

Seasonal anomalies: Empirical evidence from regional stock exchange Ivory Coast securities

Fatma Wyème Ben
Mrad Douagi^a

^a Faculty of Economic Sciences and Management,
University of Tunis El Manar, Campus Universitaire, B.P.
248 El Manar II 2092, Tunisia

Olfa Chaouachi^a

Sow Mory^a †

† ✉ sowmory@hotmail.fr (Corresponding author)



Corresponding
author

ARTICLE HISTORY:

Received: 15-Feb-2019

Accepted: 14-Apr-2019

Online available: 15-May-2019

Keywords:

The day of the week effect,
The month of the year effect,
BRVM

ABSTRACT

This paper tries to examine the efficiency of the Regional Stock Exchange in Ivory Coast Securities (BRVM), by testing two seasonal anomalies: the day of the week effect and the month of the year effect. Applying the GARCH models, we found evidence of day of the week and month of the year effects between January 2002 and December 2016. These seasonal anomalies challenge the efficiency of the market hypothesis, proposed by Fama (1970).

Contribution/ Originality

In the context of the Regional Stock Exchange Securities (BRVM), there are handful of studies, which explored the day of the year effect. The key purpose of this work is to investigate the day of the week and the month of the year effects in the BRVM over the period January 2002 to December 2016. This work will add to the existing literature on seasonal anomalies in equity markets. Its results are of great importance to both traders and investors.

DOI: [10.18488/journal.1007/2019.9.2/1007.2.38.45](https://doi.org/10.18488/journal.1007/2019.9.2/1007.2.38.45)

ISSN (P): 2306-983X, ISSN (E): 2224-4425



How to cite: Fatma Wyème Ben Mrad Douagi, Olfa Chaouachi and Sow Mory (2019). Seasonal anomalies: Empirical evidence from regional stock exchange Ivory Coast securities. Asian Journal of Empirical Research, 9(2), 38-45.

© 2019 Asian Economic and Social Society. All rights reserved

1. INTRODUCTION

One important exercise in financial literature, was to verify the existence of seasonal patterns in stock market returns. A predictable pattern is a contradiction to market efficiency, and can give beneficial clues to market participants, regarding their investment decisions. Since the eighties, numerous works have documented seasonal anomalies in securities returns. The month of the year effect and the day of the week effect are the most important calendar effects. The month of the year effect holds that, the mean stock returns for January through December are different. The day of the week effect states that, the mean stock returns is not identical for every trading day.

Recently, works on seasonal anomalies were concentrated on emerging stock markets in Africa, because these markets have started attracting investors from all over the world. The increased interest in African stock markets is explained by the fact that, these markets have experienced considerable expansion, and have low correlation with the rest of the world; with an important performance in the past. In the context of the Regional Stock Exchange of Ivory Coast Securities (BRVM), there is only one study exploring the day of the year effect. [Tachiwou \(2010\)](#) examined the day of the week effect in the West African regional stock market, for the period September 1998 to December 2007. The findings revealed low stock returns on Mondays and Tuesdays and high returns on Thursdays and Fridays. However, there is no published work examining the month of the year effect in BRVM. Therefore, the principal purpose of this work is to investigate the day of the week and the month of the year effects in the BRVM over the period of January 2002 to December 2016.

Applying the GARCH models, we found evidence of day of the week and month of the year effects in the BRVM, between January 2002 and December 2016. More specifically, we reported that the highest mean daily returns were observed on Tuesday. However, the lowest mean daily returns were produced on Wednesday. Moreover, we documented, that December and January have the highest and lowest mean daily returns, respectively. This work will add to the existing literature on seasonal anomalies in equity markets. Its results are of great importance to both traders and investors.

Following this introduction, the remaining part of the paper is organized as follows. Section two provides a literature review. In section three, we present data and methodologies used. Empirical results are reported in section four and finally section five contains the conclusions.

2. LITERATURE REVIEW

2.1. Stock market anomalies

Stock market anomalies are defined as phenomena that allow investors to achieve abnormal returns. These anomalies challenge the efficient market hypothesis, proposed by [Fama in 1970](#). This hypothesis suggests that stock prices fully mirror all available data. In stock markets, there are several kinds of anomalies, such as seasonal anomalies, book to market effect and momentum effect. Seasonal anomaly is one of the stock market anomalies indicating that abnormal returns can be acquired by trading at particular times. For practitioners, the study of seasonal anomalies in stock markets may help the investors to construct a beneficial investment strategy by observing the best time to purchase and to sell stocks. The month of the year effect and the day of the week effect are the most important seasonal anomalies.

2.2. The day of the week effect

The day of the week effect states that the mean stock returns is not identical for each trading day. Early studies by [Cross \(1973\)](#) and [French \(1980\)](#) reported that stock returns are lower on Mondays than the rest of the week in the US stock market. [Ajayi et al. \(2004\)](#) examined 11 Central and Eastern European stock markets over the 1994-2002 period and reported that the Monday effect was found in 6 of the markets studied. [Raj and Kumari \(2006\)](#), using the multiple regression model found that the stock returns are positive on Mondays and negative on Tuesdays in the Indian stock market. [Tachiwou \(2010\)](#) examined the day of the week effect in the West African regional stock market for the period

September 1998 to December 2007. The findings revealed low stock returns on Mondays and Tuesdays and high returns on Thursdays and Fridays. [Ogieva and Osamwonyi \(2013\)](#) found that Tuesday had the highest returns in the Nigerian stock market for the period April 2005 to September 2010. [Derbali and Hallara \(2016\)](#) documented that stock returns are significantly negative on Tuesdays and positive on Thursdays in the Tunisian Stock Market between 1997 and 2004. [Rita et al. \(2018\)](#), applying GARCH model found evidence of Monday effect in the Indonesian stock market. However other works revealed the absence of the day of the week effect. [Chukwuogor \(2008\)](#) found no evidence of the day effect in South Africa, Egypt, Nigeria, Ghana and Botswana stock markets between 1997 and 2004. [Gbeda and Peprah \(2018\)](#) also found that the mean stock returns are identical for each trading day in the Ghana stock market.

2.3. The Month of the year effect

The month of the year effect states that the mean stock returns are not identical for each month. [Rozeff and Kinney \(1976\)](#) showed that stock returns were higher in January than in any other month in the US stock market between 1904 and 1974. [Gultekin and Gultekin \(1983\)](#) examined 17 stock markets over the 1970-1979 period and reported that the January effect was found in 13 of the markets studied. [Alagidede and Panagiotidis \(2009\)](#) found that April had the highest returns in Ghana stock market between June 1994 and April 2004. [Alagidede \(2013\)](#) reported that stock returns in January were higher and different from the rest of the months in Egypt, Nigeria and Zimbabwe stock markets. However, he found a February effect in Kenya, Morocco and Nigeria stock markets. [Bouteska and Regaieg \(2017\)](#), using the GARCH model showed that October had the lowest return in the Tunisian stock market between January 2003 and December 2015. [Seif et al. \(2017\)](#) found that December had the highest returns in South African market between 1973 and 2014. However, other works revealed the absence of the month of the year effect. [Ayadi et al. \(1998\)](#) found no evidence of the month of the year effect in Ghana, Zimbabwe and Nigeria stock markets over 1985-1995 period. [Rossi and Gunardi \(2018\)](#), applying GARCH model and OLS regression reported that the mean returns is the same for each month in four European countries (France, Italy, Germany and Spain).

3. DATA AND METHODOLOGIES

3.1. Market and data

The regional stock exchange Ivory Coast securities (BRVM) includes eight West African countries (Cote d'Ivoire, Senegal, Mali, Burkina Faso, Benin, Togo, Guinea Bissau and Niger) and it is located in Cote d'Ivoire. The BRVM started operations in September 1998, with 35 firm listed, all of them Ivorian. The BRVM is among the fast-growing financial markets. In 2015, the total market capitalization of the BRVM was 15 Billion dollars. It has increased by more than 90% compared to 2010. The BRVM composite index rose by more than 17% in 2015. The BRVM is very liquid. Less than 5% of total listed stocks were traded previous year.

In order to test the existence of the day of the week and the month of the year effects, we used the daily closing prices of The BRVM composite index between January 2002 and December 2016. The BRVM composite index includes all stocks listed on the BRVM. The data are collected from the financial database of the BRVM. In our study, we chose to start our period of study in January 2002 to increase the number of listed firms in the BRVM. Indeed, the BRVM started operations in September 1998, with 35 firms listed, all of them Ivorian. However, in January 2002, there are 39 listed firms. The four new listed firms are from other member countries.

3.2. Methodologies

The daily returns of BRVM composite index are calculated as the difference in the natural log of the closing index values between day *t* and *t-1*.

$$R(t) = \text{Ln} \{P(t) / P(t-1)\} \dots\dots\dots (1)$$

R (t): The returns of BRVM composite index on day *t*;

$P(t)$: the closing price of BRVM composite index on day t ;
 $P(t-1)$: the closing price of BRVM composite index on day $t-1$;

Table 1: Descriptive statistics of the daily returns of BRVM composite index

Mean	0.0003
Median	0.0000
Maximum	0.4744
Minimum	-0.4704
Std. Dev.	0.0137
Skewness	-0.0285
Kurtosis	727.1638
Jarque-Bera	85435656***
Probability	0.0000
Sum	1.1470
Sum Sq. Dev.	0.7347
Observations	3910

*** Significant at 1% level

Table 1 presents the descriptive statistics for daily returns of BRVM composite index over the period January 2002 to December 2016. From this table, we see a significant non-normality for the BRVM composite index. The skewness value is negative and the kurtosis statistic is significantly larger than three, implying fatter tails than a normal distribution. Also, the normality of returns is rejected at the 1% level by the Jarque-Bera normality test.

In 1986, Engel proposed the Autoregressive Conditional Heteroskedastic (ARCH) Model. This model abandons the unconditional variance constant. It lets the conditional variance to vary over time as function of previous errors. As ARCH model has some conflicts that generally will lead to invalidation of the non-negativity constraints, [Bollerslev \(1986\)](#) introduced the Generalized Regressive Conditional Heteroskedasticity (GARCH) model to solve this problem.

[White \(1980\)](#) noted that under heteroskedasticity, Ordinary Least Squares (OLS) Methodology function inefficient and the results can be incorrect. Then, in our study if error terms shown heteroskedasticity, we will use GARCH (1.1) to examine day of the week and month of the year effects in the BRVM. This model is used by many authors ([Maghayereh, 2003](#) and [Alagidede, 2013](#)) to investigate seasonal calendars in stocks markets.

To investigate the day of the week effect in the BRVM, we used the regression described by [Gibbons and Hess \(1981\)](#).

$$R_t = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \alpha_5 D_{5t} + \varepsilon_t \quad \dots\dots\dots (2)$$

Where R_t is the returns of BRVM composite index on day t ; D_{it} indicate dummy variables such that D_{1t} takes the value one if day t is a Monday and zero otherwise and so forth; the coefficients α_1 to α_5 present the average returns for Monday through Friday. ε_t is an error term.

The existence of statistically significant α_i parameters would be indicative of day of the week effect.

At first, OLS methodology was used to the model (2), However, if error terms shown heteroskedasticity, the following GARCH (1.1) model will be used. This model is employed by [Zhang et al. \(2017\)](#).

$$R_t = \alpha_1 D_{1t} + \alpha_2 D_{2t} + \alpha_3 D_{3t} + \alpha_4 D_{4t} + \alpha_5 D_{5t} + \varepsilon_t \quad \text{(Conditional mean equation)} \quad \dots\dots\dots (3)$$

$$h_t = r_0 + r_1 \varepsilon^2_{t-1} + r_2 h_{t-1} \quad \text{(Conditional variance equation)} \quad \dots\dots\dots (4)$$

h_t : conditional variance of ε_t .
 r_0 : constant term.
 r_1 and r_2 : coefficients.
 h_{t-1} : lagged conditional variance.
 ε^2_{t-1} : lagged square of error terms.

To investigate the month of the year effect in stock returns, we use the regression described by [Gultekin and Gultekin \(1983\)](#).

$$R_t = \alpha_1 M_{1t} + \alpha_2 M_{2t} + \dots\dots\dots + \alpha_{12} M_{12t} + \varepsilon_t \quad \dots\dots\dots (5)$$

where R_t is the returns of BRVM composite index on day t ; M_{1t} through M_{12t} indicate dummy variables for each month of the year. M_{1t} takes the value 1, if the trading day t is in January and zero otherwise; M_{2t} takes the value 1, if the trading day t falls in February and zero otherwise and so on. The coefficients α_1 to α_{12} present the average returns for January through December respectively and ε_t is an error term.

The existence of statistically significant α_i parameters would be indicative of month of the year effect.

At first, OLS methodology was used to the model (5), However, if error terms shown heteroskedasticity, the following GARCH (1.1) model will be used. This model is employed by [Maghayereh \(2003\)](#).

$$R_t = \alpha_1 M_{1t} + \alpha_2 M_{2t} + \dots\dots + \alpha_{12} M_{12t} + \varepsilon \quad \text{(Conditional mean equation)} \quad \dots\dots\dots (6)$$

$$h_t = r_0 + r_1 \varepsilon^2_{t-1} + r_2 h_{t-1} \quad \text{(Conditional variance equation)} \quad \dots\dots\dots (7)$$

h_t : conditional variance of ε_t .
 r_0 : constant term.
 r_1 and r_2 : coefficients.
 h_{t-1} : lagged conditional variance.
 ε^2_{t-1} : lagged square of error terms.

4. RESULTS

4.1. Heteroskedasticity Test and results of the day of the week effect

In order to test the heteroskedasticity of residuals, we use *Lagrange multiplier test* for ARCH (ARCH LM). Table 2 presents the results of ARCH LM test. From this table we see that error terms shown heteroskedasticity. The F-statistic and the Obs*R-squared statistic are statistically significant at the 1% level. Then, we will use the GARCH (1.1) model rather than OLS method to examine the day of the week in the BRVM.

Table 2: ARCH LM test

Test Equation:		Heteroskedasticity Test: ARCH		
Dependent Variable: RESID^2				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.45E-05	7.02E-05	1.346359	0.1783
RESID^2(-1)	0.496458	0.013888	35.74815	0.0000
F-statistic	1277.930***	Prob. F(1,3907)		0.0000
Obs*R-squared	963.4517***	Prob. Chi-Square(1)		0.0000

*** Significant at 1% level

From table 3, we can see that the coefficients for all dummy variables, except Tuesday and Wednesday are insignificant. This table also reveals that the highest mean daily returns were observed on Tuesday. However, the lowest mean daily returns were observed on Wednesday. Then, between January 2002 and December 2016, we found evidence of day of the week effect, in the BRVM. More specifically, we find Tuesday and Wednesday effects. Our findings revealed the existence of arbitrage opportunities, since investors could create profitable investment strategies. Investors could buy stocks on Wednesday and sell them on Tuesday in order to enjoy the profit of this seasonal effect. Our results were in line with [Ogieva and Osamwonyi \(2013\)](#) in the Nigerian stock market. In our study, we noticed that the day of the week effect existed only in the middle of the week. This result could be explained by the fact that, investors in the BRVM preferred to observe the trend of the market on Monday in order to be able to react on Tuesdays and Wednesdays. The existence of the day of the week effect in BRVM challenges, the efficiency market hypothesis, proposed by [Fama \(1970\)](#); because it can help the investors to construct a beneficial investment strategy by observing the best time to purchase and to sell stocks.

Table 3: GARCH (1.1) Model analysis results

Variable	Coefficient	Std. Error	z-Statistic	P-value
@WEEKDAY=1	-0.0001	0.0007	-0.2001	0.8414
@WEEKDAY=2	0.0016**	0.0007	2.2134	0.0269
@WEEKDAY=3	-0.0012*	0.0007	-1.6807	0.0928
@WEEKDAY=4	-0.0003	0.0006	-0.5125	0.6083
@WEEKDAY=5	0.0009	0.0007	1.2318	0.2180

** significant at 5%

* significant at 10%

4.2. Heteroskedasticity Test and results of the month of the year effect

In order to test the heteroskedasticity of residuals, we used the *Lagrange multiplier test* for ARCH (ARCH LM). Table 4 presents the results of ARCH LM test. From this table we see that the error terms showed heteroskedasticity. The F-statistic and the Obs*R-squared statistic were statistically significant at the 1% level. Then, we used the GARCH (1.1) model rather than the OLS method, to examine the month of the year effect in the BRVM.

Table 4: ARCH LM test

Test Equation:	Heteroskedasticity Test: ARCH			
Dependent Variable: RESID^2				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.44E-05	7.04E-05	1.341429	0.1799
RESID^2(-1)	0.496681	0.013886	35.76947	0.0000
F-statistic	1279.455***	Prob. F(1,3907)		0.0000
Obs*R-squared	964.3177***	Prob. Chi-Square(1)		0.0000

*** Significant at 1% level

Table 5, shows that the coefficients of January, February, April, May, July, September and December dummy variables were statistically significant. This table also revealed that, the highest mean daily returns were produced in December. However, the lowest mean daily returns were produced in January. Then, between January 2002 and December 2016, we found evidence of month of the year effect in the BRVM. More specifically, we found December and January effects. Our results revealed the existence of arbitrage opportunities, since investors could create profitable investment strategies. Investors could buy stocks in January and sell them in December, in order to enjoy the profit of this seasonal effect. Our results were in line with [Seif et al. \(2017\)](#) in the South African market. The presence of December and January effects in BRVM could be explained by the fact that, investors

tend to invest in risky securities at the end of the year, and in less risky stocks at the beginning of the year.

Table 5: GARCH (1.1) Model analysis results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
@MONTH=1	-0.0179***	0.0002	-107.0314	0.0000
@MONTH=2	0.0007***	0.0003	2.6016	0.0093
@MONTH=3	0.0006	0.0004	1.4127	0.1578
@MONTH=4	0.0006***	0.0003	2.6997	0.0069
@MONTH=5	-0.0023***	0.0001	-19.9787	0.0000
@MONTH=6	8.94E-05	0.0003	0.2690	0.7880
@MONTH=7	-0.0011***	0.0002	-4.7562	0.0000
@MONTH=8	-7.63E-06	0.0004	-0.0184	0.9853
@MONTH=9	0.0005***	0.0002	3.1056	0.0019
@MONTH=10	-0.0003	0.0002	-1.6170	0.1059
@MONTH=11	0.0005	0.0004	1.5699	0.1164
@MONTH=12	0.0018***	0.0003	6.4629	0.0000

*** significant at 1 %

5. CONCLUSION

In this paper, we investigate the day of the week and the month of the year effects on daily returns of BRVM composite index between January 2002 and December 2016. Applying the GARCH models, we found evidence of day of the week and month of the year effects in the BRVM. More specifically, we reported that the highest mean daily returns were observed on Tuesday. However, the lowest mean daily returns were produced on Wednesday. Moreover, we documented that, December and January had the highest and lowest mean daily returns, respectively. The existence of Tuesday and Wednesday effects could be explained by the fact that investors in the BRVM preferred to observe the trend of the market on Monday in order to be able to react on Tuesdays and Wednesdays. Also, the presence of December and January effects in the BRVM could be explained by the fact that, investors tend to invest in risky securities at the end of the year and in less risky stocks at the beginning of the year.

The existence of the day of the week and the month of the year effects in BRVM between January 2002 and December 2016, challenges the efficiency market hypothesis, proposed by Fama (1970) because these anomalies can help the investors to construct a beneficial investment strategy by observing the best time to purchase and to sell stocks.

Funding: This study received no specific financial support.

Competing Interests: The authors declared that they have no conflict of interests.

Contributors/Acknowledgement: All authors participated equally in designing and estimation of current research.

Views and opinions expressed in this study are the views and opinions of the authors, Asian Journal of Empirical Research shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.

Reference

- Ajayi, R. A., Mehdian, S., & Perry, M. J. (2004). The day-off-the week effect in stock returns. *Emerging Markets Finance and Trade*, 40(4), 53-62.
- Alagidede, P. (2013). Month of the year and pre-holiday effects in African stock markets. *South African Journal of Economics and Management Sciences*, 16(1), 64-74. Doi: 10.4102/sajems.v16i1.246.
- Alagidede, P., & Panagiotidis, T. (2009). Calendar anomalies in Ghana stock exchange. *Journal of Emerging Market Finance*, 8(1), 1-23. doi: 10.1177/097265270900800101.

- Ayadi, O. F., Dufrene, U. B., & Chatterjee, A. (1998). Stock return seasonalities in low-income African emerging markets. *Managerial Finance*, 24(3), 22-33. doi: 10.1108/03074359810765408.
- Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics*, 31, 307-327. doi: 10.1016/0304-4076(86)90063-1.
- Bouteska, A., & Regaieg, B. (2017). Financial market anomalies: Evidence from Tunisia stock market. *Asian Journal of Empirical Research*, 7(9), 238-250. doi: journal.1007/2017.7.9/1007.9.238.250.
- Chukwuogor, C. (2008). An econometric analysis of African stock market: annual return analysis, day-of-the-week effect and volatility of returns. *International Research Journal of Finance and Economics*, 14, 369-378.
- Cross, F. (1973). The behavior of stock prices on Fridays and Mondays. *Financial Analysts Journal*, 29(6), 67-69. doi: 10.2469/faj.v29.n6.67.
- Derbali, A., & Hallara, S. (2016). Day-of-the-week effect on the Tunisian stock market return and volatility. *Cogent Business & Management, Taylor & Francis Journals*, 3(1), 111-114. doi: 10.1080/23311975.2016.1147111.
- Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, 25(2), 383-417. doi: 10.2307/2325486.
- French, K. R. (1980). Stock returns and the weekend effect. *Journal of Financial Economics*, 8(1), 55-69. doi: 10.1016/0304-405x(80)90021-5.
- Gbeda, J. M., & Pehrah, J. A. (2018). Day of the week effect and stock market volatility in Ghana and Nairobi stock exchanges. *Journal of Economics and Finance*, 42(4), 727-745. doi: 10.1007/s12197-017-9409-7.
- Gibbons, M. R., & Hess, P. (1981). Day of the week effects and asset returns. *Journal of Business*, 54, 569-596. doi: 10.1086/296147.
- Gultekin, M. N., & Gultekin, N. B. (1983). Stock market seasonality: international evidence. *Journal of Financial Economics*, 12(4), 469-481.
- Maghayereh, A. (2003). Seasonality and January effect anomalies in an emerging capital market. *Arab Bank Review*, 5, 25-32.
- Ogieva, O. F., & Osamwonyi, I. O. (2013). Testing calendar effect on Nigerian stock market returns: methodological approach. *Journal of Financial Management and Analysis*, 26(1), 39-64.
- Raj, M., & Kumari, D. (2006). Day-of-the-week and other market anomalies in the Indian stock market. *International Journal of Emerging Markets*, 1(3), 235-246.
- Rita, M. R., Wahyudi, S., & Muharam, H. (2018). Bad friday, monday effect and politique issue: application of arch-garch model to analyse seasonal pattern of stock return. *International Journal of Engineering & Technology*, 7(3), 38-47.
- Rossi, M., & Gunardi, A. (2018). Efficient market hypothesis and stock market anomalies: empirical evidence in four European countries. *Journal of Applied Business Research*, 34(1), 183-192.
- Rozeff, M. S., & Kinney, W. (1976). Capital market seasonality: The case of stock returns. *Journal of Financial Economics*, 3(4), 379-402.
- Seif, M., Docherty, P., & Shamsuddin, A. (2017). Seasonal anomalies in advanced emerging stock markets. *The Quarterly Review of Economics and Finance*, 66, 169-181.
- Tachiwou, A. M. (2010). Day-of-the-week-effects in West African regional stock market. *International Journal of Economics and Finance*, 2, 167-173.
- White, H. (1980). A heteroskedasticity consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48, 817-838. doi: 10.2307/1912934.
- Zhang, J., Lai, Y., & Lin, J. (2017). The day of the week effects of stock markets in different countries. *Finance Research Letters*, 20, 47-62. doi: 10.1016/j.frl.2016.09.006.