JSEG
JOURNAL OF SMART ECONOMIC GROWTH
www.jseg.ro ISSN: 2537-141X Volume 7, Number 3, Year 2022

ASSESSMENT OF DAY-OF-THE-WEEK EFFECT AND OTHER STOCK MARKET ANOMALIES: ROMANIAN EVIDENCE

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Abstract: *I examine the existence of calendar anomalies, such as the day-of-the-week effect and January effect, on the Romanian stock market. The day-of-the-week effect was analyzed for the sample period 2002-2022 and three subperiods using a dummy regression. The estimation method for the regression was OLS after testing for normality. The January effect was analyzed for a similar sample period and three subperiods using Wilcoxon rank-sum test. Data were downloaded from Refinitiv Workspace. Even though the results indicate the presence of day-of-the-week and January effects for the Romanian BET index, the conditions on the market modified during the subsample periods. Thursday was the day with the second-lowest risk measured with the standard deviation and the highest return compared to the rest of the week at a 5% significance level. However, Tuesday had a higher return for the subsample period 2011-2022 at a 1% significance level. The January effect was confirmed only for the subsample period 2003-2007, which corresponded to the pre-crisis period and the impact diminished over time, which is a similar result as the ones from the specialized literature. The changing market conditions reduce the possibility of speculating from market anomalies.*

JEL classification: E22
Key words: stock market anomalies; day-of-the-week effect; January effect

1. INTRODUCTION

Extensive research has analyzed the efficiency of financial markets over the years to understand the catalysts of stock price movements. One of the core theories is the one

developed by Fama (1970), known as the efficient market hypothesis (EMH). This theory states that the prices of financial assets fully reflect the available information if the market is efficient, following a random walk. Under the random walk hypothesis, the future prices of stocks cannot be predicted.

Seasonality and price patterns indicate that the market is not efficient and that speculators can benefit from the inefficiency. Several studies have analyzed the existence of stock market anomalies. One well-known hypothesis states the returns obtained in January are superior to the rest of the year (i.e., the January effect). The presence of this hypothesis has been demonstrated historically and the modification in the asset prices is not negligible (Ariel, 1987). The main consequences of the January effect are the presence of seasonality, which indicate that the market is inefficient.

Various factors influence the returns from January, such as the market capitalization of companies, the free float, and the proportions of institutional and retail investors. Companies with low liquidity and capitalization are more prone to be affected by this effect. More recent studies indicate that the January effect diminished as the global markets improved their efficiency (Patel, 2016; Perez, 2018). There are multiple suppositions regarding the cause of this effect, including sell-offs in December from fiscal reasoning or using the incentives obtained at the end of the last year to purchase financial assets.

Another financial theory states that certain days have superior returns (i.e., day-of-the-week effect). Similar to the proceeding theory, this anomaly is relevant, especially for speculators, which may adapt their trading strategy according to the returns obtained on particular days to reap benefits.

The presence of the day-of-the-week effect on the Romanian stock market was confirmed by multiple studies, including for the period before the economic crisis from 2008, and also for the subsequent period up to 2010 (Diaconasu et al., 2012). This study indicates a superior return obtained on Thursday and Friday. Another study confirms the presence of superior returns on Friday but demonstrates that the seasonality is caused by the global risk and does

not represent a particularity of the Romanian market (Oprea and Tilica, 2014). Even though the return obtained on Friday was positive and superior to other trading days, its magnitude was decreasing.

On the other hand, several studies reject the influence of the day-of-the-week effect on the Romanian stock market (Hourvouliades and Kourkoumelis, 2009; Georgantopoulos et al., 2011).

2. DATA AND METHODOLOGY

2.1. Data and model for testing day-of-the-week effect

The data used in the econometric modeling included the daily closing values of the main Romanian stock market index BET for the analysis period 2002-2022. The data were retrieved from Refinitiv Workspace. The daily returns were computed as:

$$R_t = \ln(P_t / P_{t-1}) * 100 \quad (1)$$

P_t consists of the closing price of the BET index at time *t*, while P_{t-1} represents the closing price of the BET index at time *t-1*.

The returns were clustered according to each day of the week for testing for day-of-the-week effects. Since generally financial time series are nonstationary, the augmented Dickey-Fuller unit root test was conducted on the series, together with Phillips–Perron test. The results of the unit root tests for stationarity indicate that the daily log returns are stationary at a 1% significance level. On the other hand, the unit root tests applied for the closing value indicate that the stationarity is attained after applying first differences, which is a consistent result with the specialized literature.

The analysis of the existence of day-of-the-week effects in the Romanian stock market was conducted employing the following model, based on the research of Ajayi et al. (2014):

$$R_t = a_1 D_{1(Mon)} + a_2 D_{2(Tue)} + a_3 D_{3(Wed)} + a_4 D_{4(Thu)} + a_5 D_{5(Fri)} + \varepsilon_t \quad (2)$$

where:

R_t represents the return of the BET index for the *t* day,

$D_{1(Mon)}$ = dummy variable, equal with 1 if *t* equals Monday;

$D_{2(Tue)}$ = dummy variable, equal with 1 if *t* equals Tuesday;

$D_{3(Wed)}$ = dummy variable, equal with 1 if *t* equals Wednesday;

$D_{4(Thu)}$ = dummy variable, equal with 1 if *t* equals Thursday;

$D_{5(Fri)}$ = dummy variable, equal with 1 if *t* equals Friday;

ε_t = the error term.

a_1 represents the mean Monday return, while $a_2,\ldots,a_5$ represent the deviations from the Monday return for Tuesday, Wednesday, Thursday, and Friday returns. The regression was applied under the hypothesis that the error term is independent and uniformly distributed, having a constant variance and zero mean.

There were applied four regressions for the returns of the BET index. One regression analyzed the day-of-the-week effect for the entire sample period, while other regressions split the period into three subsamples: a) 2002-2007; b) 2008-2010; c) 2011-2022. The subsample periods were established to analyze the effects of the Economic Crisis from 2008-2009, as well as on the conjecture that the market became more efficient as a result of Romania's adherence to the European Union. The estimation method for the regression is OLS since the returns are stationarity, as tested with augmented Dickey-Fuller and Phillips–Perron tests.

2.2. Data and model for testing January effect

The monthly closing prices of the BET index were retrieved from Refinitv Workspace for the analysis period 2003-2021. The returns were extracted directly from the database.

The returns were clustered into two main groups: the average monthly return from January and the average monthly return from the rest 11 months of the year. There were 19 observations for January and 210 rest of the year observations for the analyzed period. Following the reasoning for the day-of-the-week effect, data were also split into 3 subsamples: a) 2003-2007; b) 2008-2010; c) 2011-2021.

Firstly, the identification of the type of distribution of variables was necessary to apply the correct test for confirming or rejecting the January effect. Therefore, the Shapiro-Wilk test was applied to analyze if the sample was normally distributed and implied the following hypothesis:

H0 = Data is normally distributed;

H1 = Data is not normally distributed.

The Shapiro-Wilk test applied for the rest of the year returns and generated a p-value of 0.0185, which implies the rejection of the null hypothesis at a significance level of 5%. The distribution of data for the rest of the year is not normal for the sample period.

The application of the Student's t-test is not adequate for small samples with non-normal distribution. Therefore, the non-parametric Wilcoxon rank-sum test (also known as the Mann-Whitney test) was applied. The Wilcoxon rank-sum test is based on the following hypothesis:

H0 = The medians of the BVB index returns are the same;

H1 = The medians of the BVB index returns are different.

3. EMPIRICAL RESULTS

Firstly, the daily price series of the BET index was decomposed into its components: trend, seasonality, and the remainder (or noise) and illustrated in Fig. 1. Since the time series exhibited the characteristics of an increasing trend of roughly the same peaks, the additive decomposition method was used. The trend was positive over the analyzed period 2003-2022, even though the BET index incurred a steep decrease in prices as a result of the financial crisis from 2008-2009. The crisis had considerable implications for the stock market and the Romanian economy. BET index recovered slowly from the crisis, overtaking pre-crisis levels in 2021. The presence of the seasonal component for the daily prices is indicated.

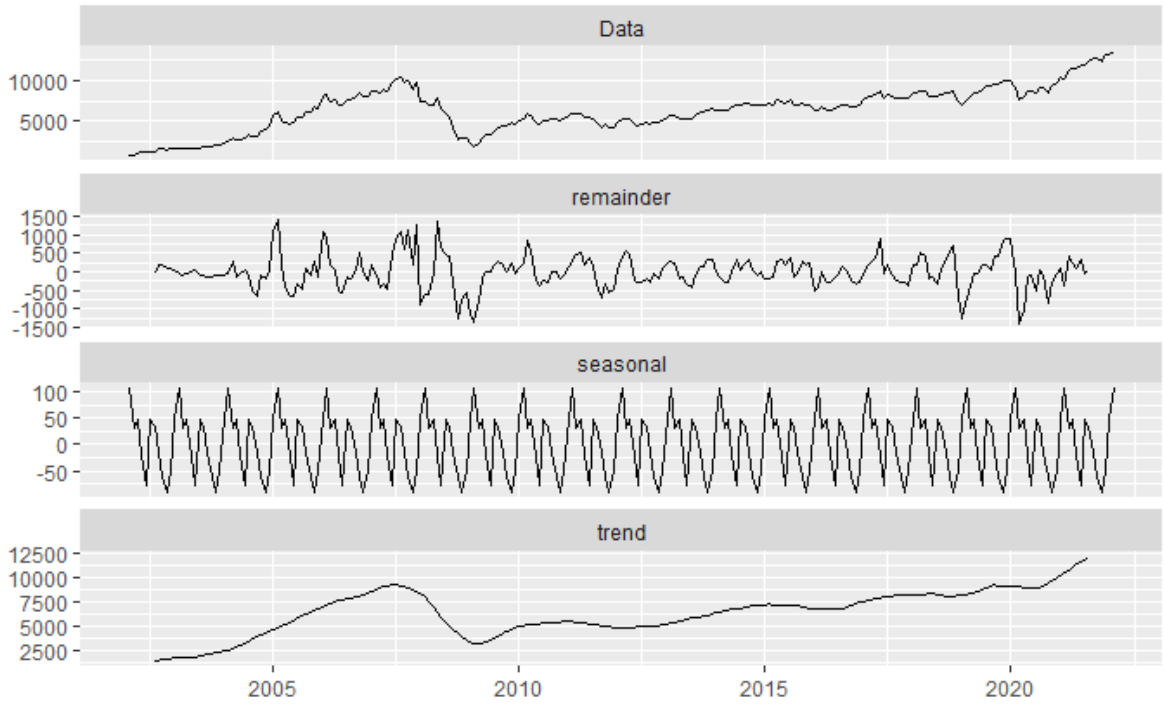

Fig. 1 - Seasonal decomposition of the daily price of BET index: 2003-2022 (own processing based on Refinitiv Workspace data)

3.1. Day-of-the-week

The descriptive statistics of the return of the BET index are illustrated in Table 1. There are 976 observations for each trading day. The highest trading return was registered on Thursday, followed by Friday and Tuesday. The lowest return occurred on Monday, being the only day with a negative mean return. Not only that the highest return was on Thursday, but it was also the day with the second-lowest risk, which was measured with the standard deviation. Even though the returns for all trading days were skewed to the left, the returns from Thursday had a skewness very close to 0. All of the trading days had fat tails (or leptokurtic distribution) since the kurtosis was higher than 3, implying that the distributions were not normal.

Table 1. Descriptive statistics of daily returns

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Observations	976	976	976	976	976

Mean	-0.0085	0.0446	0.0344	0.1174	0.0566
Median	0.0421	0.0535	0.0678	0.0935	0.0880
Maximum	10.5645	10.0907	9.0880	6.5783	8.8488
Minimum	-11.9018	-11.6117	-13.1168	-7.5649	-10.4542
Std. Dev.	1.6633	1.4483	1.4257	1.3371	1.3081
Skewness	-0.6705	-0.5537	-1.7561	-0.1105	-0.8261
Kurtosis	12.5451	13.6037	20.0392	9.0279	13.4178

(Source: Own calculations based on Refinitiv Workspace data)

The results for the four regressions applied for the period and the three aforementioned subperiods: a) 2002-2007; b) 2008-2010; c) 2011-2022 are depicted in Table 2. For the whole sample period, the only statistically significant coefficient was obtained for the Thursday returns, which corresponds to the results of the descriptive statistics and the study of Diaconasu et al. (2012), of Thursday having a superior return compared to other days for the pre-crisis and post-crisis period. This result is intuitive since Thursday was the day with the second-lowest risk, highest mean return, and a close skewness to 0.

The results obtained for the three subperiods were not unitary, indicating changing market conditions. For the first subperiod a) 2002-2007, no statistically significant coefficients were obtained, although the Monday coefficient was the largest. For the subperiod b) 2008-2010, no statistically significant coefficient was obtained, although the Thursday coefficient was the only positive one. For the subperiod c) 2011-2022, multiple coefficients were statistically significant. The return from Tuesday was significant at a 1% significance level and had the largest coefficient, while the return from Friday was significant at a 5% significance level. The return from Wednesday and Thursday were significant only at a 10% significance level. The only negative coefficient from this subperiod was the one from Monday, which lagged compared to the return of other days.

Table 2. Regression results for the sample period and the three subperiods

Period 2002-2022					
	Monday α_1 (Intercept)	Tuesday α_2	Wednesday α_3	Thursday α_4	Friday α_5
Estimate	-0.008532	0.057230	0.052961	0.136655	0.076732
Std. Error	0.046169	0.064773	0.064773	0.064773	0.064932
t value	-0.185	0.884	0.818	2.110	1.182
Pr(>|t|)	0.8534	0.3770	0.4136	0.0349 *	0.2374
Subperiod 2002-2007					
Coeficient	0.11226	0.08491	0.02020	0.10989	0.08374
Std. Error	0.08546	0.11993	0.12003	0.12003	0.12034
t value	1.314	0.708	0.168	0.916	0.696
Pr(>|t|)	0.189	0.479	0.866	0.360	0.487
Subperiod 2008-2010					
Coeficient	-0.02054	-0.39548	-0.12327	0.31166	-0.10237
Std. Error	0.19973	0.28015	0.28060	0.28015	0.28199
t value	-0.103	-1.412	-0.439	1.112	-0.363
Pr(>|t|)	0.918	0.158	0.661	0.266	0.717
Subperiod 2011-2022					
Coeficient	-0.06900	0.16645	0.11828	0.10338	0.12157
Std. Error	0.04346	0.06096	0.06091	0.06094	0.06102
t value	-1.588	2.730	1.942	1.697	1.992
Pr(>|t|)	0.11249	0.00637 **	0.05225 .	0.08989 .	0.04642 *

. Significant at a 10% threshold; * Significant at a 5% threshold; ** Significant at a 1% threshold.

(Source: Own calculations based on Refinitiv Workspace data)

3.2. January effect

Firstly, a visual analysis was conducted to identify abnormal market returns in January compared to the rest of the year. The returns from January were plotted against the returns from the rest of the year for the whole sample period (Fig. 2). The January returns were considerably higher than the rest of the year before the financial crisis from 2008-2009, while during the financial crisis the returns plummeted. Therefore, before applying statistical tests, it was intuitive that the risks from January were substantially higher than the rest of the year since the returns from January were more volatile in the Romanian stock market.

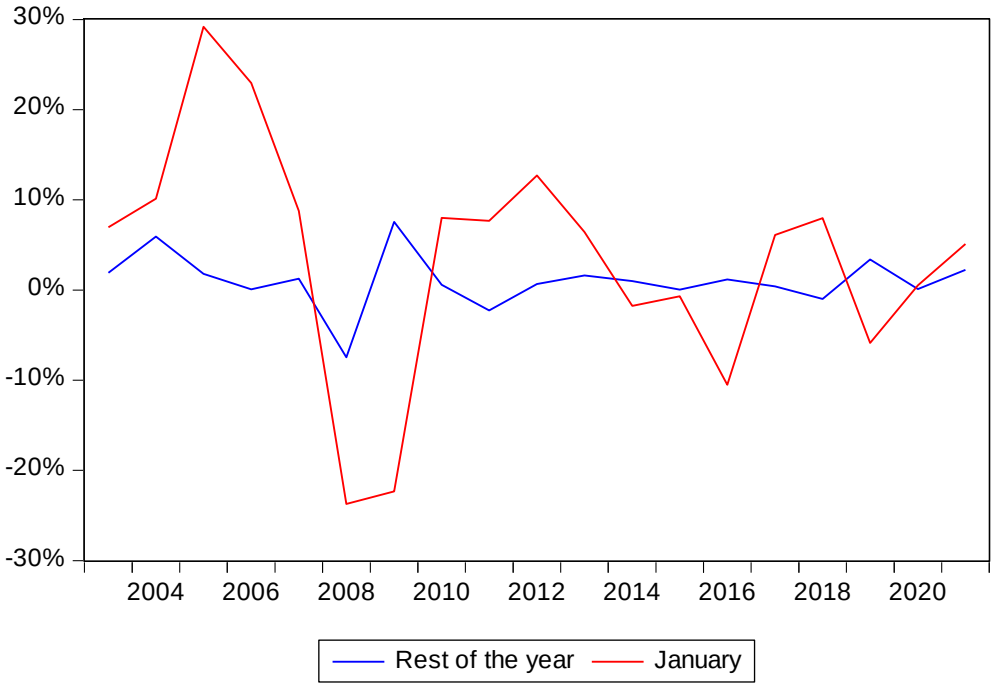

Fig. 2 - January vs rest of the year BET returns: 2003-2021 (own processing based on Refinitiv Workspace data

Following the visual analysis, median statistical tests were applied to the series to confirm or reject the presence of this anomaly in the Romanian stock market. The null hypothesis of the non-parametric Wilcoxon-rank-sum test indicated that the medians are the same. By applying the test, it was obtained a Wilcoxon p-value of 0.2579 for the sample period, indicates the failure of rejecting the null hypothesis. Therefore, the medians of the two series are the same and the January effect was not confirmed. A different result was obtained for the subsample period a) 2003-2007, where the Wilcoxon p-value was 0.0312 and the null hypothesis was rejected, indicating that medians are not the same and the January effect was confirmed. The confirmation of the January effect for this subperiod was expected since the returns from January were around 15.6%, significantly higher than the rest of the year. Even though for the subperiod b) 2008-2010 the returns from January were considerably lower than the rest of the year, the Wilcoxon rank-sum test did not confirm the existence of the January effect. The effect was neither confirmed for the subperiod c) 2011-2021 (Table 3).

The results obtained regarding the existence of the January effect on the Bucharest Stock Exchange correspond to the ones from the specialized literature. The effect diminished over the years as the market became more efficient, the effect being especially visible before the crisis in 2008 (Balint and Gică, 2012). The increase in efficiency is plausible, considering the historical and economic context of Romania which encountered a prolonged communist period and was subject to a transition phase to a market economy. The inflation rate encountered in Romania for the subperiod 2003-2007 was considerably higher than the rest of the subperiods.

Table 3. Examination of the presence of January effect on the Romanian stock market

	Average return	Shapiro Wilk p	Distribution	Wilcoxon p	Median	January effect
Period 2003-2021						
January	3.56%	0.1619	Normal			
Rest of the year	1.00%	0.0283	Not normal	0.2579	Same	Not confirmed
Subperiod 2003-2007						
January	15.59%	0.1912	Normal			
Rest of the year	2.19%	0.1583	Normal	0.0312	Different	Confirmed
Subperiod 2008-2010						
January	-12.69%	0.0737	Normal			
Rest of the year	0.23%	0.9208	Normal	0.5000	Same	Not confirmed
Subperiod 2011-2021						
January	2.51%	0.7039	Normal			
Rest of the year	0.66%	0.9879	Normal	0.4131	Same	Not confirmed

(Source: Own calculations based on Refinitiv Workspace data)

4. SUMMARY AND CONCLUSIONS

This paper examines market anomalies such as the day-of-the-week effect and January effect that are present in the Romanian stock market. There is statistically significant evidence to indicate the existence of the day-of-the-week effect and January effect in the analyzed period. However, the magnitude of the January effect diminished dramatically over the years and the

presence was only statistically significant at a 5% threshold for the subperiod 2003-2007, which corresponds to the timeframe before the financial crisis and the accession of Romania to the European Union. Throughout this subperiod Romania experienced inflationary pressure and as the capital market and overall economy increased efficiency, the impact of the January effect diminished, and the inflation rate decreased. Regarding the day-of-the-week effect, Thursday had the highest return and was statistically significant at a 5% threshold for the whole sample period.

However, establishing and benefiting from an investing strategy based on such anomalies was difficult since the coefficients modified dramatically during the subperiods and there is evidence that the market became more efficient following the economic crisis from 2008-2009.

CONFLICTS OF INTEREST AND PLAGIARISM: The author declares no conflict of interest and plagiarism.

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