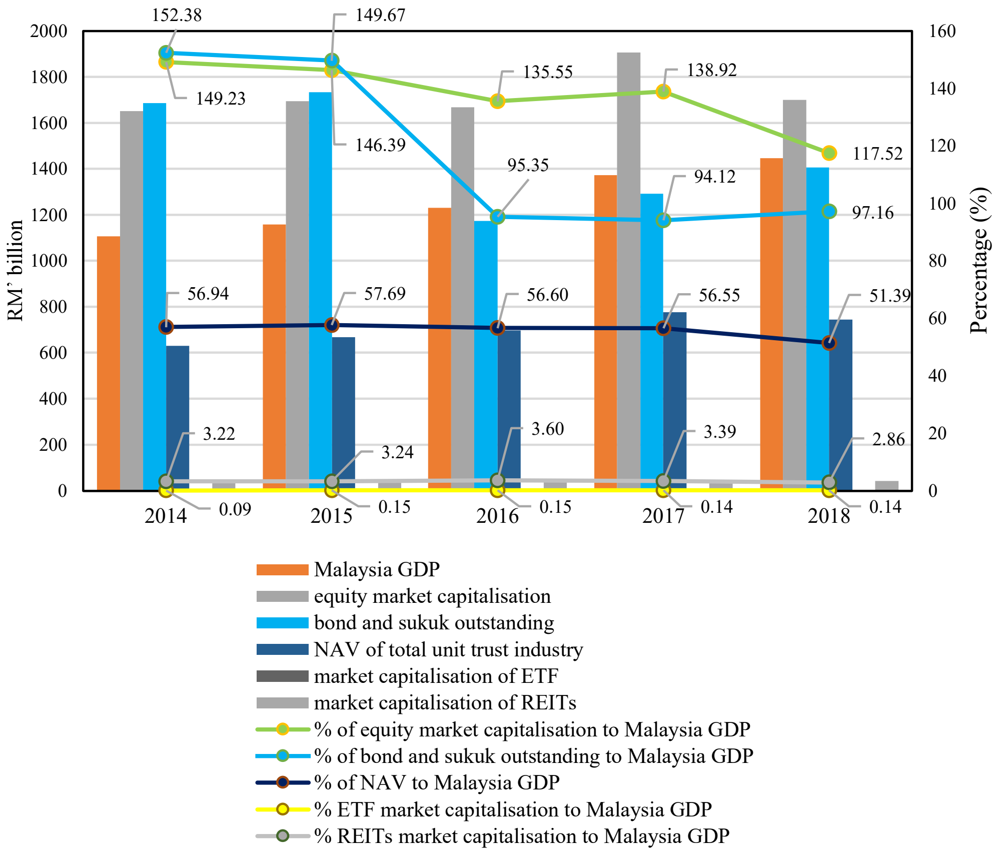

Figure 1.3 : Malaysia capital market size versus Malaysia GDP
(Sources : Securities Commission Malaysia, Bank Negara Malaysia, 2018)

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The capital market, specifically the equity market in Malaysia, has gained considerable amount of popularity as an investment vehicle for retail investors. This popularity resulted in RM106,457.4 million asset worth of Malaysia's investment at the end of 2017 compared to only RM17,725.9 million deposits by Malaysian citizens who prefer bank deposits as an alternative to invest their money (Bank Negara Malaysia, 2017). According to Bank Negara Malaysia, in 2016, investment companies managed RM232.4 billion worth of Malaysian households' financial assets. Based on this development, the study focuses on the capital market as a monetary investment platform instead of a monetary market. The relationship between risk and returns is an essential factor in making an investment decision. Therefore, the investors will try to reduce their investment risk through a diversification strategy. To experience an efficient diversification strategy, investors can participate in risky and non-risky assets. Equities, commodities, futures, mutual funds are risky markets to investors. ETFs and treasury bills are risk-free and offer investors a fixed rate return. Participants in capital markets are subjected to the volatility of their investments. Those who participate in the financial market can be divided into retail investors and institutional investors. Institutional investors refer to financial institutions, namely banks, insurance companies, mutual funds companies, and pension funds (Faias & Ferreira, 2017).

Therefore, investors must understand the co-movement of financial assets in the capital market for risk management, hedging activities, and portfolio asset allocation activities. Critical understanding of the co-movement is necessary as the most important characteristic of individual assets, portfolio sectors, and market indices return is that they have different co-movement levels. Even though the previous studies on co-movement relied on country-level analysis, studies focusing on cross-asset level analysis still lack. Therefore, a cross-asset co-movement relationship of the capital market could maintain financial stability and interest among retails and institutional investors.

Therefore, moving beyond this existing literature, this study investigates diversification of risk, particularly risky assets, namely equities, commodities, mutual funds, and non-risky assets, which are treasury bills and money market funds that offer diversification benefits. The financial assets are classified into different asset classes; they provide meaningful knowledge to understand the relationship between risky and non-risky assets. This relationship stresses the importance of a new group portfolio to diversify risk. Thus, this study extends the portfolio choice theory by examining the co-movement of risky assets and non-risky assets for capital market investment decisions. Investors seek to find which securities are the best investment opportunity to cope with their investment tasks' complexity. This study will address the discrete investors' choice problem in the capital market by extending the model using the generalized autoregressive conditional heteroskedasticity (GARCH) model and Wavelet-based analysis.

Due to Malaysia's capital market's importance in an economy, the co-movement of various asset classes' returns will significantly impact capital market performance, including composite and Shariah market indices, which should improve return on investment to the investors. Hence, understanding the co-movement of return for risky and non-risky returns can provide additional information to practitioners in making investment decisions to mitigate risk. However, the degree of co-movement power varies across time and frequency, which strong positive co-movement lowers the potential of portfolio diversification advantages.

1.3 Statement of research problem

The debates on investors' portfolio optimization and risk management have been around since the 1950s. An extensive literature and research reports describe various portfolio strategies to improve portfolio performance (Brinson, Hood, and Beebower, 1986). The polishing of the capital market policy, particularly in constructing an optimal portfolio, was also discussed. More recently, Podkaminer, Tollette, and Siegel (2019) suggested a multi-asset class investment searching for optimal portfolios by tackling the shock to economic growth. Mimouni, Charfeddine, and Al-Azzam (2016) said that during the construction of an optimal portfolio, the portfolio have to include assets that can offer a risk reduction because of their low levels of dynamic correlation. However, adequate risk diversification concerning investment decisions in the capital market is still an area of long-standing confusion. This unresolved investor's portfolio choice problem has led to the lack of rigorous effort to provide portfolio investment strategy in the capital market, and the investor's protection is indirectly affected. In this sense, one asset class's financial stability has a significant effect on capital market performance. The evidence shows that financial institutions are the major institutional investors in many asset classes (He, Kelly, & Manela, 2017). However, little is known about the simultaneous co-movement between asset classes (Škrinjarić and Šego, 2016).

In this context, Despite the rapid growth of the capital market industry in Malaysia, the Islamic capital market contributed approximately 60% in 2018 (Bank Negara Malaysia, 2018). As such, this study focuses on this market. During 12-year historical performance from 2007 until 2019, there was an unstable time variation between the FTSE Bursa Malaysia Emas Shariah index and its conventional FTSE Bursa Malaysia KLCI index, measured via daily returns. Shariah index achieved a higher return to risk indicating a better performance of the portfolio. Thus, the stable risk of the Shariah market motivates us to examine the viability of various Shariah-compliant asset classes as alternatives to enhance the performance and improve return on investment.

Next, the issue is fundraising from the capital market (Figure 1.2-1.3) shows that fundraising from the equity market was decreasing at an alarming rate over the period; on the other hand, the market capitalization of equity, bond, and sukuk outstanding was increasing. The inconsistencies between the growth and performance of the capital market industry, particularly in Malaysia, prompt an issue of the worth of investing in this industry. Substantial evidence demonstrates that the co-movement of returns in the capital market has impacted the effective portfolio diversification Marfatia (2017). Nevertheless, higher co-movement can reduce risk (Markowitz, 1952), and the relationship between various asset classes provides mixed and inconclusive results (Lombardi and Ravazzolo, 2016; Sakti, Masih, Saiti, and Tareq, 2018; Vacha and Barunik, 2012).

Given the inconclusive literature on capital market investment, mainly risky assets, the low correlation with other asset classes indicated higher performance. In addition to the diminishing benefits resulting from previous researchers' work on diversification, a study by Bessembinder (2018) revealed that the return of non-risky assets investment is higher than the return of the individual stock in the long run. Although recent findings point out that the return of non-risky assets investment might outweigh the return of risky assets investment (Bessembinder, 2018), studies that examine both assets' co-movement simultaneously are still lacking.

These observations raise the question among the retails and institutional investors of whether risky and non-risky assets can be effective diversification instruments for participants in the capital market, namely public and private companies, mutual funds, and long-term investors. Podkaminer et al. (2019) suggested that the issue raised a major concern – investors rely on the financial assets that are less sensitive to growth, namely, bonds, real estate, and some alternatives asset class. Therefore, if the aim is to minimize the portfolio risk; thus, retail and institutional investors would have to consider the risk-return interaction between different assets, including risky and non-risky assets, as a potential interest to seek portfolio diversification benefits as suggested by Škrinjarić & Šego (2016).

Recently, a few studies on the issue have been conducted focusing on cross-asset level analysis. In particular, various studies have used the co-movement analysis in different geographical regions (Marfatia, 2017; Mensi, Hammoudeh, & Kang, 2017; Mimouni, Charfeddine, and Al-Azzam, 2016). However, the measure did not capture the level of portfolio diversification implication as they measured inter-market. Therefore, as highlighted in Buchanan et al. (2011), it is possible to investigate the effectiveness of diversification in the capital market on different asset class types and improve the investor's portfolio decision (Das, Kannadhasan, Al-Yahyaee, & Yoon, 2018). These findings show a need to simultaneously analyze the co-movement of stock returns and volatility of risky and non-risky assets at the aggregate and sectoral levels.

Therefore, based on the earlier paragraphs, designing an adequate diversification of risk strategy that combines financial assets, namely risky assets, and non-risky assets, is needed. The core message derived from these issues is that the risky assets, namely equities, commodities, mutual funds, and non-risky assets, namely money market funds and treasury bills, offer an increased diversification potential. As the assets are of different classes, it helps understand the relationship between risky and non-risky assets. It provides insight into the importance of a new diversification strategy to minimize portfolio risk. To deal with more complex investment tasks, investors look for the best securities in the investment opportunity. Therefore, this study will address the discrete investor's choice problem in the capital market on the frequency domain approach as other previous studies on diversification issues related to the traditional time-domain viewpoint through correlation and co-integration analyses.

1.4 Research questions

The main problem this research attempts to address is developing a solid risky and non-risky assets' price simultaneous co-movement. The questions the study attempts to answer are:

i. Do the risky and non-risky assets in the capital market positively or negatively co-move with the market index?
ii. Do risky assets and non-risky asset returns have dynamic co-movements with the market index over time?
iii. Do portfolio diversification benefits vary with different frequencies or investment horizons of risky assets and non-risky assets?

1.5 Objectives of the study

The study's primary objectives aim to examine the risk diversification in the capital market towards Malaysian market index performance. In particular, the specific objectives for this study are as follows:

i. To investigate the daily co-movement between risky assets (equity, bonds, commodity, and mutual funds) return and non-risky assets (treasury bills and money market funds) return and composite and Shariah index for a capital market investment decision.
ii. To examine the dynamic co-movement trend between various risky and non-risky assets return towards composite and Shariah index to gain portfolio diversification benefits.
iii. To identify the portfolio diversification benefits for risky and non-risky portfolios over different frequencies or investment horizons.

1.6 Significance of the study

The study contributes to the literature in fourfold aspects. Firstly, it contributes to the financial market institution. Secondly, a contribution to the academic. Thirdly, a contribution to the body of knowledge and, finally, to investors and portfolio managers.

1.6.1 Contribution to the financial market institution

First, assessing the diversification of risk on the capital market can help investors improve return on investment and quality of life. According to the Malaysian Employees Provident Fund (EPF), risky assets, particularly equities portfolios, remain the most significant contributor to the institution's investors. On top of that, the capital market industry is ranked fifth most prominent in Asia (Securities Commission Malaysia, 2017). The importance of this industry has been highlighted in the Financial Sector Blueprint 2. Based on the Blueprint, the government has identified the capital market industry as one of the eight service subsectors that should be focused on for further development during this plan period. According to the 11th Malaysia plan, the target is for the capital market industry to allocate financial resources and maintain financial stability efficiently. Among the different sectors of this industry, the finance, insurance, real estate, and business services sector contributes, on the averages, 6.8 percent of gross domestic product (Bank Negara Malaysia, 2011) which is the highlight of the contribution of the capital market industry's revenue.

1.6.2 Contribution to academic

Second, this study contributes to the literature in terms of academic's purposes. Most previous studies focused on a specific or similar asset type without considering the risky and non-risky assets in the investment portfolio. The study fills this gap by examining multi-assets via risky and non-risky assets using multiple measures of GARCH and alternative methods of estimating co-movement, specifically wavelet analysis that contributes to additional literature in asset performance measures. This study will provide a comprehensive model to contribute to the body of knowledge and provide room for significant improvement in the quality of research done in the area.

The study contributes to the literature by emphasizing the time-varying association between risky and non-risky assets with composite and Shariah indices, unlike previous studies that relied on country-level analysis. This study focuses on cross-asset level analysis to obtain the opportunity for diversification benefits by incorporating risky assets and non-risky assets indices across short, medium, and long-term investment horizons. Insofar as our knowledge, these trends have not been documented in previous literature of the Malaysian capital market in both time and frequency domains. With this regard, this allows retail and institutional investors to rebalance their portfolios dynamically according to the marginal contribution of each asset class.

1.6.3 Contribution to body of knowledge

Next, the findings of the current study contributed to the body of knowledge. The study will add to the current knowledge of the optimal portfolio of risky and non-risky assets. It can also be used to understand investment decisions better and in a meaningful way, enabling considerable insights into the role of risky and non-risky assets in a mixed-asset portfolio. This knowledge and understanding would increase relevance for retail investors or institutional investors and industry players, namely portfolio managers, to improve the return on investment by identifying the best securities to enhance the portfolio's risk-return profile. According to the statistics, the risky assets (equities) portfolio remains the most significant contributor to the institutional investor. Despite this, institutional portfolio managers, namely mutual funds, insurance companies, bank trusts, pension funds, and hedge funds, are the key players in the world's capital market. Asset prices should converge across countries as the investors hound more industry and global-focused portfolio strategies. Investors are more likely to choose an asset that will enhance the risk-return profile of the portfolio. In particular, the study's findings will help international investors better understand the potential portfolio implications of investing in the Malaysian capital market.

1.6.4 Contribution to individual and institutional investors

Finally, the findings of the current contributed to the investor's decision-making. The study also attempts to identify the importance of financial institutions and analysts in assessing the future trend of the market and a valuable guideline for portfolio formation. By analyzing the diversification of risk, the performance of risky or non-risky assets could be further examined. Since portfolio performance may significantly contribute to higher or lower profitability for the investors, it is important to provide comprehensive insights into individual and institutional investors' strategies in making an investment decision.

The study also has practical significance to individual and institutional investors. Firstly, the study reveals to investors the need for research to understand the diversification of risk based on differences in investment horizons, unlike the previous studies that undertook a time-domain approach that cannot capture the investor's expectation of future capital market volatility and neglected the heterogeneity of the possible outcomes in the various levels of return. Thus, this study allows a time-frequency domain approach to the analysis to distinguish the time horizon of investment due to the risk differences among short-term and long-term investments to plan investment strategy and portfolio diversification strategy using wavelet analysis. One of the novelties of the study analysis is to take a more heterogeneous time scale such as 4, 16, 64, 256, and 1024 days as an investment holding periods to unveil the actual dynamics of the co-movement relationship between its various asset classes by taking risky assets and non-risky assets indices for the period from 1 January 2007 to 6 February 2019. Therefore, the time-varying volatilities and co-movement dynamics of various asset classes returns are well captured to ensure the investment in the capital market is at the maximum level.

1.7 Scope of the study

This study examines the diversification benefits in capital market investment categorized into risky and non-risky assets in Malaysia. The data gathered are from 2007 to 2019. This period is chosen because the stock return for conventional and Islamic data is available for each stock using DataStream. The beginning of the sample period is restricted by the starting year of the Islamic indexes' availability for the Malaysian market. First, the FTSE Bursa Malaysia EMAS Shariah was established and added to the Sharia investible database in January 2007; thus, our co-movement analysis cannot be conducted before. Second, the purpose of index data used in this study is to control the asset prices suggested by Erdogan, Tata, Karahasan, and Sengoz (2013); these indices represent most stocks in Malaysia often used in studies of stock performance. Using the conventional and Islamic index data, investors look at these indices as a benchmark for capital market investment. Consistent with Schroder (2007), the study assumes that index-level data provides a better performance comparison of screened indices than the mutual fund or portfolio construction approach (Dash & Maitra, 2018). As benchmarks for comparison, the corresponding sectoral industry equity indices, which represent the mainstream counterparts of conventional stock indices, are also utilized. The sectoral industry breakdown in this study follows the industry classification of the Securities Commission of Malaysia. The ten industries categorized by the Securities Commission are construction, consumer products, finance industries, industrial products, plantation, properties, technology, tin and mining, and trade and services. In the study conducted in Malaysia's capital market, one of the possible reasons is that both Islamic and conventional capital markets have become the primary market that contributed to foreign portfolio investment (R. M. Yusof & Shabri, 2008).

The sample data covers risky assets, namely equity, bonds, commodity, exchange-traded funds (ETFs), and non-risky assets, namely money market funds and treasury bills. However, this study did not cover private equity as an asset class, including buyout, venture capital, and fund-of-funds. Thus, the study utilizes the correlation-based on Ordinary Least Square (OLS), Multivariate GARCH Dynamic Conditional Correlation (DCC) model proposed by Engle (2002), and Wavelet analysis proposed by Aguiar-Conraria and Soares (2014) to examine conditional correlation and diversification effect of Malaysia risky asset returns with non-risky asset returns. Meanwhile, the study utilizes continuous wavelet analysis to address whether portfolio diversification opportunities change the given varying stock holding periods.

1.8 The organization of the chapters

The remainder of this study is organized as follows. Chapter two focuses on the empirical literature, hypothesis developments, and literature gap. Chapter three develops a methodology for measuring the diversification potential of risky assets and non-risky assets and defines the empirical model to seek solutions to research objectives, data sources and offers initial statistics. Chapter four presents and interprets the empirical results drawn from hypothesis testing. Chapter five discusses the research's central finding, points out the research limitation and implication, provides recommendations for future research, and draws conclusions.

1.9 Chapter summary

This chapter introduces the issue related to the topic under investigation and explains the research's basic idea. This chapter mainly explains the situation that warrants research on risk diversification portfolio of risky assets, namely equities, commodities, bond and mutual fund or unit trusts and non-risky assets, namely treasury bills and money market funds, which are widely discussed by the existing literature on the role of diversification benefits. Then, it outlines the questions of the problem to address, the research objectives to pursue, the expected contributions to achieve, and the overall scope of this research. The next chapter offers discussions of the existing literature and a detailed explanation of the underpinning theories, research framework, and research hypotheses.

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