

A Semi-Strong Form Test of Emerging Market Efficiency: Evidence to An African Stock Market

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Abstract:

Based on the semi-strong form tests of an Efficient Market Hypothesis (EMH) a market that adjusts rapidly to new information, this paper contributes to the existing literature by examining the way stock markets react to political news. Using the event study methodology, we assess the speed of stock price adjustment to nine political events that occurred in the West African Economic and Monetary Union (WAEMU) from 1999 to 2020 for a sample of 25 firms listed on this regional African Stock Market (ASM). News related to political events are analyzed because of their impact on stock prices. The abnormal returns are determined by using the multivariate regression model of Binder (1985) associated with EGARCH (1.1) modeling to reflect the asymmetric specification of events and changes in volatility over time. The graphical representation and statistical analysis of Average Abnormal Return (AAR), document the existence of Average Abnormal Return statistically significant and abnormal price reactions before the public announcement of political events. In economic terms, this might indicate that market agents receive or anticipate the information even before their effective disclosure to the public. Besides, the speed of stock price adjustment to political events is slow. These results are not consistent with EMH in its semi-strong form. In general, these findings estimate the scale of market reaction and its speed in an emerging market such as WAEMU Stock Exchange through its significant effects on asset pricing. Finally, these findings reinforce the role of political risk on financial markets in emerging economies and allow economic agents to outline strategies to predict stock return behavior during periods of political turmoil.

Keywords: Stock market reaction, Event study, abnormal returns.

JEL classification: C32, G14, G15

Paper type: Empirical Research

1- introduction

Since 1960, Efficient Market Hypothesis (EMH) has been a central assumption in financial theory. Indeed, most financial models take this premise as their paradigm. In the theoretical literature, a financial market is said to be efficient if stock prices instantaneously reflect all available information. This implies that, a market in which, firms can make production-investment decisions, and investors can choose among the securities that represent ownership of firms' activities under the assumption that security prices at any time "fully reflect" all available information. (Fama, 1970). On a stock exchange, information may be public or private. Those informations are the basis of the three forms of the efficient market hypothesis (EMH) tests (weak form, semi-strong form and strong form tests). As regards semi-strong form tests, a lot of works have been done since the pioneer work of Fama, Fisher, Jensen and Roll (1969). The objective of those works was to check if a publicly known information is instantaneously incorporated into stock prices. The recent wave of global events, such as socio-political and financial crises in Africa, Europe, United States, and the Middle East with the "Arab Spring" of 2010, the European Sovereign Debt Crisis (ESDC) of 2010, the earthquake in Japan, the British referendum in 2016, and, most recently, the COVID-19 pandemic, as well as the military conflict between Russia and Ukraine, have brought to the fore the debate over whether markets adjust quickly and accurately to the arrival of new information. This occurrence increased market uncertainty. A large number of works on developed stock markets (particularly American and European stock markets) and the type of information have been conducted using the event study methodology. This occurrence increased market uncertainty. A large number of works based on the event study methodology have been conducted on developed stock markets (particularly the American and European stock markets), and the type of information involved is what we can call frequent or predictable.

In fact, as far back as from the works of Beaver (1968), Ball and Brown (1968), FFJR (1969), empirical literature that specialized on the antiphon of financial markets to the announcement of new information is extensive and covers a broad range of events such as announcements of annual earnings, announcements of stock splits, announcements of mergers/acquisitions, the issue of new shares, etc. Especially the impact of announcements of profits on stock prices has been a research domain that has captured the researchers' attention for quite some time now. Most of the studies undertaken in the domain have dwelt in developed markets and less consideration has been devoted to emerging markets. The results obtained from these studies were essentially in favor of the validity of the semi-strong form of the EMH in developed markets insofar as these markets react briskly and efficiently to announcements of profits. However, just a handful of studies with reference to stock market reaction to announcements of sporadic and unpredicted events such as political events have been carried out, with exceptions to African stock markets.

This paper contributes to the extant literature by examining emerging stock market reactions to public announcements of political events through a thorough examination of the speed at which prices adjust when such events occur.

As a matter of fact and with respect to recent sociopolitical troubles¹ in Ivory Coast, we could question ourselves about the briskness and consistency with which such events have been incorporated into the stock prices. Explicitly, we question ourselves about the speed at which stock prices adjust on the West African Economic and Monetary Union (WAEMU) Stock Exchange, the so-called BRVM (Bourse Régionale des Valeurs Mobilières), when a given

¹ *coup d'Etat, armed conflicts, riots and butchery*

political event occurs. We also check if the speed of adjustment of stock prices to the announcement of a given political event depends on the level of capitalization of the firms, an intuitive idea being that large capitalization firms may be more sensitive to political events if we take into consideration the fact that those firms generally maintain a close relationship with the politicians. The Ivorian case is of particular interest because in spite of the recent political and military crises no study on the reaction of stock prices to announcements of political events has been carried out. Such a study may have a far-reaching interest. First of all, Ivory Coast is the headquarter of the BRVM which is the first multi-country stock exchange in the world; secondly, the BRVM is an emerging stock market and nowadays, there is a renewed interest in those markets since there exist a possibility of international diversification of portfolio by foreign investors; thirdly, Ivory Coast has become an ideal “laboratory” for examining the impact of political events on a stock exchange, because this country has experienced an unprecedented instability from the coup d’état of 24th December 1999 to 11th April 2011, the latest being the date when President GBAGBO was arrested.

The rest of this paper is organized as follows: in section two, we present the literature review and the hypotheses of the study; the third section is devoted to the methodological aspects of the study; the fourth section discusses the main results ushering from the different statistical tests and the last section of the work brings out the conclusion of the study.

2- literature review

The present study falls within the framework of research related to stock market efficiency and announcements of unpredicted information such as the stock market crashes, political events, terrorist attacks, nuclear and chemical explosions, etc. It departs from former studies that have been interested in the impact of announcements of news specific to listed firms and which have generally led to the support of the semi-strong form of the EMH, insofar as the information has been instantaneously and fully incorporated into stock prices. Obviously, in the context of an efficient market, only investors who have been informed and initiated about an incident prior to its official publication will be able to profit from positive abnormal returns.

Unexpected events such as coup d’état, resignation of governments, earthquakes, terrorist attacks, chemical disaster or air crash often generate more stress and uncertainty in financial markets. Hence, financial market participants might lose their abilities to rationally assess the value implications of events. Accordingly, a number of studies have examined the behavior of stock prices when the degree of uncertainty increases at the announcement of unforeseen events and more precisely political events.

2.1- The relationship between political risk and the behavior of stock prices

One of the earliest studies that dealt with the relationship between economic performance and political events was undertaken by Nordhaus (1975), who has developed the political cycle of business in an effort to show why the unemployment rate in the United States declined before the presidential elections and augmented afterwards. To the best of our knowledge, there exists few specific works on the link between political events and movements in stock markets because of the difficulties observed in identifying and measuring political changes. Nonetheless, the existing literature can be divided into two basic groups: studies based on the short-term events and those carried out over longer horizons. This distinction is due to Tzachi (2003).

- **Studies Based on Short-term Events**

Niederhoffer (1971) has investigated on the reaction of stock exchange to announcements of short-term international events. He has matched short-term worldwide events to movements observed in the S&P 500 index. World events were carefully selected from the 'New York Times' magazines in terms of the frequency of appearance in the headlines. The author concluded that international events exert a well-known influence on the changes observed on the S&P 500 index. Simply put, the returns following far-reaching short-term world events tend to be higher in absolute value than returns observed on days without events.

Cutler, Poterba and Summers (1989) have also undertaken a similar finding. They analyzed the reaction of stock exchange with respect to 49 thoughtfully chosen events between 1941 and 1987, and ascertain that, on average, the absolute value of daily returns for the 49 selected dates amounted to 1.46% for a standard deviation of 2.08%. Besides, the average absolute value of returns for days without events during the same period of time amounted to 0.56% for a standard deviation of 0.83% ; their conclusion was that market returns for days with sudden events were more unstable than for ordinary days.

Curiously, these same authors undertook a similar study on changes in the S&P 500 index. They simultaneously inspected fifty biggest fluctuations observed in the index alongside major headlines of the "New York Times" magazines for the same period, to see if mentions justified the unusual trends in the index. To the authors' surprise, the movements on the market were not associated to the publication of major political information.

Kim and Mei (1994) have examined movements on the Hong Kong stock exchange and their relationship with political events. Using the events-study methodology, they demonstrated that political events sway significantly on stock prices. They have equally revealed that, by introducing a political variable to the regression specified by Fama (1991), the explanatory power of this model improved. Finally, these authors have more formally modeled the change in volatility in terms of political events.

Klibanoff, Lamont and Wizman (1998) have explored a sample of mutual funds of a small number of countries in order to test whether "major current events" led some market participants to react temporary faster to changes in the basic value of stocks. They have found that, the absolute value and standard deviation of the returns of these funds as well as the changes in the value of the net asset are clearly higher in the weeks having major events than in those without. They have also disclosed that, the price elasticity of the funds relative to their net present value was higher in the weeks that witnessed the presence of events than in those weeks prior to such events. This proof is in line with the hypothesis according to which investors react weakly to changes in the net present value which take place each week, but their behavior changes when they observe tragic information. In weeks with existing events, investors respond much more to changes in the basic value.

Aktas and Oncu (2006) have analyzed the reaction of stock prices on the Turkish stock exchange as a result of a major political event² having important economic and political implications for market participants. Globally, their results indicated that the estimates of the historical betas offered highly significant explanatory variables the first day of negotiations after the rejection of a bill. In addition, they did not find any evidence of slow or excessive reaction from investors which break up the hypothesis of efficient markets theory.

Wan et al (2015) investigates market reactions to short-run political events in the companies connected to bi-power business-political elite of the state of Sarawak in Malaysia. They find that the under-reaction market behavior of investors existed in politically connected firms

² On March 1 2003, the Turkish parliament has rejected the higly controversial bill that allows the deployment of U.S Troops in Turkey.

upon the holding of the Balingan general election. Their result also suggests that in short-run political events, investors are unable to predict abnormal returns in politically connected companies upon the announcement of surprising political news, signaling an inefficient market.

Lausegger. M (2020) explores how elections impact stock markets across diverse political institutions. Its results suggest that electoral and party systems impact the fragmentation, credibility, and predictability of electoral information, influencing levels of uncertainty resolved by-elections and leading to distinct stock market reactions. He also finds that, on the one hand, elections in majoritarian electoral systems produce larger cumulative abnormal returns (CARs) than elections in proportional representation systems. And the other hand, the weaker institutionalized party system is, the larger are the CARs around elections.

In the same vein, Pereira et al . (2021) analyzes the role of political events in shaping the returns on financial assets. The regressions using the Propensity Score Matching technique suggest that companies linked to the government had positive cumulative abnormal returns around relevant events compared with otherwise identical firms. These results reinforce the role of political risk on financial markets in emerging economies and allow economic agents to outline strategies to predict stock return behavior during periods of political turmoil.

- **The Studies Are Based on Long-term Events**

Diamonte et al (1996) and Bilson et al (2002) have examined the long-run association between political risk and returns on stock markets. Their findings have revealed that political risk had a higher bearing on returns on emerging markets than on those on developed markets. Bilson et al. (2002) on their part, exhibited results showing that political risk could explain a fraction of changes in returns of securities in emerging markets at the country level and in global portfolios. Both conclusions revealed that political risk play an important role in explaining discrepancies in returns on emerging markets, predominantly in the Pacific Basin, but not in developed markets. It should be noted that, both studies were designed to assess political risk, based on long-term events to latch on its correlation with movements in the stock market over a long time period.

Tzachi (2003) has carried out a study in order to illustrate the power of political events on the returns of shares listed on the Tel-Aviv stock exchange between 1993 and 1997. The purpose of his investigation was to show how the Israeli stock market responds to disturbances from the Israeli political environment and above all, to events related to the peace process between Israel and Palestine. His findings showed that returns on the Tel-Aviv stock exchange index following some political events were higher and more volatile than those of the same index during ordinary days. Moreover, the returns on shares quoted in Israel and in the United States had a similar behavior. This was in sharp contrast to results of previous studies which found that peace process did not have any consequence on the Israeli economy.

Chen and Siems (2004) have used events-study methodology to investigate the effects of terrorism on a set of financial markets. They analyzed the response of American financial market to 14 terrorist and military attacks since 1915, including two far-reaching topical events: the Iraqi invasion of Kuwait in 1990 and the terrorist attacks of September 11th 2001. They found that, American financial markets were more flexible than in the past and that they adjust faster than other capital markets as a whole. This result could suggest that, the increase in the flexibility of American stock exchange could partially be attributed to the stability of the financial and banking sector which has been providing an appropriate liquidity in order to promote market stability and reduce to a minimum the panic amongst investors.

Dar, Feng and Chun (2005) have probed into the impact of political events on stock prices of the Taiwan stock exchange. They found that, the reaction of prices to most political events

were rather insignificant, implying that these events were largely uninformative, with only a few exceptions.

Mehdian, Nas and Perry (2005) have tested the power of forecasts of two conflicting theories on the response of stock market to unpredicted economic and political events in Turkey. Their study revealed that, the Turkish stock exchange systematically adjusts the price of securities below their basic value in case of unforeseen events. As such, the role of political events in explaining stock market behaviors is not only through their impact on prospective factors such as cash flows (Hoe & Nippani, 2017), but also to their effect on the degree of uncertainty they propagate in the stock markets (Hill et al, 2017 and Hillier & Loncan, 2019). This uncertainty may or may not affect further changes of variables such as profits or the total production, but it certainly has an effect on current prices.

2.2- Research hypotheses

Events-study tests are aimed at determining whether stock prices immediately and fully integrate all publicly available information. The reaction of the market within the epoch surrounding the date of occurrence of the event is therefore measured by analyzing the speed at which prices adjust to this information. According to Busse and Green (2002), the adjustment speed of stock prices to the announcement of pertinent information is been measured by the existence or not, and the degree of statistical significance of abnormal returns.

The outcomes of studies that have examined the response of stock markets after the announcement of information specific to firms in developed markets have led to the confirmation of the EMH, insofar as all the available information related to a listed stock is reflected in the price of this asset at the moment where this information is announced. Therefore, these markets are informationally efficient.

Yet, studies carried out on the semi-strong form of the EMH in African stock markets show an opposite result (Oludoyi (1999), Adelegan (2006, 2009) and Afego (2011)). This is because adjustments of prices to new information are slow, spread out over time and significant abnormal return is observed around the date of the announcement of the information (event). Some researchers Such as Osei (2002), Adelegan (2006, 2009) and Afego (2011), explain these results by the structural specificities known to these markets as identified by many authors (Bekaert and Harvey (1997), Osei (2002)).

Therefore, on the basis of the afore-mentioned empirical results obtained on other African emerging stock markets, we can formulate the following main hypothesis:

The “BRVM” does not react efficiently to the announcement of a given political event in terms of the speed of price adjustment.

3. methodology

3.1. Data source and sample

The data collected for the empirical study came from two sources: on the one hand, historical data on the political history of Ivory Coast. These allowed us to select nine dates of political events considered major because of their impact on stock prices and Ivorian politics. Table 1 below provides a brief description of the nine major political events selected.

Table 1: Description and chronology of events

Events	Date of the announcement of the event	Date of the event (t=0) ³	Description of the event
1	24/12/1999	27/12/1999	Military coup d'état as a result of a mutiny (rebellion), the president Aimé Henri Konan Bédié is overthrown by the army because of a reform of the constitution which would have allowed him to stand for president up to the age of 75 years. The concept of "ivorianity" disappears but the xenophobic tensions persist and General Robert Guei comes to power in January 2000 up to the organization of new elections.
2	19/09/2002	19/09/2002	An armed revolt against the State in Abidjan spreads towards the Centre and the north of the country: the towns of Bouaké and Korhogo come under the control of the rebels.
3	24/01/2003	24/01/2003	Signature of a peace agreement in Linas-Marcoussis which makes provision for the upholding of President Gbagbo in power and a government open to all the parties, including the three rebel movements, united within the New Forces Movement (NF).
4	04/11/2004	04/11/2004	Bombardment by the Ivorian aviation (mistakenly according to the Ivorian government) of the rebels' positions and the French base of Bouaké killing nine persons (8 Frenchmen and 1 American civilian) and making several wounded persons. The French forces then destroy the military bases of the State army to prevent them from attacking the New Forces positions.
5	04/03/2007	05/03/2007	Signature of the Ouagadougou political agreement between the presidential forces and the New Forces.
6	02/12/2010	02/12/2010	The Independent Electoral Commission proclaims the victory of Alassane Ouattara with 54.1% against 45.9% for Gbagbo. The constitutional council invalidates these results and announces the victory of the outgoing president on the 3 rd December 2010 with a score of 51.45%.
7	11/04/2011	11/04/2011	Laurent Gbagbo is arrested by the rebel forces of Ivory Coast with the indirect support of the "ONUCI" troops and the "Licorne Force" through the application of the resolution 1975 of the Security Council of the United Nations Organization.
8	28/10/2015	28/10/2015	Faced with an opposition weakened by divisions, the Independent Electoral Commission announced the

³ It is advisable to notice that in the table above, the date of appearance is not necessarily the event date (t=0). For some of these events, the date of occurrence of the event can be a non working day or a public holiday or in a weekend where the stock market is closed; thus, the date of event (t=0) is defined as the first working day following the date of occurrence.

			victory of Alassane Ouattara in the presidential election with 83.66% of the votes cast. But the turnout was relatively low (52.86%). This result will be confirmed on 02/11/2015 by the Ivorian Constitutional Council.
9	03/11/2020	03/11/2020	The Independent Electoral Commission publishes the provisional results, announcing the victory of Alassane Ouattara in the presidential election with more than 94% of the votes, for a participation rate of 53.90%. This result was confirmed a few days later by the Ivorian Constitutional Council.

Source: articles published by the "CEAN" and "ONUCL"

The stock market data are obtained from the "Historical data" of the BRVM's financial data CD-ROM and covering a period from September 1998 to December 2020. However, our study period is from July 1999 to December 2020. The work carried out on efficiency in the semi-strong form via event studies used to focus on monthly and weekly frequency data⁴. However, Brown and Warner (1985), MacKinlay (1997), Osei (2002) and Afego (2011) measure the reaction time of stock prices to firms' public announcements on the basis of daily data. We have therefore chosen to use a daily frequency of closing data. Our sample is composed of only 25⁵ stocks divided into two portfolios according to the level of market capitalisation of each stock listed on the BRVM and for which we have daily closing data for the period from 2nd July 1999 to 31th December 2020, i.e. 81050 daily observations, as well as the BRVM composite index series⁶ for the same period, i.e. 3242 daily observations. These data allowed us to relate the dates of political events to the returns of the various securities. A statistical study of the distribution of the series of stock market returns shows that all the series of stock market returns are stationary at a level of significance of 1%. Moreover, the observation of the coefficients of Kurtosis, Skewness and Jaque-Bera makes it possible to note that the distributions of the series of stock market returns do not follow that of a normal distribution. Finally, the results of the heteroscedasticity tests show that all the stock return series exhibit an ARCH effect.

3.2. Event Study Methodology

According to MacKinlay (1997), The event study is an important research tool in economics and finance. Its goal is to measure the effects of an economic event on the value of firms. Event study methods exploit the fact that, given rationality in the market place, the effects of an event will be reflected immediately in security prices. Thus the impact can be measured by examining security prices surrounding the event. Generally, the event study methodology consists of three steps:

Step 1: definition of the parameters of the study namely the date of the event, the period of the event and the estimation period.

Step 2: definition of the theoretical model, estimation of the parameters of the model and the evaluation of abnormal returns.

⁴ See the works of Fama et al. (1969).

⁵ See table N° 1 of the appendix, the missing data of our sample is replaced by the method of predecessor i.e., by the last available stock prices quoted. The stocks which have a great number of missing data have been suppressed from our sample as well as those that were not present at the date of announcement of any seven political events selected.

⁶ It represents the movements of stock prices of all companies listed on the "BRVM" stock exchange. It gives a more complete and global representation of the market.

Step 3: definition of statistical tests.

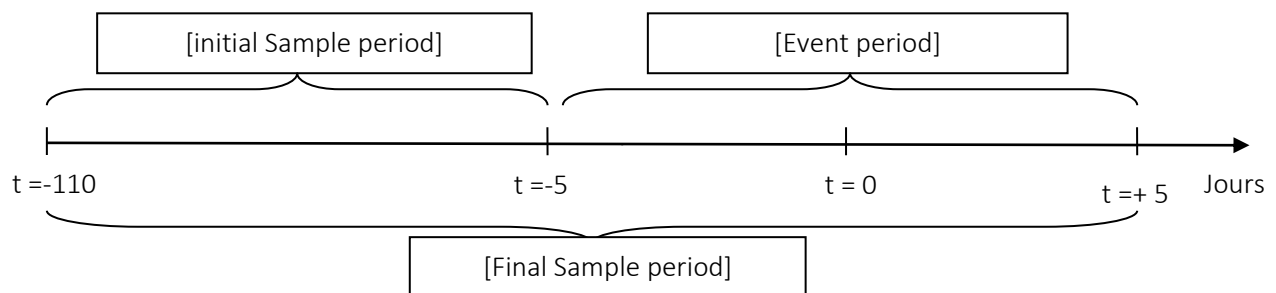
3.2.1. Definition and identification of the event period

This involves of defining the event and identifying the period during which this event will be studied. Thus, for each event, we construct different time intervals:

- The Sample window allows us to estimate the parameters of the theoretical model when the information is specific to the firm. However, when the event is exogenous to the firm, the initial estimation window can be extended to the event window to form a final estimation window (Binder, 1985 ; Binder, 1998). According to Brown and Warner (1985), the initial estimation window should be at least three times the length of the event window. To estimate the parameters of our theoretical model, we have chosen 121 stock market days as the Sample period.
- The event window, also known as the test period, is considered as the period during which, abnormal investor behavior is supposed to occur. It is centered around the event date in order to allow the detection of trends before, during and after the event. According to Panayides and Gong (2002), an event window of 11 days is sufficient to fully capture the announcement effects of an event in the market. Our event window was set at 11 trading days in order to study the significance of each event.

Thus, for each event, we construct a time interval allowing the estimation of abnormal returns and the calculation of average abnormal returns. These intervals are constructed according to the following figure 1:

Figure 1: Time line of the event study



Source: Authors

3.2.2. Measurement of abnormal returns

In order to gauge the reaction of a stock market following the announcement of new information (a political event), it is necessary to observe abnormal market behavior around the announcement date. This abnormal market reaction is measured by calculating abnormal returns. According to Binder (1985a), Malatesta (1986) and Binder (1998), abnormal returns can be determined by two methods, depending on whether the information is firm-specific or firm-exogenous. If the information is firm-specific, then, abnormal returns are measured as residuals (actually as prediction errors in most cases) from some benchmark model of normal returns, such as the market model. On the other hand, if the information is exogenous and therefore affects a set of firms at the same time, such as a change in accounting or tax regulations induced by the legislator, then, Multivariate Regression Model (MVRM) is more appropriate. That is the case where the abnormal returns are modeled as coefficients in a regression model and the sample includes the event period and data before (or after) it.

The MVRM approach has an advantage over the classical MEE in that it allows the abnormal returns of each firms to be different. For this reason, the MVRM approach is preferred to the classical MEE in this study, the MVRM approach thus allows the definition and estimation of

abnormal returns under the hypothesis of the existence of an impact of the event on the firm's profitability. This model is described as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \sum_{k=t_1}^{t_2} \gamma_{ik} D_{ikt} + \varepsilon_{it} \quad \text{avec } \varepsilon_{it} \rightarrow N(0, \sigma^2) \quad (3.2)$$

Where γ_{ik} : represents the abnormal return of the firm i on day k;

D_{ikt} : represents a dummy variable which takes the value 1 if $k=t$ and 0 otherwise ;

t_1 et t_2 : denotes the beginning and end of the event window respectively;

ε_{it} : refers to the error term.

This modelling allows the clustering effect to be considered. Clustering occurs when there is an overlap between events for all firms (MacKinlay, 1997). This overlap should generate a non-zero covariance between firms' abnormal returns since the event affects all firms at the same time. Thus, the clustering effect could lead to a decrease in the quality of statistical inferences in the case of classical MEE (MacKinlay, 1997). According to Binder (1985) and Malatesta (1986), the estimation of this model is performed over a period of the initial estimation period and the event window. That is, this approach parameterizes the abnormal return in the market model regression equation. The main limitation of this model is that the variance is assumed to be constant over time. In other words, the announcement of new information does not modify the risk of the stock concerned. However, Brown and Warner (1985) and French and Roll (1986) have highlighted the modification of the variance of returns around stock distributions. The application of an ARCH test on the series of returns also shows that they all present a phenomenon of conditional heteroscedasticity. Some work has lifted the assumption of independence of variance with respect to time by introducing a GARCH model. Unfortunately, GARCH modelling of a news event only captures the magnitude and not the sign of the potential link between volatility and profitability, as well as the asymmetric nature of the news. To fill these gaps, the literature proposes the extension of simple GARCH models to asymmetric GARCH models such as GJR GARCH (p,q), TGARCH (p,q), EGARCH (p, q), etc... In this study, we retain an EGARCH(1,1) model insofar as according to Nelson (1991) it is the GARCH(1,1) and EGARCH(1,1) specifications that maximise the log-likelihood in each of the GARCH(p,q) and EGARCH(p,q) models. It consists of two equations: the first is the mean equation, based on the multivariate model of Binder (1985), and the second is the conditional variance equation. Using the maximum likelihood method, we estimate the following EGARCH(1,1) model (equation 3.3), in order to obtain abnormal returns around the event date.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \sum_{k=t_1}^{t_2} \gamma_{ik} D_{ikt} + \varepsilon_{it} \quad (3.3)$$

$$\varepsilon_{it} | \varepsilon_{it-1}, \varepsilon_{it-2}, \dots \rightarrow N(0, \sigma_{it}^2)$$

$$\sigma_{it}^2 = \exp \left[\omega + \rho_1 \frac{\varepsilon_{it-1}}{\sigma_{it-1}} + \phi_1 \left(\left| \frac{\varepsilon_{it-1}}{\sigma_{it-1}} \right| + \frac{\Gamma(2/\nu)}{\sqrt{\Gamma(1/\nu)\Gamma(3/\nu)}} \right) + \theta_1 \ln \sigma_{it-1}^2 \right]$$

The parameter ν defines the size of the distribution tails. Given the results obtained from the normality tests, we set the parameter to 1.5 like Nelson (1991).

Then, in order to investigate the effect of the political event studied on a given day of the event window and to extend our analysis, we calculate Average Abnormal Returns (AAR_t) at each date t of the event window from the following relationship :

$$\gamma_{ik} = AR_{ik} = AR_{it} \text{ when } k = t$$

$$AAR_t = AAR_k = \frac{1}{N} \sum_{i=1}^N \gamma_{ik} = \frac{1}{N} \sum_{i=1}^N AR_{ik} \quad (3.4)$$

With $t = k = t_1, t_1 + 1, t_1 + 2, \dots, t_2$.

Where: AR_{it} stands for the abnormal return of stock (i) for each date (t) of the event window, and N is the number of securities in our sample.

Finally, in order to have the global impact of the event, from the beginning of the event window up to the date considered as the end of the window, we calculate the cumulated average abnormal returns ($CAAR_{t_1, t_2}$) during the 11 days of the event window by cumulating the average abnormal returns AAR_t .

$$CAAR_{t_1, t_2} = \sum_{t=t_1}^{t_2} AAR_t \quad (3.5)$$

Where t_1 and t_2 are the dates at the beginning, and at the end on the event window.

Finally, we test the significance of the average abnormal returns using the different statistical tests.

3.2.3. Statistical analysis of abnormal returns

In the events study methodology, there are two types of significance tests that can be run: parametric tests⁷ and nonparametric tests⁸.

- **Cross-sectional Student test**

In order to justify the use of this test, we have carried out a heteroskedastic test on the series of returns. Our results⁹ show that, the series of security returns of our sample were heteroskedastic, i.e., their volatility varies across time. To get unbiased results, it was necessary to take this feature into account by carrying out the cross-sectional Student test. This test enables us to calculate the variance of abnormal returns at each date (t) on the event window.

By supposing that abnormal returns are normally distributed, we consider the following hypotheses:

$$H_0 : AAR_t = 0$$

$$H_1 : AAR_t \neq 0$$

Where AAR_t represents the Average Abnormal Returns for each date (T).

Under the null hypothesis H_0 , the calculated value of the Student T statistic is calculated for each date (t) of the event period through the following relation:

$$T = \frac{\sqrt{N} * AAR_t}{\sigma_{t(AAR_t)}} \quad (3.6)$$

$$\text{with } \sigma_{AAR_t} = S_{AAR_t} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (AR_{it} - AAR_t)^2} \quad (3.7)$$

Here, σ_{AAR_t} represents the estimated standard deviation of the average abnormal returns (AAR_t), and N is the number of stocks in the sample. Under the hypothesis of normality, the Student T statistics follow a Student distribution with (n-1) degrees of freedom.

⁷ The Student test, the Boehmer test and the Subramanyan test.

⁸ The rank sign test of Wilcoxon, the rank test of Corrado, the rank test of Spearman and the sign test.

⁹ The results are not reported in this paper. However, they are available from the authors.

However, since the Student test is a parametric test whose specific assumptions were not all fulfilled, especially, the normality of the rates of returns; the independence and the absence of correlation between the stock returns¹⁰, we also carried out a nonparametric test in order to give more robustness to our results.

• The Wilcoxon Signed-Rank Test

This nonparametric test denoted by Z_{rank} , is free of specific assumptions concerning the distribution of returns. Otherwise, this test is used in order to curb the specific conditions for the validity of the Student T test. The test is based on the hypothesis of a symmetrical allocation of the abnormal returns. Simultaneously, it considers the sign and the rank of the abnormal changes for a given day in the event window.

The principle of the test is as follows: first, the positive and negative changes in returns are ranked in increasing order without considering their signs¹¹. Next, the sum of the ranks of positive variations is obtained as follows:

$$T^+ = \sum_{i=1}^n R_i \times d_i \quad (3.8)$$

Where:

- T^+ : stands for the sum of the ranks of positive variations;
- R_i : stands for the rank of variation;
- $d_i = 1$ if the variation is positive;
- $d_i = 0$ if the variation is negative;
- n : stands for the sample size.

Finally, the statistic of the test is given by:

$$Z_{rank} = \frac{T^+ - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}} \quad (3.9)$$

Under the null hypothesis H_0 (absence of average abnormal returns), the statistic of Wilcoxon follows a standard normal distribution.

4- Results and Discussions

The results of this study are presented in the following tables. We present the results of the reaction of stock prices to the announcements of the nine political events, for each period from $t = -5$ to $t = +5$.

4.1. Reaction of the stock prices around the date of the announcement of a given political event: a multi-event analysis.

The table 4-1 below shows different items which allow appreciating the market reaction to the announcement of each political event. First of all, we have the event window; it is the time period over which the effect of an event will be examined. An event window is denoted as $(-5, +5)$. The announcement date of an event is set as day 0. Secondly, we have the Average Abnormal Return (AAR_t) which allows observing abnormal market behavior around the announcement date. Finally, two types of significance tests that can be run: parametric tests (T Student test) and nonparametric tests (The Z rank signed test of Wilcoxon), are used to test the significance of the average abnormal returns.

¹⁰ We found that the series of the returns are neither distributed according to the normal distribution, nor identically and independently distributed.

¹¹ For the negative variations, we consider their absolute value.

Table N° 4-1: Results related to the average abnormal returns for each event.

Event Day (t)	(1) : Coup d'Etat on 24 /12/ 1999			(2) : Attempt of coup d'Etat on 19 /09/ 2002(1)			(3): Signature of the agreement Linas-Marcoussis on 24/01/2003(1)			(4) : Bombardement of Bouaké région's on 08/11/2004		
	AAR _t	T	Z _{rank}	AAR _t	T	Z _{rank}	AAR _t	T	Z _{rank}	AAR _t	T	Z _{rank}
-5	0,0173	0,4602	2,8571*	0,0029	1,3020	0,6592	-0,0011	-0,3285	3,057*	-0,0003	-0,0781	-1,6857
-4	0,0208	1,2422	2,4286*	0,0029	1,0840	1,4126	0,0015	2,396*	2,371*	0,0065	2,2583*	3,37**
-3	0,0247	0,8521	-0,2000	0,0020	2,043*	2,2198*	-0,0034	-0,3817	3,257*	0,0005	0,6138	0,4571
-2	0,0288	1,3889	0,6286	-0,0003	-0,1517	1,0359	-0,0005	-0,8373	0,1143	-0,0019	-0,3651	2,4*
-1	0,0332	1,3914	0,6286	0,0003	0,4431	3,1885**	-0,0187	-1,1131	-1,7143	-0,0014	-0,7991	1,2
0	0,0343	0,7514	-0,2286	0,0008	2,074*	2,4351*	-0,0019	-0,5938	1,8286	0,0003	1,0084	1,4
1	0,0372	0,7267	0,1143	0,0030	3,22*	1,7893	0,0005	1,0210	0,9429	0,0003	1,1091	1,4571
2	0,0450	1,4202	-0,4286	-0,0015	-1,3204	2,5696*	-0,0014	-2,209*	-1,4857	0,0003	1,0523	1,4
3	0,0452	1,9719*	2,0857*	0,0018	1,0634	1,3319	0,0013	0,4794	-0,9143	0,0029	0,7448	2,6*
4	0,0469	0,4277	3,2**	-0,0008	-1,9878*	2,4620*	-0,0023	-3,072*	-2,4*	0,0038	2,0563**	-0,3429
5	0,0478	2,1489**	3,6**	0,0057	1,2478	2,5696*	-0,0011	-2,061*	-0,9143	0,0053	2,8793**	-1,9886*

* Significance at the 5% level; ** significance at the 1% level¹².

Source: Authors

¹² When the calculated statistical values (T) are greater in absolute values than 1.9600, we reject the null hypothesis (RAM = 0) at 5% level of significance. However, when the estimated statistical value (Z_{rank}) is greater in absolute values than 1.9600 and 3.100, we reject the null hypothesis (RAM = 0) at 5% and 1% level of significance respectively. These precisions are still valid for all the tables of results of the test of Student in cross section and the rank-order test of Wilcoxon respectively.

Table N° 4-1 (concluded): Results related to the average abnormal returns for each event.

Event Day (t)	(5): Signature of the agreement Ouagadougou on 04/03/2007			(6): Proclamation of the results of the second round of Presidential election on 02/12/2010			(7): The arrest of Laurent Gbagbo on 11/04/2011		
	AAR _t	T	Z _{rank}	AAR _t	T	Z _{rank}	AAR _t	T	Z _{rank}
-5	0,0030	0,6823	-1,2781	-0,0017	-1,8181	-0,5714	-0,0014	-0,7336	1,2
-4	0,0034	0,6420	-0,5785	0,0012	1,9959*	-0,0571	-0,0014	-0,7336	1,2
-3	0,0064	1,2019	0,2018	0,0027	2,1984**	-0,4	-0,0014	-0,7336	1,2
-2	-0,0035	-0,5076	-0,5247	-0,0004	-1,5479	-1,2	-0,0025	-0,6148	0,9143
-1	0,0005	0,1000	-1,1166	0,0024	1,9655*	1,	-0,0014	-0,7336	1,2
0	0,0021	1,9811*	-1,5429	0,0033	1,9767*	-1,982*	-0,0014	-0,7336	1,2
1	0,0036	1,4441	0,3143	0,0025	0,5532	-0,9283	-0,0014	-0,7336	1,2
2	0,0030	1,2422	-0,4	0,0014	0,2559	-0,5516	-0,0046	-2,092*	0,5429
3	-0,0023	-1,9843*	-1,1429	-0,0038	-2,6704**	-1,9781*	-0,0046	-2,092*	2,2913*
4	-0,0031	-2,2754**	-2,4571**	0,0031	2,0294*	-1,5471	-0,0014	-0,7336	2,4169*
5	-0,0033	-2,7525**	-2,5429**	0,0036	2,5603**	-1,2781	-0,0034	-1,9736*	1,2

* Significance at the 5% level; ** significance at the 1% level.

Source: Authors

Table N° 4-1: Results related to the average abnormal returns for each event.

Event Day (t)	(8) : Proclamation of the results of presidential election on 28/10/2015			(9) : Proclamation of the results of presidential election on 03/11/2020		
	AAR _t	T	Z _{rank}	AAR _t	T	Z _{rank}
-5	-0,0001	-0,0017	2,6286*	0,0037	1,7049	2,5158*
-4	0,0022	0,4774	2,4*	0,0010	1,0519	1,4126
-3	0,0060	0,7735	0,4286	0,0006	1,6137	2,8925*
-2	0,0144	2,0844*	1,0	0,0007	1,6587	3,2154**
-1	0,0163	1,4948	1,9429*	0,0024	1,7499	2,2736*
0	0,0173	1,4602	2,8571*	0,0029	1,9921*	0,6592
1	0,0208	1,2422	1,4286	0,0029	1,9921*	1,4126
2	0,0247	1,8521	-0,2000	0,0020	1,043	1,2198
3	0,0288	0,1517	0,6286	-0,0003	-1,3889	1,9859*
4	0,0332	0,4431	0,6286	0,0003	2,3889**	1,9885*
5	0,0343	1,074	-0,2286	0,0008	1,9754*	1,4351

* Significance at the 5% level; ** significance at the 1% level

Source: Authors

4.2. Discussions of results

From the above table 4-1, we have observed for the nine political events that:

The “BRVM” stock market reacts on dates more or less distant from the date of actual announcement: an anticipation effect that could be justified by the incidence of other secluded informational sources which allow investors to forecast the informative content of political events. In economic terms, the average abnormal return was more intense in the day before than in the days after the event, which might indicate that market agents receive or anticipate the information even before their effective disclosure to the public. However, such an anticipation effect has not been noticed before the official announcement of the signature of the Ouagadougou agreement.

Besides, the existence of a statistically significant Average Abnormal Return (AAR) is an indicator of continuity in adjustments of stock price - after the date of the announcement demonstrates that, the “BRVM” stock market is informationally inefficient in a semi-strong form. Empirically, more than ten days are needed for events (1), (2) and (4); eight days for the event (3) and three days for events (6) and (7) to be entirely integrated in stock prices of our sample. This is inconsistent with the Efficient Markets Hypothesis (EMH). Fama (1991) has attributed this case of slow adjustment of stock prices to a problem of methodology. Fama (1991) has associated it to the problem of the joint hypothesis: according to which any test of efficiency is a joint test of efficient hypothesis and that of evaluation model of assets.

Conversely, we notice that information is fully integrated in stock prices at the announcement of the event (5) insofar as no significant and abnormal reactions are observed in stock prices after this event.

It is, however, sagacious to mention that of the first four events, the results obtained from the statistics test (Z_{rank}) is better in terms of significance as compared to the result of the Student statistic test (T). The reactions of the market which were not evident with the Student test are therefore revealed.

It should be noted that, this result is inconsistent with that of Dar, Feng and Chung (2005) on the Taiwan stock exchange. They have found that the reactions of price to most political events studied were insignificant. They also differ from those of Ndong (2007) on the “BRVM” which showed that, the information associated with the announcement of dividends and annual earnings have correctly been incorporated in stock prices. Interestingly, this result is consistent with that of Kim and Mei (1994) on the Hong Kong stock market. Concretely, these authors have shown that political events have a significant bearing on the price securities. Spontzol (2005), Hoe & Nippani (2017), Hill et al (2017) and Pereira et al (2021) have obtained abnormal reactions of prices around the date of the announcement of the annual earnings of the firms listed on the stock exchange, the presidential election and the Brexit Referendum. The author had attributed the slow adjustment of stock prices after the announcement to the small size of the Danish stock market. This disagreement in results could be explained by the length of the event window used in each study, the structural specificities of emerging markets, as well as the nature of data.

5- conclusion

In this study, we examined the reaction of stock prices to the announcement of political events with an application of the event study methodology on the West African Economic and Monetary Union (WAEMU) Stock Exchange, during the years 1999 to 2020 on stock prices of a sample of twenty-five firms established in West Africa. The results of our study showed that, the “BRVM” stock market is inefficient with respect to EMH semi-strong form.

Empirically, for the nine political events, we noticed that:

- The “BRVM” stock market reacted at dates more or less distant from the date of effective announcement: an anticipation effect.
- The presence of a statistically significant Average Abnormal Return (AAR) is an indicator of continuity in adjustments of stock price - after the date of the announcement demonstrated that, the “BRVM” stock market is informationally inefficient in a semi-strong form. In other words, investors react gradually to the publication of information and therefore, the market does not integrate new information rapidly.
- However, the absence of a statistically significant AAR during and after the announcement of the event (8) showed that the “BRVM” stock exchange has fully integrated this event without delay.

These results were consistent with those of Charest (1978) observed in his study which dealt on the announcement of dividends of firms listed on the N.Y.S.E between 1947 and 1967. Moreover, its non-consistency with the EMH in its semi-strong form confirms our first hypothesis of this study.

The results of our study open several grounds for further research. Two potential research avenues could be suggested. On the one hand, the study of the asymmetric reaction of emerging stock markets to news. On the other hand, a study could be carried out on the “BRVM” stock market using the speed adjustment ratio of Bae et al. (2008), in order to examine the adjustment speed of stock prices to the announcement of several types of public information (political information, macroeconomic information, information specific to enterprises, etc.) and thus see those that are integrated rapidly in stock prices.

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Appendix

Appendix 1 : Statistics of stock returns sample

Firm	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Obs	decision
BERNABE-CI	9.340935	0.349554	1.158935	4.243274	564.9907	0.000000	2742	Rejet
BICI-CI	10.05822	0.223113	0.174287	1.725484	142.5813	0.000000	2742	Rejet
CIE-CI	9.345724	0.150439	0.640856	3.532389	157.3083	0.000000	2742	Rejet
CROWN SIEM-CI	10.01934	0.311507	-0.320843	2.223407	82.87993	0.000000	2742	Rejet
FILTISAC-CI	9.291239	0.377751	-0.138446	2.375341	38.12755	0.000000	2742	Rejet
NESTLE-CI	11.06722	0.269339	-1.817245	5.901509	1766.309	0.000000	2742	Rejet
PALM_CI	10.01623	0.368751	-0.310943	2.485641	192.1351	0.000000	2742	Rejet
SAFCA-CI	10.41962	0.210820	-0.174106	2.950180	10.10490	0.006394	2742	Rejet
SAPH-CI	8.441560	0.773280	0.796402	2.896589	208.0634	0.000000	2742	Rejet
SARI-CI	11.01193	0.098503	2.540052	12.62066	9666.441	0.000000	2742	Rejet
SGB-CI	9.681532	0.305664	0.478088	2.493235	95.63862	0.000000	2742	Rejet
SHELL-CI	9.538251	0.284712	0.625843	2.282091	170.0391	0.000000	2742	Rejet
SICABLE-CI	9.708542	0.621659	0.353392	1.793562	159.6612	0.000000	2742	Rejet
SICOR-CI	8.806065	0.313037	0.191816	2.202553	63.95282	0.000000	2742	Rejet
SITAB-CI	10.71725	0.254683	1.100194	3.876254	458.1112	0.000000	2742	Rejet
SIVOA-CI	8.313472	1.273462	-6.080226	39.90412	123299.5	0.000000	2742	Rejet
SIVOM-CI	8.527901	0.597879	-0.875070	2.207994	301.3716	0.000000	2505	Rejet
SMB-CI	10.00037	0.574035	-0.024203	2.046326	74.46678	0.000000	2742	Rejet
SOGB-CI	9.019943	0.467467	1.358889	4.219500	724.6693	0.000000	2742	Rejet
SOLIBRA-CI	11.87780	0.407105	0.238851	2.480351	40.68913	0.000000	2742	Rejet
SONATEL	10.53658	0.668316	0.822189	2.252648	266.4387	0.000000	2742	Rejet
TOTAL-CI	10.64146	0.341386	0.708749	2.404052	193.0970	0.000000	2742	Rejet
TRITURAF-CI	8.374001	0.496331	-0.222733	1.842534	125.6171	0.000000	2742	Rejet
UNIWAX-CI	10.08016	0.545314	0.604882	2.195060	172.4356	0.000000	2742	Rejet
SODE-CI	9.141579	0.278978	0.075433	2.284107	43.71318	0.000000	2742	Rejet
BRVMCOM	4.512983	0.294875	1.061784	3.150388	370.1264	0.000000	2742	Rejet

Source : Authors