January Effect and the Impact of the Great Recession on Six Balkan Stock Markets

Borislava Toleva
Faculty of Economics and Business Administration, Sofia University "St. Kliment Ohridski", Bulgaria
Bozhidar Nedev
Faculty of Economics and Business Administration, Sofia University "St. Kliment Ohridski", Bulgaria

Abstract

Background: In this research, Patel's methodology is applied to analyse the presence of calendar effects on six Balkan stock markets before, during, and after the Great Recession. These stock exchanges are Greece, Serbia, Romania, Croatia, Turkey, and Bulgaria. **Objectives:** This paper is the first study to offer a consistent methodology for researching the 2008 financial crisis impact on the leading market indices in these countries through the lens of the January effect. **Methods/Approach:** This study is also the first to apply Patel's methodology to the Balkans, using consistent periods for research. **Results:** The key findings from this research are that the January effect is detected only in Serbia during the crisis period. During the same period, there is an April effect in Greece, during the post-crisis period, a November effect in Turkey, and a June effect in Bulgaria after the crisis ended. Romania exhibits lower returns in February and August before the crisis, while January returns are lower during it. Croatia is the only country where a calendar effect was present only during the pre-crisis period. **Conclusions:** As the study shows, the calendar effects on the six Balkan stock exchanges do not exhibit common patterns before, during, and after the 2008 financial crisis. These results are not surprising given the diverse political and economic environment in each country, which is also reflected by their stock exchanges.

Keywords: Balkan stock exchanges; calendar effects; January effect; 2008 financial crisis

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Introduction

Calendar effects assume that stock market prices fluctuate depending on the specific moment in time – i.e., hour, day, or month. Usually, calendar anomalies rise at the beginning of the period. According to the literature, the release of systematic announcements may not explain the existence of calendar effects (Nasir et al., 2017, p. 56), suggesting that market inefficiencies and behavioural factors may be at the core of calendar effects. Current research focuses on the January effect or the turn of the year effect. It assumes that the mean raw returns in January are substantially higher than the raw returns in any other month throughout the year. Thus, investors might benefit from this market anomaly by buying securities in December and selling them at a higher price in January (Patel, 2016). Previous research (Sahin et al.,2018; Eyuboglu & Eyuboglu, 2016) has predominantly focused on major international stock exchanges or on isolated smaller markets; however, a comprehensive and systematic examination of calendar effects within a distinct regional context, such as the Balkan stock markets, has been largely absent from the literature.

This paper aims to fill these gaps. More precisely, the objectives of this paper are as follows: to 1) extend Patel's (2016) model to the context of Balkan stock market indices; (2) establish a consistent methodology for analysing these indices; (3) investigate calendar effects in the Balkan stock exchanges by examining the periods before, during, and after the 2008 Great Recession; and (4) control for potential distortions arising from the Covid-19 pandemic, which may represent a structural break capable of altering index behaviour in the period after the end of the financial crisis. This research makes several key contributions to existing literature. First, Patel's methodology is applied to understudied markets like those in the Balkans, therefore filling an empirical gap. In addition, this paper offers a replicable methodology for consistent study of calendar effects across diverse stock exchange markets, regardless of their size and region. Finally, by dividing the data into three subperiods (before, during, and after the crisis), this study provides detailed insights into how financial crises can impact the persistence or disappearance of calendar effects. These contributions enhance the empirical understanding of market efficiency and anomaly behaviour in the Balkans, while extending the empirical setting related to calendar anomalies on diverse stock exchanges.

Literature Review

Rozeff and Kinney (1976) first document the existence of significant returns in January on the New York Stock Exchange in the USA from 1904-1928 and from 1941-1974. However, dispersion does not display seasonality. In the 1980s, scholars found that the January effect is predominantly available in small market caps with low stock prices and with poor past performance. Recent research literature is ambiguous on the magnitude or even the existence of this market anomaly in US stock markets. The emergence of futures on variable US market indices after 1987 is claimed to have provided investors with the opportunity to exploit the January effect (Moller & Zilca, 2008). Gultekin and Gultekin (1983) find out that significant returns are generated in January in a list of industrialised countries with no reference to the size of the company. Their study investigates Western European and North American countries and Japan. Patel (2016) argues that the January effect is no longer available on the US stock market, investigating monthly returns from 1997-2014 based on the Russell 3000 market index. Comparable results are obtained for developed and regional markets in Latin America and Asia, with January being the least profitable month. Even when allowing for sub-periods, eliminating periods of financial crises, and differentiating between

bullish and bearish markets, the January effect is still not evident. Enow (2024) explores the existence of the January effect on the Tokyo Stock Exchange (Nikkei 225 index), the Johannesburg Stock Exchange (JSE index), the Frankfurt Stock Exchange (DAX index), NASDAQ index, and Euronext Paris (CAC 40 index) from February 2019 to February 2024. The researcher concludes that for all five market indices there is no January effect, as returns in January are not statistically different from all other months.

Dzhabarov and Ziemba (2011) claim that the January effect of small public corporations has ceased to exist, examining the period from1993-2010 in US stock markets, as the returns of small-cap companies have dropped below large market caps in the first month of the year. However, researchers find a December effect when it comes to company size. Perez (2018) investigates the existence of the January effect in eighty-six countries and jurisdictions all around the world from 2002-2017. Globally, it is concluded that the January effect is not present, with some exceptions like Nigeria. In general, realised returns in January tend to be lower than those in other months, which applies especially to Estonia. Perez (2018) also evaluates the presence of the January effect around the globe for the entire time series available for each market index. For the examined market indices in Bulgaria, Croatia, and Greece, there are no statistically different market returns in January compared to any other month. However, on the Serbian Stock Exchange, Perez (2018) finds only one month with statistically different returns, which was tough higher than the return observed in January. Referring to the Borsa Istanbul XU100 Index, Perez (2018) concludes that there is no January effect, since the median value of the return in the first month of the year is negative. Moreover, June, August, September, and December feature positive and significantly different returns than January. Romania is not included in the study.

Mylonakis and Tserkezos (2008) investigate the Athens Stock Exchange between 1985 and 2001. After removing abnormal returns observed on the Greek stock market from the sample, the researchers manage to identify the existence of a turn-of-the-year effect. Thus, January turns out to provide substantially higher and statistically significant returns compared to all the other months. When segregating the period in two subperiods, the researchers claim that, from 1993-2001, the mean daily return in January has decreased by 25%, indicating a drop in the magnitude of the market anomaly. Coutts et al. (2000) document the existence of a January effect on the Athens Stock Exchange from October 14th,1986, to August 14th, 1996, in three major industry indices – banking, insurance, and leasing sector. The researchers conclude that the turn-of-the-year effect is getting stronger within the sample period. However, after considering transaction costs, no profitability for investors is retained, which aligns with the Efficient Market Hypothesis. No evidence of the January effect is identified for the Athens Stock Exchange General Index. Mills et al. (2000) identify that the Athens Stock Exchange General Index features statistically significantly higher mean returns in January and February from October 1986 to April 1997. However, the researchers investigate the availability of monthly effects by each of the sixty constituent stocks in the index and reveal that only 23% of them provide significantly higher January returns and only 12% provide higher February returns. Therefore, the researchers conclude that using market indices to reveal monthly effects might be biased.

Enescu (2022) examines the January effect on the Romanian stock market based on the BET index from 2002-2021. He concludes that the anomaly is only present before the financial crisis of 2008 (in the period from 2002 to 2007). After the Great Recession, the turn-of-the-year effect has not reappeared. Asteriou and Kavetsos (2006) examine the January effect for 8 Eastern European countries, including Romania, from January 1991 to March 2003. The authors claim that January provides statistically significantly higher returns than three other months in the year, which proves the existence of the

market anomaly. The authors find evidence of the validity of the tax-selling hypothesis for Romania as a driver of the turn-of-the-year effect. March is the month with the lowest returns. Árendáš et al. (2021) document a statistically significant January effect in Estonian, Lithuanian, Czech, Romanian and Latvian stock markets. In Romania and Lithuania, increased January returns are also accompanied by increased volatility in the same month. For the Bulgarian and Turkish stock markets (SOFIX and XU 100 index, respectively), the authors find higher mean returns in January compared to the average rest-of-the-year returns, but these differences are not statistically significant. According to Škrinjarić (2018), there is no statistically significant January effect on any stock exchange in Central and South-Eastern Europe (Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Serbia, Slovakia, Slovenia, Romania and Ukraine) except for the PX index (Prague Stock Exchange). The study covers the period between 2010 and 2018. However, among other indices, BELEX 15, CROBEX, and SOFIX are found to manifest the Monday effect. Miloș et al. (2019) examine the existence of the January effect starting from 2009 onwards. They conclude that the Croatian, Bulgarian, Estonian, and Latvian stock markets display statistically significant returns in January, which are higher than in any other month. Milošević Avdalović and Milenković (2017) investigate emerging Balkan equity markets (Serbia, Bosnia and Herzegovina, Macedonia, Montenegro, Croatia, Romania, and Bulgaria) for the availability of the January effect. Statistically significant results are as follows. For the examined period 2008-2014, the researchers document the existence of the turn of the year effect only in Macedonia. Moreover, there is a May effect in this market as well.

For the Serbian BELEX 15 index, it can be concluded that November features the worst performance compared to other months. A similar negative effect is detected in November and March on the Montenegro Stock Exchange. However, December turns out to be significantly more profitable than any other month, which translates into a December effect for the Monex index. Both in Croatia and Macedonia, there is a negative November effect. For SOFIX on the Bulgarian stock exchange, there is a positive August and a negative October effect. For Romania and the BET index, no monthly effects are documented. Sajter (2012) reports statistically significant differences in returns on the Croatian stock market compared to other months. The time span covers the period from the initial establishment of the exchange till October 13th, 2011. When examining the sub-period of economic decline, Sajter (2012) finds no January effect with the CROBEX index. The BELEX 15 index on the Serbian stock exchange does not display any January effect neither for the whole sample size nor for the pre-crisis period. In the latter time frame, examined January returns are positive and statistically significant, but lower than those in July and March.

According to Georgantopoulos et al. (2011), there is no January effect on any of the investigated stock markets in the Balkans (Greece, Romania, Bulgaria, Croatia, and Turkey) in the period between 2000 and 2008. However, when the authors investigate statistically significant differences in the variance on a monthly basis, they find that in Greece, Croatia, and Turkey there is a January effect in variance, meaning that the first month of the year is mostly volatile. Sahin et al. (2018) examine the January effect between 2000 and 2014 for Borsa Istanbul (BIST-100 index) and the Bucharest Stock Exchange (BET index) and reveal that this anomaly is persistent for both markets. For the BET index, the highest January return is observed in 2000, with no turn-of-the-year effect in 2002, 2007, 2008, and 2009. For the BIST-100 index, the highest January effect is observed in 2006, with no effect in 2004, 2008, and 2009. Eyuboglu and Eyuboglu (2016) evaluate the availability of the January effect on Borsa Istanbul from January 2005 to February 2015 for the BIST-100 index and twenty-three sector and

sub-sector indices. They do not document any turn-of-the-month effect on the whole market (BIST-100) and in twenty-one sector indices, except for the sports and leasing factoring sectors. For the sports sector, January and March provide higher returns (0.32 and 0.27%, respectively), whereas May is significantly losing (-0.40%). In the leasing factoring sector, January (0.29%), April (0.33%), and June (0.31%) are the most profitable.

Despite the extensive research on the calendar effects, particularly the January effects, on the Balkans, several research gaps still exist. First, findings about calendar effects on the Balkans are not generated based on a consistent methodology applied to all indices in question. Second, the findings are based on inconsistent periods of time, e.g., Georgantopoulos et al. (2011) examine Balkan stock exchanges between 2000 and 2008, while Miloș et al. (2019) focus on 2009 onwards. In other cases, several researchers may cover the same index for partly matching periods (e.g., Sahin et al. (2018); Eyuboglu & Eyuboglu, 2016), leading to inconsistencies in the interpretation of the results. Therefore, the aims of this paper are to 1) extend Patel's (2016) model to the Balkan stock exchange indices, 2) provide a consistent methodology for examining the Balkan stock exchange indices, and 3) examine the calendar effects on the Balkan stock exchange considering the Great Recession of 2008 through the lens of consistent periods before, during, and after the financial crisis. 4) At the same time, to exclude the possible COVID-19 influence on the indices, as COVID-19 can be a breakpoint changing the behaviour of the indices. This is not done by some researchers in the field (e.g., Enescu, 2022). For example, we consider the period between 2000 and 2007 as a pre-crisis period, Jan 2008-Dec 2009 as the crisis period, and the period from Jan 2010 to Feb 2020 as the after-crisis period.

As a result, this is the first paper to apply Patel's methodology as a consistent methodology to the Balkan market indices for a consecutive period of time that does not contain the Covid-19 outbreak. Therefore, this paper provides systematic insights into the January effect and other calendar effects of the Balkan indices that are related to the 2008 economic crisis, excluding other breakpoints like the COVID-19 pandemic. The next section describes the methodology and indices we use. Section 3 describes the results from our models. Section 4 discusses our model's implications. Section 5 concludes.

Methodology

To identify the presence of the January effect and other calendar effects on the Balkan stock markets, this research follows the methodology used by Patel (2016). Patel's methodology is adapted to be applied to six Balkan stock market indices, using a laptop Asus X409F, Intel Core i3 processor (model 9461NGW), RAM 64GB, Windows 11 in Spyder 3.11 (a Python distribution). These indices include ATHEX Composite (Greece), BELEX 15 (Serbia), BET (Romania), XU100 (Turkey), CROBEX (Croatia), and SOFIX (Bulgaria). The ATHEX Composite is Greece's main index, covering all listed companies and reflecting sectors such as banking, energy, and telecommunications. BELEX 15 is Serbia's blue-chip index, tracking the fifteen largest and most liquid companies across finance, manufacturing, and trade, while BET, Romania's primary index, represents the most traded companies with strong fundamentals in energy, banking, and telecommunications. XU100 (BIST 100) is Turkey's leading index, which comprises the top one hundred companies by market value and liquidity across banking, industrials, and technology. CROBEX is Croatia's headline index and includes the largest and most liquid firms in banking, telecommunications, and tourism. Finally, SOFIX, Bulgaria's flagship index, tracks the largest and most actively traded companies, serving as a benchmark for banking, energy, and manufacturing sectors.

Between 2000 and July 2025, the mentioned Balkan equity indices exhibited heterogeneous performance patterns. The ATHEX Composite (Greece) and SOFIX (Bulgaria) recovered strongly from early declines and the 2008–2012 crisis. By 2025, they have reflected improved corporate fundamentals and investor confidence. The BET index (Romania) similarly rebounded from the 2008–2009 financial shock to record levels, signalling market maturation. In contrast, CROBEX (Croatia) and BELEX 15 (Serbia) remain below their pre-crisis peaks, indicating slower recoveries. XU100 (Turkey) demonstrated resilience to global and regional shocks, reflecting its larger and more diversified market. Overall, the indices' trajectories highlight the impact of market size, liquidity, regulatory development, and macroeconomic conditions on long-term equity performance in the region. To examine calendar effects in these complex conditions for the six Balkan indices, Patel's methodology has been adapted to account for the breakpoint. This is a novel angle that the current paper offers on Patel's methodology. The adapted methodology consists of four steps as follows.

Step 1: Data are collected from the respective stock exchange, and necessary data transformations are performed. First, the closing price is transformed into percentage returns using pct_change() in Python 3.11. Then, the closing price is transformed into log returns, and the results are compared to select the most appropriate returns formula that will be used in the calculations. As the resulting returns are similar, the percentage returns formula is used further in the study. Second, as Patel (2016) advises, the closing daily observation from each month is used in the study rather than daily observations. Therefore, a new dataset is produced for each index, containing the monthly returns of the index as of the end of the month. Table 1 presents the descriptive statistics of the converted returns as used in the models.

Table 1
Descriptive Statistics of Transformed End-of-month Returns

	ATHEX Composite	BET	CROBEX	SOFIX	BELEX 15	XU100
Mean	0.0034	0.0023	0.0011	0.0037	0.0015	-0.0032
Standard Error	0.0008	0.0008	0.0005	0.0008	0.0006	0.0013
Median	0.0028	0.0016	0.0007	0.0020	0.0007	-0.0034
Mode	0.0000	#N/A	0.0000	0.0000	#N/A	-0.0054
Standard Deviation	0.0146	0.0137	0.0094	0.0137	0.0092	0.0231
Sample Variance	0.0002	0.0002	0.0001	0.0002	0.0001	0.0005
Kurtosis	2.7751	3.6575	3.7205	10.1252	2.5624	8.4353
Skewness	0.1132	0.5633	0.2698	1.4162	0.6862	1.3506
Range	0.1244	0.1147	0.0836	0.1554	0.0690	0.2296
Minimum	-0.0631	-0.0462	-0.0435	-0.0679	-0.0263	-0.0868
Maximum	0.0613	0.0685	0.0401	0.0875	0.0427	0.1427
Sum	1.0514	0.6794	0.3316	1.1150	0.3546	-0.9691
Count	306	296	306	298	237	306

Source: Authors' calculations

Step 2: Each index is divided into three subperiods: the period between 2000 and 2007 as a pre-crisis period, Jan 2008-Dec 2009 as the crisis period, and the period from Jan 2010 to Feb 2020 as the after-crisis period. This division is based on the official onset of the Great Recession of 2008 according to the Federal Reserve (Rich, 2013) and the

official outbreak of the COVID-19 pandemic according to the World Health Organisation (European Medicines Agency (EMA), 2025). Although the financial crisis was officially cited to have started in December 2007, its effects started to deepen even more at the beginning of 2008. Therefore, this is the onset of the 2008 financial crisis in the presented model. The World Health Organisation officially declared the start of the COVID-19 pandemic in March 2020, which is the end of the post-crisis period in our models.

Step 3: An econometric model is built to examine whether the January effect is present in each subperiod from Step 2. To do that, an analysis of whether the January mean returns are statistically significant and higher than the returns of the other eleven months for the whole period is conducted. If they are, then the January effect is present. To examine this hypothesis, a regression equation (Patel, 2016) is evaluated:

$$R_{it} = \beta_0 + \beta_i \, January + \varepsilon_t \quad (1)$$

Where R_{it} is the monthly return of each stock exchange index used in the study. The term β_i is a dummy variable that equals 1 for January returns and 0 for other months' returns. The coefficient β_i designates the presence or lack of the January effect on the given stock exchange. The term $\beta_i \, January$ represents the difference between mean monthly returns during January and the mean monthly returns of the other eleven months (Patel, 2016). The presence of the January effect is then represented by a positive and statistically significant $\beta_i \, January$. If the term $\beta_i \, January$ is statistically significant but negative, then a negative January effect is present.
The coefficient β_0 represents the mean monthly returns of the remaining eleven months.

Step 4: Investigation whether other calendar effects are present in the three subperiods is conducted. Comparison of January returns with the returns of each specific month in the year for each index using equation 2 (Patel, 2016) is made.

$$R_{it} = \beta_{1i}D_1 + \beta_{2i}D_2 + \beta_{3i}D_3 + \beta_{4i}D_4 + \beta_{5i}D_5 + \beta_{6i}D_6 + \beta_{7i}D_7 + \beta_{8i}D_8 + \beta_{9i}D_9 + \beta_{10i}D_{10} + \beta_{11i}D_{11} + \beta_{12i}D_{12} + \varepsilon_t \quad (2)$$

Where R_{it} is the monthly return of each index. D_1 through D_{12} are dummies for each month of the year. When D_1 equals 1, monthly returns fall in January. If it equals 0, monthly returns fall in any other calendar month of the year. The same applies for D_2 to D_{12}. The β_is are coefficients estimated from the regression equation for each month. Last, ε_t is the error term (Patel, 2016). If a coefficient before a dummy variable is statistically significant and positive, then the respective calendar effect is present, e.g., February effect, March effect, etc. To provide detailed analysis of the presence of calendar effects, the following notation is used: three asterisks (***) denote that the result is highly reliable, being statistically significant at the 5% level, while one asterisk shows moderate reliability, significant at the 10% level. The next section presents the results of our research.

Results

January Effect

Table 2 shows the output from equation 1, where the presence of the January effect is examined. A January effect is found when the coefficient for January is statistically significant and positive.

Table 2
Presence of January Effect (eq. 1) – Coefficients and Statistical Significance

Index	Pre-crisis period	The Great Recession	Post-crisis period
ATHEX Composite	0.0048	-0.006	0.0047
BELEX 15	-0.0025	0.0217*	0.002
BET	-0.0053	-0.0438***	-0.0009
XU100	-0.0065	-0.0253*	-0.0026
CROBEX	0.0012	-0.0092	-0.0003
SOFIX	0.0076	0.0076	0.0014

Note: *** indicates significance at the 5% level, * indicates significance at the 10% level
Source: Authors' calculations

Table 2 demonstrates that the January effect is noticed only in the BELEX 15 index (Serbia) during the 2008 financial crisis. In the pre- and post-crisis periods, this index does not exhibit any January effect. The turn-of-the-year effect is not present in the pre-crisis period in all six examined Balkan countries (Bulgaria, Serbia, Greece, Croatia, Romania, and Turkey). The same is valid for the post-crisis period. The crisis period between 2008 and 2009, however, exhibits different patterns depending on the country. This is not surprising, as the 2008 financial crisis is a shock to the markets, becoming a breaking point. During the crisis period, all countries except for Serbia do not exhibit January effects. However, countries like Romania and Turkey have January average returns lower than the average returns compared to the remaining 11 months. Although this is not the January effect, it shows that the crisis period affected the January returns of Romania and Turkey negatively. This is not the case in Greece, Bulgaria, and Croatia, where the average January returns exhibited the same patterns during the three periods.

This finding is consistent with Perez's (2018) conclusion that there is no January effect on those three markets when the indices are explored from their starting date to their ending date. However, the current paper extends his results, as it is shown that his finding is also valid for the pre-crisis, crisis, and post-crisis periods of Bulgaria, Greece, and Croatia. Perez (2018) also concluded that there is no January effect on the Turkish stock exchange index when examined from its start to its end date. According to Table 2, this is valid for the pre-crisis, crisis, and post-crisis periods. However, as Table 2 shows, the XU100 index demonstrated lower January returns than the rest of the months, meaning the Great Recession of 2008 has impacted it negatively. This reversed after the financial crisis. For the post-crisis period, we do not document the January effect on any of the six stock exchanges. While the lack of the January effect after the Great Recession is confirmed by the results, the hypothesis for the availability of the year effect during the pre-crisis period (2000-2007) can be rejected.

Other Calendar Effects

Table 3 demonstrates the coefficients and statistical significance from equation 2, where other calendar effects are examined. A monthly effect existing will be a month when the coefficient is statistically significant and positive. Table 3 shows that the Greek stock exchange does not have any calendar effects in the pre-crisis period and in the post-crisis period. However, the 2008 financial crisis was a breakpoint, as an April effect is detected. The coefficient before April is positive (0.0326), and it is statistically significant. During the crisis period in Greece, April mean returns were higher than those of the other months. The April effect in Greece during the crisis period is not

observed in any of the investigated countries, as Table 3 shows. Therefore, the April effect during the Great Recession is a phenomenon that is unique to Greece.

Table 3
Summary of Calendar Effects by Period and Market Index

Market Index	Jan 2000 – Dec 2007	Jan 2008 – Dec 2009	Jan 2010 – Feb 2020
	Pre-crisis period	**Crisis period**	**Post-crisis period**
ATHEX Composite	no effects	April effect (0.0326 *)	no effects
BELEX 15	no effects	no effects	lower returns in April, June, September, October, and December, but no January effect (see Table 4)
BET	lower returns in February (-0.0199***) and August (-0.0154*)	lower returns in January (-0.0494***), no January effect	no effects
XU100	No effects	lower returns in January (-0.0423*)	November effect (0.014***)
CROBEX	lower returns in May (-0.0108***)	no effects	no effects
SOFIX (See table 5)	lower returns in May, August, October and December	lower returns in September	June effect

Note: *** indicates significance at the 5% level, * indicates significance at the 10% level
Source: Author's calculations

In Serbia, the pre-crisis and crisis periods are not marked by any calendar effects. However, this pattern changes in the post-crisis period. As Table 4 shows, the BELEX 15 index during the post-crisis period exhibits lower mean returns in April, June, September, October, and December than the rest of the months. However, given that the effects in April, June, October, and December are statistically significant at the 10% significance level, these effects may be related not to the recovery of the economy but rather to some seasonal one-off event. On the other hand, only the lower mean returns in September are statistically significant at the 5% significance level, which may indicate a calendar effect related to the post-crisis period in Serbia.

Table 4
BELEX 15 (Serbia): Post-crisis Calendar Effects

	Coefficient	P-value
Intercept	0.0067	0.013
January	-0.0033	0.367
February	-0.0056	0.129
March	-0.0054	0.156
April	-0.007	0.064*

May	-0.0021	0.571
June	-0.0066	0.084*
July	-0.0042	0.263
August	-0.004	0.286
September	-0.0106	0.006***
October	-0.0036	0.058*
November	-0.0062	0.102
December	-0.0036	0.058*

Note: *** indicates significance at the 5% level, * indicates significance at the 10% level
Source: Author's calculations

Table 3 also outlines the change in calendar effects in Romania before, during, and after the 2008 financial crisis. For instance, in the pre-crisis period, the mean returns for the BET index are lower and statistically significant in February and August. However, these calendar effects are not present in the crisis period, where the January mean returns are lower than the rest of the months, as the January effect cannot be detected. In the post-crisis period, calendar effects have not been detected.

Turkey is another Balkan country that exhibits differing patterns on their stock exchange during the three sub-periods. In the pre-crisis period, no calendar effects can be detected. However, during the 2008 financial crisis, the mean returns in January are lower than the rest of the months and statistically significant at the 10% level of significance. The prominent level of statistical significance may mean that the lower January returns are an isolated event, not related to the crisis period. Therefore, this calendar effect may also be non-existent depending on whether the researcher accepts the 10% significance level as valid. For example, Patel (2016) used only the 5% significance level in his interpretations; therefore, it can be accepted that Turkey does not exhibit calendar effects in the crisis period. On the other hand, in the post-crisis period, the November effect is present. This means that the November mean returns for the XU100 index are higher and statistically significant than the rest of the months.

Unlike Turkey, Croatia demonstrates lower and statistically significant mean returns in May before the crisis, while during and after the crisis, no calendar effects are detectable. Unlike Greece, Croatia, Turkey, Serbia, and Romania, which have at least one subperiod without any calendar effects, Bulgaria has calendar effects in all three subperiods. As Tables 3 and 5 show, in the pre-crisis period, SOFIX has lower mean returns in May, August, October, and December, which are statistically significant.

Table 5
SOFIX (Bulgaria) Results for the Three Subperiods

	Pre-crisis period		**Crisis period**		**Post-crisis period**	
	Coef.	**p-val.**	**Coef.**	**p-val.**	**Coef.**	**p-val.**
Intercept	0.0201	0.003	-0.0004	0.977	0.0007	0.815
January	-0.0049	0.613	0.007	0.73	0.003	0.474
February	-0.0127	0.189	0.0099	0.626	0.0035	0.401
March	-0.0149	0.124	0.0006	0.978	0.0032	0.447
April	-0.0145	0.134	0.0127	0.533	0.0035	0.414
May	-0.0189	0.052	0.0106	0.602	0.0015	0.731
June	-0.01	0.298	0.0042	0.835	0.0083	0.052

July	-0.0026	0.789	0.0026	0.898	0.0037	0.386
August	-0.0176	0.071	-0.0089	0.662	-0.0011	0.788
September	-0.0126	0.192	-0.0397	0.069	-0.0053	0.216
October	-0.0118	0.013	-0.0023	0.82	0.0005	0.796
November	-0.0102	0.271	0.0064	0.753	-0.001	0.812
December	-0.0118	0.013	-0.0023	0.82	0.0005	0.796

Source: Author's calculations

As the lower May and August returns are statistically significant at the 10% significance level, it may be questionable whether these anomalies can be attributed to calendar effects or are isolated phenomena. But the October and December lower mean returns of SOFIX are statistically significant at the 5% significance level, meaning calendar effects for these months are present in the pre-crisis period. However, this pattern changes in the crisis period, where only lower mean returns, statistically significant at the 10% level, are present (e.g., a negative September effect). In the after-crisis period, the June effect is present, where the mean returns in June are higher and statistically significant than those in other months.

Discussion

This paper is a detailed study of the patterns of six Balkan stock exchanges (Greece, Serbia, Romania, Croatia, Turkey and Bulgaria), using a unified methodology, following Patel's paper (2016). This is the first research on the six countries, which uses a consistent methodology over the same period and considers breakpoints. However, several limitations are present. First, the number of observations is small. On the one hand, using one observation per month (end-of-month returns) and the short period of time, defined by the start and end of the Great Recession, results in a noticeably short crisis period (2 years). On the other hand, the pre-crisis period contains 7 years, while the after-crisis period is about ten years. If the number of observations for each market index in every period is similar, then the results might be more accurate. Patel applies his methodology to indices for which data for the same periods are available, so that the number of observations for each period and index is the same.

This, though, is not applicable in our research. First, Patel does not adjust the periods for breakpoints, as the current paper does. This research considers the onset of the Great Recession to be the first break point, while its end is the second break point. Then, a third breakpoint defines the end of the after-crisis period when the COVID-19 pandemic starts. Therefore, having periods with different lengths is a consequence of the phenomena considered in the model. As a result, the small number of observations in the crisis period and the different lengths of the pre- and after-crisis periods may not be a limitation of the model. This is a setting that reflects the actual financial situation at the time. If these breakpoints are not used in the definition of the periods, then the model can be biased. On the other hand, using a two-year pre- and post-crisis period to match the length of the crisis period is not justified, as it does not reflect the periods before the crisis and the new breakpoint after the crisis. Thus, the periods as defined in this research, along with the number of observations in each period and stock index, are viewed as modelling real-life conditions more accurately in the presence of break points rather than a limitation of the model. Therefore, this paper proposes an extension of Patel's methodology to data with structural breaks.

Patel's model has distinct advantages that apply to the six Balkan stock exchanges in this research. First, the underlying dataset is time-series, which is converted into a

cross-sectional dataset, where linear regression is applicable. This is done by two data transformations – converting prices into returns (whose stationarity would need to be verified). The second data transformation is removing the time component by transforming the month-year into categorical variables, designating whether the returns are relevant for the given month. Taking the last observation from the month rather than using all daily observations allows for understanding the calendar effect present in the month, not the daily return fluctuations. Therefore, this methodology preserves the information for calendar effects and allows for these effects to be detected and examined. As the aim of this research is to examine calendar effects on the six Balkan stock exchanges, the advantages of Patel's methodology are suitable for the current study. Another advantage of his approach that is relevant to this paper is that the model is simple to apply and interpret. In comparison, if the original time series dataset were used, identifying calendar effects would be difficult due to the time-varying characteristics of the data.

Using the proposed methodology allows for a systematic approach to calendar effects present in one region, e.g., the Balkans. As demonstrated in the Introduction section, a consistent approach to modelling calendar effects is not utilised in academic research, which results in varying and sometimes contradictory conclusions. Also, when breakpoints are not considered in modelling calendar effects, the findings can be biased. Therefore, the methodology utilised by this paper combines the advantages of Patel's model for calendar effects, while proposing an original approach to understanding calendar effects in-depth by adjusting Patel's model for break points. Therefore, this is the first study to: 1) offer a consistent approach to modelling calendar effects on six Balkan stock exchanges, 2) adjust Patel's model for breakpoints to have an unbiased analysis of calendar effects, and 3) offer a consistent approach for modelling calendar effects with breakpoints that can be applied to any group of market indices and stock exchanges to understand calendar effects within the group and breakpoints in depth. The proposed methodology can also be used to model calendar effects on a single stock exchange/market index. This makes the proposed approach appropriate for modelling calendar effects for a group of indices or a single stock, while accounting for shocks on the markets. Therefore, we propose a novel approach that is easy to apply, interpret, has various practical implications, and can offer a more unbiased analysis of calendar effects than Patel and other existing research, as demonstrated in the Introduction section.

As demonstrated, examining calendar effects within a region may provide a deeper understanding not only for the stock exchange but also outline the differences among stock exchanges within a region. For example, examining the six Balkan stock exchanges uncovered totally different patterns of calendar effects in the six countries during all periods. Therefore, a major finding from our research is that calendar effects may be country-specific for each stock exchange rather than related to dependencies among the neighbours. On the other hand, the six Balkan stock exchanges demonstrate that the impact of the same break point translates into differing patterns of change in the calendar effects on each stock exchange. This may be further evidence that calendar effects are country-specific. Therefore, examining the calendar effects for several stock exchanges within a region may be a better approach to understanding them rather than examining a specific country. The adjusted methodology for structural breaks, proposed by this paper, may be utilised to achieve this aim.

Conclusion

This paper follows Patel's methodology (2016) to analyse the calendar effects present in the six Balkan countries before, during and after the Great Recession of 2008. Regardless of the many papers analysing calendar effects on the Balkans, this study is the first one to:

- Apply a consistent methodology for calendar effects to all six Balkan countries – Greece, Bulgaria, Romania, Turkey, Serbia and Croatia.
- Apply Patel's methodology (2016) to the Balkan stock exchanges.
- Examine the six countries using consistent pre-, during, and post-crisis periods so that a comparison of the 2008 financial crisis effects on the stock exchanges of the six countries can be made.

The key findings of this study demonstrate that the 2008 financial crisis affected each of the six countries in a unique way. Therefore, the calendar effects patterns for each country before, during, and after the crisis differ from stock market to stock market. This is not surprising, as each of the six countries has different economic and financial development. Also, the only country where the January effect is detected is Serbia during the crisis period. Several markets exhibit statistically significant positive or negative monthly deviations, although these patterns differ across countries and periods. Monthly effects, which are characterised by a positive and statistically significant coefficient, can be detected only in a few countries. For instance, during the crisis period in Greece – April effect, November effect in Turkey during the post-crisis period and June effect in Bulgaria after the crisis end. Another key finding from our research is that Bulgaria is the only country where the calendar effects change during each period. For the rest of the stock exchanges, there are at least one or two periods where calendar effects are not detected.

These findings are related to crucial practical implications for the Balkan region. On the one hand, understanding the differences in calendar effects resulting from the differing impact of the financial crisis on the Balkan stock exchanges can facilitate investors in devising the appropriate investment strategy based on country-specific effects, as the results demonstrate that investment strategies should be tailored to the specific stock exchange, not the region. In addition, the lack of consistent calendar anomalies on the examined Balkan stock exchanges suggests that Balkan indices may not be susceptible to seasonal fluctuations, indicating that investing strategies may need to rely on technical and fundamental analysis rather than seasonality strategies. Moreover, the contrasting patterns of calendar effects during each period and in each country highlight the importance of suitable diversification strategies, which can be developed only by discovering the regional differences in the stock exchanges' behaviour. The proposed framework can be used by policymakers to monitor pre-, during, and post-crisis markets and adapt decision-making accordingly. Finally, using the proposed methodology, international investors can devise flexible investing strategies that adapt to the seasonal and non-seasonal behaviour of the local markets.

In conclusion, the Great Recession of 2008 impacted each of the six Balkan stock exchanges differently. To be able to compare how this impact differs from country to country, a consistent methodology and pre-, during, and post- crisis periods need to be defined. As the results from this paper have key policymaking, investing, and diversification implications, the adapted Patel's methodology proposed by this paper can be replicated by investors and governments to monitor and change policies about diverse stock exchange markets before, during, and after financial crises. Therefore, this paper offers a consistent approach for modelling the calendar effects on the Balkans before, during, and after the financial crisis. This is the first research to

offer such a consistent approach, applied to the six Balkan stock markets – Bulgaria, Greece, Turkey, Romania, Serbia, and Croatia.

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About the authors

Borislava Toleva, PhD, is a data science practitioner. Her research areas include practical applications of machine learning algorithms for prediction and how their performance can be boosted. Also, applications of big data techniques to small datasets in the field of economics as an alternative to traditional econometric theory are topics of interest. She challenges traditional econometric modelling techniques used to find connections among variables from institutional economics by combining feature selection methods and big data prediction models. As a result, new applications of machine learning techniques to economic data appear. The author can be contacted at **vrigazova@uni-sofia.bg**.

Bozhidar Nedev, PhD, is an associate professor at the Faculty of Economics and Business Administration at Sofia University "St. Kliment Ohridski" (Bulgaria) in the Department of "Finance and Accounting". His research interests include behavioural finance, international financial markets, and corporate finance. He is interested in studying both macro and micro behavioural phenomena in finance and applies international research in this area to Bulgaria and Southeast Europe. Thus, new knowledge of documented market anomalies and economic agents' behaviour in terms of biases emerges. The author can be contacted at **bozhidar.nedev@feb.uni-sofia.bg**.