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VOLATILITY FORECASTING APPROACH TO RISK ASSESSMENT OF PRIVATE EQUITY MUTUAL FUNDS IN MALAYSIA

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VOLATILITY FORECASTING APPROACH TO RISK ASSESSMENT OF PRIVATE EQUITY MUTUAL FUNDS IN MALAYSIA

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VOLATILITY FORECASTING APPROACH TO RISK ASSESSMENT OF PRIVATE EQUITY MUTUAL FUNDS IN MALAYSIA

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Volatility, though unobservable and latent in nature, is forecastable due to its persistency over time. Financial volatility measures the risk of financial assets' returns. Voluminous literatures on volatility forecasting studies imply risk assessment through volatility study is a pre-requisite in managing risk of financial assets. Stocks volatility studies have well contributed to the financial volatility literatures but not mutual funds volatility, typically in the case of Malaysia. Inconsistency between funds' objectives and their risk-return relationship attributed to fund managers inability to time the market and stocks selectivity over different business cycles as documented in past studies, substantiate the risk involved in mutual funds investment.

The key motivation of the study is to examine risk of mutual funds investment through volatility forecasting approach. The approach of this study focussed on developing and determining appropriate forecasting models by way of forecasting accuracy comparison. Daily return of seven fund indices (Growth, Growth & Income, Income, Balanced Growth, Balanced Growth & Income, Balanced Income and Mixed Asset Growth) generated from 57 private equity mutual funds of different investment objective and corresponding risk-return characteristics across two sub-periods "with financial crisis" (2005-2011) and "without financial crisis" (2012-2019) are examined. The empirical evidence from GARCH in Mean (GARCH-M) revealed existence of inconsistency between fund objectives and risk-return relationship across seven fund indices. Funds' return volatility is found to be more volatility in sub-period with financial crisis. The asymmetric EGARCH under Student-t distribution captures the asymmetrical leverage effect well and emerge as the best GARCH model. However, the robust and outlier resilience STES with Error and Absolute Error transition variable is the overall best model in the one-day ahead volatility forecasting.

The Realized Variance MIDAS (RVar-MIDAS) model outperformed both the STES methods and the GARCH models in longer lead time (one-week ahead) forecasting. Results from the GARCH-MIDAS revealed macroeconomic variables (output, inflation, interest rate, money supply and exchange rate) examined exert small impact on funds volatility while realized volatility exerts stronger impact, implying sensitivity of mutual funds volatility to financial or macroeconomic news than changes of the macroeconomic variables.

Findings of this study has contributed empirical forecasting models in assessing risk of mutual funds investment using the mutual funds indices generated allows a macro-analysis of funds risk. Inconsistency between funds objectives and their risk-return relationship warrants tighter monitoring of fund managers trading behaviour by Securities Commission of Malaysia. The sensitivity of funds volatility to both financial and macroeconomic news provides a direction to the Malaysian government to exercise cautious execution of macroeconomic policies so as not to trigger unnecessary volatility in the Malaysian financial market.

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

PENILAIAN RISIKO MENERUSI PENDEKATAN RAMALAN KEMUDAHRUAPAN PULANGAN DANA AMANAH EKUITI SWASTA DI MALAYSIA

Oleh

WAN CHEONG KIN

September 2021

Pengerusi : Profesor Madya Choo Wei Chong, PhD
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Walaupun kemudahruapan tidak dapat dilihat dan bersifat pendam, ianya boleh diramalkan kerana kewujudannya kekal sehingga jangkamasa panjang. Kemudahruapan kewangan mengukur risiko pulangan aset kewangan. Sebilangan besar literatur kajian kemudahruapan pulangan aset kewangan menyiratkan penilaian risiko berasaskan pendekatan ramalan kemudahruapan pulangan aset adalah pra-syarat kepada pengurusan risiko aset kewangan. Walaupun kajian keatas kemudahruapan pulangan saham telah banyak menyumbang kepada literatur kemudahruapan kewangan, namun kajian keatas volatiliti pulangan dana amanah amat kekurangan terutamanya di Malaysia. Ketidakselarasan hubungan diantara objektif pelaburan dana dengan pulangan dan risiko dana yang berpunca dari ketidakmampuan pengurus dana didalam penentuan masa pelaburan terbaik serta ketidakmampuan didalam pemilihan saham yang bersesuaian dengan profil portfolio, membuktikan bahawa risiko wujud didalam pelaburan dana amanah.

Motivasi utama kajian ini adalah untuk mengkaji risiko pelaburan dana amanah menerusi pendekatan ramalan kemudahruapan. Fokus pendekatan kajian ini bertumpu kepada pembinaan model peramalan yang paling berkemampuan menerusi perbandingan ketepatan ramalan diantara model-model yang diselidiki. Pulangan harian tujuh indeks dana (terdiri daripada dana Pertumbuhan, dana Pertumbuhan & Pendapatan, dana Pendapatan, dana Pertumbuhan Seimbang, dana Pertumbuhan & Pendapatan Seimbang, dana Pendapatan Seimbang dan dana Pertumbuhan Aset Campuran) yang dihasilkan daripada 57 dana amanah ekuiti individu dari dua jangkamasa berlainan, iaitu jangkamasa "dengan krisis kewangan" (2005-2011) dan jangkamasa "tanpa krisis kewangan" (2012-2019). Bukti empirikal dari model Teritlak Autoregresi dan Heteroskedastisiti Bersyarat (TAHB) Dalam Min mendedahkan kewujudan ketidakselarasan hubungan antara objektif pelaburan dana dengan pulangan dan risiko didalam ketujuh-tujuh indeks dana yang dikaji. Kemudahruapan pulangan dana didapati

kurang stabil didalam jangkamasa “dengan krisis kewangan”. Model TAHB Eksponen Asimetri dengan taburan “Student-t” berjaya mengesan impak “leverage” asimetri dengan baik dan muncul sebagai model TAHB terbaik. Walau bagaimanapun, kemampuan kaedah Kelancaran Eksponential Peralihan Lancar (KEPL) dengan pengubahsuai peralihan Ralat & Ralat Mutlak didalam menangani isu “outlier” membuktikan keunggulan kaedah ini dan seterusnya menyerlah sebagai model terbaik alam ramalan kemudahruapan pulangan dana satu-hari-kehadapan.

Model Realisasi Varians MIDAS (RVar-MIDAS) mengatasi kedua-dua kaedah KEPL dan model TAHB dalam ramalan pulangan dana satu-minggu-kehadapan. Keputusan kajian yang di perolehi dari model TAHB-MIDAS mendedahkan pengubahsuai makroekonomi (terdiri daripada kadar ouput negara, kadar inflasi, kadar faedah, kadar penawaran wang dan kadar pertukaran asing) hanya memberikan impak yang lemah terhadap kemudahruapan pulangan dana, sementara kemudahruapan yang direalisasikan (realized volatility) memberikan impak yang lebih kuat disebabkan kepekaan kemudahruapan pulangan dana amanah terhadap berita kewangan serta berita makroekonomi yang berpunca daripada perubahan pengubahsuai makroekonomi.

Penemuan kajian ini telah menyumbangkan model-model peramalan empirikal untuk menilai risiko pelaburan dana amanah menggunakan indeks dana amanah yang membolehkan analisis-makro risiko dana dilaksanakan. Ketidakselarasan hubungan diantara objektif dana dengan pulangan dan risiko dana menyarankan Suruhanjaya Sekuriti Malaysia agar lebih berhati-hati memantau tingkah laku pengurus dana semasa urusan jual-beli harian. Sensitiviti kemudahruapan pulangan dana terhadap berita kewangan serta berita makroekonomi menyarankan kerajaan Malaysia untuk melaksanakan polisi makroekonomi secara berhati-hati agar tidak mencetuskan ketidakstabilan pasaran kewangan Malaysia yang tidak diingini.

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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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This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
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CHAPTER 1

INTRODUCTION

1.1 Background to the Study

Expected outcome of each decision made across a vast sphere of everyone's life is a function of risk involved. In financial world, "risk" is often associated with a negative connotation involving negative returns (Poon and Granger, 2003). It can be broadly defined as "uncertainty" or "unfavourable" outcome of an event (Ladokhin, 2009). Risk can be defined quantitatively and qualitatively. From a qualitative perspective, the notion of 'risk' includes some degree of uncertainty and loss (damage) that might be realised. However, when defined quantitatively, it involves analysis of the consequences, arising from an action taken, that usually comprise of some commonly asked questions, for instance what can possibly happen and what is the probability of it happening (Kaplan and Garrick, 1981).

Given this, risk can be quantified from the perspective of "probability" (chances of loss occurring) and "consequences" (degree or impact of loss) as Kaplan and Garrick (1981) remarked:

> "…the purpose of risk analysis and risk quantification is always to provide input to an underlying decision problem which involves not just risks but also other forms of costs and benefits. Risk must thus be considered within a decision theory context. Within this context, that risk is acceptable, which comes along with optimum decision option, all other risks are unacceptable, even if smaller."
>
> [Kaplan and Garrick (1981), p. 25-26]

Risk can be either upside or downside. While upside and downside risk produce different expected outcomes, both leads to a loss if not managed. The former produces a favourable expected outcome in the form of an "opportunity", may result in a loss due to "missed opportunity" while the latter produces a "threat", which obviously resulting in a loss. This provides a valid reason why risk must be managed to minimize losses. When the earlier statement from Kaplan and Garrick (1981) is applied in the context of financial market, managing financial risk involves making investment decision within the context of several available options. Once an option with the lowest expected loss or damage cost (or rather highest profit, gain or benefit) is identified and chosen, this itself represents an optimum investment decision made given available information on risk.

Within the vocabulary of risk, the fundamental for portfolio optimization, asset pricing and risk management centres around volatility, an important concept in financial investment. Volatility is the quantified measurement of risk. On this notion, in the

context of financial market, the spread (probability) of all outcomes (gain or loss) arising from uncertain of an event (investment) is known as volatility (Ladokhin, 2009). Prior to assessing risk of an investment, information on volatility of assets' return within an investment horizon (Poon and Granger, 2003) is crucial to investors. A financial asset with high volatility in its return would means that value or price of the asset fluctuates greatly in either directions, either upside (higher than average return) or downside (lower than average return) within a stipulated investment horizon. Since volatility is the quantitative measure of risk, a highly volatile financial asset is generally perceived to be of high risk. For decades, the risk-return relationship in financial investments, stock particularly, has been the central focus of many researchers and academicians. Industry experts like investment or fund managers and investing public who forms bulk of the investment community are equally concerned about managing risk of financial investment.

Why is financial risk arising from asset price volatility a concern? For a simple reason, investment community in the financial market are largely risk averse by nature with exception of a small number who are risk-seeker. This explains why a higher return known as "risk premium" is often required to entice investors to accept higher investment risk. This is so because investors' ultimate investment objective is to maximize return on money invested given an acceptable level of risk within a stipulated investment horizon.

The long history of stock market's existence has enabled it to be the most common and popularly accepted form of financial investment globally. As such, stock market volatility is the most studied financial economics literatures for the past many decades up to present. However, the growing importance of equity mutual funds worldwide is undeniable. Mutual fund is a form of collective investment where money form investors are pooled together and invested into a well-diversified portfolio comprising of stocks listed in stock markets, bonds and money market instruments. Given the fact that mutual funds are largely invested into stocks, price movement of both stocks and mutual funds are certainly correlated. Any changes in one market will influence the other. A plethora of past studies have well documented correlation between both mutual funds and stock market through inflow and outflow of mutual funds from stock market (Warther, 1995;Wermers, 1999;Oh and Parwada, 2007;Low and Ghazali, 2007;Cao, Chang, and Wang, 2008;Hung, Lu, and Lee, 2010;Kim, Kwon, and Oh, 2016;Qureshi, Kutan, Ismail, and Gee, 2017).

Given the co-movement of stocks prices and mutual funds prices (Warther, 1995), measured as Net Asset Value (NAV henceforth), daily funds inflow into and outflow from stock market driven by stock prices volatility ultimately influence volatility in funds' return. This means a positive correlation between mutual funds flow and funds' daily NAV exist (Kim et al., 2016). Sentiment of funds investors and fund managers are vital factor in determining inflow and outflow of equity funds which influences stocks return (Goetzmann and Massa, 2003). Fund investors may react by either increasing (top up) or decreasing (repurchase or switch out) their equity funds holding in their investment portfolio depending on the news impact in the market. Similarly, fund

managers too will adjust risk in their portfolio by picking up or disposing appropriate stocks, depending on the market conditions. A negative or "bad news" will result in investor "herding" (follow what other investors decide due to lack of information in making decision) behaviour of repurchasing (selling) their funds units driving funds prices down and vice-versa (Frazzini and Lamont, 2008). This explains why stock prices volatility arising from news impact drive investors' and fund managers to react, hence influencing volatility of equity mutual funds return as daily NAV changes.

In the case of Malaysia, although mutual funds industry commenced in 1959, slightly later than many other countries, it's significant contribution to the Malaysian capital market is noteworthy. Figure 1.1a shows the strong growth of Malaysian mutual funds industry, particularly in the last four years since 2016 has resulted a significant 28.2% Net Asset Value contribution to total Malaysian capital market capitalization as of end of 2019 as captured by the Securities Commission of Malaysia. Interestingly and worth noting that during period 2007-2008 of global financial crisis, although mutual funds NAV declined in year 2008, its contribution against total market capitalization of Bursa Malaysia continued to grow from 15.2% in 2007 to 19.7% in 2008 (see Figure 1.1a).

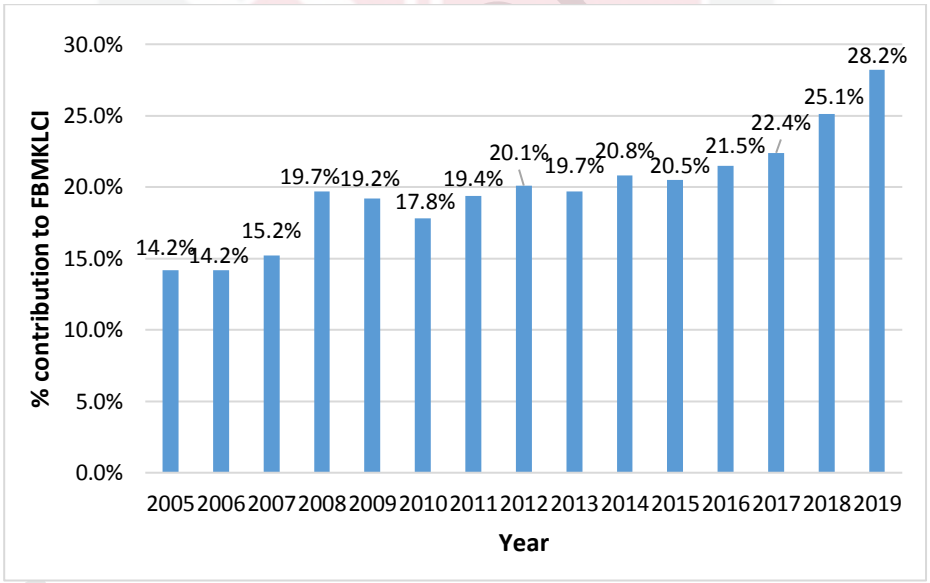

Figure 1.1a : Contribution of NAV over total market capitalization of Bursa Malaysia 2005-2019
(Source: Author's own compilation from data extracted from the official website of the Malaysian Securities Commission, available at: www.sc.com.my)

This may be due to risk averse stocks investors prefers to hold their investment position in mutual funds market instead of direct investment in the Malaysian stock market in view of the stock market volatility during the Global Financial Crisis period. While mutual funds total NAV in 2017 and 2018 are almost on par (see Figure 1.1b), the

contribution to Malaysian total market capitalization has risen from 22.4% in 2017 to 25.1% in 2018 (see Figure 1.1a), implying mutual funds is growing at a faster pace than the Malaysian stock market in terms of market capitalization. The increasing number of mutual funds launched in Malaysia after 2004 has resulted in continuous uptrend with significant growth over the past fifteen years, implying growing acceptance of mutual funds as an alternative investment option to stock market among Malaysians.

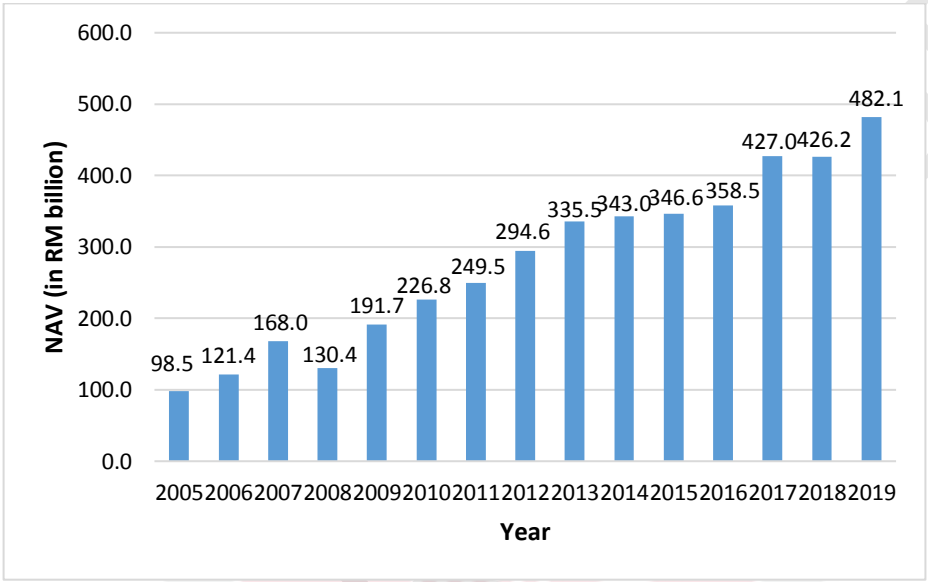

Figure 1.1b :Net Asset Value (NAV) of Malaysian mutual funds from 2005-2019
(Source: Author's own compilation from data extracted from official website of the Malaysian Securities Commission, available at: www.sc.com.my)

The significant growth and importance of mutual funds as an investment option both globally and in Malaysia has caused emergence of voluminous mutual funds studies in past decades. Most of past literatures focussed predominantly on evaluation of mutual funds' performance, covering both international (Sharpe, 1966; Jensen, 1967b; Lehmann and Modest, 1987; Ippolito, 1989; Grinblatt and Titman, 1989; Rao, Tauni, Iqbal, and Umar, 2017) as well in Malaysia (Shamser Mohamed and Mohd Nassir, 1995; Md Nassir, Mohamed, and Ngu, 1997; Abdullah, Hassan, and Mohamad, 2007; Low, 2007b; Low, 2012; Boo, Ee, Li, and Rashid, 2017; Alwi, Ahmad, Amir Hashim, and Mohd Naim, 2019).

However, given the best knowledge of the author of this study, mutual funds volatility studies in Malaysia have been observed to be scanty or possibly none to date. In addition, there were only a few studies abroad documenting mutual funds volatility (Busse, 1999; Giambona and Golec, 2009; Xie and Huang, 2013a; Livingston, Yao, and Zhou, 2019). This identified research gap sets the foundation of this study, aimed at assessing financial risk of mutual funds in Malaysia through modelling and forecasting volatility, while the

need to address research issues raised and summarized in problem statement is the primary motivation of this study.

1.2 Problem Statement

Financial risk-return relationship is an area well researched upon. Given the risk averse nature of investors, acceptance of higher investment risk must be compensated with higher expected return or risk premium. Managing financial investment is not merely selecting a fund with high historical return without assessing its risk. The first step in managing an investment return should begin with managing risk associated with it. Development of a good financial volatility forecast of financial asset over its investment horizon is a crucial first step in managing risk (Poon and Granger, 2003). This notion sets the foundation of this study and the motivation is driven by a need to address the following research issues surrounding risk in mutual funds investment documented in past literatures:

a) Inconsistency of investment objectives and its risk-return relationship.
b) Unobservable volatility and stylized facts of financial time series.
c) Impact of macroeconomic on funds' short-term and long-term volatility.

1.2.1 Inconsistency of investment objectives and risk-return relationship

Risk exposure of each mutual fund is governed strictly by its investment objectives stated in the Fund Prospectus and Trust Deed of each fund. The daily trading operation of mutual fund managers are strictly governed by the guidelines on asset allocation outlined in these documents. Performance of funds are largely dependent on fund managers' ability to strike balance between diversifying risk and optimizing return for unit holders (mutual funds investors). This challenging task certainly requires fund managers' ability in "timing the market" as well as "selectivity" of appropriate stocks to be included into their funds' portfolio which comply with the stipulated asset allocation guidelines. In short, integrity and professionalism of fund managers in discharging the mandate entrusted by fund investors are the underlying crucial factors determining risk diversification and return optimization of a fund. Herein lies the element of "human risk" as one of the many types of other risks, for example, market risk, inflation risk, interest rate risk, exchange rate risk, credit risk, liquidity risk, country risk (political instability) and so on. Such "human risk" is known as "fund management risk", a form of unsystematic risk (diversifiable risk).

Mutual fund is itself a portfolio comprising securities from several asset classes comprise of stocks, bonds and money market instruments. Risk diversification is a key salient feature of mutual funds, often heavily promoted by fund management companies besides its cost-efficient approach to accessing a diversified investment portfolio (Humphrey, Benson, Low, and Lee, 2015) compared to high risk exposure of investing directly in specific stocks listed on stock exchange. A fund portfolio risk is deemed 75%-80%

diversified if it consists of at least 15 stocks (Evans and Archer, 1968; Surz and Price, 2000) while Statman (1987) recommended between 30 to 40 stocks in one mutual fund.

Risk diversification in unit trust can be viewed from two perspectives, one being the "diversification within an asset class" while the other being "diversification across asset classes" (commonly called "asset allocation" between asset classes of stocks, bonds and money market instruments). Asset allocation addresses mutual funds investors' concern as to how much to diversify in stocks, bonds and money market instruments. Technically, given appropriate asset allocation that corresponds to its investment objectives, a mutual fund should appropriately reflect the fund's risk exposure and the expected return that closely related to its investment objective. Appendix A1 shows how risk exposure of mutual funds is categorized in accordance to corresponding funds' investment objectives and its asset allocation in the Malaysian context.

However, despite the risk diversification rules, it is common for fund managers to adopt "active portfolio management" style particularly during period of market uptrend. This implies tendency of a trade-off between portfolio return optimization and portfolio risk diversification. Given "peer-pressure" and competitive environment to perform, fund managers tend to disregard asset allocation guidelines governing their daily trading activities (Kim, Shukla, and Tomas, 2000). This often resulted in failure of funds portfolio risk diversification as tendency of fund managers to pick riskier equity stocks may jeopardize overall portfolio return (DiBartolomeo and Witkowski, 1997; Md Nassir et al., 1997).

Such irrational behaviour of fund managers may lead to misjudgement in selecting the wrong stocks (selectivity inability issue) at the wrong timing (market timing inability issue) into their funds' portfolio. With the exception of study by Mansor and Bhatti (2011), evidences documented in many past literature seem to incline towards fund managers' "market timing inability" (Treynor and Mazuy, 1966a; Hendriksson, 1984; Chen, Lee, Rahman, and Chan, 1992; Md Nassir et al., 1997; Low, 2007a; Ünal and Faruk, 2015; He and Cao, 2015) than "stocks selection inability" (Jensen, 1967; Chan and Cheng, 2003). In addition, some past literature has documented fund managers to be both poor "market timer" and poor "stock selector" (Musah, Senyo, and Nuhu, 2014; Veloso Neto, Sequeira da Mota Lobao, and Vieira, 2017).

Nevertheless, past studies, see (Chen et al., 1992; Md Nassir et al., 1997; Kao, Cheng, and Chan, 1998) do revealed selectivity ability of fund managers where their "time-varying skills" enable them to be competent "market timer" during market downturn or crisis period. Meanwhile in a market uptrend or non-crisis period, past studies, see (Kok, Goh, and Wong, 2004; Kacperczyk, Nieuwerburgh, and Veldkamp, 2014) highlighted fund managers "stocks selectivity" inability. Interestingly, riskier funds were found to have negative relationship with fund managers' stocks selectivity ability (Low, 2012). Such risky fund will not be able to produce good returns as market risk arising from unpredictable dynamism of stock price movement undermine capability of fund managers to appropriately select stocks into their funds' portfolio. As such, Low (2012)

suggested that high risk funds should be managed by fund manager possessing market timing ability instead.

Pressures attributed to "investment return accountability" and "peer competition", compounded by inability to time the market and poor stock selection ability have driven fund managers to act irrationally, thus disregarding funds objectives outlined in fund's prospectus. Brown and Goetzmann (1997) commented such fund managers' behaviour as follows:

> "It is not surprising that the categories based on returns outperform the standard industry classifications. Funds categories like 'growth' and 'growth and income' represent an invitation to fund management gamesmanship. Once a fund is classified into a category, there is little incentive to pursue an investment strategy that will ensure that future fund performance will be close to the category average in the future…mutual funds investors flock to superior performers in each fund category. Given this information, fund managers are not rewarded by maintaining strategies consistent with their industry classification."
>
> [Brown and Goetzmann (1997), p.395]

Such behaviour of fund managers is the primary reason of inconsistency found between funds' objectives and the funds' risk-return attributes. DiBartolomeo and Witkowski (1997) validated such behaviour when 40% (298 out of 748) of the mutual funds were found to have misclassified fund objectives. Similarly, the study of Kim, Shukla, and Tomas (2000) found about 50% of the funds sampled have inconsistency between pre-determined objectives and funds risk characteristics. In addition, returns of 33% of funds sampled were found to be severely deviated from their stated objectives. Meanwhile, a separate study of Chinese mutual funds using discriminant analysis, 50% (11 out of 22 funds examined) of the funds also have such inconsistency (Jin and Yang, 2004). Such deviations exert detrimental impact on investors' expected investment return.

In the case of Malaysia, micro-analysis into 31 individual domestic mutual funds by Md Nassir et al. (1997) revealed 81% of the funds sampled failed to achieve the minimum 50% diversification against market risk, measured by the coefficient of determination R^2 (correlation between the fund's return and market returns). Surprisingly, riskier growth funds category scored the lowest level of diversification at 53% but lower risk balance funds category scored higher level of diversification at 60%. Riskier high growth funds are generally actively managed with high degree of selectivity (stocks picking) more so during stock market uptrend. Therefore, an inverse relationship exists between stock selectivity and asset allocation, implying a trade-off between "selectivity" and portfolio risk diversification.

The findings of Md Nassir et al. (1997) concurred with an earlier study of similar capacity by (Mohamed & Mohd Nassir, 1995) and was even supported in a later study by Chen, Adams, and Taf (2013). Such trade-off is expected when fund managers

managing higher risk growth funds tend to increase portfolio risk by selecting riskier and volatile stocks especially during market uptrend, hoping to reap higher profit. This has resulted inconsistency between funds objectives and its risk-return relationship at the expense of risk diversification. Such issue if left unchecked, can adversely affect mutual funds investors who are largely risk averse yet lack expertise to directly invest in stock markets. Fund investors may end up receiving lower than expected profit or even loss. Over time, this issue may lead to fading confidence in mutual fund investment among existing and potential mutual funds investors. This consequently triggers huge exit of mutual funds from financial market causing volatility of stock market and eventually impede the growth of economy as investment takes a setback.

1.2.2 Unobservable volatility and financial series stylized facts

Market uncertainty and volatility of financial assets returns are often attributed to impact from news and information available in both financial market and the economic environment. News impact of financial market is visibly seen in the behaviour of largely risk-averse investors which reflect their perception towards risk (Engle and Ng, 1993). In a study related to mutual funds, it was found that both stock market and macroeconomic related factors (proxied by dividend yield and consumption wealth) contributed 40.8% and 51.7% respectively to mutual fund flowing into stock market (Jank, 2012) which obviously cause volatility in both stocks and mutual funds markets. This explains how news impact affects volatility of financial markets. Such investors' behaviour often led many financial time series (stocks in particular and mutual funds likewise) to exhibit a set of unique attributes or characteristics comprise of volatility clustering, volatility persistency, asymmetrical (skewed) and leptokurtic distribution as well as leverage effect (Poon and Granger, 2003; Malmsten and Teräsvirta, 2010).

A thorough review of ninety three past working or published papers dwelling into performance of various volatility forecasting models by Granger and Poon (2003) highlights the existence of these stylized facts of financial time series:

> "There are several salient features about financial time series and financial market volatility that are now well documented. These include fat tail distributions of risky asset returns, volatility clustering, asymmetry and mean reversion, and co-movements of volatilities across assets and financial markets. More recent research finds correlation among volatility is stronger than that among returns and both tend to increase during bear markets and financial crises."
>
> [Granger and Poon (2003), p. 481]

Random Walk Theory assumed that successive prices of financial assets are independent (Fama, 1965a). The independency of successive changes in stock prices advocated by the Random Walk Theory implies successive stock price changes has "no memory". As such, the error term of return in each time period is independently and identically distributed (iid.) or rather random, with constant variance. This means there is no possibility of using past information on stock returns to predict or forecast the random

error term of future returns (Figlewski, 1997). From perspective of investment practicality, past prices of stock cannot be used to predict future stock prices. This means all available news or information which influences the behaviour of stocks investors has been fully reflected in the prevailing stock prices. On the same note, Efficient Market Hypothesis (EMH) advocated that when stock prices reflect the "intrinsic value" of each stock, the stock market is deemed as efficient and investors will not be able to reap extra capital gain from stock trading since all market information is known to all investors (symmetric information).

However, Mandelbrot (1963) asserted that financial time series are not independently and identically distributed, hence invalidated the Efficient Market Hypothesis which serves as the foundation of Random Walk Theory. In fact, he argued that:

> "At a closer inspection, however, one notes that large price changes are not isolated between period of slow change; they rather tend to be the result of several fluctuations, some of which 'overshoot' the final change…In other words, large changes tend to be followed by large changes – of either sign – and small changes tend to be followed by small changes."
>
> [Mandelbrot (1963), p. 418]

Mandelbrot's "eye-opening" statement triggered the start of an insight into the existence of "volatility clustering" in financial return time series. The nature of financial return time series which often comprise of high frequency observations (inter-day or even intra-day) can intensify the influence of non-systematic factors (for example news impact triggering reaction from investors) on prices volatility of financial instrument over time. Such phenomena reflect the behaviour or reaction of financial investors during the ups and downs of financial market since investors are largely risk-averse in nature. Given this, the random error term of financial time series should not contain a constant variance, instead a time-varying non-constant variance arising from autocorrelation between the error terms, hence not identically (asymmetrically) distributed. This phenomenon of non-constant variance of the error term is statistically known as heteroskedasticity (Engle, 1982; Bollerslev, 1986; Schwert, 1989; Nelson, 1991). Mutual funds literatures on volatilities by Busse (1999), Giambona and Golec (2009), Xie and Huang, (2013a) and Livingston et al. (2019) are the very few initial studies that confirmed presence of heteroskedasticity in equity mutual funds in both the United States and China.

The presence of heteroskedastic nature in mutual funds series directly opposes standard deviation measurement for risk where the assumptions of constant variance over time (non-time varying) and normal distribution must be fulfilled. Assuming financial asset returns are truly independent and identically distributed and constant variance of the error term prevails, then obtaining a long-term variance of return is relatively straight forward, simply multiplying the one period variance of return with the number of periods into future. However, this is never the case in reality (Granger and Poon, 2003) thus rejecting the validity of the Random Walk Theory claiming existence of randomness between successive prices of financial assets.

The existence of heteroskedasticity in financial returns time series is attributed to correlation between the returns across periods. Heteroskedasticity can be captured by a conditional variance process where the non-constant or time-varying variance of the error term is modelled as a function of the residuals obtained from the conditional mean process (Akgiray, 1989). In fact, the conditional variance of financial returns persists (volatility persistency) (Engle & Bollerslev, 1986) and gradually decays overtime, implying a mean reverting process. Such persistency could possibly remain in effect at half of the initial volatility impact even after a year (Chou, 1988). Given volatility persistency over time in the financial time series, volatility of mutual funds certainly can be modelled and is forecastable.

The Autoregressive Conditional Heteroskedasticity (ARCH) introduced by Engle (1982), and later improvised by Bollerslev (1986) to become Generalized Autoregressive Conditional Heteroskedasticity (GARCH henceforth), are regarded as a reliable "workhorse" for volatility forecasting as documented in abundant past literatures. However, almost two decades post introduction of the GARCH framework, a more robust method of forecasting volatility known as Smooth Transition Exponential Smoothing (STES) was introduced by Taylor (2004a) which employed an adaptive smoothing parameter that vary as characteristics of time series changes via a logistic function of user-specified transition variable. This method though emerged later than the GARCH models, has shown empirical superiority over the GARCH model and the exponential smoothing methods (Taylor, 2004b; Liu, Taylor, and Choo, 2020). Since volatility is unobservable, squared residuals have been widely adopted as closest proxy for actual or true volatility in post-sample forecasting error evaluation of the GARCH models and STES method. The overall conceptual framework of volatility forecasting is illustrated in Figure 1.2.

In mutual fund industry, Fund Volatility Factor (FVF henceforth) is the volatility indicator calculated monthly by Lipper Analytics, an independent international Funds Performance Rating Organization (FPRO) actively involved in funds' performance rating regionally and globally. Only mutual funds that have survived a period of three year (36 months) in the market since inception or launch will be assigned FVF. The main aim of FVF is to provide investors with a first glance of a fund's risk within the preceding immediate 36 months period. Information on FVF for each fund is made accessible to public and investors through periodical (usually monthly or quarterly) funds review reports via official website of respective fund management company.

The value of FVF calculated for each fund varies from one reporting period to the other when stock market condition changes in accordance to systematic risk (non-diversifiable market risk). Since mutual funds are invested in stock market, any volatility in stock market over time certainly exerts impact on volatility of mutual funds as there is a co-movement in both stock market volatility and equity mutual.

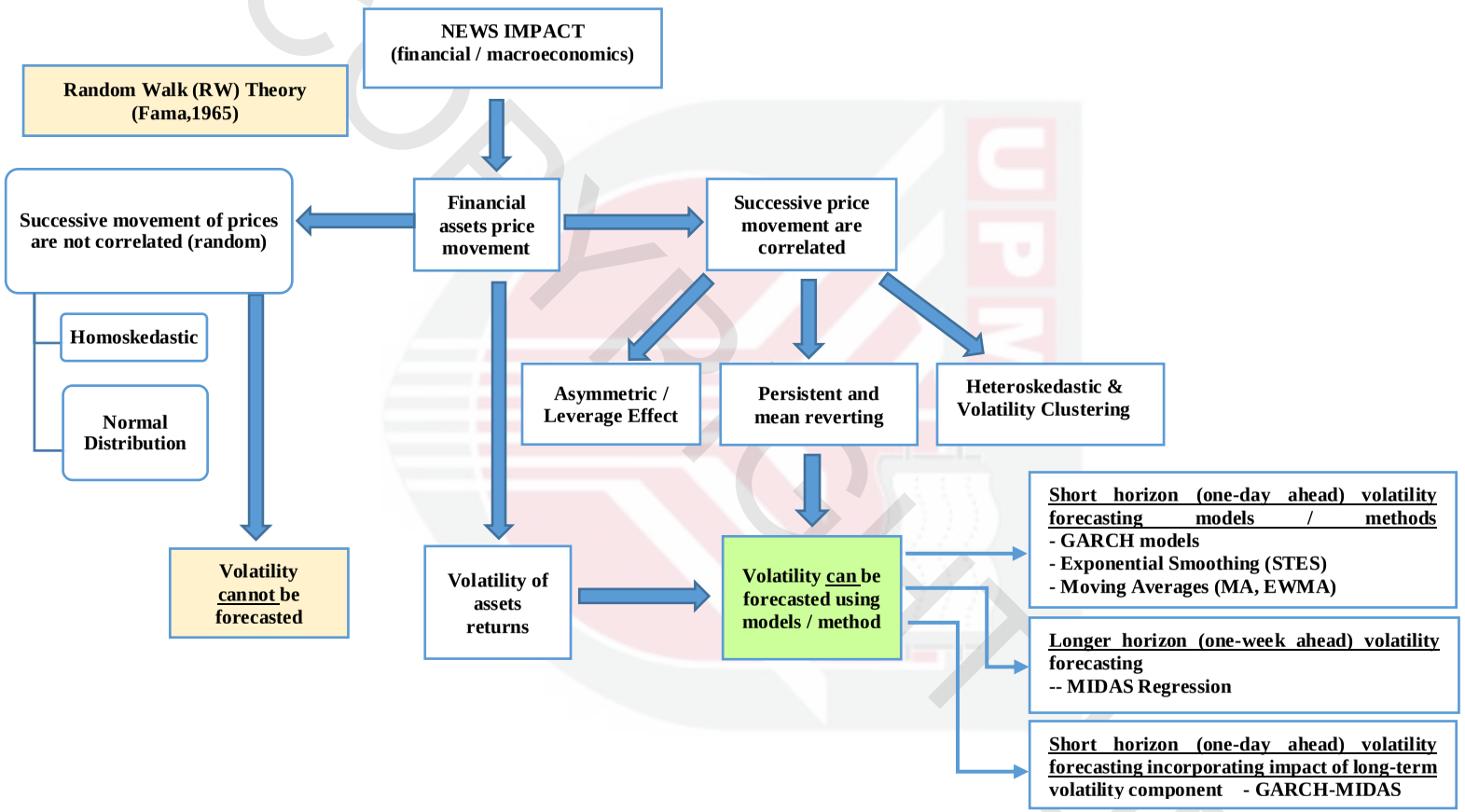

Figure 1.2 : Conceptual Framework of Volatility Forecasting
(Source: Author's own illustration)

Funds market as described in the Positive Feedback Trading Hypothesis (momentum behaviour), implying stock volatility influenced equity mutual funds inflow into and outflow from stock market. In contrast, the balanced funds inflow into and outflow from stock market is inversely related to stock market volatility, implying a Negative Feedback Trading Hypothesis (contrarian behaviour) of funds investors (Warther, 1995; Jank, 2012; Qureshi et al., 2017). This explains why a fund with low FVF value in one period has tendency to become higher in another period, depending on stock market volatility which influences mutual fund flows besides changes in the macroeconomic landscape.

FVF is defined as annualised standard deviation of mutual fund's total month-end returns for a rolling period of past 36 months (3 years). FVF is calculated using a sample standard deviation measurement:

$$\text{Suppose standard deviation} = \sqrt{A}, \text{ and } A = \frac{\sum_{i=1}^{N}(X_i-\mu)^2}{N-1} \text{ where}$$

Xi = month-end total return for the *ith* month
N = number of month-end total returns in the period
μ = the mean of the month-end total returns for the period

FVF (annualised standard deviation) = $\sqrt{}$ number of periods per year x standard deviation. As prior discussion has elaborated the weakness of standard deviation measurement for risk, FVF is an "unconditional variance", calculated from historical returns of each fund in past 36 months period does not depends on information from past periods or rather it is non-time varying.

Reliability of standard deviation as a fund risk indicator is subject to fulfilment of the assumption of normality of a fund's return series distribution, where mean is used as the central tendency indicator. Given its historical nature, it is certainly not a "forward-looking" risk indicator, hence not value-added to funds investors as an appropriate fund risk indicator in selecting funds. Past performance (whether good or bad) is not an indication or benchmark for future performance of a fund. Furthermore, the stylized facts of financial return time series will certainly undermine FVF as a fund risk indicator since it a standard deviation measurement. FVF could possibly misled investors and ended up selecting funds which contradict investors' risk tolerance, thus jeopardising their investment returns.

1.2.3 Impact of macroeconomics on long term volatility of mutual funds

Changes in macroeconomics variables like gross domestic product (GDP), general price level, supply of money, interest rates, exchange rate and unemployment do exert impact on financial market, stocks market typically. The effect from changes in macroeconomics variables can influence expectation of economic units (individuals, firms and government) with regards to expected outcome of economic condition not

merely short-term but long-term as well in view of lagged effect of macroeconomic variables on real economic variables like output and employment. The role of expectation determines the behaviors of economic units in their decision-making which influences level of consumption and investment and ultimately aggregate output of an economy.

Economic conditions constantly change over time and moves in a cyclical manner represented by business cycles. Short run economic shock or fluctuations can either result in a "recessionary gap" or an "inflationary gap" where both are not desirable. Appropriate macroeconomic policies, namely Monetary, Fiscal, Supply Side and Foreign Exchange policy, are often employed by both the Central Bank and government to eliminate imbalances and steer the economy back to its intended long-term growth path. Execution of policies will result in changes to macroeconomic variables like interest rate, money supply and exchange rate, which will affect three key macroeconomics goals of Gross Domestic Product (GDP) growth, low unemployment and manageable inflation.

Stock market is often regarded as the barometer of an economy. A strong financial market implies the strength, stability and health of an economy. Stock prices reflects investors' confidence in the companies as well as an optimistic outlook towards an economy. The fact that influence of changes in macroeconomics variables on stock prices volatility is unavoidable as documented in voluminous past literatures (Chen et al., 1986; Schwert, 1989; Schwert, 1990; Thorbecke, 1997; Kwon and Shin, 1999; Nasseh and Strauss, 2000; Abbas, Mcmillan, and Wang, 2018; John, Scicluna, and Bai, 2019). Stocks volatility triggers "wealth effect" that changes the level of consumption, investment and eventually affect aggregate demand of an economy (Schwert, 1990).

The amount of literature documenting relationships between stocks returns and mutual funds flow are significant. According to Feedback Trader hypothesis, although positive co-movement exist (Warther, 1995), stock returns induce inflows into equity based mutual funds and vice-versa, the causality is bi-directional (Jank, 2012). Given existence of co-movement between stocks return and mutual funds' performance, macroeconomic variables influencing long run volatility of stocks returns could possibly influence returns of mutual funds. While there are decent amount of literature concerning influence of macroeconomic variables on mutual funds' long-term return performance, in-depth study on its long-term volatility are scarce, both internationally and domestically. There is possibly none been done for the case of Malaysia.

The greatest challenge in assessing long-term volatility of mutual funds is differences in data frequency. Mutual funds or any other financial assets prices are in daily frequency, hence short-term volatility forecasting is never an issue. However, macroeconomics variables are generally recorded in month, quarter or annual frequency. Among the few past literatures examining long-term mutual funds' return performance in Malaysian market (Abdullah Othman, Kameel, and Abdul Aziz, 2013; Hasan, Kameel, and Aziz, 2015; Othman, Aziz, and Kassim, 2018), the dependent variables were aggregated to the

same frequency as the explanatory macroeconomic variables. The aggregation of higher frequency daily funds NAV to monthly, quarterly or annually will cause valuable information to be discarded, causing an inaccurate estimation of impact of macroeconomic variables on a fund's performance.

GARCH-MIDAS is a robust component GARCH model capable of decomposing short-term and long-term volatility components of a financial asset. Lower frequency macroeconomic variables (often sampled in monthly, quarterly or annually) can be directly imputed into the model without penalizing valuable information on volatility residing in the higher frequency funds' daily NAV via a parsimoniously parametrized MIDAS filter (Mixed Data Sampling) which uses a lag polynomial function with choices of different weighting scheme. Past literature using GARCH-MIDAS has documented better accuracy in volatility forecasting when long term volatility component is incorporated (Engle, Ghysels, & Sohn, 2013; Asgharian, Hou, & Javed, 2013; Girardin & Joyeux, 2013; Zhou, Fu, Jiang, Zeng, & Lin, 2019; Abebe, 2020).

The emergence of MIDAS Regression has resolved the issue of regression between dependent and independent variables of different frequency. Higher frequency data (intraday, daily or weekly) which contains more information on volatility can be regressed against lower frequency data (the dependent variable) capitalizing on the robust feature of the MIDAS lag polynomial function (Ghysels, Santa-Clara, & Valkanov, 2004). The MIDAS filter in the GARCH-MIDAS has enabled application of "Realized Volatility", a more robust and accurate volatility forecasting obtained from summation of squared return (higher frequency data) over a stipulated period in the long-term volatility component of GARCH-MIDAS model. Realized Volatility (standard deviation of Realized Variance) is an "unbiased estimator" for funds' return volatility as well as being proxy to actual or true volatility which is often unobservable in reality (Bollerslev and Andersen, 1998; Andersen, Bollerslev, Diebold, and Labys, 2003).

1.3 Research Questions

The following research questions are derived from various research issues highlighted as summarized in the problem statement:

Research Question 1: Do respective mutual funds' investment objectives correctly reflect funds potential return and their risk exposure indicated by the industrial accepted standard deviation based FVF (Funds Volatility Factor)?

Research Question 2: Do STES methods outperform GARCH models and other ad-hoc methods in one day ahead volatility forecasting of mutual funds' return while asymmetric GARCH outperform symmetric GARCH in capturing leverage effect?

Research Question 3: Does combination of Mixed Data Sampling (MIDAS) method with Realized Variance (RVar) measures outperform other models in longer lead time (one - week ahead) volatility forecasting of mutual funds' return?

Research Question 4: Does long-term impact of macroeconomic variables influence volatility of mutual funds and GARCH-MIDAS model outperform standard GARCH (1,1) in short-term volatility forecasting of mutual funds' return?

1.4 Research Objectives

General objective of this study is to assess risk of private equity mutual funds in Malaysia through volatility forecasting with the following four specific research objectives:

Specific Objective 1:

To examine consistency between of mutual funds' investment objective against its potential risk-return relationship of mutual fund indices measured by FVF under two different economic conditions (with and without financial crisis) using alternative risk measurement to FVF calculation.

Specific Objective 2:

To determine best model or method (among GARCH, STES, Ad-hoc) for short-term (one-day ahead) post-sample volatility forecasting of mutual fund indices under two different sub-periods of with and without financial crisis.

Specific Objective 3:

To verify supremacy of a combined mixed data sampling regression with realized variance measures in longer lead-time (one-week ahead) volatility forecasting of mutual fund indices under two different sub-periods of with and without financial crisis.

Specific Objective 4:

To examine the long-term impact of changes in macroeconomic variables on short-term volatility forecasting of mutual fund indices' return.

1.5 Scope of study

This study examines only private (exclude public equity mutual funds) equity mutual funds (exclude wholesale) in Malaysia managed by top seven private funds management companies comprising Public Mutual Bhd, CIMB-Principal Asset Management Bhd,

Affin-Hwang Capital Management Bhd, RHB Asset Management Bhd, AmFunds Management Bhd, Eastspring Investments Bhd and Manulife Investment Management Bhd. These seven local fund management companies are chosen as summation of their asset under management (up to 30th Sept 2020) is approximately 93% of total net asset value of private mutual funds in Malaysia. Their respective market share is shown in Figure 1.6.

A total of fifty-seven private equity mutual funds (exclude bond or fixed income and money market funds) from seven different fund investment objectives namely equity growth, equity growth & income, equity income, balanced growth, balanced growth & income, balanced income and mixed asset growth) are selected based on the availability of data fitting the chosen analysis period covering January 3rd 2005 to December 31st 2019. Data from year 2020 and beyond is not explored in view of possible effect by the COVID-19 pandemic as this study is specifically keen to examine behaviour of mutual funds in sub-periods with and without financial crisis.

1.6 Significance of the study

Significance of any research work implies its novelty and importance. The significance of this study lies in assessing risk of equity mutual funds in Malaysia where mutual fund investment is generally perceived as a relatively lower risk type of investment option compared to investment in stocks. For decades, most prior studies were primarily focusing on factors affecting return performance of mutual funds covering a wide scope of market timing and selectivity ability of fund managers, funds risk diversification against market risk, characteristics of mutual funds, investors behaviour, risk-return relationship, fund flow and stock market returns relationship. Effective management of fund performance does not merely revolve around maximizing returns but equally important is to manage the risk associated with the expected return as reflected in a fund's returns volatility.

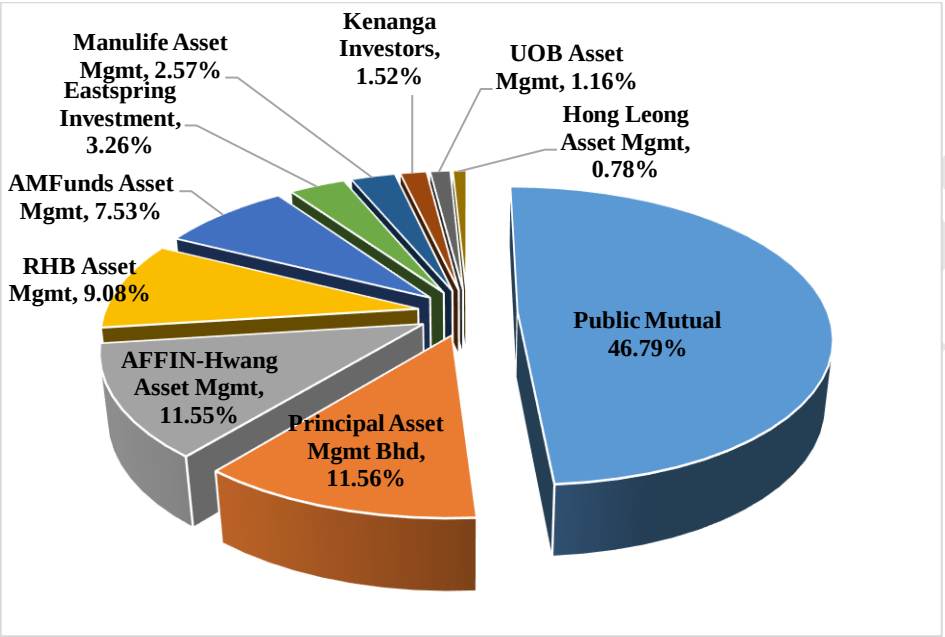

Figure 1.6 : Market share of top seven private mutual funds management companies in Malaysia
(Source: author's own compilation from respective company's website).

Past studies have merely examined trade-off between return and degree of risk diversification of a selection of individual mutual funds against market risk using the popular Capital Asset Pricing Model (CAPM). However, CAPM is not able to address issue of unique stylized fact of heteroskedasticity (non-constant variance of the error term) often found in financial return time series. It has been observed that none of the past studies on mutual fund in Malaysia have examined mutual funds' risk from a volatility forecasting perspective using Conditional Variance modelling.

Appropriately, this study offers insights into volatility of fifty-seven mutual funds of seven different fund investment objectives represented by seven fund indices, created by clustering mutual funds of the same investment objectives together as indicated in each fund's fact sheets available in the official website of respective fund management company. Using the seven equity mutual fund indices generated, this study applied several volatility forecasting models and methods comprise of the Generalized Autoregressive Conditional Heteroscedasticity (henceforth GARCH), Smooth Transition Exponential Smoothing (henceforth STES) methods, Mixed Data Sampling (henceforth MIDAS) Regression and the component GARCH-MIDAS model to estimate and forecast both short-term and long-term volatility of private equity mutual funds in Malaysia under two different sub-periods of with and without financial crisis.

The author believes this volatility study is possibly the first to assess risk of private equity mutual funds in Malaysia based on a macro-analysis perspective using seven created mutual fund indices that have existed in Malaysia to the best knowledge of the author. In addition, application of several statistically robust forecasting models and methods to examine volatility of mutual funds returns has been observed not applied before in past studies. Furthermore, the industry wide endorsed "Fund Volatility Factor" (FVF) as the funds' risk indicator has never been questioned or empirically examined about its reliability in terms of correctly reflecting the risk level of funds. Based on several weaknesses highlighted in the problem statement, it is vital to thoroughly examine using alternative approach in calculating FVF to determine consistency and reliability of the FVF risk indicator across funds of different investment objectives. Outcomes from this study provide significant managerial, business as well as policymaking implications in the following manner:

a) Existing or potential investors of unit trust funds will be able to make better informed decision of their investment in various mutual fund category when NAV of funds can be forecasted based on the volatility forecasting model developed from this study.

b) Fund managers able to better manage their customers' investment portfolio based on volatility forecasting approach using various funds' indices created.

c) Policymaker (government) will be able to gauge the impact of changes in macroeconomic variables studied with regards to volatility of various mutual funds indices, hence exercise prudence management of macroeconomic policies so as not to trigger unnecessary distortion to mutual funds market as well as stocks market (given the co-movement of both markers) that may destabilize total capital market and the Malaysian economy.

The research gaps highlighted serves as the basis of novelty and significance of this study.

1.7 Organization of the study

Following this introduction chapter, the remaining chapters of this study shall be organized in the follow manner. Chapter 2 reviews past literatures, both theoretical and empirical, on financial volatility studies covering various statistical models and methods of volatility forecasting including the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model, Smooth Transition Exponential Smoothing (STES) methods with five different transition variables, MIDAS Regression with its supremacy in handling data of different frequency and finally the GARCH-MIDAS models in accounting for impact of long-term volatility component on short-term volatility forecasting.

The methodology adopted, results and discussion on findings are presented in Chapter 3,4,5 and 6 for respective specific research objectives. Chapter 3 examines the inconsistency between risk-return and funds' objective using the GARCH in Mean

model. It also examines alternative fund risk measurements in calculating FVF by comparing two alternative measurements of Median Absolute Deviation and Realized Variance against the standard deviation measurement presently adopted by the mutual funds industry. Chapter 4 provides methodology adopted for a short-term one-day ahead volatility forecasting for all seven fund indices in two different sub-periods of with and without crisis. The in-sample and post-sample forecasting results comparison between GARCH models, STES methods and other approaches to ascertain the best volatility forecasting model under different post-sample evaluation criteria are provided and discussed. Chapter 5 elaborates the methodology adopted in a longer lead-time one-week ahead volatility forecasting. Comparative results to verify supremacy of MIDAS (Mixed Data Sampling) Regression models applied with both realized variance and residual squared measurements, against DAILYGARCH, WEEKLY-GARCH, DAILY-STES, WEEKLY-STES and Weekly Realized Variance Autoregressive model. Chapter 6 discusses the GARCH-MIDAS methodology and provides empirical results on the long-term association between volatility of fund indices and several identified macroeconomic variables using the GARCH-MIDAS model.

Lastly, Chapter 7 concludes the whole study with elaboration on the contribution of the findings from this study and its implication on macroeconomic policies management, operations of mutual funds industry (practitioners) as well as enrichment of literatures on volatility studies from perspective of mutual funds particularly. Limitations and suggestions for future research undertakings are put forth for further exploration.

1.8 Summary of the chapter

This chapter commences with highlights on the importance of managing risk reflected by volatility of financial assets' return. Forecasting volatility of asset returns is the first step towards risk assessment. The research issues highlighted three key areas of concern pertaining to risk management of mutual funds investment which serves as the foundation and motivation towards completion of this study. Four research questions are raised from the problem statement leading to establishment of four corresponding specific research objectives. Scope of study is specified while significance of the study reflects its importance and implications to literature of volatility forecasting, industrial practitioners (fund managers and fund investors) and government's macroeconomic policy planning and administration.

REFERENCES

Abbas, G., Mcmillan, D. G., & Wang, S. (2018). Conditional volatility nexus between stock markets and macroeconomic variables Empirical evidence of G-7 countries. *Journal of Economic Studies*, *45*(1), 77–99.

Abdullah, F., Hassan, T., & Mohamad, S. (2007). Investigation of performance of Malaysian Islamic unit trust funds: Comparison with conventional unit trust funds. *Managerial Finance*, *33*(2), 142–153.

Abdullah Othman, A. H., Abdul Aziz, H., & Kassim, S. (2018). Identification of macroeconomic determinants for diversification and investment strategy for Islamic unit trust funds in Malaysia. *International Journal of Emerging Markets*, *13*(4), 653–675.

Abdullah Othman, A. H., Kameel, A., & Abdul Aziz, H. (2013). Relationship between Macroeconomic Variables and Net Asset Value (NAV) of Islamic Equity Funds : Evidence from Pakistan. *Global Journal of Business and Social Science Review*, *1*(3), 5–16.

Abebe, T. H. (2020). Modeling time-varying coffee price volatility in Ethiopia. *Journal of Applied Economics*, *23*(1), 497–518.

Abebe, T. H., Woldesenbet, E. G., & Zeleke, B. L. (2020). Statistical Analysis of Price Volatility of Agricultural Commodities Traded at the Ethiopian Commodity Exchange (ECX) Using Multiplicative GARCH-MIDAS Two-component Model. *Global Business Review*, *1*(21), 1–21.

Agrawal, G., Srivastav, A. K., & Srivastava, A. (2010). A Study of Exchange Rates Movement and Stock Market Volatility. *International Journal of Business and Management*, *5*(12), 62–73.

Ahmad Hamidi, H. N., Khalid, N., & Abdu Karim, Z. (2018). Revisiting Relationship Between Malaysian Stock Market Index and Selected Macroeconomic Variables Using Asymmetric Cointegration. *Jurnal Ekonomi Malaysia*, *52*(1), 311–319.

Akgiray, V. (1989). Conditional Heteroscedasticity in Time Series of Stock Returns: Evidence and Forecasts. *The Journal of Business*, *62*(1), 55–80.

Alberg, D., Shalit, H., & Yosef, R. (2008). Estimating stock market volatility using asymmetric GARCH models. *Applied Financial Economics*, *18*(15), 1201–1208.

Alper, C. E., Fendoglu, S., & Saltoglu, B. (2012). MIDAS volatility forecast performance under market stress : Evidence from emerging stock markets. *Economics Letters*, *117*(2), 528–532.

Alwi, S., Ahmad, R., Amir Hashim, I. Z., & Mohd Naim, N. (2019). Investigating the Islamic and Conventional Mutual Fund Performance: Evidence From Malaysia Equity Market. *Journal of Modern Accounting and Auditing*, *15*(7), 371–384.

Andersen, T. G., Bollerslev, T., Diebold, F. X., & Labys, P. (2003). Modeling and forecasting realized volatility. *Econometrica*, *71*(2), 579–625.

Andreou, E., Ghysels, E., & Kourtellos, A. (2013). Should Macroeconomic Forecasters Use Daily Financial Data and How? *Journal of Business & Economic Statistics*, *31*(2), 240–251.

Angabini, A., & Wasiuzzaman, S. (2011). GARCH Models and financial crisis -A case study of the Malaysian stock market. *The International Journal of Applied Economics and Finance*, *5*(3), 226–236.

Ardhani, I. A., Effendi, J., & Irfany, M. I. (2020). The effect of macroeconomics variables to Net Asset Value (NAV) growth of shariah mutual funds in Indonesia. *Jurnal Ekonomi & Kewangan Islam*, *6*(2), 134–148.

Armesto, M. T., Engemann, K. M., & Owyang, M. T. (2010). Forecasting with Mixed Frequencies. *Federal Reserve Bank of St Louis Review*, *92*, 521–536.

Asgharian, H., Hou, A. J., & Javed, F. (2013). Importance of the macroeconomic variables for variance prediction: A GARCH-MIDAS approach. *Journal of Forecasting*, *32*(7), 600–612.

Bahmani-Oskooee, M., & Saha, S. (2015). On the relation between stock prices and exchange rates : a review article. *Journal of Economic Studies*, *42*(4), 707–732.

Bahmani-Oskooee, M., & Sohrabian, A. (1992). Stock prices and the effective exchange rate of the dollar. *Applied Economics*, *24*(4), 459–464.

Baillie, R. T., & DeGennaro, R. P. (1990). Stock Returns and Volatility. *The Journal of Financial and Quantative Analysis*, *25*(2), 203–214.

Barndorff-Nielsen, O. E., & Shepard, N. (2002). Econometric analysis of realised volatility and its use in estimating stochastic volatility models. *Journal of Royal Statistic Society*, *64*(September 2000), 253–280.

Barnes, M., Boyd, J. H., & Smith, B. D. (1999). Inflation and asset returns. *European Economic Review*, *43*(4–6), 737–754.

Barsoum, F., & Stankiewicz, S. (2015). Forecasting GDP growth using mixed-frequency models with switching regimes. *International Journal of Forecasting*, *31*(1), 33–50.

Bernardi, M., & Catania, L. (2018). The model confidence set package for R. *International Journal of Computational Economics and Econometrics*, *8*(2), 144–158.

Black, F., & Scholes, M. (1972). The Valuation of Option Contracts and A Test of Market Efficiency. *Journal of Finance*, *27*(2), 399–417.

Bliemel, F. (1973). Theil ' s Forecast Accuracy Coefficient : A Clarification. *Journal of Marketing Research*, *10*(4), 444–446.

Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics*, *31*(3), 307–327.

Bollerslev, T., & Andersen, T. (1998). Answering the Skeptics : Yes, Standard Volatility Models do Provide Accurate Forecasts. *International Economic Review*, *39*(4), 1–22.

Bollerslev, T., Chou, R. Y., & Kroner, K. F. (1992). ARCH modeling in finance - A review of the theory and empirical evidence. *Journal of Econometrics*, *52*(1–2), 5–59.

Bollerslev, T., & Wooldridge, J. M. (1992). Quasi-maximum likelihood estimation and inference in dynamic models with time-varying covariances. *Econometric Reviews*, *11*(2), 143–172.

Boo, Y. L., Ee, M. S., Li, B., & Rashid, M. (2017). Islamic or conventional mutual funds: Who has the upper hand? Evidence from Malaysia. *Pacific Basin Finance Journal*, *42*, 183–192.

Box, G. E. P., & Pierce, D. A. (1970). Distribution of Residual in Autoregressive-Autocorrelations Integrated Moving Average Time Series Models. *Journal of the American Statistical Association*, *65*(332), 1509–1526.

Breen, W., & Glosten, L. R. (1989). Economic Significance of Predictable Variations in Stock Index Returns. *The Journal of Finance*, *XLIV*(5), 1177–1189.

Brooks, C. (1998). Predicting stock index volatility : can market volume help ? *Journal of Forecasting*, *17*(1), 59–80.

Brown, S. J., & Goetzmann, W. N. (1997). Mutual Fund Styles. *Journal of Financial Economics*, *43*(3), 373–399.

Busse, J. A. (1999). Volatility Timing in Mutual Funds : Evidence from Daily Returns. *The Review of Financial Studies*, *12*(5), 1009–1041.

Campbell.J.Y. (1987). Stock returns and the term structure. *Journal of Financial Economics*, *18*(2), 373–399.

Campbell, J. Y., & Hentschel, L. (1992). No news is good news An asymmetric model of changing volatility in stock returns. *Journal of Financial Economics*, *31*(3), 281–318.

Cao, C., Chang, E. C., & Wang, Y. (2008). An empirical analysis of the dynamic relationship between mutual fund flow and market return volatility. *Journal of Banking and Finance*, *32*(10), 2111–2123.

Çelik, S., & Ergin, H. (2014). Volatility forecasting using high frequency data : Evidence from stock markets ☆. *Economic Modelling*, *36*, 176–190.

Chan, K. C., Karolyi, A., & Stulz, R. M. (1992). Global financial markets and the risk premium on U . S . equity. *Journal of Financial Economics*, *32*(2), 137–167.

Chan, Y., & Cheng, T. . L. (2003). Asset Allocation and Selectivity of Asian Mutual Funds During Financial Crisis. *Review of Quantative Finance and Accounting*, *21*, 233–250.

Charles, A., & Darné, O. (2019). The accuracy of asymmetric GARCH model estimation. *International Economics*, *157*(March 2018), 179–202.

Chen, C. R., Lee, C. F., Rahman, S., & Chan, A. (1992). A cross-sectional analysis of mutual funds' market timing and security selection skill. *Journal of Business Finance & Accounting*, *19*(5), 659–675.

Chen, L., Adams, A., & Taf, R. (2013). What style-timing skills do mutual fund " stars " possess ? *Journal of Empirical Finance*, *21*, 156–173.

Chen, N., Roll, R., & Ross, S. A. (1986). Economic Forces and the Stock Market. *Journal of Business*, *59*(3), 383–403.

Choo, W.-C., Lee, S.-N., & Ung, S.-N. (2011). Macroeconomics uncertainty and performance of GARCH models in forecasting Japan stock market volatility. *International Journal of Business and Social Science*, *2*(1), 200–208.

Choo, W. C., Ahmad, M. I., & Abdullah, M. Y. (1999). Performance of GARCH models in forecasting stock market volatility. *Journal of Forecasting*, *18*(5), 333–343.

Chou, R. A. Y. Y. (1988). Volatility Persistence and Stock Valuations: Some empirical evidence using GARCH. *Journal of Applied Econometrics*, *3*(4), 279–294.

Choudhry, T. (1995). Integrated-GARCH and non-stationary variances: Evidence from European stock markets during the 1920s and 1930s. *Economics Letters*, *48*(1), 55–59.

Christie, A. A. (1982). The Stochastic Behaviour of Common Stock Variances. *Journal of Financial Economics*, *10*, 407–432.

Chuang, I.-Y., Lu, J., & Lee, P. (2007). Forecasting volatility in the financial markets : a comparison of alternative distributional assumptions. *Applied Financial Economics*, *17*(13), 1051–1060.

Clements, M. P. (2008). Macroeconomic Forecasting With Mixed-Frequency Data : Forecasting Output Growth in the United States. *Journal of Business & Economic Statistics*, *26*(4), 546–554.

Conrad, C., & Loch, K. (2015). Anticipating Long-Term Stock Market Volatility. *Journal of Applied Econometrics*, *30*(7), 1090–1114.

Corielli, F., & Marcellino, M. (2006). Factor based index tracking. *Journal of Banking and Finance*, *30*(8), 2215–2233.

Cousineau, D., & Chartier, S. (2010). Outliers detection and treatment : a review. *International Journal of Psychological Research*, *3*(1), 58–67.

Darrat, A. F., Gilley, O. W., Li, B., & Wu, Y. (2011). Revisiting the risk/return relations in the Asian Pacific markets: New evidence from alternative models. *Journal of Business Research*, *64*(2), 199–206.

Day, T. E., & Lewis, C. M. (1992). Stock market volatility and the information content of stock index options. *Journal of Econometrics*, *52*(1–2), 267–287.

De Long, J. B. et. a. (1990). Noise Trader Risk in Financial Markets. *The Journal of Political Economy*, *98*(4), 703–738.

DiBartolomeo, D., & Witkowski, E. R. (1997). Mutual fund misclassification : evidence based on style analysis. *Financial Analysts Journal*, *53*(5), 32.

Diebold, F. X., & Mariano, R. S. (2002). Comparing Predictive Accuracy. *Journal of Business and Economics Statistics*, *20*(1), 134–144.

Dönmez, A., & Magrini, E. (2013). *Agricultural Commodity Price Volatility and Its Macroeconomic Determinants : A GARCH-MIDAS Approach*. Seville, Spain.

Dritsaki, C. (2017). An Empirical Evaluation in GARCH Volatility Modeling : Evidence from the Stockholm Stock Exchange. *Journal of Mathematical Finance*, *7*(2), 366–390.

Edelen, R. M., & Warner, J. B. (2001). Aggregate price effects of institutional trading: A study of mutual fund flow and market returns. *Journal of Financial Economics*, *59*(2), 195–220.

Engle, R. F. (1982). Autoregressive Conditional Heteroscedasticity with estimates of the variance of UK inflation. *Econometrica*, *50*(4), 987–1007.

Engle, R. F., & Bollerslev, T. (1986). Modelling the persistence of conditional variances. *Economic Reviews*, *5*(1), 1–50.

Engle, R. F., Ghysels, E., & Sohn, B. (2008). On the Economic Sources of Stock Market Volatility. In *AFA 2008 New Orleans Meeting paper*.

Engle, R. F., Ghysels, E., & Sohn, B. (2013). Stock Market Volatility and Macroeconomic Fundamentals. *The Reivew of Economics and Statistics*, *95*(3), 776–797.

Engle, R. F., & Gonzalez-Rivera, G. (1991). Semiparametric ARCH models. *Journal of Business & Economic Statistics*, *9*(4), 345–359.

Engle, R. F., Lilien, D. M., & Robins, R. P. (1987). Estimating Time Varying Risk Premia in the Term Structure: The Arch-M Model. *Econometrica*, *55*(2), 391–407.

Engle, R. F., & Ng, V. K. (1993). Measuring and testing impact of news on volatility. *The Journal of Finance*, *48*(5), 1749–1778.

Engle, R. F., & Rangel, J. G. (2008). The Spline-GARCH model for low frequency volatility and its global macroeconomics causes. *Review Finance Studies*, *21*(3), 1187–1222.

Evans, J. L., & Archer, S. H. (1968). Diversification and the reduction of dispersion: An empirical analysis. *The Journal of Finance*, *23*(5), 761–767.

Fama, E. F. (1965a). Random Walks in Stock Market Prices. *Financial Analysts Journal*, *51*(1), 75–80.

Fama, E. F. (1965b). The Behaviour of Stock Market Prices. *Journal of Business*, *38*(1), 34–105.

Fama, E. F. (1990). Stock Returns, Expected Returns, and Real Activity. *The Journal of Finance*, *45*(4), 1089–1108.

Fama, E. F., & Schwert, G. W. (1977). Asset returns and inflation. *Journal of Financial Economics*, *5*(2), 115–146.

Feng, L., & Shi, Y. (2017). A simulation study on the distributions of disturbances in the GARCH model. *Cogent Economics and Finance*, *5*(1), 1–19.

Figlewski, S. (1997). Forecasting Volatility. *Financial Markets, Institutions & Instruments*, *6*(1), 1–88.

Foroni, C., Marcellino, M., & Schumacher, C. (2011). *U-MIDAS : MIDAS regressions with unrestricted lag polynomials* (No. 35/2011). Frankfurt, Germany.

Foroni, C., Marcellino, M., & Schumacher, C. (2015). Unrestricted mixed data sampling (MIDAS): MIDAS regressions with unrestricted lag polynomials. *Journal of the Royal Statistical Society*, *178*(1), 57–82.

Franses, P. H., & Ghijsels, H. (1999). Additive outliers , GARCH and forecasting volatility. *International Journal of Forecasting*, *15*(1), 1–9.

Franses, P. H., & Van Dijk, D. (1996). Forecasting sock market volatility using non-linear GARCH models. *Journal of Forecasting*, *15*(3), 229–235.

Frazzini, A., & Lamont, O. A. (2008). Dumb money : Mutual fund flows and the cross-section of stock returns. *Journal of Financial Economics*, *88*(2), 299–322.

French, K. R., Schwert, G. W., & Stambaugh, R. F. (1987). Expected stock returns and variance. *Journal of Financial Economics*, *19*, 3–29.

Gabriel, A. S. (2012). Evaluating the Forecasting Performance of GARCH Models. Evidence from Romania. *Procedia - Social and Behavioral Sciences*, *62*, 1006–1010.

Gao, Y., Zhang, C., & Zhang, L. (2012). Comparison of GARCH models based on different distributions. *Journal of Computers*, *7*(8), 1967–1973.

Gardner, E. S. (1985). Exponential Smoothing: The State of the Art. *Journal of Forecasting*, *4*(1), 1–28.

Ghysels, E., & Hang, Q. (2019). Estimating MIDAS regressions via OLS with polynomial parameter profiling. *Econometrics and Statistics*, *9*, 1–16.

Ghysels, E., Santa-Clara, P., & Valkanov, R. (2004). *The MIDAS Touch : Mixed Data Sampling Regression Models*. Los Angeles, United States of America.

Ghysels, E., Santa-Clara, P., & Valkanov, R. (2005). There is a risk-return trade-off after all. *Journal of Financial Economics*, *76*(3), 509–548.

Ghysels, E., Santa-Clara, P., & Valkanov, R. (2006). Predicting volatility: Getting the most out of return data sampled at different frequencies. *Journal of Econometrics*, *131*(1–2), 59–95.

Ghysels, E., Sinko, A., & Valkanov, R. (2007). MIDAS Regressions : Further Results and New Directions. *Econometric Reviews*, *26*(1), 53–90.

Giambona, E., & Golec, J. (2009). Mutual fund volatility timing and management fees. *Journal of Banking and Finance*, *33*(4), 589–599.

Girardin, E., & Joyeux, R. (2013). Macro fundamentals as a source of stock market volatility in China: A GARCH-MIDAS approach. *Economic Modelling*, *34*, 59–68.

Glosten, L. R., Jagannathan, R., & Runkle, D. E. (1993). On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks. *Journal of Finance*, *48*(5), 1779–1801.

Goetzmann, W. N., & Massa, M. (2003). Index Funds and Stock Market Growth. *Journal of Business*, *76*(1), 1–28.

Grinblatt, M., & Titman, S. (1989). Mutual fund performance - an analysis of quarterly portfolio holdings. *The Journal of Business*, *62*(3), 393–416.

Grinblatt, M., Titman, S., & Wermers, R. (1995). Momentum Investment Strategy, Portfolio performance and Herding - A study of mutual fund behaviour. *The American Economic Review*, *85*(5), 1088–1105.

Guan-Ru Wu, G., Chieh-Tse Hou, T., & Lin, J. L. (2018). Can economic news predict Taiwan stock market returns? *Asia Pacific Management Review*, *24*(1), 54–59.

Habibullah, M. S., & Baharunshah, A. Z. (1996). Money, Output and Stock Prices in Malaysia: an Application of the Cointegration Tests. *International Economic Journal*, *10*(2), 121–130.

Hamao, Y. (1988). An Empirical Examination of the Arbitrage Pricing Theory: Using Japanese Data. *Japan and the Word Economy*, *1*(1), 45–61.

Hamilton, J. D., & Susmel, R. (1994). Autoregressive conditional heteroskedasticity and changes in regime. *Journal of Econometrics*, *64*(1–2), 307–333.

Hammami, Y., Jilani, F., & Oueslati, A. (2013). Mutual fund performance in Tunisia: A multivariate GARCH approach. *Research in International Business and Finance*, *29*(1), 35–51.

Hansen, Peter R., Huang, Z., & Shek, H. H. (2011). Realized GARCH: A joint model for returns and realized measures of volatility. *Journal of Applied Econometrics*, *27*(6), 877–906.

Hansen, Peter R., & Lunde, A. (2005). A forecast comparison of volatility models: Does anything beat a GARCH(1,1)? *Journal of Applied Econometrics*, *20*(7), 873–889.

Hansen, Peter R., Lunde, A., & Nason, J. N. (2011). The Model Confidence Set. *Econometrica*, *79*(2), 453–497.

Hansen, Peter R., & Timmermann, A. (2012). *Choice of Sample Split in Out-of-Sample Forecast Evaluation* (No. EUI Working Paper ECO2012/10). Florence, Italy.

Hansen, Peter Reinhard, & Lunde, A. (2003). *Consistent preordering with an estimated criterion function, with an application to the evaluation and comparison of volatility models* (No. 2003–01). Rhode Island, United States.

Hansen, Peter Reinhard, Lunde, A., & Nason, J. M. (2003). Choosing the Best Volatility Models: The Model Confidence Set Approach. *Oxford Bulletin of Economics and Statistics*, *65*.

Harvey, C. R. (2001). The specification of conditional expectations. *Journal of Empirical Finance*, *8*(5), 573–637.

Hasan, A. A. O., Kameel, A., & Aziz, H. A. (2015). Causal Relationship between Macro-Economic Indicators and Funds Unit Prices Behavior : Evidence from Malaysian Islamic Equity Unit Trust Funds Industry. *International Journal of Social, Education, Economics and Management Engineering*, *9*(1), 192–200.

He, W., & Cao, B. (2015). The Performance and Market Timing Ability of Chinese Mutual Funds. *Financial Services Review*, *24*(3), 289.

Hendriksson, R. D. (1984). Market Timing & funds performance. *The Journal of Business*, *57*(1), 73–96.

Herwartz, H. (2017). Stock return prediction under GARCH — An empirical assessment. *International Journal of Forecasting*, *33*(3), 569–580.

Huber, P. J. (1981). Robust statistics. In *John Wiley & Sons Inc* (Vol. 60). New York: John Wiley & Sons Inc.

Hudson, Y., Yan, M., & Zhang, D. (2020). Herd behaviour & investor sentiment: Evidence from UK mutual funds. *International Review of Financial Analysis*, *71*(January), 2–14.

Humphrey, J. E., Benson, K. L., Low, R. K. Y., & Lee, W. L. (2015). Is diversification always optimal? *Pacific Basin Finance Journal*, *35*(Part B), 521–532.

Hung, W., Lu, C., & Lee, C. F. (2010). Mutual fund herding its impact on stock returns : Evidence from the Taiwan stock market. *Pacific-Basin Finance Journal*, *18*(5), 477–493.

Inci, A. C., & Lee, B. S. (2014). Dynamic relations between stock returns and exchange rate changes. *European Financial Management*, *20*(1), 71–106.

Indro, D. C. (2013). Does Mutual Fund Flow Reflect Investor Sentiment? *Journal of Behavioral Finance*, *5*(2), 105–115.

Inoue, A., & Kilian, L. (2004). In-sample or out-of-sample tests of predictability: Which one should we use? *Econometric Reviews*, *23*(4), 371–402.

Ippolito, R. A. (1989). Efficiency with costly information: A study of mutual fund performacne 1965 - 1984. *The Quarterly Journal of Economics*, *CIV*(1), 1–23.

Jank, S. (2012). Mutual fund flows , expected returns , and the real economy. *Journal of Banking and Finance*, *36*(11), 3060–3070.

Jarque, C. M., & Bera, A. K. (1980). Efficient tests for normality, homoscedasticity and serial independence of regression residuals. *Economics Letters*, *6*(3), 255–259.

Javed, F., & Mantalos, P. (2013). GARCH-Type models and performance of Information Criteria. *Communication in Statistics - Simulation & Computations*, *42*(8), 1917–1933.

Jensen, M. C. (1967). The Performance Of Mutual Funds In The Period 1945-1964. *Journal of Finance*, *23*(2), 389–416.

Jensen, M. C. (1969). Risk, The pricing of capital assets, and the evaluation of investment portfolios. *The Journal of Business*, *42*(2), 167–247.

Jiang, Y., Guo, Y., & Zhang, Y. (2017). Forecasting China ' s GDP growth using dynamic factors and mixed-frequency data. *Economic Modelling*, *66*, 132–138.

Jin, X., & Yang, X. (2004). Empirical study on mutual fund objective classification. *Journal of Zhejiang University-SCIENCE A*, *5*(5), 533–538.

John Camilleri, S., Scicluna, N., & Bai, Y. (2019). Do stock markets lead or lag macroeconomic variables ? Evidence from select European countries. *North American Journal of Economics and Finance*, *48*(February), 170–186.

Kacperczyk, M., Nieuwerburgh, S. V. A. N., & Veldkamp, L. (2014). Time-Varying Fund Manager Skill. *The Journal of Finance*, *LXIX*(4), 1455–1484.

Kalam, K. (2020). The Effects of Macroeconomic Variables on Stock Market Returns : Evidence The Effects of Macroeconomic Variables on Stock Market Returns : Malaysia ' s Stock Market Return Performance Evidence from. *Journal of World Business*, *55*(August).

Kao, G. W., Cheng, L. T. W., & Chan, K. C. (1998). International mutual fund selectivity and market timing during up and down market conditions. *The Financial Review*, *33*(2), 127–144.

Kaplan, S., & Garrick, J. (1981). On the definition of risk aversion. *Risk Analysis*, *1*(1), 11–27.

Kaul, G. (1987). Stock returns and inflation. The role of the monetary sector. *Journal of Financial Economics*, *18*(2), 253–276.

Kim, H., Kwon, O., & Oh, G. (2016). A causality between fund performance and stock market. *Physica A*, *443*(September 2008), 439–450.

Kim, M., Shukla, R., & Tomas, M. (2000). Mutual Fund Objective Misclassification. *Journal of Economics and Business*, *52*(4), 309–323.

Kingnetr, N., Tungtrakul, T., & Sriboonchitta, S. (2017). Forecasting GDP Growth in Thailand with Different Leading Indicators Using MIDAS Regression Models. *Robustness in Econometrics*, *692*, 511–521.

Kok, K., Goh, K., & Wong, Y. (2004). Selectivity and Market Timing Performance of Malaysian Unit Trusts. *Malaysian Journal of Economic Studies*, *XXXXI*(1 & 2), 71–85.

Kuhe, D. A. (2018). Modelling volatility persistence and asymmetry with exogenous breaks in the Nigerian stocks returns. *Journal of Applied Statistics*, *9*(1), 167–196.

Kuzin, V., Marcellino, M., & Schumacher, C. (2011). MIDAS vs . mixed-frequency VAR : Nowcasting GDP in the euro area. *International Journal of Forecasting*, *27*(2), 529–542.

Kwon, C. S., & Shin, T. S. (1999). Cointegration and causality between macroeconomic variables and stock market returns. *Global Finance Journal*, *10*(1), 71–81.

Ladokhin, S. (2009). *Forecasting Volatility in the Stock*. Amsterdam.

Lamoureux, C. G., & Lastrapes, W. D. (1990). Persistence in Variance , Structural Change and the GARCH Mode. *Journal of Business & Economic Statistics*, *8*(2), 225–234.

Lee, C. F., Chen, G.-M., & Rui, O. M. (2001a). Stock returns and volatility on chinas stock markets. *The Journal of Financial Research*, *24*(4), 523–543.

Lee, C. F., Chen, G. M., & Rui, O. M. (2001b). Stock returns and volatility on china's stock markets. *Journal of Financial Research*, *24*(4), 523–543.

Lehmann, B. N., & Modest, D. M. (1987). Mutual fund performance evaluation - a comparison of benchmarks. *The Journal of Finance*, *42*(2), 233–265.

Leys, C., Klein, O., Bernard, P., & Licata, L. (2013). Detecting outliers : Do not use standard deviation around the mean , use absolute deviation around the median. *Journal of Experimental Social Psychology*, *49*(4), 764–766.

Li, B., Su, J. J., & Wu, Y. (2011). Risk and Returns in the Asian Pacific Markets : The MIDAS Approach. *European Journal of Economics, Finance & Administrative Sciences*, (30), 76–83.

Lim, C. M., & Sek, S. K. (2013). Comparing the performances of GARCH-type models in capturing the stock market volatility in Malaysia. *Procedia Economics and Finance*, *5*(13), 478–487.

Liu, H., Chiang, S., & Cheng, N. Y. (2012). Forecasting the volatility of S & P depositary receipts using GARCH-type models under intraday range-based and return-based proxy measures. *International Review of Economics and Finance*, *22*(1), 78–91.

Liu, M., Taylor, J. W., & Choo, W. C. (2020). Further empirical evidence on the forecasting of volatility with smooth transition exponential smoothing. *Economic Modelling*, *93*(November 2019), 651–659.

Livingston, M., Yao, P., & Zhou, L. (2019). The volatility of mutual fund performance. *Journal of Economics and Business*, (February), 1–19.

Ljung, G. M., & Box, G. E. P. (1978). On a Measure of Lack of Fit in Time Series Models. *Biometrika*, *65*(2), 297–303.

Ljung, G. M., & Box, G. E. P. (1979). The likelihood function of stationary autoregressive-moving average models. *Biometrika*, *66*(2), 265–270.

Low, S.-W. (2007a). Malaysian unit trust funds' performance during up and down market conditions: a comparison of market benchmark. *Managerial Finance*, *33*(2), 154–166.

Low, S.-W. (2007b). Malaysian unit trust funds ' performance during up and down market conditions. *Managerial Finance*, *33*(2), 154–166.

Low, Soo-wah. (2012). Market Timing and Selectivity Performance: A cross-sectional analysis of Malaysian unit trust. *Prague Economic Papers*, *2*, 205–219.

Low, Soo- Wah, & Ghazali, N. A. (2007). The price linkages between Malaysian unit trust funds and the stock market. *Managerial Finance*, *33*(2), 89–101.

Ma, X., Yang, R., Zou, D., & Liu, R. (2020). Measuring extreme risk of sustainable financial system using GJR-GARCH model trading data-based. *International Journal of Information Management*, *50*(January 2019), 526–537.

Malkiel, B. G. (1979). The Capital Formation Problem in the United States. *The Journal of Finance*, *34*(2), 291–306.

Malmsten, H., & Teräsvirta, T. (2010). Stylized Facts of Financial Time Series and Three Popular Models of Volatility. *European Journal of Pure and Aplplied Mathematics*, *3*(3), 443–477.

Mandelbrot, B. (1963). The Variation of Certain Speculative Prices. *The Journal of Business*, *36*(4), 394.

Mandelker, G., & Tandon, K. (1985). Common stock returns, real activity, money, and inflation: Some international evidence. *Journal of International Money and Finance*, *4*(2), 267–286.

Mansor, F., & Bhatti, M. I. (2011). The Islamic mutual fund performance : New evidence on market timing and stock selectivity. *International Conference on Economics and Finance Research*, 487–494.

Mansor, F., & Bhatti, M. I. (2017). Evidence of risk and return performance of Islamic mutual funds: The case of Malaysia. *Advances in Islamic Finance, Marketing, and Management*, 81–101.

Maysami, R. C., & Koh, T. S. (2000). A vector error correction model of the Singapore stock market. *International Review of Economics and Finance*, *9*(October 1980), 79–96.

McLeod, I. A., & Li, W. . (1983). Diagnostic Checking ARMA Time Series Models Using Squared-Residual Autocorrelation. *Journal of Time Series Analysis*, *4*(4), 269–273.

McMillan, D. G., & Speight, A. E. H. (2004). Daily volatility forecasts: Reassessing the performance of GARCH models. *Journal of Forecasting*, *23*(6), 449–460.

Md Nassir, A., Mohamed, S., & Ngu, M. H. (1997). Selectivity and Timing : Evidence from the Performance of Malaysian Unit Trusts. *Pertanika Journal of Social Science and Humanities*, *5*(1), 45–57.

Merton, R. C. (1980). On estimating the expected return on the market. *Journal of Financial Economics*, *8*(4), 323–361.

Mohamed, S., & Mohd Nassir, A. (1995). The Performance of Unit Trusts in Malaysia: Some evidence. *Capital Market Review*, *3*(2).

Mohd Hussin, M. Y., Muhammad, F., Abu, M. F., & Awang, S. A. (2012). Macroeconomic Variables and Malaysian Islamic Stock Market : A Time Series Analysis. *Journal of Business Studies Quarterly*, *3*(4), 1–13.

Morana, C. (2002). IGARCH effects: An interpretation. *Applied Economics Letters*, *9*(11), 745–748.

Mukherjee, T. K., & Naka, A. (1995). Dynamic Relations between Macroeconomic Variables and the Japanese Stock Market : An Application of a Vector Error Correction ... *Journal of Financial Research*, *18*(2), 223–237.

Musa, Y., Adamu, I., & Sani Dauran, N. (2020). Forecasting of the Nigeria Stock Returns Volatility Using GARCH Models with Structural Breaks. *Asian Research Journal of Mathematics*, *16*(2), 39–50.

Musah, A., Senyo, D. B., & Nuhu, E. (2014). Market timing and selectivity performance of mutual funds in Ghana. *Management Science Lettrs*, *4*(7), 1361–1368.

Nasseh, A., & Strauss, J. (2000). Stock prices and domestic and international macroeconomic activity : a cointegration approach. *The Quarterly Review of Economics and Finance*, *40*(2), 229–245.

Nelson, D. B. (1991a). Conditional Heteroscedasticity in Asset Returns - A New Approach. *Econometrica*, *59*(2), 347–370.

Nelson, D. B. (1991b). Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica*, *59*(2), 347–370.

Nikmanesh, L., Nor, A. H. S. M., Sarmidi, T., & Janor, H. (2014). Causal relationship between the volatility of stock market and selected macroeconomic variables: Case of Malaysia. *Jurnal Ekonomi Malaysia*, *48*(1), 143–154.

Oh, N. Y., & Parwada, J. T. (2007). Relations between mutual fund flows and stock market returns in Korea. *International Financial Markets Institutions & Money*, *17*(2), 140–151.

Pal, K., & Mittal, R. (2011). Impact of macroeconomic indicators on Indian capital markets. *Journal of Risk Finance*, *12*(2), 84–97.

Pan, Z., & Liu, L. (2018). Forecasting stock return volatility : A comparison between the roles of short-term and long-term leverage effects. *Physica A*, *492*(Feb 2018), 168–180.

Pan, Z., Wang, Q., Wang, Y., & Yang, L. (2018). Forecasting US Real GDP using oil prices: A time-varying parameter MIDAS model. *Energy Economics*, *72*(May 2018), 177–187.

Parasuraman, N. R., & Ramudu, P. J. (2014). *Price Weighted Vs . Value Weighted Index : A Comparative Analysis and Impact on Index Based Portfolio Performance*. Bangalore, India.

Peters, J. (2001). *Estimating and forecasting volatility of stock indices using asymmetric GARCH models and (Skewed) Student-t densities*. Belgium.

Phillips, P. C. ., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335–346.

Pindyck, R. S., Abel, A., Black, F., Bodie, Z., Friedman, B., Holland, D., … Ruback, R. (1984). Risk, Inflation and Stock Market. *American Economic Review*, *74*(3), 335–351.

Poon, S.-H., & Granger, C. W. J. (2003). Forecasting Volatility in Financial Markets: A Review. *Journal of Economic Literature*, *XLI*(June), 478–539.

Poon, S., & Granger, C. (2005). Practical Issues in Forecasting Volatility. *Financial Analysts Journal*, *61*(1), 45–56.

Poon, S., & Taylor, S. J. (1992). Stock returns and volatility : An empirical study of the UK stock market. *Journal of Banking and Finance*, *16*(1), 37–59.

Poterba, J. M., & Summers, L. H. (1986). The persistence of volatility and stock market fluctuations. *American Economic Review*, *76*(5), 1142–1151.

Pownall, R. A. J., & Koedijk, K. G. (1999). Capturing downside risk in financial markets: The case of the Asian crisis. *Journal of International Money and Finance*, *18*(6), 853–870.

Qureshi, F., Kutan, A. M., Ismail, I., & Gee, C. S. (2017). Mutual funds and stock market volatility: An empirical analysis of Asian emerging markets. *Emerging Markets Review*, *31*(June), 176–192.

Rabemananjara, R., & Zakoian, J. M. (1993). Threshold arch models and asymmetries in volatility. *Journal of Applied Econometrics*, *8*(1), 31–49.

Rana, S. B. (2020). Dynamics of Time Varying Volatility in Stock Returns : Evidence from Nepal Stock Exchange. *Journal of Business and Social Sciences Research*, *5*(1), 15–34.

Rao, Z., Tauni, M. Z., Iqbal, A., & Umar, M. (2017). Emerging market mutual fund performance : evidence for China. *Journal of Asia Business Studies*, *11*(2), 167–187.

Rapach, D. E., & Wohar, M. E. (2006). In-sample vs. out-of-sample tests of stock return predictability in the context of data mining. *Journal of Empirical Finance*, *13*(2), 231–247.

RiskMetrics. (1996). *Risk Metrics TM, Technical Document. Risk Metrics Group* (4th ed; J. Longerstaey & M. Spencer, Eds.). New York, US: JP Morgan / Reuters.

Rousseeuw, P. J., & Croux, C. (1993). Alternatives to the median absolute deviation. *Journal of the American Statistical Association*, *88*(424), 1273–1283.

Rousseeuw, P. J., & Hubert, M. (2011). Robust statistics for outlier detection. *WIREs Data Mining Knowledge Discovery*, *1*(February), 73–79.

Said, S. E., & Dickey, D. A. (1984). Testing for unit roots in autoregressive-moving average models of unknown order. *Biometrika*, *71*(3), 599–607.

Schwert. William G. (1989). Why does stock market volatility change over time? *The Journal of Finance*, *44*(5), 1115–1153.

Schwert, G. W. (1990). Stock Returns and Real Activity : A Century of Evidence. *The Journal of Finance*, *XLV*(4), 1237–1257.

Shamiri, A., & Isa, Z. (2009). Modelling & forecasting stock market in Malaysia. *Journal of Mathematics and Statistics*, *5*(3), 234–240.

Sharpe, W. F. (1966). Mutual-Fund-Performance. *The Journal of Business*, *39*(1), 119–138.

Singhania, M., & Anchalia, J. (2013). Volatility in Asian stock markets and global financial crisis. *Journal of Advances in Management Research*, *10*(3), 333–351.

Song, H., Liu, X., & Romilly, P. (1998). Stock returns and volatility: An empirical study of Chinese stock markets. *International Review of Applied Economics*, *12*(1), 129–139.

Statman, M. (1987). How Many Stocks Make a Diversified Portfolio ? *The Journal of Financial and Quantitative Analysis*, *22*(3), 353–363.

Surz, R. J., & Price, M. (2000). The Truth About Diversification by the Numbers. *The Journal of Investing*, *9*(4), 93–95.

Tang, K., Wang, W., & Xu, R. (2012). Size and performance of Chinese mutual funds: The role of economy of scale and liquidity. *Pacific Basin Finance Journal*, *20*(2), 228–246.

Tashman, L. J. (2000). Out-of-sample tests of forecasting accuracy: An analysis and review. *International Journal of Forecasting*, *16*(4), 437–450.

Taylor, J. W. (2004a). Smooth Transition Exponential Smoothing. *Journal of Forecasting*, *23*(6), 385–404.

Taylor, J. W. (2004b). Volatility forecasting with smooth transition exponential smoothing. *International Journal of Forecasting*, *20*(2), 273–286.

Thorbecke, W. (1997). On stock market returns and monetary policy. *Journal of Finance*, Vol. 52, pp. 635–654.

Treynor, J. L., & Mazuy, K. K. (1966). Can Mutual Fund Outguess the Market. *Harvard Business Review*, 131–136.

Trigg, D. W., & Leach, A. G. (1967). Exponential Smoothing with an Adaptive Response Rate. *The Journal of Operational Research*, *18*(1), 53–59.

Tsui, A. K., Xu, C. Y., & Zhang, Z. (2018). Macroeconomic forecasting with mixed data sampling frequencies: Evidence from a small open economy. *Journal of Forecasting*, *37*(6), 666–675.

Ünal, G., & Faruk, Ö. (2015). Selectivity and Market Timing Ability of Polish Fund Managers Analysis of Selected Equity Funds. *Procedia - Social and Behavioral Sciences*, *213*(212), 411–416.

V. Rasiah, R. R. (2010). Macroeconomic Activity and the Malaysian Stock Market: Empirical Evidence of Dynamic Relations. *The International Journal of Business & Finance Research*, *4*(2), 59–69.

Veloso Neto, N. M., Sequeira da Mota Lobao, J. F. S., & Vieira, E. S. (2017). Do Portuguese mutual funds display forecasting skills ? *Studies in Economics and Finance*, *34*(4), 597–631.

Wander, B. H., & D'Vari, R. (2003). The Limitations of Standard Deviation as a Measure of Bond Portfolio Risk. *The Journal of Wealth Management*, *6*(3), 35–38.

Wang, L., Ma, F., Liu, J., & Yang, L. (2020). Forecasting stock price volatility: New evidence from the GARCH-MIDAS model. *International Journal of Forecasting*, *36*(2), 684–694.

Warther, V. A. (1995). Aggregate mutual fund flows and security returns. *Journal of Financial Economics*, *39*(2–3), 209–235.

Watson, J., & Wickramanayake, J. (2012). The relationship between aggregate managed fund flows and share market returns in Australia. *"Journal of International Financial Markets, Institutions & Money," 22*(3), 451–472.

Wei, W. (2002). Forecasting stock market volatility with non-linear GARCH models: a case for China. *Applied Economics Letters*, *9*(3), 163–166.

Wei, Y., Yu, Q., Liu, J., & Cao, Y. (2018). Hot money and China ' s stock market volatility : Further evidence using the GARCH – MIDAS model. *Physica A*, *492*(February), 923–930.

Weiss, A. A. (1986). Asymtotic theory for ARCH models: Estimation and Testing. *Econometric Theory*, *2*(1), 107–131.

Wermers, R. (1999). Mutual Fund Herding and the Impact on Stock Prices. *The Journal of Finance*, *LIV*(2).

Wilhelmsson, A. (2006). Garch Forecasting Performance under Different Distribution Assumptions. *Journal of Forecasting*, *25*(8), 561–578.

Wilhelmsson, A. (2013). Density forecasting with time-varying higher moments: A model confidence set approach. *Journal of Forecasting*, *32*(1), 19–31.

Williams, D. W., & Miller, D. (1999). Level-adjusted exponential smoothing for modeling planned. *International Journal of Forecasting*, *15*(3), 273–289.

Xie, S., & Huang, X. (2013). An Empirical Analysis of the Volatility in the Open-End Fund Market : Evidence from China. *Emerging Markets Finance & Trade*, *49*(4), 150–162.

Xiong, X., Liu, J., & Liu, Z. (2020). Can economic policy uncertainty predict financial stress? A MIDAS approach. *Applied Economics Letters*, *27*, 1–8.

Xu, X., & Taylor, S. J. (1995). Conditional volatility and the informational efficiency of the PHLX currency options market. *Journal of Banking and Finance*, *19*(5), 803–821.

Yu, H., Fang, L., & Sun, W. (2018). Forecasting performance of global economic policy uncertainty for volatility of Chinese stock market. *Physica A*, *505*(22), 931–940.

Zakaria, S., Abdalla, S., & Winker, P. (2012). Modelling Stock Market Volatility Using Univariate GARCH Models : Evidence from Sudan and Egypt. *International Journal of Economics and Finance*, *4*(8), 161–176.

Zakaria, Z., & Shamsuddin, S. (2012). Empirical Evidence on the Relationship between Stock Market Volatility and Macroeconomics Volatility in Malaysia. *Journal of Business Studies Quarterly*, *4*(2), 61–71.

Zakoian, J. M. (1994). Threshold heteroskedastic models. *Journal of Economic Dynamics and Control*, *18*(5), 931–955.

Zhao, H. (2010). Dynamic relationship between exchange rate and stock price: Evidence from China. *Research in International Business and Finance*, *24*(2), 103–112.

Zhe, L. (2018). Modelling and forecasting the stock market volatility of SSE Composite Index using GARCH models. *Future Generation Computer Systems*, *79*(Part 3), 960–972.

Zhou, Z., Fu, Z., Jiang, Y., Zeng, X., & Lin, L. (2019). Can economic policy uncertainty predict exchange rate volatility? New evidence from the GARCH-MIDAS model. *Finance Research Letters*, *34*(May), 1–8.

Zouaoui, M. (2019). Impact of Tunisian Revolution on the Relationship Between Macroeconomic Factors and Mutual Funds Performance. *Journal of Economics and Business*, *2*(2), 489–498.

BIODATA OF STUDENT

Wan Cheong Kin was born on 9th August 1968 in Kuala Lumpur, capital of Malaysia, to a family of three siblings, older sister Yoke Ping and a younger sister Yoke Kit. His parents are Wan Foong Chin and Yap Mew Yin, a retired government servant and housewife respectively. Cheong Kin received his primary and secondary education in SRK (1) Jalan Bukit Kajang and Kajang High School respectively. His strong interest in studying economics has led him to further his tertiary education in Universiti Utara Malaysia (UUM), Kedah, Malaysia, pursuing a degree in Bachelor of Economics (Hons) from July 1988 to May 1992. He graduated with a First-Class Honours Bachelor of Economics degree, obtaining a CGPA of 3.84. Though offered a fully-sponsor opportunity to pursue PhD Economics abroad by his alma mater, he turned down the offer and enter the corporate world instead to support his family as his father retired the same year he graduated. During his corporate days, he pursued his Master of Business Administration (Finance) in Multimedia University, Cyberjaya as a part-timer from 2009-2012 and obtained CGPA of 3.78.

In his 21 years of corporate working life, he has acquired vast experiences across various fields and positions. Upon graduation, his career commenced with Development & Commercial Bank Bhd (currently RHB Bank Bhd) as a Banking Operation Officer based in the bank's Sg. Petani branch and later returned to Kuala Lumpur to join a stockbroking company, Sime Securities Sdn Bhd., as a Credit Executive. In 1994, he moved out of financial industry into consumer marketing and joined Diethelm (M) Sdn Bhd, a Switzerland based consumer goods trading firms in Petaling Jaya, Malaysia as a marketing executive handling brands like Equal Artificial Sweetener and Ovaltine malt beverages. His last and most rewarding career in his corporate life was with the world's largest food manufacturer, NESTLE Products Sdn Bhd in Damansara, Malaysia where he stayed the longest, almost 17 years. He started as a Vending Brand Executive, a pioneer member of Nestle Food Services Vending Team in 1997, subsequently seconded to sales exposure as Area Sales Executive in 1999 based in Penang, promoted to Brand Manager (Nestle Foodservices) in 2000 and Senior Brand Manager (Nestle Ice-Cream division) in 2004, over to Sales Division as Channel Sales Manager in 2006 and finally as Integrated Commercial Planning Manager in 2010 until he decided to leave the corporate world towards end 2014 to join the academia.

The motivation behind this decision was to share his knowledge and experiences with young learners as a way to contribute to society and repay gratitude to those who have shaped his value creative life, especially his mentor in life for past 40 years, Dr Daisaku Ikeda, President of Soka Gakkai International (SGI). In education industry, Cheong Kin started his career as a senior lecturer in KL Metropolitan University College in Jan 2015 and later joined HELP University, Kuala Lumpur, Malaysia in May 2016 until present. His taught courses include Intermediate Microeconomics, Macroeconomics Analysis and Monetary Economics for Year 2 and Year 3 Bachelor of Economics degree programme. Cheong Kin came to Universiti Putra Malaysia to pursue PhD Business Economics on 19th Feb 2016 at age 48 to fulfil his determination of obtaining a PhD, the

opportunity he has foregone more than twenty years ago. He is married to Lim Suat San with three teenage children, two daughters age, 17 and 15 and a son age, 12.

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