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## Day-of-the-week Effect on Stock Markets in the Region

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**Abstract:** *This research examines calendar anomalies (day-of-the-week effect) on stock exchanges in the region. The main objective of the study is to examine the effect of days of the week on stock exchanges in the region in the period from 2008 to 2014, and whether there are differences in relation to the effects that occur during the crisis period from 2008 to 2011 and post-crisis period from 2012 to 2014. The subsample of the analysis shows different results due to an increase in the maturity of the capital market, the financial crisis, accession to the European Union and other important events for the financial markets in the region. The purpose of this paper is to determine whether the relationships between the average stock returns in emerging markets are the same or different across different days of the week. The study includes a quantitative analysis of the yield of stock exchange indices on a certain day that uses daily data from 01.01.2008 to 31.12.2014 for capital markets in Bosnia and Herzegovina, Bulgaria, Montenegro, Croatia, Macedonia, Romania and Serbia. The results of the study indicate the effect of the days of the week on all observed stock markets in the region, except for the stock market in Bulgaria. Obtained panel results support earlier studies conducted on emerging markets and provide evidence of stock market inefficiency.*

**Keywords:** *Day effect, Market efficiency, Emerging markets, Calendar anomalies, Stock Exchange, Region.*

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## Efekat dana u nedelji na berzama u regionu

**Apstrakt:** Ovo istraživanje preispituje kalendarske anomalije (dan u nedelji) na berzama u regionu. Glavni cilj istraživanja predstavlja ispitivanje postojanja efekata dana u nedelji na berzama u regionu u periodu od 2008. do 2014. godine, i da li postoje razlike u odnosu na efekte koje se javljaju u kriznom periodu od 2008. do 2011. godine i posle kriznom periodu od 2012. do 2014. godine. Poduzorak analize daje različite rezultate zbog povećanja stepena zrelosti tržišta kapitala, finansijske krize, pristupanja Evropskoj uniji i drugih bitnih događaja za finansijska tržišta u regionu. Svrha ovog rada je da odredi da li su odnosi između prosečnih prinosa akcija na tržištima u razvoju isti ili različiti tokom različitih dana u nedelji. Istraživanje obuhvata kvantitativnu analizu prinosa berzanskih indeksa na određeni dan koji koristi dnevne podatke od 01.01.2008. do 31.12.2014. godine za tržišta kapitala u Bosni i Hercegovini, Bugarskoj, Crnoj Gori, Hrvatskoj, Makedoniji, Rumuniji i Srbiji. Rezultati istraživanja ukazuju na prisustvo efekta dana u nedelji na svim posmatranim tržištima akcija u regionu izuzev tržišta akcija u Bugarskoj. Panel dobijenih rezultata podržava ranije studije koje su sprovedene na berzama u nastajanju i koje pružaju dokaz o neefikasnosti berzi.

**Gljučne reči:** Efekat dana, Efikasnost tržišta, Berze u nastajanju, Kalendarske anomalije, Berza, Region.

## 1. Introduction

The idea of capital market efficiency originally emerged in the nineteenth century, but it reached its academic maturity in the 80s. With the development of the capital market, the significance and empirical validity of the theory of capital market efficiency is changing. The efficient market hypothesis stems from the view that it is impossible to predict the future price of shares on the basis of the previous price information and that the prices represent a reflection of all relevant information. The efficient market hypothesis claims that securities prices reflect all available information and fair value, while excessive instability of the capital market is in direct contradiction to the efficient market hypothesis. This hypothesis is the subject of debate in numerous literature due to its important implications. Academics, investors and regulators are ready to investigate the behaviour of stock prices and react whenever they notice underestimated or overestimated securities in the financial market. In the world of the efficient market hypothesis, there is no possibility to take advantage of the underestimation or overestimation of assets, as the invisible hand of the market moves faster than any individual agent. The purpose of this paper is to determine whether the relationships between the average stock returns in emerging markets are the same or

different across different days of the week. Milošević-Avdalović and Milenković (2017) investigated the effects of the months on the observed stock exchanges in the region. The results of the survey indicated that most of the observed stock exchanges in the region (Serbia, Montenegro, Croatia and Macedonia) recorded negative returns on stocks in November. On the stock exchanges in Bosnia and Herzegovina and Romania the effects of the month were not recorded. The stock market in Bulgaria recorded a positive effect in August, while the negative effects were present on this stock exchange during the month of October.

After the World War II, the number of EMH studies increased, but not all studies confirmed the hypothesis. During this period, the theory of market efficiency remained in the shadow of the theory of rational expectation and the capital valuation model. To some extent, the theoretical logic of EMH, articulated by Regnault (1863), Cowles (1937), Fama (1965), Samuelson (1965) and Mandelbort (1963) provides convincing and useful means to develop price models of assets so it has become intellectual paradigm for generations of scientists (Ang et al., 2011).

## **2. Literature review**

In modern finance, the theory of the efficient market hypothesis remains the subject of further discussion. On the one hand, the efficient market hypothesis perfectly describes the conditions of trading on modern stock exchanges, as the flow of information and the execution of trade is faster than ever. On the other hand, there are certain patterns in stock prices, which the efficient market hypothesis did not explain. In the last decades of the twentieth century, many EMH studies have concluded the existence of inefficiency, so called the efficient market paradox. Regarding the day-of-the-week literature, it claims that investors behave differently in various days of the week (Berument and Dogan, 2012).

Bildik (1999) investigated the stock exchange yields and trading activities in emerging markets, such as the Istanbul Stock Exchange. By using the daily stock exchange index values at the closing on ISE-100 from 1988 to 1999, he found that Monday showed the lowest return and recorded the greatest instability during the week. On the other hand, Marquering, Nisser and Valla (2006) recorded the decrease in Monday effect on DJIA from 1960 to 2003. Doyle and Chen (2009) documented a wandering weekday effect for eleven major stock markets over the period from 1993 to 2007. Al-Khazali et al. (2008) using stochastic dominance analysis recorded that there exists a strong day effect with the highest observed on Fridays and the lowest on Tuesdays in the Athens Stock Exchange.

Muhammad and Rahman (2010) investigated the elements of financial market efficiency and market anomalies. The study examined whether the day of the week effect really exists in Malaysia and whether there are differences in relation to the effect that occurs in the period between the beginning of financial crisis (1999-2002) and four years after the financial crisis (2003-2006), using daily data in the period from 04.01.1999 until 29.12.2006, which is a total of 2,085 observations. The researchers concluded that the effect of the day in a week was present in the capital market in Malaysia.

Ivanov, Lomeov and Bogdanova (2012) examined the market efficiency of seven Eastern European stock exchanges based on the main stock exchange indices (BELEX15, BET, CROBEX, ISE100, PFTS, RTSI, SOFIX). Findings indicate that there is strong evidence of a deviation from market efficiency in Eastern European financial markets.

Diaconasu and associates (2012) investigated the stock exchange in Bucharest, and the study results for the entire period from 2000 to 2011 point to the absence of any calendar effects - Monday's effect and the effect of January (2012).

Caporale and Zakirova (2017) document in the Russian stock market, analysing the behaviour of the MICEX index over the period Sept.1997–Apr. 2016, that once transaction costs (proxied by the bid-ask spreads) are taken into account calendar anomalies disappear.

Based on all of the above, it can be noticed that the financial market efficiency has stirred up the interest of many researchers and has been the subject of debate for decades. The efficient market hypothesis has its advocates as well as opponents. It is clear that some markets are characterized by a higher, and some by lower efficiency together with the existence of anomalies.

### **3. Research methodology**

While the calendar anomalies in developed capital markets have been explored intensively, stock exchanges in emerging economies have received less attention. This study includes analysis of the anomalies of the seven stock exchange indices that are indicators of changes in the capital market in the countries of the region (Serbia-BELEXline, Bosnia and Herzegovina-BIRS, Bulgaria-SOFIX, Montenegro-MONEX, Croatia-CROBEX, Macedonia-MBI10 and Romania-BET). It is important to emphasize that during this study data of daily changes of stock exchange indices were used, in the period from 01.01.2008 to 31.12.2014. For the analysis Day-of-the-week effect, daily data on stock market indices were used, taken from the archives of daily reports(indices) available on the official websites of the observed stock

exchanges in the region. The number of observations in the observed period amounts to 1,767 trading days on the Belgrade Stock Exchange; 1,741 trading days on the Banja Luka Stock Exchange; 1,734 trading days on the Sofia Stock Exchange; 1,728 trading days on the Montenegro Stock Exchange; 1,747 trading days on the Zagreb Stock Exchange; 1,718 trading days on the Macedonian Stock Exchange and 1,760 trading days at the Bucharest Stock Exchange.

The T-test was used to indicate significant differences in average yields on the stock market. The obtained results are dependent on the characteristics of the capital market (maturity, size, degree of integration, models, data frequencies, etc.). The daily return to stock exchange indices is used through the following mathematical formula:

$$r_t = \ln \left[ \frac{P_{nt}}{P_{nt-1}} \right] \times 100 \quad (1)$$

Where is:

$P_{nt}$  – return in period t

$P_{nt-1}$  – return in period t-1

The next step, after conducting the analysis of average stock market yields on the stock markets in the region, is to test the value of average daily yields for all days of the week, in order to examine whether they are statistically different from zero. In order to test this hypothesis, it is necessary to use the T-test, which is calculated using the following formula:

$$t = \frac{\bar{X} - \mu}{\frac{\delta}{\sqrt{n}}} \quad (2)$$

Where is:

$\bar{X}$ - average daily return

$\mu$  - hypothetical value that is equal to zero (0)

$\sigma/\sqrt{n}$  - standard error

Hypothesis in the case day-of-the-week effect is:

$H_0 = \mu_1 = \mu_2$

$H_1 = \mu_1 \neq \mu_2$

$\mu_1$  – average yield of the stock exchange index on a certain day in%

$\mu_2$  –yield of the stock exchange index on the remaining days of the week in%

The results of the conducted research are presented in the following tables using statistical measures: mean values, standard deviation, T-test and p-values. The mean value indicates the central tendency of return on the stock exchange, shown in%. Standard deviation is a risk indicator and indicates a statistical dispersion around the mean value. The T-test was used to test the mean value and test the existence of equality in yields for the observed days. The P-value indicates whether the hypothesis is accepted or rejected. The question posed in this section, and necessary for further research through the work, is whether there is a sensitivity to the effects of days of the week on capital markets in the region?

#### 4. Results and discussion

Table 1. Descriptive statistics of the stock exchange index returns for the period from 2008 to 2014

	No of obs.	Min.	Max.	Mean	St.Dev.	Skew.
Bulgaria	1734	-11.36	7.29	-.0704	1.42559	-.995
Serbia	1767	-6.73	10.37	-.0541	1.01038	.529
Romania	1760	-13.12	10.56	-.0177	1.77648	-.601
Bosnia and Herzegovina	1741	-4.78	6.53	-.0728	.71183	.154
Croatia	1747	-11.36	13.74	-.0756	1.39865	-.337
Macedonia	1718	-10.28	6.66	-.0835	1.32177	-.628
Montenegro	1728	-9.71	11.29	-.0639	1.52580	.856

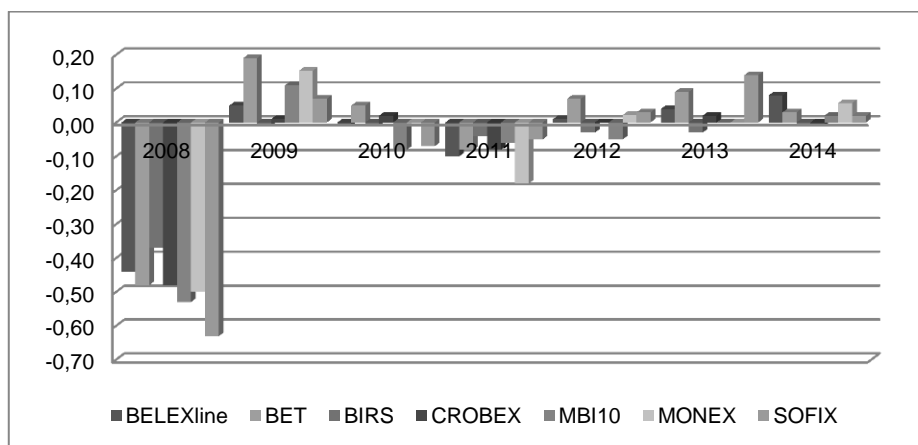
Source: Author

Table 1 shows descriptive statistics of the stock exchange index returns in the local currency for each country. The average daily returns range between -0.0835% for Macedonia and -0.0177% for Romania. The skewness ranges between -0.995 for Bulgaria and 0.856 for Montenegro.

The following figures show the average daily return of stock exchange indexes for observed stock exchanges in the region.

The Fig.1 represents the daily yields of stock exchange indices for countries in the region in the period from 2008 to 2014. The greatest instability of daily yields in the countries in the region is visible in the period of 2008, when all observed stock exchanges recorded an average negative yield rate. All stock exchanges show a clear tendency to renew the standard model of behaviour during 2009 and 2010. In contrast, 2011 brings a new wave of instability for all stock exchanges, because the sovereign debt crisis in the Eurozone deepened during the second half of 2011. The next figure represents the standard deviations of the stock exchange index yield.

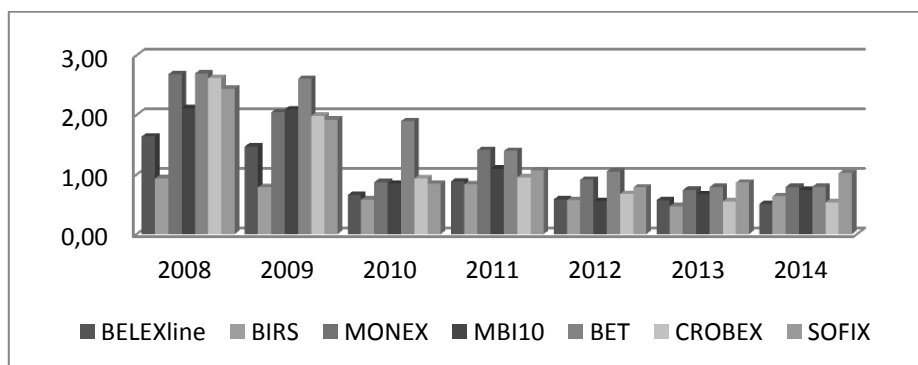
Figure 1. Average daily returns stock indexes in the region for the period from 2008 to 2014



Source: Author

From the presented Fig.2, it can be noted that the highest standard deviation was recorded on all observed stock exchanges during 2008 and 2009, and since 2012 the effect of standard deviation has been reduced. From the presented figures it can be concluded that standard deviations on the observed stock exchanges recorded a similar level, while the average yields differed on the stock exchanges during the observed period.

Figure 2. Standard deviation of the stock exchange indices in the region for the period from 2008 to 2014



Source: Author

Table 2. The effect of the day on the week for the stock exchange index BELEXline – Serbia

Day of the week	N	Mean	St.dev.	T-test	Sig	H0
2008-2011						
Monday	197	-.1382	1.44132	-.133	.894	Accept
Other days	815	-.1245	1.19103			
Tuesday	205	-.2885	1.33934	-2.163	.032	<b>Reject</b>
Other days	807	-.0862	1.21470			
Wednesday	206	-.1043	1.17020	.352	.725	Accept
Other days	806	-.1330	1.26149			
Thursday	206	-.0419	1.12387	1.367	.173	Accept
Other days	806	-.1489	1.27132			
Friday	198	-.0616	1.10676	1.037	.301	Accept
Other days	814	-.1431	1.27398			
2012-2014						
Monday	149	-.0244	.60237	-1.742	.084	Accept
Other days	606	.0616	.53781			
Tuesday	152	-.0094	.55606	-1.499	.136	Accept
Other days	603	.0582	.55034			
Wednesday	152	.0054	.55379	-1.093	.276	Accept
Other days	603	.0545	.55131			
Thursday	152	.1138	.53413	1.998	.042	<b>Reject</b>
Other days	603	.0272	.55523			
Friday	150	.1375	.49420	2.871	.005	<b>Reject</b>
Other days	605	.0216	.56318			
2008-2014						
Monday	346	-.0892	1.15717	-.707	.480	Accept
Other days	1421	-.0452	.97204			
Tuesday	357	-.1697	1.08544	-2.529	.012	<b>Reject</b>
Other days	1410	-.0244	.98922			
Wednesday	358	-.0577	.95864	-.097	.922	Accept
Other days	1409	-.0528	1.02391			
Thursday	358	.0242	.92299	2.005	.046	<b>Reject</b>
Other days	1409	-.0736	1.03125			
Friday	348	.0242	.90002	2.013	.045	<b>Reject</b>
Other days	1419	-.0729	1.03552			

Source: Author

In the period from 2008 to 2011, there was a negative effect on Tuesdays on the Belgrade Stock Exchange and the hypothesis that the average daily yield in the observed period is equal to the yield on other days of the week can be rejected. After the crisis period, the research indicates that the stock index BELEXline records positive effects on Thursdays and Fridays, as the p value is significantly lower than 0.05 and the direction is positive. The effect of the day of week for the entire observed period observed (2008-2014) indicates that the negative average yield recorded on Tuesdays on the Belgrade Stock Exchange is statistically significant in relation to the average yields of the



index, as well as the positive average yield on Thursdays and Fridays in relation to other days in a week.

Table 3. The effect of the day on the week for the stock exchange index BIRS – Bosnia and Herzegovina

Day of the week	N	Mean	St.dev.	T-test	Sig	H0
2008-2011						
Monday	195	-.1789	.80566	-1.533	.127	Accept
Other days	803	-.0904	.80445			
Tuesday	203	-.1906	.88729	-1.672	.096	Accept
Other days	795	-.0865	.78186			
Wednesday	204	-.1000	.67714	.201	.841	Accept
Other days	794	-.1096	.83512			
Thursday	201	-.0713	.81473	.794	.428	Accept
Other days	797	-.1169	.80284			
Friday	195	.0044	.81939	2.374	.019	<b>Reject</b>
Other days	803	-.1349	.79967			
2012-2014						
Monday	150	-.0161	.49596	.305	.760	Accept
Other days	593	-.0285	.57541			
Tuesday	152	-.0480	.58439	-.581	.562	Accept
Other days	591	-.0204	.55390			
Wednesday	147	-.0978	.64831	-1.674	.096	Accept
Other days	596	-.0083	.53510			
Thursday	148	.0005	.56311	.718	.474	Accept
Other days	595	-.0327	.55948			
Friday	146	.0319	.49159	1.773	.078	Accept
Other days	597	-.0402	.57496			
2008-2014						
Monday	345	-.1081	.69219	-1.181	.238	Accept
Other days	1396	-.0641	.71658			
Tuesday	355	-.1295	.77454	-1.733	.084	Accept
Other days	1386	-.0583	.69442			
Wednesday	351	-.0991	.66428	-.928	.354	Accept
Other days	1390	-.0662	.72343			
Thursday	349	-.0408	.71881	1.041	.298	Accept
Other days	1392	-.0809	.71011			
Friday	341	.0162	.69738	2.931	.004	<b>Reject</b>
Other days	1400	-.0945	.71388			

Source: Author

The observed day of the week anomaly is in line with the studies conducted by numerous researchers in the world and confirms the notion that the negative average yield is present on Tuesdays, while the positive average yield is present on Thursdays and Fridays, which is in line with Western theoretical frameworks. The obtained results thus indicate that Tuesday has recorded a negative effect during the crisis period and entire observation

period, while Thursday and Friday recorded a positive effect during the post-crisis period and entire observation period. From all of the above, it can be concluded that the negative and positive effects, measured by the BELEXline stock market index, are stable for the whole period of observation. One possible explanation for the effect of the days of the week is that most negative economic news comes early in the week and investors are trying to sell their investments, which results in a negative statistically significant yield at the beginning of the week. Comparing the crisis and post-crisis period on the Belgrade Stock Exchange, it was noticed that the standard deviation was significantly higher during the crisis period, which is in line with the higher risk. The lowest average yield was recorded on Tuesday (-1697), while the highest average yield was recorded on the last days of the week, i.e. Thursday and Friday (0.0242). The highest instability measured by standard deviation was recorded on Monday (1.15717).

In the observed crisis period, the BIRS Stock Exchange index recorded positive effects on Fridays and the null hypothesis is rejected, as the average yield of the stock exchange index is significantly higher than on other days of the week, which suggests to investors what the ideal timing for gaining return on the stock market is. Post-crisis period did not record significant effects of the days of the week, as evidenced by the obtained p-values of the T-test, which are significantly higher than the critical value of 0.05. The research results for the period from 2008 to 2014 indicate that a positive effect exists on Friday, but it is not stable for the entire research period. Positive returns on Friday, after the crisis period, indicate that they are slightly different from other days of the week. During the crisis period, there was a significantly higher standard deviation compared to the post-crisis period. Interestingly, during the crisis period, positive average yield on the observed stock market was recorded on Friday, while other days recorded negative average yields. The highest average yield was recorded on Friday and was 0.0162. The greatest instability, measured by the standard deviation, was present at the Banja Luka Stock Exchange on Tuesdays and Mondays, 0.77454 and 0.69219, respectively. Based on the conducted empirical research, it can be concluded that the effects of the day are present (lower average return on Mondays and Tuesdays compared to Friday).

The observed crisis period did not record the effect of the days of the week. In the period from 2008 to 2011, on the Sofia Stock Exchange negative average yield of the SOFIX Stock Exchange index for all trading days, as well as high standard deviation, was recorded. The null hypothesis is accepted, because not one day in a week has recorded a significantly higher or lower yield compared to the average yield on other days of the week. In the period from 2012 to 2014, there was also no day of the week effect. The highest average yield was recorded in the middle, but it is not statistically significant, that is, p-value is greater than 0.05 and is 0.175.

Table 4. The effect of the day on the week for the stock exchange index SOFIX – Bulgaria

Day of the week	N	Mean	St.dev.	T-test	Sig	H0
2008-2011						
Monday	193	-.3662	1.89620	-1.667	.097	Accept
Other days	800	-.1387	1.77024			
Tuesday	202	-.2869	1.80545	-1.028	.305	Accept
Other days	791	-.1564	1.79462			
Wednesday	204	-.0731	1.46340	1.348	.179	Accept
Other days	789	-.2113	1.87301			
Thursday	201	-.1868	2.09056	-.032	.974	Accept
Other days	792	-.1820	1.71561			
Friday	193	-.0030	1.66225	1.867	.063	Accept
Other days	800	-.2264	1.82596			
2012-2014						
Monday	144	.0394	.97340	-.419	.676	Accept
Other days	596	.0734	.87406			
Tuesday	150	-.0137	.90869	-1.361	.176	Accept
Other days	590	.0873	.88943			
Wednesday	151	.1413	.84360	1.363	.175	Accept
Other days	589	.0477	.90576			
Thursday	150	.1047	.93315	.623	.534	Accept
Other days	590	.0572	.88391			
Friday	145	.0606	.80382	-.115	.909	Accept
Other days	595	.0683	.91485			
2008-2014						
Monday	337	-.1929	1.58059	-1.678	.094	Accept
Other days	1397	-.0484	1.45955			
Tuesday	353	-.1709	1.49304	-1.493	.136	Accept
Other days	1381	-.0523	1.48186			
Wednesday	355	.0181	1.24132	1.804	.072	Accept
Other days	1379	-.1008	1.54034			
Thursday	351	-.0622	1.69969	.197	.844	Accept
Other days	1383	-.0801	1.42536			
Friday	338	.0243	1.36062	1.691	.092	Accept
Other days	1396	-.1008	1.51239			

Source: Author

Testing the effect of the day of the week indicates that the lowest average yield was recorded at the beginning of the week compared to the last days of the week. The lowest average yield was recorded on Monday and Tuesday and was -0.1929 and -0.1709, respectively. The highest average yield is on Friday and is 0.0243. The highest instability, measured by standard deviation, was on the Sofia Stock Exchange on Monday (1.58059) and Thursday (1.69969), while the lowest instability was recorded on Wednesday (1.24132) and on Friday (1.36062). Based on the conducted empirical research, it can be concluded that the effects of the days of the week are not present, i.e. there were no statistically significant differences in yields for certain days and

therefore the null hypothesis is accepted. It follows that the capital market in Bulgaria in the observed period is effective, i.e. that prices reflect all available information.

Table 5. The effect of the day on the week for the stock exchange index MONEX – Montenegro

Day of the week	N	Mean	St.dev.	T-test	Sig	H0
2008-2011						
Monday	194	.0890	2.11358	1.809	.072	Accept
Other days	793	-.1855	1.82741			
Tuesday	199	-.2322	2.00000	-.889	.375	Accept
Other days	788	-.1062	1.86052			
Wednesday	201	-.4117	1.71906	-2.902	.004	<b>Reject</b>
Other days	786	-.0599	1.92467			
Thursday	199	-.2322	1.69258	-1.050	.295	Accept
Other days	788	-.1062	1.93575			
Friday	194	.1446	1.85242	2.584	.010	<b>Reject</b>
Other days	793	-.1991	1.89299			
2012-2014						
Monday	146	-.0517	.88755	-1.322	.188	Accept
Other days	595	.0454	.79553			
Tuesday	149	-.0397	.75048	-1.343	.181	Accept
Other days	592	.0429	.82994			
Wednesday	149	.0571	.80101	.588	.557	Accept
Other days	592	.0185	.81868			
Thursday	150	.0967	.77705	1.391	.166	Accept
Other days	591	.0084	.82375			
Friday	147	.0676	.85236	.733	.465	Accept
Other days	594	.0161	.80561			
2008-2014						
Monday	340	.0286	1.69856	1.2449	.213	Accept
Other days	1388	-.0865	1.48020			
Tuesday	348	-.1498	1.59115	-1.261	.208	Accept
Other days	1380	-.0422	1.50869			
Wednesday	350	-.2121	1.42109	-2.448	.015	<b>Reject</b>
Other days	1378	-.0262	1.54950			
Thursday	349	-.0908	1.38387	-.457	.648	Accept
Other days	1379	-.0570	1.56007			
Friday	341	.1114	1.50376	2.682	.008	<b>Reject</b>
Other days	1387	-.1070	1.52862			

Source: Author

The T-test points to statistically significant differences in yields on the observed stock market on a certain day, compared to the average yields of other days. Thus, the highest negative and statistically significant yield for the observed period was recorded in Wednesday, while the highest positive yield was recorded on Friday. The null hypothesis for these days in the period from 2008 to 2011 is rejected. In the aftermath of the crisis period, the effect of the

days of the week on the observed stock exchange was not recorded. It is believed that the high market instability that followed the period of the financial crisis led to the disappearance of calendar anomalies - days of the week effect. Analysing the day of the week effect on the Montenegro Stock Exchange, during the entire research period, results indicate that a positive effect exists on Friday. Testing effects of the day of the week indicates that the lowest average yield was recorded in Wednesday, and the highest average yield was recorded on Friday at 0.1114. The greatest instability, measured by the standard deviation, was present at the Montenegro Stock Exchange on Monday at 1.69856.

Table 6. The effect of the day on the week for the stock exchange index CROBEX – Croatia

Day of the week	N	Mean	St.dev.	T-test	Sig	H0
2008-2011						
Monday	199	-.3763	2.11060	-2.219	.028	<b>Reject</b>
Other days	800	-.0443	1.67734			
Tuesday	204	-.0903	1.76686	.204	.838	Accept
Other days	795	-.1156	1.77929			
Wednesday	204	.0088	1.68764	1.269	.206	Accept
Other days	795	-.1411	1.79761			
Thursday	198	-.0220	1.60836	.965	.336	Accept
Other days	801	-.1323	1.81522			
Friday	194	-.0747	1.64959	.375	.708	Accept
Other days	805	-.1191	1.80590			
2012-2014						
Monday	150	-.1597	.56028	-4.401	.000	<b>Reject</b>
Other days	597	.0416	.58437			
Tuesday	150	-.0578	.55475	-1.629	.105	Accept
Other days	597	.0160	.59168			
Wednesday	149	.0348	.56661	.906	.367	Accept
Other days	598	-.0072	.58946			
Thursday	148	.1011	.55246	2.743	.007	<b>Reject</b>
Other days	599	-.0235	.59040			
Friday	150	.0891	.64994	2.072	.040	<b>Reject</b>
Other days	597	-.0209	.56575			
2008-2014						
Monday	349	-.2832	1.63721	-3.145	.002	<b>Reject</b>
Other days	1397	-.0076	1.32585			
Tuesday	354	-.0766	1.38759	-.235	.814	Accept
Other days	1392	-.0592	1.40049			
Wednesday	353	.0198	1.33329	1.457	.146	Accept
Other days	1393	-.0836	1.41301			
Thursday	346	.0307	1.26920	1.707	.089	Accept
Other days	1400	-.0858	1.42692			
Friday	344	-.0033	1.31196	1.046	.296	Accept
Other days	1402	-.0773	1.41777			

Source: Author

During the crisis period, the T-test confirms the presence of anomalies on the Zagreb Stock Exchange, i.e. confirms that the average yields realized on Monday compared to other days in the observed period are negative and statistically significant, and hence the null hypothesis due to the existence of anomalies is rejected. In the period after the crisis on the Zagreb Stock Exchange, a negative effect was observed on Mondays and a positive effect was recorded on Thursday and Friday.

Table 7. The effect of the day on the week for the stock exchange index MBI10 – Macedonia

Day of the week	N	Mean	St.dev.	T-test	Sig	H0
2008-2011						
Monday	191	-.2820	1.66905	-1.464	.145	Accept
Other days	787	-.1052	1.65026			
Tuesday	198	-.1913	1.67971	-.541	.589	Accept
Other days	780	-.1267	1.64897			
Wednesday	200	-.0318	1.63104	1.177	.241	Accept
Other days	778	-.1675	1.66047			
Thursday	197	-.1069	1.74718	.331	.741	Accept
Other days	781	-.1481	1.63145			
Friday	192	-.0914	1.54250	.541	.589	Accept
Other days	786	-.1516	1.68154			
2012-2014						
Monday	143	-.0664	.65598	-1.289	.199	Accept
Other days	593	.0043	.65781			
Tuesday	151	-.1445	.62734	-3.328	.001	<b>Reject</b>
Other days	585	.0254	.66124			
Wednesday	148	.0049	.66534	.328	.743	Accept
Other days	588	-.0131	.65616			
Thursday	148	.0667	.64976	1.784	.076	Accept
Other days	588	-.0286	.65872			
Friday	146	.0943	.66898	2.337	.021	<b>Reject</b>
Other days	590	-.0351	.65279			
2008-2014						
Monday	334	-.1897	1.33580	-1.801	.073	Accept
Other days	1381	-.0581	1.31899			
Tuesday	349	-.1710	1.32942	-1.541	.124	Accept
Other days	1366	-.0614	1.32081			
Wednesday	349	-.0158	1.30715	1.217	.224	Accept
Other days	1366	-.1010	1.32683			
Thursday	345	-.0324	1.38820	.859	.391	Accept
Other days	1370	-.0966	1.30617			
Friday	338	-.0112	1.24481	1.334	.183	Accept
Other days	1377	-.1015	1.34122			

Source: Author

Based on the analysis of the entire research period, the obtained results indicate that there is a negative effect on Mondays and such an effect was stable for the whole observation period while the positive effects were observed on Thursdays and Fridays but only in the period from 2011 to 2014, that is, in the post-crisis period. Testing the effects of the day of the week indicates that the lowest average yield was recorded on Mondays and Tuesdays, respectively at the beginning of the week compared to the last days of the week. The highest average yield was recorded on Thursday and is 0.0307. The highest instability, measured by the standard deviation, is present at the Zagreb Stock Exchange on Monday and equals 1.63721. Based on the conducted empirical research, it can be concluded that the effects of the day are present (lower average yield on Monday compared to Friday). It is considered that the negative average return on Tuesday was caused by a negative return that is present on the stock exchanges on Monday.

The observed crisis period did not record the presence of calendar anomalies on the Macedonian Stock Exchange. All days recorded a negative return on the stock market index MBI10, as well as a high standard deviation. The post-crisis period recorded the effects of days on Tuesdays and Fridays. Tuesday was marked by negative yields, while Friday recorded positive yields and indicates the presence of anomalies after the crisis period.

The conducted study for the period from January 2008 to December 2014 indicates that the lowest average yield was recorded at the beginning of the week compared to the last days of the week. The lowest average yield was recorded on Tuesdays and Mondays, amounting to -0.1897 and -0.1710, respectively. The highest average yield was recorded on Friday and amounted to -0.0112, (if we exclude the business data on Saturday, since only 3 days of trading were recorded). The greatest instability, measured by standard deviation, was present on the Macedonian Stock Exchange on Thursdays and Mondays, amounting to 1.38820 and 1.33580, respectively. Based on the conducted empirical research, it can be concluded that the effects of the day were present (lower average return on Mondays compared to Friday). The obtained results of the research on the Macedonian Stock Exchange indicate the presence of a positive effect on Friday and a negative effect on Tuesdays after the crisis period, but it is not stable for the duration of the research, neither for the crisis period nor the entire research period.

The observed crisis period, from 2008 to 2011, recorded the presence of a negative effect on Tuesdays and a positive effect on Thursday, indicating that the beginning of the week is characterised by lower return rates compared to the end of the week which recorded higher statistically significant return rates. The observed period from 2012 to 2014 has no traditional effect on Mondays or any other days. It is possible that the financial crisis has led to the disappearance of calendar anomalies on the observed stock exchanges.

Table 8. The effect of the day on the week for the stock exchange index BET – Romania

Day of the week	N	Mean	St.dev.	T-test	Sig	H0
2008-2011						
Monday	196	-.1274	2.42548	-.344	.731	Accept
Other days	814	-.0678	2.16486			
Tuesday	205	-.3680	2.31594	-2.240	.026	<b>Reject</b>
Other days	805	-.0058	2.18610			
Wednesday	204	-.0319	2.17636	.391	.696	Accept
Other days	806	-.0914	2.22796			
Thursday	204	.1889	2.05198	2.340	.020	<b>Reject</b>
Other days	806	-.1473	2.25262			
Friday	201	-.0586	2.08275	.177	.860	Accept
Other days	809	-.0845	2.24994			
2012-2014						
Monday	147	-.0254	.98239	-1.394	.165	Accept
Other days	603	.0876	.85668			
Tuesday	151	.0509	.77924	-.287	.775	Accept
Other days	599	.0691	.90806			
Wednesday	149	.0609	.84479	-.083	.934	Accept
Other days	601	.0666	.89311			
Thursday	150	.1376	.85546	1.291	.199	Accept
Other days	600	.0474	.88975			
Friday	153	.1007	.94365	.581	.562	Accept
Other days	597	.0564	.86760			
2008-2014						
Monday	343	-.0837	1.94136	-.782	.342	Accept
Other days	1417	-.0017	1.73457			
Tuesday	356	-.1903	1.83895	-2.221	.027	<b>Reject</b>
Other days	1404	.0261	1.75827			
Wednesday	353	.0073	1.74177	.336	.737	Accept
Other days	1407	-.0239	1.78564			
Thursday	354	.1672	1.65256	2.634	.009	<b>Reject</b>
Other days	1406	-.0642	1.80392			
Friday	354	.0103	1.68742	.390	.697	Accept
Other days	1406	-.0247	1.79872			

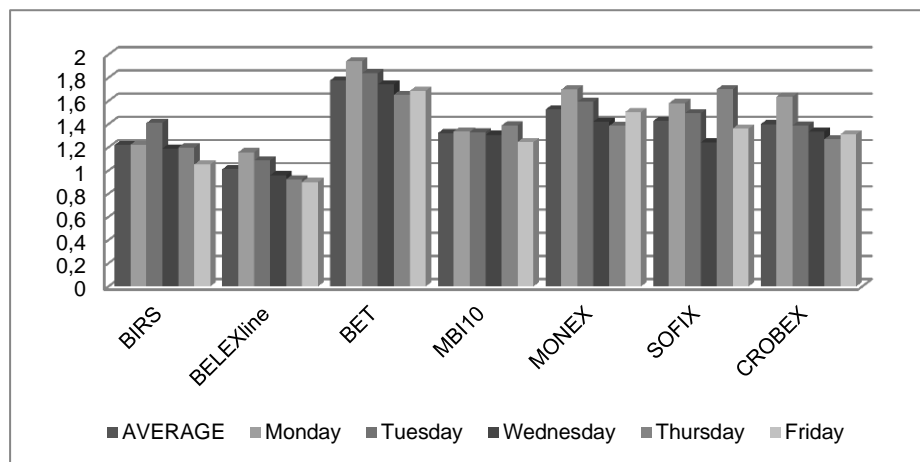
Source: Author

The analysis of the T-test for the entire research period confirms the presence of anomalies on the Bucharest Stock Exchange, that is, statistically significant negative yields on Tuesdays and positive yields on Thursdays, as effects of the day in the week. Testing the effects of the day on the week indicates that the lowest average yield was recorded at the beginning of the week compared to the last days of the week. The lowest average yield was recorded on Tuesdays and Mondays at -0.1903 and -0.0837, respectively. The highest average yield was recorded on Thursdays and Fridays, and is 0.1672 and 0.0103, respectively. The highest instability, measured by the standard



deviation, is present at the Bucharest Stock Exchange on Monday, amounting to 1.94136. Based on the conducted empirical research, it can be concluded that the effects of the day are present. It is considered that the negative average yield on Tuesday was caused by the negative yield that is present on the stock exchange on Monday. The analysis of the entire period rejects the null hypothesis of equal average yields on all days of the week, since a higher yield rate was recorded on Thursday (as well as a lower dispersion around the mean value), while a statistically significantly lower yield rate was present on Tuesday (with greater dispersion over the mean values). The obtained results indicate that the effects of the days of the week were not stable for the observed periods, i.e. they were not recorded only in the post-crisis period.

Figure 3. Average standard deviation by days on observed stock exchanges in the region from 2008 to 2014



Source: Author

From the presented graph, one can generalize the result for countries in the region (emerging economies) that average standard deviations are higher at the beginning of the week (Monday, Tuesday, Wednesday) compared to the end of the week (Thursday, Friday) in the period from 2008 to 2014. The following table also presents statistical calculations of standard deviation values per day compared to the average value of standard deviation. Standard deviation values for a particular day that are higher than the average standard deviation of up to 5% represent a mean standard deviation, while values greater than the average standard deviation of 5-10% represent a high standard deviation for a particular day.

Table 9. Display of standard deviation by days on stock exchanges in the region.

Day of the week \ Stock Exchange	Monday	Tuesday	Wednesday	Thursday	Friday
Banja Luka Stock Exchange	Medium	High	Medium	Medium	Low
Belgrade Stock Exchange	High	High	Medium	Low	Low
Bucharest Stock Exchange	High	Medium	Medium	Low	Low
Macedonian Stock Exchange	Medium	Medium	Medium	High	Low
Montenegro Stock Exchange	High	Medium	Low	Low	Medium
Bulgarian Stock Exchange - Sofia	High	Medium	Low	High	Low
Zagreb Stock Exchange	High	Medium	Medium	Low	Medium

Source: Author

The displayed table confirms the conclusions drawn from the visual insight into Fig.3. All stock exchanges in the region record more standard deviations at the beginning of the week compared to the end of the week.

All presented findings point to the presence of anomalies on the stock exchanges and the possibility of extra returns (returns) by properly monitoring and interpreting the behaviour of stock index movements in selected emergent economies. The following table summarizes the results of the study of the effects of the day of the week on the stock exchanges in the region.

Table 10. Summary of effects of the day of the week for observed stock exchanges in the region

Day of the week	2008-2011	2012-2014	2008-2014
Monday	(-) Croatia-CROBEX	(-) Croatia-CROBEX	(-) Croatia-CROBEX
Tuesday	(-) Serbia-BELEXline (-) Romania-BET	(-) Macedonia-MBI10	(-) Serbia-BELEXline (-) Romania-BET
Wednesday	(-) Montenegro-MONEX		(-) Montenegro-MONEX
Thursday	(+) Romania-BET	(+) Serbia-BELEXline (+) Croatia-CROBEX	(+) Serbia-BELEXline (+) Romania-BET
Friday	(+) Bosnia and Herzegovina-BIRS (+) Montenegro-MONEX	(+) Serbia-BELEXline (+) Croatia-CROBEX (+) Macedonia-MBI10	(+) Serbia-BELEXline (+) Bosnia and Herzegovina-BIRS (+) Montenegro-MONEX
Note: (+) indicates a positive and (-) negative daily average return. A statistically significant hypothesis is at 5%.			

Source: Author

The presented table shows that the statistically significant negative and positive rates of stock market yields in the region were recorded on certain days of the week. In the beginning of the week, the negative return on the stock exchanges in selected emerging economies gives clear signals to investors when they need to buy, when to sell certain securities, in order to achieve higher yields. It is noticeable that in the observed period only the Sofia Stock Exchange did not register statistically (the tests values are not significant) significant anomalies (effects of the day). Numerous research in Europe indicate that membership in the European Union leads to a reduction in calendar anomalies. Bulgaria joined the EU in 2007. Likewise, this result can be a consequence of the global financial crisis, after which investors got more cautious on the stock market. From the foregoing findings, it follows that the capital market in Bulgaria is reasonably efficient, where prices reflect all publicly available information.

## **5. Conclusions**

Since its inception in the 1980s, the efficient market hypothesis has gained much attention and has been seen as an absolute truth. However, since then, it has provoked numerous controversies. Many studies concluded the inefficiency of the market, and the EMH is currently seen as a relative truth.

Obtained panel results obtained support earlier studies conducted on emerging markets and provide evidence of stock market inefficiency. The obtained results indicate that the P value is lower than 0.05 indicating that the mean value on observed days is different from other days, and the null hypothesis can be rejected. Such findings are in line with the numerous studies in the world that prove the presence of the effect of days of the week, or the presence of anomalies on stock exchanges. The results show that all stock exchanges, except the Sofia Stock Exchange, recorded statistically significant negative returns at the beginning of the week, while average yields are higher at the end of the week, i.e. Thursday and Friday. These findings are in general agreement with those of Al-Khazali et al. (2008), Bildik (1999), Muhammad and Rahman (2010), they are somewhat different from Brusa, Pu and Schulman (2000), Brusa and Liu (2004). Interestingly, the only stock market in Croatia recorded the traditional effect on Monday, which reflects statistically significant negative directions of the average return of the stock index CROBEX for all periods of observation. Other stock exchanges in the region record positive or negative effects on a particular day, but not on Monday. Different statistical approaches have been developed to address the issue of market efficiency. Alternative methodologies and alternative theoretical frameworks are examined to obtain a valuable insight that would help resolve the debate in the future.

The obtained research results on the effects of the day on the week, can have significant implications for different players in the capital market, such as investors, managers and regulatory bodies. Investors can formulate their strategies based on this result and can earn more yields by predicting future prices. The only weakness of this part of the study is that it does not consider the individual stock price but stock exchange indices. Thus, the investment strategy based on the findings of these studies can not provide the expected results when investing in individual securities. But, if the size of a portfolio closely represents market, then such an investment strategy, based on the findings of stock market studies in the region, can provide extra profit for investors. As the presence of the day of week-anomalies indicates the inefficiency of the financial market, it informs regulators and economic policy makers to take the appropriate steps to remove such anomalies in order to make the market efficient.

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