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## A Literature Review of the Efficient Market Hypothesis

By Bachar FAKHRY <sup>†</sup>

**Abstract.** The efficient market hypothesis and behavioural finance theory have been the cornerstone of modern asset pricing for the past 50 odd years. Although both theories are fundamental in explaining modern asset pricing, they are opposing views. The efficient market hypothesis dictates that the price of any asset depends on the information, while the behavioural finance theory dictates that the price depends on the reaction of the market participants to the information. Therein lays the key to the argument influencing modern asset pricing, does price immediately reflect the information or market participants' perception of the information. In this paper, we will critical evaluate the theory influencing the efficient market hypothesis. We will review the neoclassical economics underpinning the efficient market hypothesis and the recent empirical evidence. In concluding, we find that although the efficient market hypothesis has difficulties in testing and the empirical evidence is mixed. Yet it is useful as a benchmark for regulators and central bankers alike. However, market participants are homo sapiens and not homo economics; hence there is a requirement to understand their reaction. So in essence leading to a requirement to include the behavioural finance theory, if we are to understand asset pricing.

**Keywords.** Efficient market hypothesis, Behavioural finance theory, Neoclassical economics

**JEL.** B13, G02, G03, G12, G14.

### 1. Introduction

The dominant asset pricing theory since the early to mid-1960s have been the efficient market hypothesis, developed through the contributions of prominence articles such as Malkiel (1962), Fama (1965) and Malkiel & Fama (1970). As proposed by Malkiel (1962) and Fama (1965), the efficient market hypothesis argues that the price of any asset must immediately reflect fundamental information about the asset. However, to a certain degree the efficient market hypothesis relies on some untestable assumptions and models. Yet it is possible to test the key assumptions of random walk and efficiency individually thru the use of prominent tests like the variance ratio and bound tests proposed by Lo & MacKinlay (1989) and Shiller (1981) respectively.

At the basic level, the efficient market hypothesis is the perfect competition, which is widely used in neoclassical economics. Perfect competition implies the assumption that market participants are rational, risk averse and profit maximising. This assumption of market participants' behaviour extends to the efficient market hypothesis, as proposed by Fama (1965) and Malkiel (1962). This highlights the needs to evaluate the assumptions influencing the behaviour of market participants under uncertainty before we can research the efficient market hypothesis.

The paper will open with a brief overview of the fundamental economic paradigm underpinning the efficient market hypothesis, namely neoclassical

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economics. This will be followed by an in depth review of the efficient market hypothesis before concluding.

### 2. Neoclassical Economics

Historically, neoclassical economics have been the dominant view in explaining the behaviour of financial markets under uncertainty. In essence, this view dictates that rational market participants should follow the key assumptions of profit maximization, Friedman (1953) and Alchian (1950), and risk aversion, Pratt & Zeckhauser (1987) and Kimball (1993), in their choice of investment. The key in understanding this argument is the negative correlation effect that the assumptions of profit maximization and risk aversion have on financial asset prices. This view has been criticised by many including proponents of the theory of behavioural finance such as Freeman et al. (2004) and Kourtidis et al. (2011). The key problem is the assumptions underpinning the view, are unrealistic, for example rational agents as explained by De Bondt et al. (2008) and stockholder theory as argued by Philips (1997). In this section, we critically review the neoclassical view concentrating on the arguments influencing the assumptions of profit maximization and risk aversion.

However, since financial institutions with stockholders, dominate the sovereign debt market; it is necessary to discuss the stockholder theory. The stockholder theory dictates that businesses only exist to maximize the stockholders' wealth within the rule of the law; and as Alchian (1950) and Friedman (1953) hints this means the realization of profits; put simply as Alchian (1950, p. 213) states:

“This is the criterion by which the economic system selects survivors: those who realize positive profits are the survivors; those who suffer losses disappear.”

This is also argued by Friedman (1953, p. 22)

“Whenever the determinant happens to lead to behavior consistent with rational and informed maximization of returns, the business will prosper and acquire resources with which to expand; whenever it does not, the business will tend to lose resources and can be kept in existence only by the addition of resources from outside.”

However, as many proponents of the stakeholder theory (such as Freeman et al. 2004; Philips et al., 2003; Philips, 1997 and Hosseini & Brenner, 1992) would point out there is more to business ethics than just profits. The idea as defined by Jensen (2002) is that businesses have to take into account the interests of all stakeholders in the firm. By definition stakeholders includes all individuals and groups who can affect the welfare of the business and not just shareholders. However, Friedman (1970) argues that the only social responsibility for a business is to increase its profit.

This seems to be suggesting that as dictated by the market selection hypothesis in order for the financial institutions to survive, there is a need to attract investment funds and thus generate huge profits as hinted by Dutta & Radner (1999). The problem is that the behaviour of many of these financial institutions during the asset price boom of the mid 2000s points towards pure profit maximization. As defined by De Scitovszky (1943), pure profit maximization is the constant shifting of profit targets to maximize the utility function of the shareholders. In contrast, the key argument of Alchian (1950) and Tintner (1941) is that businesses just have to make a positive profit to survive. The key point is, if they make losses they struggle to survive as hinted by many including Alchian (1950) and Friedman (1953). A point in case is the bankruptcy of Lehman Brothers and hence the government bailout of many financial institutions during the financial crisis.

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In a way this led to the accusations by many including government inquiries<sup>2</sup> into the crises of financial institutions being too risk loving and greedy. However, the point defined by Kimball (1993), standard risk aversion follows a marginal increasing function, which means that bearing one risk makes the market participant less willing to bear another risk. Another argument highlighting this is that increasing risk leads to an upward shift in risk aversion as noted by Diamond & Stiglitz (1974). This seems to be the overwhelming behaviour during the recent financial and sovereign debt crises. A counter argument is that market participants' behaviour seems to be following proper risk aversion. As defined by Pratt & Zeckhauser (1987), proper risk aversion dictates that with respect to two independent risks, the rejection of one risk does not automatically deflect the market participants from taking the other independent risk. This is mainly due to market participants hedging their risks by the use of derivatives instruments such as options and futures. An example is the use of credit default swaps as hedges against the risk of a government defaulting on its debts. However, a key point made in Alchian (1950) definition above is that companies that make losses do not survive and this highlights an alternative argument that many market participants display loss aversion rather than risk aversion. As defined by Kahneman et al. (1991) and Thaler et al. (1997), loss aversion dictates that market participants tend to be increasingly sensitive to a loss than to a gain or put simply the feedback effect. This is obvious from the reaction of the financial institutions during the sovereign debt crises where a loss made the institutions averse to any further losses. This meant that the crises quickly spread from Greece to other sovereign debt markets.

This leads us to the utility functions of the agents, since these agents caused the problems as often cited by government inquiries into the crises (see footnote 4). Given an option between a number of similarly risky investments, utility maximization theories dictate that the agent chooses the one with the highest income. However, in a situation where the agents of financial institutions face investments of different risks, the key question is how can they choose the investment, which maximizes their utility? This problem occurs if interest rates are low and banks therefore take on larger risks for a higher return. This has resulted in the development of a sub-prime mortgage market, for example, where prices no longer reflect the risks, which ultimately led to the collapse of the market. The collapse occurred despite the existence of derivatives instruments such as CDS to insure against that risk. Surely, this would conflict with the utility maximization behaviour of buying risky securities such as subprime mortgage securities. Still, this behaviour can be justified as rational, when one takes into account an S-shaped utility curve. Friedman & Savage (1948) and Hartley & Farrell (2002) argue the possibility of non-concave or non-diminishing marginal utility function leads to different behaviour towards risk. This could explain the rational behaviour of the huge gamble taken by the agents during the recent housing and mortgage backed securities prices bubble. So in essence, the argument is that even efficient markets can lead to market instabilities. As the crisis has shown, however, many market participants did not actually know what they were buying as illustrated by (Beltran & Thomas, 2010; Brunnermeier, 2009; Gorton, 2008). Therefore, the validity of this argument is questionable in the least.

However, as argued by Pennings & Smidts (2003) the evidence points towards an S-shaped utility function curve governed by the agent's attitude towards profit

<sup>2</sup> Such as the House of Commons Treasury Committee Report Number 416 in the UK and Financial Crisis Inquiry Commission Report of January 2011 in the US.

and loss, in other words, the shape of the utility function depends on the initial situation, which is not compatible with rational behaviour. As this makes the utility function unstable resulting in higher volatility of observed bond prices, as buying and selling of bonds depended on the changing utility function. So in essence, the argument is that even efficient markets can lead to market instabilities.

The utility function of the agents in the financial sector dictates the supply and demand model is the reverse of the standard model as suggested by Cifuentes et al. (2005) and Shin (2008). And as hinted by Shin (2008), this means under profit maximization behaviour demand in high return assets increase putting upward pressures on the equilibrium price, while risk aversion behaviour not only reverses the demand for high return assets, due to the high risk associated with these assets, but also increases supply leading to a decrease in the equilibrium price. The sovereign debt crises elegantly illustrated this, in the high demand environment of the flight to liquidity or quality during the financial crises; governments were able to control the increase of demand by issuing more debt. During the sovereign debt crises demand for several sovereign debts decreased hugely but the point here is, the supply also increased putting huge downward pressures on the prices. The reasons are simple unlike the standard model of supply and demand which dictates when prices go down the issuer could reduce the supply to ease the pressures on the equilibrium price. The existence of a secondary market meant that as market participants became increasingly risk averse due to a high possibility of defaults, they sold the debts meaning the secondary market became overstocked and the prices plummeted. So no matter what the governments of the GIPS nations or the Eurozone tried to do, they could not reduce the supply and hence the yield.

As hinted previously, an argument often used against the neoclassical economics is that market participants are not all rational as suggested by Hong & Stein (1999) and Kourtidis et al. (2011). In addition, unlike the assumption dictating that the impact on the prices from irrational market participants is short-lived, the evidence from Barberis & Thaler (2003) is that the impact is long-lived. The other issue concerning neoclassical economics is that the basis for many of the simplifying assumption of the models is that all market participants exhibit rational risk averse profit maximisation behaviour. As with the previous argument, the existence of heterogeneous market participants each with a different attitude to risks and earnings means that this assumption of homogeneous behaviour regarding risks and earnings does not hold. In this case, we need to use behavioural finance theories to identify the impact of heterogeneous market participants in different circumstances as illustrated by Hong & Stein (1999).

### 3. The Efficient Market Hypothesis

Before we can start reviewing the efficient market hypothesis, there is a need to define information in the context of this research. Although as hinted by Malkiel & Fama (1970) and Malkiel (2003), the efficient market hypothesis dictates that prices should reflect all available information (which is why we use prices rather than spreads to check for market efficiency in this thesis). It is common practice to distinguish information in terms of fundamental and non-fundamental information (Bollerslev & Hodrick, 1992). In other words, information is the summation:

- the fundamentals, such as yields or macroeconomic factors in the sovereign debt market, as hinted by Cochrane (1991) and Malkiel (2003),
- non-fundamentals, such as information from news (i.e. they do not have any direct relationship to the asset but still have the power to influence the price such as the 9/11 terrorist attacks, Lehman Brothers bankruptcy in 2008 and Japanese Earthquake in 2011), as hinted by Caballero & Krishnamurthy (2008).

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Malkiel & Fama (1970) notes simply put the efficient market is a market where market participants are assumed to exhibit rational profit maximization behaviour and prices always fully reflect available information. In essence, as Malkiel (2003) states the view influencing the efficient market hypothesis is information spreads quickly and priced into asset valuation immediately. Hence, as Malkiel (2005) states this means that no arbitrage opportunities exist that allows for excess returns without excess risks. As Malkiel (2003) hints in an efficient market, competition will mean that opportunities for excessive risk adjusted returns will not persist. However, this does not mean that the efficient market hypothesis imply market prices will always be accurate and all market participants will always exhibit rational profit maximization behaviour.

According to Malkiel & Fama (1970), the efficient market hypothesis dictates that any model of expected price should follow the notation of  $E(\tilde{p}_{j,t+1}|\phi_t) = [1 + E(\tilde{r}_{j,t+1}|\phi_t)]p_{jt}$ . The importance of this equation in the concept of this research is  $\phi_t$ . According to Malkiel & Fama (1970), this suggests that the expected price based on all available information at present is the price at present plus the expected return based on all available information at present. As Malkiel & Fama (1970), states this notation of the expected price, means regardless of which model (e.g. APT or CAPM) used to derive the equilibrium price, expected return should fully reflect all information available at present, transaction costs and taxations being equal. Remember, as noted by Malkiel & Fama (1970), where expected excess value or return on the asset is equal to zero then by definition the excess value or return is a fair game with respect to the information available. In essence as quoted by Malkiel (1962), the expectation of the future price of the asset strongly influences the price of any long-lived asset. However, as put by Malkiel (1962), it is plausible that the recent past dictates the market participants' expectations.

As suggested by both Fama (1965) and Malkiel (2003), the efficient market hypothesis is associated with the idea influencing the random walk model. A big issue with regard to the pricing of information, as seen in numerous events during the recent financial and sovereign debt crises, is nobody can predict the impact of information especially under uncertainty. Hence, as Fama (1965) states during periods of uncertainty the equilibrium price can never be determined exactly. Moreover, as hinted by Fama (1965) the instantaneous adjustment property of the efficient market hypothesis may cause successive independent price changes, which imply prices follow the random walk model. As defined by Malkiel (2003, p. 59)

“The logic of the random walk idea is that if the flow of information is unimpeded and information is immediately reflected in stock prices, then tomorrow's price change will reflect only tomorrow's news and will be independent of the price changes today.”

Although, as stated by Malkiel & Fama (1970), the random walk model does not state that past information has no value in assessing distribution of future returns. However, the random walk model does state that the sequencing of past returns has no value in assessing distribution of future returns. This last statement could infer the random walk model simply put is the direction in the short run of expected returns and hence prices is unpredictable given all available information; however, in the long run the trend in the market prices is partially predictable as stated by Malkiel (2005). Furthermore, as stated by Timmermann & Granger (2004), this makes the efficient market hypothesis notoriously difficult to forecast prices and returns. The key logic behind this is if prices and returns were forecastable, it would mean the existence of unlimited profit, which would make the economy unstable as noted by Timmermann & Granger (2004).



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As hinted by Ball (2009), many in the regulatory, financial markets and academic environments were critical of the efficient market hypothesis in the aftermath of the financial crisis. The reasoning behind their argument boils down to the key notation underpinning the efficient market hypothesis that market prices should reflect all available information. This led to the false sense of security by regulators and market participants that market prices were correct based on all information leading to an asset price bubble. Ball (2009) argues that while like all good theories the efficient market hypothesis does have major limitations; however, appear to exaggerate the criticisms in the aftermath of the global financial crises. Since the theory of the efficient market hypothesis was only published by Fama (1965), this argument is invalid since there have been many crises based on the asset price bubble before the advent of the efficient market hypothesis. Ball (2009) points to the fact that the efficient market hypothesis states current asset prices are correct based on all available information; this means that market participants should accept asset prices as correct. However, in the pre-crises asset price bubble many market participants thought that asset prices were “incorrect” and hence they could beat the market. This does seem to suggest that for some market efficiency based on all information the price is right/correct. However, this is misleading, since the efficient market hypothesis, as defined by Malkiel & Fama (1970), does not state that the price is right/correct; it only states the price should reflect all available information.

A key argument often put against the efficient market hypothesis is that sometimes asset prices deviate from the fundamental value as hinted by many including Barberis & Thaler (2003) and De Bondt et al. (2008). In addition, as illustrated by Barberis & Thaler (2003) these deviations can be long-lived and substantial. Another issue raised by Hong & Stein (1999) is that market participants may not have access to all the information. And even if they do, as suggested by De Bondt (2000) and Daniel et al. (1998) they may have different sentiment about the information.

A key assumption used in the efficient market hypothesis is the existence of well-informed wealthy rational arbitrageurs who push the asset price back to its fundamental value (Fama, 1965). As Hong & Stein (1999) illustrate the existence of these arbitrageurs does not counter the effect of other market participants and Abreu & Brunnermeier (2003) argue that these arbitrageurs sometime like to take advantage of the circumstances therefore pushing the price further from the fundamental value.

Another key argument is that markets often go thru phases where the efficient market hypothesis is not enough to explain the anomalies, e.g. bubbles (see Blanchard & Watson, 1982; Hong & Stein, 1999; De Bondt, 2000; Abreu & Brunnermeier, 2003). Hence, there is a need to research the psychology of market participants as suggested by De Bondt et al. (2008) and Kourtidis et al. (2011). This leads towards the use of the behavioural finance theory.

The evidence seems to suggest there is a link between the pricing of information and sovereign debt markets and as Brandt & Kavajecz (2004) hints there are two main mechanisms for the daily changes in yields on sovereign debts: flow of public information and price discovery. However, as illustrated by the numerous empirical studies, the majority of the evidence is on the effect of macroeconomic information and the heterogeneous interpretation, known as price discovery, or public information. Christiansen (2000) argues that contrary to equity and corporate bond, in general there is no private information in sovereign debts returns. Thus, generally any movement in the returns on sovereign debts must come from public information, i.e. macroeconomic announcements and since the time varying return volatility of financial assets are autocorrelated and highly persistent, hence

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macroeconomic announcements could explain the high persistent observed in the volatility of sovereign debt markets. However, according to Greenwood & Vayanos (2010), macroeconomic variables sometimes cannot fully explain the variation in the yield curve and hence shifts in demand and/or supply of sovereign debts are other important drivers in understanding the movements in the yield curve.

According to Fleming & Remolona (1999), the key implications stemming from how public information influences the US Treasury market is the extent to which it drives the price movement and market makers are not confronted by imperfect information when trading. As implied by the article unlike many other financial markets, the treasury market being dominated by non-market based trading hence it is restricted by maximum or minimum limits on bid-ask spreads or price changes, therefore spreads and prices can adjust endogenously on public information. They identify two stages in the market's adjustment for price formation and liquidity provision in the immediate aftermath of the announcement of public information: during the brief first stage, there is a sharp and instantaneous change in prices and a reduction in the trading volume. During the next stage persistence trading surges leads to high price volatility and moderately wide bid-ask spreads.

Bollerslev et al. (2000) analysed the 5 min intraday US Treasury bond futures data over the period January 1994 to December 1997; researching long-memory volatility in macroeconomic announcements in the observed data. They found that US Treasuries futures exhibit long memory volatility in certain macroeconomic announcements. According to their research, the open and close of markets have higher volatilities than mid-day. The results indicate macroeconomic announcement is a key source of US Treasuries market volatility compared with prior results for FX and equity markets.

In an empirical study by Balduzzi et al. (2001) on the effect of regular macroeconomics news on a number of US Treasuries, the study found the greater the unexpected macroeconomic news announcement is, the more significant the impact on the price of at least one of the US Treasuries. They found that generally the price is usually the first affected by the announcement hinting that public information mainly drives the initial price adjustment. The next stage is the widening of the bid-ask spread suggesting informed trading drives both volatility and volume. The final stage is the continuation of the volatility and volume beyond the normality of the bid-ask spread hinting at liquidity trading. According to the article, different macroeconomic factors have different effects on the various securities. However, several announcements have significant impact on a number of securities and the impact varies depending on the maturity. They conclude that surprises in the announcement have a substantial impact on the price volatility but the bid-ask spreads seem to recover quickly hinting at public information being rapidly absorbed into the price.

In another empirical study by Brandt & Kavajecz (2004); show that price discovery is not necessarily concentrated around the time of the public information announcement. They imply at the existence of many factors influencing changes in the daily yield and therefore the structure of the yield curve but highlight two main complimentary factors: public information flow, such as periodically macroeconomic information releases, and heterogeneous interpretation of public information, i.e. price discovery, via trading in the Treasury market.

Interestingly, the Andersson et al. (2006) study of the effect of macroeconomic news from various countries on price discovery in the German long-term government bonds market finds that in general macroeconomic news have a stronger longer-lasting impact on volatility. In addition, they found that



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macroeconomic news from the US have more influence than the Eurozone announcements or various countries within the Eurozone.

An important aspect of market participants' behaviour as hinted by Caballero & Krishnamurthy (2008) is market participants face immeasurable systemic risks under certain market conditions, which lead to market participants exhibiting flight to quality or liquidity behaviour. Acknowledged as Knightian Uncertainty, it is believed to explain the behaviour of market participants in the aftermath of a wide range of events such as the Lehman Brothers Collapse in September 2008, Greek sovereign debt crisis and 9/11 terrorist attacks. The common factor is the lack of previous similar events to base information on. However, these events are based on news and hence as hinted by Malkiel (2003) news is by definition unpredictable resulting in price changes tending towards unpredictability and hence randomness.

In general, there is a large body of empirical literatures on the efficiency of the financial market. A large percentage of these are based on the stock market, the recent evidence on the efficiency of the stock market is mixed. Some found the stock market to be inefficient; an example is Cajueiro et al. (2009) who found the liberalization of the Greek stock market made it significantly less efficient. However, the evidence from Cuthbertson & Hyde (2002) seem to suggest the acceptance of the EMH for the French stock market and slightly less so for the German.

In comparison, the body of empirical literatures on the efficiency of the sovereign debt market is limited despite the first model of international efficient market being based on the French sovereign debt market as stated by Zunino et al. (2012). As Zunino et al. (2012) suggest the main reasons are the size of trading on the stock market and the type of trading for the sovereign debt market, mainly traded "over-the-counter". Like the stock market, the recent empirical evidence on efficiency in the sovereign debt market is mixed. Zunino et al. (2012) using sovereign debt indices found that developed markets tend to be more efficient than emerging markets.

Fakhry & Richter (2015) studying the impact of the recent financial and sovereign debt crises on the US and German sovereign debt markets found in general both markets were too volatile to be efficient. Although the US datasets do suggest the market is efficient, yet the subsamples suggest a mixed results pointing to both crises having an impact on the efficiency of the US and German markets. Conversely, Fakhry et al. (2016) extending the method used in Fakhry & Richter (2015) to the GIPS markets, also find mixed evidence of efficiency during the crises. This leads to a possible explanation of the efficiency of the US datasets using the behavioural finance theory. Since market participants were overreacting/underreacting to information during different periods, one possible conclusion is that the overreaction/underreaction cancel each other out leading to a stable state in the datasets giving the impression of market efficiency.

## 4. Conclusion

The efficient market hypothesis has been the mainstream of finance for nearly 50 years. However, as highlighted in the review, there are many issues with this theory and it does throw up a basic flawed idea. The concept is that the price always incorporates all the information at the time and hence the price reflects the given information. This idea is at the centre of the debate surrounding the efficient market hypothesis in the aftermath of the financial crisis. The other key issue is that it relies on key assumptions made in neoclassical economics, which do not always hold in the real world, i.e. the existence of rational market participants and perfectly competitive markets. In truth, both the efficient market hypothesis and

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neoclassical economics view are essentially just models of the financial market and are therefore best used as benchmarks and not observations of the real world. A key factor to note is that market participants are *homo sapiens* and not *homo economics*.

Another issue as highlighted by Ball (2009), many were critical of the efficient market hypothesis in the aftermath of the financial crisis. The issue seems to be based around the price is correct argument, however this is dangerously misleading; since the efficient market hypothesis only states the price should reflect all available information at the time. There are two arguments regarding this issue; firstly, as highlighted by Ball (2009) in the pre-crisis period many market participants thought prices were incorrect and using sophisticated forecasting models, they could beat the market. Secondly, the efficient market hypothesis does not work when there is unequalled access to information resulting in incomplete or asymmetrical information. This goes back to the neoclassical economics assumption of perfect competition; in a perfectly competitive environment, information should be complete and accessible to all market participants.

Of course, a key neoclassical economics assumption is that market participants are risk averse. However, as hinted by Buiter (2007) and Feldstein (2007), as early as 2005 many thought there was massive under-pricing of risks. Hence, market participants were not following this fundamental assumption of neoclassical economics and thus the efficient market hypothesis. This goes to the heart of the problem during any asset price bubble, as illustrated in the next section, it is often the case that market participants usually think they could beat the market and therefore consistently under-price risk in the attempt of making increasingly large profits. Therefore, distorting the market from the fundamental price leading to increased asymmetrical information.

The key is determining whether the financial market accept the efficient market hypothesis, we presented strong historical empirical evidence suggesting financial markets are not efficient. The tests and methods used to test the efficiency of the markets in the empirical evidences are wide ranging, e.g. variance bound tests (Shiller, 1979), variance ratio tests (Lo & MacKinlay, 1988) and cointegration tests (Engle & Granger; 1987). Moreover, although the majority of the evidence seems to be based around the stock market, yet it does suggest that the global financial market is not random and asset prices are too volatile to be explained by the information. This is the key to our research, if markets are too volatile to be efficient then what is explaining the behaviour of volatility in the markets. Another key factor to our research as pointed out by Bollerslev & Hodrick (1992), the use of GARCH models can overcome clustering issues with the variance bound tests. A possible issue in the variance bound tests is that market participants seem to react differently to negative or positive information. In order to analyse whether markets are more efficient during phases of negative or positive shocks, there is a requirement to include the asymmetrical/leverage effect in the variance bound test.

In concluding, the efficient market hypothesis and behavioural finance theory explain different parts of asset pricing. However, as things stand at present, both have strong weaknesses. This means in order to fully understand the pricing of assets there is still a requirement to use both fundamental theories. Coincidentally, the behavioural finance theory could be extended to explain the efficient market hypothesis by using the overreaction/underreaction steady state and the key is that this is testable. So in essence the behavioural finance theory is a more complete and therefore theoretically superior theory of asset pricing.

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