Amity Journal of Management Research

Efficient Market Hypothesis in Market Crashes: The 2008 Global Market Meltdown

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Abstract

This study investigates the relationship between stock market crash and capital market efficiency with emphasis on the 2018 global market meltdown using information from January 2005 to December 2015. Event study was employed to investigate the effect of the 2008 market crash on share price returns as well as the validity of the event studies form of the Efficient Market Hypothesis (EMH). The study showed that the semi-strong form of EMH was deficient in explaining the price fluctuations of assets in the stock market between July 2008 and January 2009. Moreover, the results generally demonstrated that the market crashes around global stock markets created strong effects on individual markets, irrespective of the level of development. This suggests that global stock markets were not efficient in the period around and including the 2008 market crash. It is recommended that market fundamentals should return to its pride of place in the analysis of stock market behaviour.

Keywords: Market Efficiency, Stock Prices, Market crisis, Bubbles, Event Study

JEL Classification: GO1, G1, G14

Paper Classification: Research Paper

Introduction

Stock markets experience periods of rising and falling prices as dictated by various endogenous and exogenous factors (Osaze, 2007). Over the years and since the commencement of the twentieth century, there have been series of major stock market crashes that have tremendously disrupted global economies. In 2008, the global financial crisis led to the disintegration of large financial institutions as well as downturn in stock markets around the world. It has also shaken the foundations of the view that capital markets are essentially efficient. According to Malkiel (2011), some critics have suggested that the Efficient Market Hypothesis (EMH) was mainly the cause of the crisis. Could this be true or are the critics of EMH using a far too limiting explanation of what EMH denotes? For example, EMH was identified as the major factor accountable for the crisis

because it tends to push financial intermediaries and regulators to underestimate the dangers of asset bubbles (Malkiel, 2011). Krugman (2009) asserts that the belief that the capital markets are efficient has prevented many economists from recognizing the signals of one of the largest financial bubble in history (the 2008 US subprime mortgage). Shiller (2000) has described the Efficient Market Hypothesis (EMH) as the most notable error in the history of economic thought.

The objective of this study is to use the tool of EMH to investigate stock market efficiency during crash periods, with focus on the 2008 global market meltdown. In particular, the study seeks to demonstrate that efficiency in stock markets could be eroded significantly by frequent crashes in the market.

Review of Related Literature

Market Efficiency and the Efficient Market Hypothesis

The theory of capital market efficiency is a basic financial proposition underpinning asset pricing models. A financial market is described as efficient when the prices of shares in the market fully reflect all available information (Fama, 1970). The major assumptions are absence of transaction costs, homogenous expectations of investors, and perfect market. EMH stipulates that the prices of securities impound quickly and completely (Reilly, 1989; Samuels and Wilkes, 1980). Fama (1970) grouped EMH into weak, semi-strong and strong forms. Fama (1991) reviewed the taxonomy as tests for return predictability, event studies and tests for private information. The relevance of market efficiency has been examined by Barone-Adesi and Sala (2019). The 1970 taxonomy is adopted in this study, using event study to test the semi-strong version.

Stock Market Crash

Shiller (1989) asserts that a stock market crash occurs when the investing public unexpectedly changes its mind, resulting in a steep decline in stock prices and loss of wealth across a significant cross-section of a stock market. This is not a satisfactory explanation for the occurrence of tremendous and unexpected changes. In reality, such bubble reversals occur when the market realizes that the level of price rise is not supported by market fundamentals. The large decline in the aggregate value of a market is almost unquestionably attributable to the sudden burst of a bubble, with many investors seeking to exit the market simultaneously. To avoid expected losses related to bubble reversal, investors will engage in panic fire sales, hoping to unload their declining stocks onto other non- knowledgeable investors. The fire sales in turn, contribute to the deteriorating market, which eventually crashes. Typically, crashes in the stock markets are followed by a depression. Bordo (2003); Brownlee, Chabot, Glysels and Kurz (2020) argues that many stock market crashes are associated with recessions. The others are associated with monetary instability and political events.

From the foregoing, it can be implied that a stock market crash is an abrupt and speedy decline in the prices of securities bought and sold in a stock exchange, and it is usually aggravated by panic selling that may persist for months or years. Stock market crashes are triggered typically by panic and worsened by investors' loss of confidence. Market crashes usually occur after a period of prolonged inflation, political and economic uncertainties, as well as speculative activities. Often, market crash can result in the failure of normal economic activities, wiping out investments, and bringing widespread misery especially for the vulnerable groups in the society. The severity of a stock market crash depends on both the underlying financial events that precipitated the problem and the pressure placed on the stock market by investors' reaction (Osaze, 2007; 2011).

Bubbles and Sunspots

Financial bubbles refer to trade in high volumes of stock, at prices that are considerably at variance with their intrinsic values. The reasons for the occurrence of bubbles are embedded in the investors' belief that demand for the securities will continue to grow and they will soon be profitable. A reversal or market correction will terminate the trend when investors realize that they have been building on quicksand (Osamwonyi, 2013; Osamwonyi & Igbinosa, 2012). More often than not, speculative activities create financial bubble driven by the presence of investors with 'herd mentality.' When this set of investors no longer exists to sustain the speculation, a reversal or market correction occurs resulting in a crash.

The relationship between bubbles and crashes can be likened to that of clouds and rain. Historically, a market crash has always precipitated from a bubble (Beattie, 2010). Abreu and Brunnermeier (2003) identified as examples of bubbles that were immediately followed by crash to include the Dutch Tulip bulb craze of 1634, the South Sea crash in 1720 and the internet bubble that peaked in 2000.

According to Osamwonyi (2013), sunspots are extrinsic random variables upon which investors coordinate their decisions, and they are transmitted through expectations. That is, they are external random uncertainties that inform the decision of market participants. They provide shocks that create the cyclical patterns and corrections in stock markets. Farmer (1993) and Farmer and Guo (1994) put together a formal rational expectations model of the business cycle that features self-fulfilling prophecies. Behaviourists in finance tend to hold onto the belief that financial bubble, sunspots and other common occurrences of market anomalies can be explained from the perspective of cognitive psychology.

Historical Episodes of Stock Market crash and their causes

Stock market crash is a regular occurrence globally. Osaze (2007) outlines five major factors that appear to be indicative of stock market collapse. They include dividend restraint, political and economic uncertainty, high interest rate, falling real estate values and the narrowing yield gap between shares and bond. Galbraith (1954 and 1988) and Kindleberger (1978) emphasized the irrational causative factors. According to Kindleberger (1996), Stock market meltdowns can be traced back to the early part of the eighteenth century, when stocks of the South Sea Company in the United Kingdom crashed following a bubble burst (Bordo, 2003). Although asset booms and bursts are said to have occurred earlier in the seventeenth century as regards the famous Dutch Tulip bulb craze (mania) of 1634-1637 in Holland (Garber, 1989), none of them was induced by technological advancement. After the South Sea crash in the eighteenth century, the early part of the nineteenth century witnessed the April 1825 infamous boom – burst or market collapse in the UK (Bordo, 1998, 2003). The twentieth and twenty-first centuries have witnessed a number of significant market crashes.

The 1929 stock market crash: The Wall Street crash of 1929 is one of the most famous stock market crashes that began on Thursday the 24th of October, 1929 when the Dow Jones Industrial Average recorded a total loss of about fifty percent during this stock market crash. The crash is often seen as the end of the prosperity of the 1920s. It was said to have led to the recession in the 1930s. Nevertheless, the consensus view by economists is that the 1929 crash was not the pivot of the Great Depression (Friedman &Schwartz, 1963 and Romer, 1993) but that it had a major effect on the first year of the recession. While there have been many suggested explanations for the crash, no one can fully account for it. However, some of the explanations proposed suggest that the market crash was characterized by : (1) overpriced stocks, (2) massive fraud and illegal

activities, (3) margin buying, (4) the prevailing policy of the Federal Reserve, and (5) the general state of the economy. These signs coupled with the resultant effect of the herd mentality may have spurred stock sell-off.

The New York stock market crash of 1987: Monday the 19th of October, 1987 witnessed the largest one-day percentage decline in the history of the U.S. equity market as major indexes of market valuation in the United States dropped by 30 percent or more. McKeon and Netter (2009) assert that while the S&P 500 index fell by 57.86 points which amounts to a decline of20.46%, the Dow Jones Industrial average fell by 508points which amounts to 22.6% of its value and the NASDAQ also recorded a decline of 11.35% of its value. Stock prices had risen dramatically in the first half of 1987, with the Dow Jones Industrial Average reaching a peak of 2,722.44 on August 25. During the next five weeks prices fell by about 8 percent, but then rose again by 6 percent. Prices fell steadily the following week. But on October 19, stock prices fell more than any other single day in the twentieth century. As a result, the stock market crash of 1987 is said to be the worst one-day fall in stock prices in the twentieth century.

The U.S. stock market crash of October 1987 inspired several studies (Patel and Sarkar, 1998), which seek to explain the crash in terms of shifts in fundamental factors, such as downwards revision in expectations about global economic activity, or higher equilibrium required returns (Black, 1988; Fama, 1989 and Roll, 1989). Contrary to this view, Seyhun (1990) argues that based on the behaviour of corporate insiders, investors' overreaction was a causative factor that necessitated the crash. McKeon and Netter (2009) suggested three reasons for the 1987 stock market crash. The first one is an efficient market issue (the market reacted to some fundamental news that led market participants to revalue stock prices downwards by more than 20% in one day). The second evaluation is a liquidity issue (liquidity declined significantly probably due to a large number of sell orders and depressing prices). The third reason is a behavioural finance issue where investors act irrationally to drive up prices, followed by a significant fall in prices or panic sell off of stocks.

The 2007 black Tuesday in China: On February 27, 2007, global stock market plunged after the Chinese Stock Market experienced a major crash that was said to have corrected the preceding bubble. The plunge in the Chinese and other Asian markets triggered crashes in nearly all financial markets around the globe and this wiped out hundreds of billions of market value. The Chinese market crashed after rumors that her government was going to implement some sort of monetary policy (raise interest rate) in an attempt to control inflation and restrict speculative trading with borrowed money. The market recorded the largest drop in 10 years as the Shanghai Stock Exchange (SSE) Composite Index fell by 9%. Similarly, the Dow Jones Industrial Average in the United States (US) dropped by 416 points (3.29%) from 12,632 to 12,216. According to Yao and Luo (2008), the Chinese stock markets have been extremely volatile beginning mid- 2006, and the market bubble could have been as a result of the speculative psychology of the average Chinese investor.

The housing bubble and global financial crises of 2008: Bubbles are particularly dangerous most especially when their existence is financed with debt. The US 2008 housing bubble and its associated derivative securities left both the consumer and financial sectors dangerously leveraged. It is pertinent to note that while policy makers may not be able to identify bubbles in advance, they should pay attention to asset-price increases that are financed with debt. The housing bubble and credit crisis began in July 2007 when investors' confidence in the value of securitized mortgages in the US declined (McCarthy, Solomon and Mihalek, 2012). According to Osamwonyi (2013), the rapid rise in house prices in the US resulted in a housing boom that birthed relatively high returns. The high returns in turn resulted in global financial flows into the US housing markets. This powered rapid growth in the mortgage market and thus provided

incentives for rapid growth in subprime mortgages. Speculative activities in the market created a financial bubble that went burst manifesting as a slump in the US housing market. Osaze (2011) affirms that the international financial crisis called global meltdown or stock market crash in 2008 affected other countries subsequently, through channels of financial contagion and systematic risk as financial institutions collapsed. Farmer (2011) argues that the stock market crash of 2008 was triggered by collapse in house prices in the US. From this review, most stock market crashes tend to be related to asset boom and burst.

Market Efficiency and the 2008 Stock Market Crash Regime: If markets are truly efficient, why are there incessant crash regimes? Following the 2008 stock market crisis, some critics argue that economics failed because it did not predict the crisis. According to Uchitelle (2010), stock markets are not self-correcting. In consonance, the critics appear to be saying that the market cannot be efficient since financial economists failed to predict the crisis. Stakeholders' belief in the EMH misled them by creating a false sense of security. Conversely, Ball (2009) opines that critics who argue that a failure to predict the crisis disproves the EMH are simply confused, since a central proposition of the EMH is that such events should be unpredictable. In a market where prices already reflect all existing information, only new information can change prices. But new information, by definition, is unpredictable, both in content and in timing.

Malkiel (2003) affirms that financial crisis do occur because the financial market is dominated by people who view current prices of securities as correct (that is, the prices have informational efficiency and exhibit random behaviour) and as such, they do not deem it necessary to verify the asset true value. Like the random walk theory, the weak form of market efficiency is characterized by a price series where all subsequent price changes represent random departures from previous prices. The logic in this idea is that stock price changes are random and unpredictable. In the same vein, the EMH does not say that the market should be able to predict the future and any possible financial crisis. Therefore, the main link between capital market efficiency and stock market crash or crisis is that stock market crises cannot be accurately predicted since stock prices are random walk.

McCarthy, Solomon and Mihalek (2012) examine the factors that precipitated the 2007 and 2008 global financial crises, other recent anomalies and the extent to which the crisis can be explained by the efficient market hypothesis as well as the extent to which behavioural finance ideology has compromised the EMH. They conclude that the behaviour of rational and irrational investors cannot be overlooked. Fama's concept of the EMH posits that in a market where prices already reflect all available information, only new information can change prices, and that new information is usually unpredictable in content and timing. Since most of the stock market crashes were unpredicted and more so, did not follow a sequence or pattern, would it be right to infer that the critics of EMH employed far too limiting interpretation of what EMH mean? Winful, Sarpong and Agbodohu (2013) argue that in spite of the undoubted limitations of the EMH, the claim that it is responsible for the past and the 2008 global financial crisis appears to be greatly exaggerated. Ball (2009) argues that if the EMH is responsible for the asset bubbles that eventually culminated into market crash, one wonders how bubbles could have occurred before the 'efficient market' concept was birthed in 1965. Furthermore, there are numerical amount of empirical evidence that validates the EMH. One of such evidences was that of Ball and Brown (1968) which led Fama to conclude that stock prices do not follow a pattern and are unpredictable. Also, Malkiel (2003) defends the efficient market hypothesis by attributing market crash to the cumulative effect of a number of unfavorable fundamental events. Malkiel (2003) further states that stock markets are more efficient and less predictable than other studies would make to believe. From the foregoing, can it be inferred that the global market meltdown of 2008 occurred in an efficient market with unpredictable cause? That is, one may be tempted to draw a non-

conclusive deduction that the stock market crash may have occurred in an efficient market with other causes (factors) that were unpredictable at the time of the event, or perhaps other factors that are predictable and related to irrational behaviour. The views of Karas and Szczepaniak (2020), and Brownlee et al (2020) concerning systemic risk are important as well as the conclusion drawn by Chen, Mrkaic, and Nabar (2019) concerning the 2008 financial crisis.

Behavioural Finance Approach to stock market crash: The 1970s was the age of traditional finance model which asserted that agents are rational because they update their beliefs with new information and this enable them make acceptable standard choices (Merton, 1973; Fama, 1991 and Shiller, 2003). In the subsequent decade, the occurrence of market anomalies and bubbles questioned this belief (Osamwonyi, 2013). These anomalies are not consistent with the rationality assumption as put forward in the 1970s but they are rather attributable to psychological factors of behavioural finance. These psychological factors such as overconfidence, conservatism, belief perseverance, loss aversion, narrow framing, representativeness, availability biases, optimism and wishful thinking *inter alia* can bring about 'belief formation' and preferences that can in turn have substantial and long-lived impact on stock price. According to DeBondt and Thaler (1986), studies in experimental psychology suggests that most people overreact to unexpected and notable news events that can lead to or precipitate a significant fall in stock market prices.

Methodology

Procedure for Event Study Form of EMH: The methodology adopted therefore is the event study procedure. The aim is to operationalize a semi-strong form of the EMH with the 2008 market crash episode. Essentially, the goal is to determine express changes in returns in the market arising from the news or information about extreme values of the market indicators. Thus, it seeks to show whether a significant difference occurred in the pattern of stock market returns following the market crash. This is invariably an event study, in which the market crash itself is the event. Since initial information about the extreme movement in the market returns is both unexpected and uncertain, the pattern of stock return behaviour following the crash can be determined by computing cumulative abnormal returns (CARs) for the market crash event period in comparison with the non-crash period. As a deviation from the usual patterns, the CARs are computed based on the method developed in Ajayi and Mehdian (1994).

In the first stage, the abnormal return for each index i at period t following the unexpected extreme event d (i.e. AR_{itd}) is calculated by taking the difference between the mean return of the particular market from the daily return on the same market

$$AR_{itd} = R_{itd} - \bar{R}_i \qquad (3.1)$$

where d is the occurrence of unexpected extreme event (or crash) in each market; R_{itd} denotes the return of each market during the event period; and equals the mean return of each market for non-event days.

In the second step the mean abnormal return is obtained, for period t by adding the abnormal return for the event period and divided by the length of the event period (n) as follows:

$$\overline{AR}_{it} = \frac{1}{n}\left(\sum_{d=1}^{n} AR_{itd}\right) \qquad (3.2)$$

Eventually, the CARs are calculated by adding the mean abnormal returns over the event period as:

$$CAR_{it} = CAR_{i(t-1)} + \overline{AR}_{it} \qquad (3.3)$$

The statistical significance of the CARs is tested by using a standard t-test of the null

hypothesis that states that the CARs for each day are equal to zero during the post-event window. T-statistic is obtained as:

$$t = \frac{CAR_{it}}{[Var(CAR_{it})]^{1/2}} \quad (3.4)$$

The method outlined is different from the ubiquitous market model often used for estimating abnormal returns. The relevance and supremacy of this method (within the context of the current study) is that it completely makes use of data from the market under study without recourse to using other external market-based index in determining the benchmark returns for computing abnormal returns. This is essential given that global market indices were in turmoil themselves during the market crashes. This shows that adoption of a market model for estimating abnormal returns would have implied that shocks in the international markets could be imported into the estimation of domestic market abnormal returns.

The Variables and Data: The study draws its sample from all stock quoted in the stock exchanges of the developed and emerging economies in general. Eleven bourses, which can be categorized into three stock market stages, are used. These include France, USA, United Kingdom, Hong Kong, Germany and Japan (for developed markets); China and South Africa (for the emerging markets); Nigeria, Kenya and Ghana (for the frontier markets). Data for the study are monthly time series data for the period January 2005 to December 2015. The data were obtained from global stock indices, supplied by Morgan Stanley Capital International (MSCI) and the Dow Jones Indexes Country Classification System. Stock market returns are computed from the following formula

$$R_t = ln\left(\frac{SP_t}{SP_{t-1}}\right) * 100$$

where R_t = return on stock market index

SP_t = contemporary market price index

SP_{t-1} = previous period stock market price index

ln = natural logarithm

The stock market index prices are taken as the reported index of the stock market for the given period.

The hypothesis of the study is tested based on the analytical framework and model presented in the previous section. The hypothesis is stated in its null form as *The semi strong or the event study form of the Efficient Market Hypothesis has no validity as regards the 2008 market crash regime.*

This hypothesis was tested solely using the event study procedure demonstrated in the analytical background. In order to test the hypothesis, the t-test for the CARs was obtained for each of the markets considered. A significant t-value indicates that the Efficient Market Hypothesis was valid as regards the 2008 market crash regime.

Empirical Analysis

The empirical analysis that is performed in this study is to conduct an Event Study with respect to stock markets in the sample to identify the effects of the 2008 stock market crash on stock markets across the globe. It also indicates essentially whether a significant difference occurred in the pattern of stock market returns following the market crash. In Table 1, the initial pattern of stock returns for the pre-event, event, and post event periods are presented with respect to

average values and variances. For all the markets, average returns were higher for the pre-event period than for the event period. For the markets (except Japan), returns were positive on average for the pre-event period but turned negative during the event period.

Table 1: Mean and Variances of Stock Returns for the Event Window

Market	*Mean*			*Variances*		
	Non-event days	*Event days*	*Post-event days*	*Non-event days*	*Event days*	*Post-event days*
UK	0.9943	-2.9966	1.6847	8.5882	67.591	34.812
US	0.8548	-2.2948	1.8922	5.8897	50.785	24.469
SA	1.8768	-0.8930	2.9074	36.035	149.09	44.701
NIG	5.4427	-3.4017	0.0281	74.868	367.93	44.356
H-K	2.9195	-2.0955	2.0585	20.538	99.961	36.334
China	5.2580	-1.5165	1.1634	66.450	172.86	28.194
Kenya	2.4268	-1.6206	1.4435	37.449	217.14	16.179
Japan	-0.0852	-1.6452	0.9159	4.3792	56.401	12.987
FRA	1.4259	-2.8179	1.3336	8.6477	94.915	69.358
GER	2.6475	-3.1127	1.8731	9.2344	117.25	54.331
GHA	2.9464	-2.9421	2.6534	7.2751	81.722	21.050

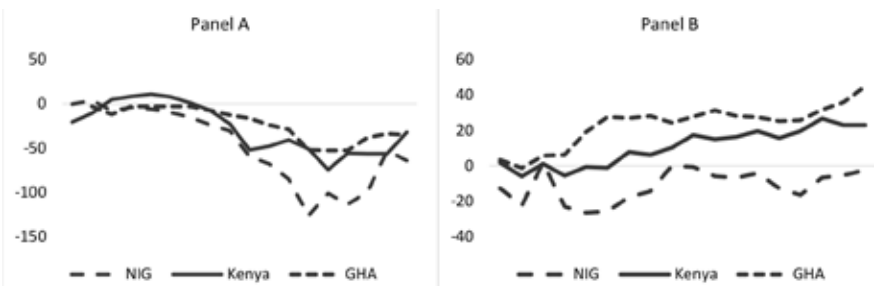
Source: Authors' compilation.

This obviously shows that the market crash of 2008 led to drastic declines in stock market returns across the globe. The mean returns also turned positive for all the markets after the crash period was over. Indeed, the returns became higher than that of the pre-event period for some of the markets, such as South Africa, UK and USA. The variances for the stock returns for the various time periods are also shown in Table 1. The variances were also higher for the event period than the pre- or post- event periods. This indicates that stock returns became quite volatile during the crisis period. Apparently, most of the amplified movements were negative in nature.

In conducting the event study, the abnormal returns are computed from the Cumulative Abnormal Returns (CAR) and tested for significance. The CARs obtained are presented in various figures. In the charts for frontier markets, it can be seen that there was steady and monotonic decline in cumulative returns for all the markets during the crisis period. The decline became more pronounced towards the end of the crash period for each of the markets. For the post-event period, there is steady increase in the CAR for each of the frontier markets in the sample.

Fig. 1A: CAR for Frontier Markets: Event Period

1B: CAR for Frontier Markets: Post-event Period

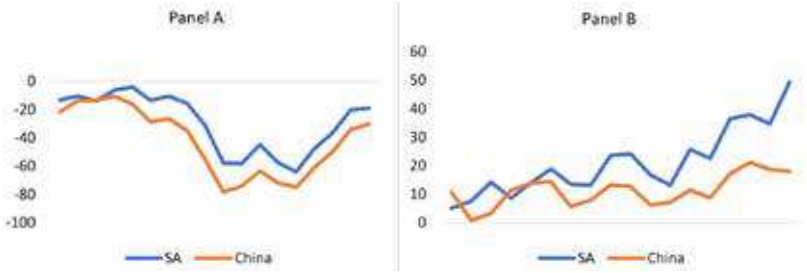


Source: Authors' charts.

The CARs for the two emerging markets in the sample are reported in Fig.1A and 1B. There are similar movements in the CARs for each of the countries in comparison to that of the frontier markets during the crisis period. For the post crisis period however, there are marked increases and drops for the returns in the market. This implies that after the crisis, the emerging markets tend to have unstable returns regime.

Fig. 2A: CAR for Emerging Markets: Event Period

2B: CAR for Emerging Markets: Post-event Period

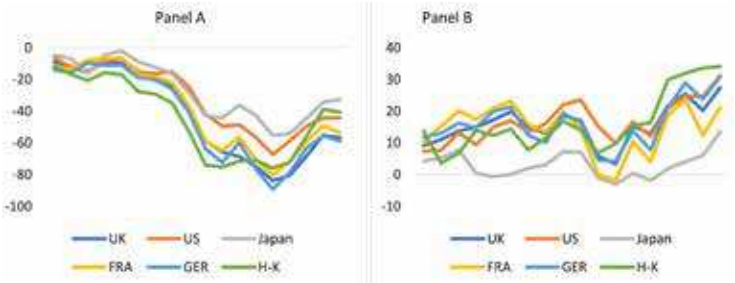


Source: Authors' charts.

For the developed markets, the CARs also followed the pattern of the other markets during crisis period dipping significantly towards the end of the crisis period. For the non-crisis period, there was a generally rise in the CARs for each of the markets, although there were periods of collective deviations from the rise. A unique aspect of the CARs demonstrated for each of the market groupings in this section is that there is a high level of similarity among the markets in terms of movement in the CARs for each of the periods.

Fig. 3A: CAR for Developed Markets: Event Period

3B: CAR for Developed Markets: Post-event Period



Source: Authors' charts.

Table 2: CAR and t-values for Frontier Markets

	Nigeria		*Kenya*		*Ghana*	
	CAR	**t-stat**	**CAR**	**t-stat**	**CAR**	**t-stat**
1	-12.61	-0.02	1.77	1.40	3.30	0.0
2	-22.55	-0.20	-6.03	-0.71	-1.28	-0.32
3	1.75	0.40	1.05	0.33	5.70	1.31
4	-23.08	-0.21	-5.56	-0.57	6.25	0.32
5	-26.45	-0.31	-0.60	-0.75	19.13	0.32

6	-25.67	-0.51	-1.11	-0.54	27.67	0.32
7	-17.64	-0.79	7.78	0.07	26.94	0.32
8	-14.34	-1.23	6.19	-0.50	28.17	0.83
9	0.11	1.59	10.32	1.54	24.32	1.39
10	-0.62	-3.11	17.37	3.54	27.74	1.80
11	-5.85	-3.53	15.06	3.24	31.33	2.63
12	-6.83	-4.43	16.40	2.76	28.19	3.20
13	-4.12	-6.59	19.61	3.44	27.49	5.76
14	-12.66	-5.27	15.68	5.05	25.21	5.80
15	-16.52	-5.91	19.62	3.78	25.84	5.81
16	-6.57	-5.18	26.68	3.81	31.76	4.21
17	-5.30	-2.75	23.04	3.81	35.91	3.71
18	-2.38	-3.34	23.09	2.18	44.87	3.90

Source: Authors' compilation

Finally, in this section, the post event CAR values along with the calculated t-values for the market groups are presented and analyzed. The t-statistics are computed to test the null hypothesis that the CARs are equal to zero. For the frontier markets, only the Nigerian market returns have a unique and generally negative outcome throughout the event window period. For the other markets, there is a steady rise in the CARs over the months following the market crash period. It can be seen from the results in Table 2 that the CARs are not significant in the markets for 8 months after the crash period, but after that time, most of the CARs rise sharply and become significant based on the t-values. As noted earlier, the CARs for the Nigerian market are all negative for the 18 months after the market crash. This implies that the market crash led to a slightly permanent significant decline in stock returns in the Nigerian market. Note that for the other markets, there were periods of negative CARs after the market crash. The results from the frontier markets indicate that stock markets in the region were significantly affected by the global stock market crash in 2008. The direction of the effects was varied with some markets exhibiting strong negative outcomes, while others had positive outcomes.

Table 3: CAR and t-values for Emerging Markets

Month	*South Africa*		*China*	
	CAR	**t-stat**	**CAR**	**t-stat**
1	5.06	1.08	10.82	-1.64
2	7.62	0.84	0.89	-1.04
3	14.26	1.14	3.37	-1.01
4	8.66	0.50	11.48	-0.80
5	14.03	0.31	13.93	-1.22
6	18.95	1.09	14.39	-2.18
7	13.56	0.86	5.75	-2.00
8	13.17	1.28	7.95	-2.63
9	23.57	2.56	13.36	-4.22

10	24.17	4.74	12.77	-5.95
11	16.81	4.76	6.28	-5.62
12	13.19	3.65	7.19	-4.82
13	25.68	4.70	11.52	-5.45
14	22.60	5.23	8.76	-5.70
15	36.55	3.90	17.28	-4.62
16	37.89	2.98	21.16	-3.79
17	34.70	1.64	18.78	-2.57
18	49.44	1.55	18.05	-2.30

Source: Authors' compilation

The CARs for the emerging markets are shown in Table 3. The results do not show any strong pattern of movement for the two markets, although the CARs for both markets become quite significant after the fifth month following the market crash. This implies that the markets began to respond strongly to the negative crash regime after about five months of recovery. South African market exhibited positive CARs throughout the post-crash period, suggesting that for this market, there appeared to be full recovery after the market crash. The CARs for the developed markets are shown in Table 4. It can be seen that the CARs for each of the markets for the post-crash period is positive. Only the Japanese market exhibited negative CARs after about one year of the crash.

This result shows that the developed markets adjusted quite well after the market crash of 2008. Moreover, the market returns were significant as from the seventh and ninth months after the crash, indicating that the CARs were significant for long periods after the crash. From the results obtained from the event study, it is seen that there was significant difference between returns in the market for the pre-crash period and the post-crash period. Apparently, for each of the market, the crash in 2008 led to strong declines in the returns. In the same vein, the responses of the markets to the crash, as seen from the perspective of the CARs during the post-event period, is different among the market groups used in the sample. It appears that the crash was more deleterious to the frontier markets than any other markets in the sample. This is expected because they are more fragile. Also, the results indicate that even though more advanced markets were hit by the crash in 2008, they responded better than the developing markets in terms of returns after the crash.

Table 4: CAR and t-values for Developed Markets

	UK		*US*		*Japan*		*France*		*Germany*		***Hong Kong***	
	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat	CAR	t-stat
1	9.13	1.09	7.39	0.87	4.24	0.61	10.40	1.24	11.77	1.29	13.76	1.16
2	11.13	1.44	7.74	1.74	5.27	0.91	15.28	1.37	13.05	1.44	3.61	1.68
3	13.75	1.81	**13.20**	**2.21**	**7.82**	**2.14**	20.12	0.79	16.25	0.88	**6.75**	**2.05**
4	14.94	1.06	9.41	1.14	0.42	0.59	17.40	0.70	14.91	1.03	13.93	1.57
5	17.29	1.18	15.10	0.94	-0.59	0.26	20.98	0.64	20.05	1.00	12.34	1.69
6	19.85	1.98	**17.00**	**2.11**	0.11	1.17	23.22	1.68	21.26	1.74	**14.37**	**2.76**
7	**14.98**	**2.49**	**13.40**	**2.29**	2.00	1.63	15.83	1.89	12.39	1.84	**7.79**	**2.91**
8	**12.99**	**2.96**	**16.25**	**2.13**	**3.09**	**2.16**	**13.50**	**2.25**	**10.17**	**2.41**	**11.63**	**3.47**
9	**18.53**	**4.79**	**22.07**	**3.44**	7.28	3.74	19.72	3.73	19.21	3.74	16.88	5.25

10	**17.18**	**7.12**	**23.57**	**5.86**	**7.08**	**5.71**	**14.56**	**6.03**	**16.57**	5.87	14.02	7.40
11	**5.85**	**7.98**	**15.30**	**6.93**	**-1.01**	**-5.88**	**-0.07**	**6.65**	**4.58**	**6.69**	**6.91**	**7.52**
12	**3.37**	**8.35**	**9.83**	**6.79**	**-3.06**	**-4.81**	**-1.93**	**5.78**	**4.28**	**5.51**	**9.78**	**7.15**
13	**15.36**	**9.11**	**16.70**	**7.95**	0.47	5.71	10.37	7.25	13.77	7.09	15.59	7.11
14	**12.88**	**10.19**	**12.03**	**9.44**	**-1.85**	**-7.37**	**4.16**	**8.23**	**7.84**	8.25	16.33	7.59
15	**21.66**	**9.80**	**20.95**	**8.27**	**1.94**	**7.20**	**18.64**	**7.38**	**21.10**	**7.27**	**29.92**	**7.23**
16	**25.45**	**8.32**	**24.77**	**6.94**	**3.98**	**5.92**	**23.73**	**6.09**	**28.90**	**5.85**	**31.99**	**5.59**
17	**20.22**	**6.71**	**24.65**	**6.21**	6.06	4.56	12.43	5.03	23.82	5.12	33.60	3.89
18	**27.43**	**6.91**	**31.17**	**6.20**	**13.59**	**4.33**	**21.11**	**5.50**	**30.82**	**5.44**	**34.16**	**4.06**

Source: Author's compilation from regression estimates, November 2016

Hypothesis Testing: *The event study or the semi strong form of the Efficient Market Hypothesis has no validity as regards the 2008 market crash regime.*

The result obtained from the empirical analysis fully addresses the hypothesis above. The t-statistics were computed to test the null hypothesis that the CARs are equal to zero. Based on the t-test of significance, the results obtained from the event study indicate that there was significant difference between returns in the market for the pre-crash period and the post-crash period. Apparently, for each of the markets, the crash in 2008 led to strong declines in the returns. Thus, the null hypothesis is accepted that the semi strong form of the Efficient Market Hypothesis was not valid as regards the 2008 market crash regime for all of the stock markets in the study.

Conclusion

The Efficient Market Hypothesis has been tested on individual markets to ascertain or explain the pattern of information processing and assimilation among the markets. This study extends the application of the EMH to explain overall stock market crash in 2008 for eleven selected stock markets. From the findings of the study, it has been shown that the event study form of the Efficient Market Hypothesis was not valid with respect to the 2008 market crash for most of the stock markets under review. The empirical analysis revealed that there was significant difference between returns in the market for the pre-crash period and the post-crash period. Apparently, for each of the markets, the crash in 2008 led to strong declines in the returns. This suggests that global stock markets were not efficient during the 2008 market crash. This result is in line with Stefan (2009) who found that the EMH was deficient in explaining the price fluctuations of assets in the stock market between July 2008 and January 2009. Moreover, the results generally show that the market crashes around global stock markets created strong effects on individual markets, irrespective of the level of development.

The results from the study indicate that Stock Market efficiency has strong effects on stock market crash as the assumption of efficiency by market stakeholders and participants tend to shoot up expectations in the market, thereby preventing the stakeholders from investing based on the intrinsic value of share prices and making them invest based on speculative activities and herd mentality. In the same vein, McCarthy, Solomon and Mihalek (2012) conclude that the behaviour of rational and irrational investors cannot be overlooked as it affects share price volatility. There is therefore evidence that for market crashes to be effectively monitored and swiftly curtailed, factors other than essential market fundamentals would need to be considered in both analyzing market efficiency and addressing its outcomes. Arbitrary confidence in market efficiency could pose a stronger danger in both stimulating and exacerbating crashes in the market in the long run.

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