An Examination of the Calendar Anomalies on Emerging Central and Eastern European Stock Markets

OVIDIU STOICA, DELIA-ELENA DIACONAŞU
Department of Business Administration
"Alexandru Ioan Cuza" University of Iasi
Carol I Bd., No.11, Iasi
ROMANIA
ostoica@uaic.ro, delia_diaconasu@yahoo.com

Abstract: The main aim of this article is to analyse the influence of day of the week and month of the year effect on CEE stock markets between 2000 and 2010. Some of the main findings of the paper are: the Friday effect in Czech Republic, Croatia and Hungary, positive and significant yields on Thursday in the majority of the cases, the recording of a higher return on Wednesday, the existence of the month of the year effect and the existence of January effect in Czech Republic, Croatia, Macedonia, Romania, Slovenia and Hungary. Also, the results are very different if the regression is applied for sub periods, pre and post accession in the EU, because of the degree of capital market maturity, EU accession and other important events, like the financial crisis.

Keywords: day of the week effect, month of the year effect, efficiency, capital market, return

1 Introduction

The significance of calendar anomalies derives from the fact that they have important implications for capital market efficiency. The presence of these anomalies in the capital markets, under the conditions of internationalization, reflects a greater opportunity to gain up on the market portfolio, on the one side and their poor integration, on the other side.

Some of the justifications for the registration of day of the week anomalies are (Apolinario et al., 2006): the lack of weekend negotiations, the availability of information on Monday regarding on the answers of the information generated during the non-listing days, the procedures on arrangements for payment transactions, the liquidity effects etc. Regarding the reasons for the month of the year effect are mainly (Floros C., 2008): the fact that people spend more around winter holidays, the tax losses from the sale of assets at end of year, the rebalancing of financial assets portfolio, the fact that most traders take their holidays during this period etc.

In this study we analyze the day of week effect and the month effect in several emerging countries from Central and Eastern Europe, namely: Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia, Republic of Croatia, and Macedonia, for the period 2000-2010. The linear regression we used is applied to both, the entire period and the sub-periods. The rest of the paper proceeds as follows. Section 2 consists of literature review. Section 3 describes briefly the development of Eastern European equity markets. Section 4 explains the data and the methodology used. Section 5 discusses the empirical results. Section 6 concludes.

2 Literature Review

The researches in this area are conducted in different regions and time periods, and also are used different methods for demonstration. Thus, the results are contradictory depending on the characteristics of capital markets (the maturity of the capital market, the size, the business cycle, the organisational structure, the degree of integration and liberalization etc.).

On European emerging markets are conducted numerous studies in this regard. Borges (2009) is showing the absence of the day of the week and January effect in the Western and Central Europe during 1994-2007. Taken together, in the seventeen countries analyzed is observed higher returns on Thursday and Friday and lower on Monday on the one hand, and lower returns in August and September, on the other side. Chukwuogor-Ndu (2006) studied the day of the week effect for fifteen European financial markets in the period 1997-2004. The findings are: seven countries recorded negative returns on Monday (Czech Republic, France, Italy, Slovakia, Turkey, Spain and U.K.)

and others on Wednesday (Czech Republic, Germany, Russia, Spain, Sweden).

Keef, Khaled and Hui Zhu (2009) perform an analysis of the Monday effect on the international stock market indices of fifty states, stressing that this anomaly is higher by 1994 in the developing states. Until 2006, these effects disappeared in both, the developing countries and the poor countries. Doyle and Chen (2009) confirmed the disappearance of Monday effect on stock market in USA, Japan, UK, Germany, France, Hong Kong, China and India, between 1993 and 2007, but emphasize the persistence of the day of the week effect in this sample. The authors thus, invalidates the assumption that the day of the week effect has disappeared since the early '90s in most developed markets (Kohers et al., 2004), on the background of improved market efficiency over time.

Hourvouliades and Kourkoumelis (2009) investigate the Monday effect in Turkey, Bulgaria, Romania, Ukraine, Cyprus and Greece in the contemporary financial crisis. The highlighting are the existence of these anomalies in the second sub-period (2007-2009) only in Romania and Ukraine and the existence of this effect over time in Turkey, Bulgaria and Greece (not conditioned by the current crisis). These differences result because of varying degrees of maturity and interdependence. Francesco et al. (2010) shows on a sample of capital markets from Poland, Hungary, Czech Republic, Slovakia, Romania, Bulgaria and Slovenia in the period 1999-2009, that the day of the week effect on returns and volatility is present in four indices, stating that after EU accession this effect on return is present only in one index. Patev (2003) examines the day of the week effects on Central and Eastern Europe in the period 1997-2002. The results are showing the existence of negative returns on Monday in Romania and Czech Republic. Ajayi, Mehdian and Perry (2004) examines the day of the week effect in the emerging markets of Eastern Europe in 1990-2002, finding statistically significant on Monday return only two negative and one positive result.

Also, Heinineni and Puttonen (2008) analyzed seasonal anomalies in the Central and Eastern Europe, highlighting the poor efficiency of capital markets in terms of day and month effects. The authors show that the anomalies are not present during the entire period, but they disappear when joining the EU. Tudor (2006) denies the existence of the day of the week effect and the month of the year effect on the BET-C return in the Bucharest Stock Exchange in 2000-2005.

Traditionally, empirical researches on seasonal anomalies were tested using ANOVA or Kruskall-Wallis test. Other approaches have been made in terms of OLS regression, and newer ARCH / GARCH family models, the latter being designed to evaluate the yield volatility measures.

3 A Brief Review of Central and Eastern European Stock Markets

After the collapse of communist equity exchanges have been re-established in the region. Beginning with Ljubljana Stock Exchange, which was the first stock exchange that reopened in the area on March 29, 1990 and continuing with the other markets, by now these markets have displayed considerable growth in their size and in their degree of sophistication. So, during the transition period to the market economy closely related to the privatization process, the stock market was created, regulated and developed. The stock markets in the area are attractive to investors because of the high potential to growth, in this sense some stock markets have became interested to become regional leaders, like Vienna and Athens.

Stock markets in Central and Eastern Europe, especially those in Warsaw, Vienna, Athens and Prague, have the greater market capitalization in the area. The market capitalization of WSE in December 2010, represents 40.30% from the total market capitalization in the region, while CEESEGs' market capitalization is about 42.79% from the total market capitalization in the region. So, only Poland seems to have a stock market being able to compete with others developed stock markets and to expand in the region.

After the European integration, the new member states benefited of a prosperous period for the financial markets, which enhanced their preoccupations for growing and expansion. The financial system of all these countries largely remains bank-dominated and the stock exchanges are different or not at all integrated with the world financial markets. In addition, these markets are small compared to the stock exchanges of the largest OECD countries, in terms of listed companies, market capitalization and turnover value. Therefore, it may be sensitive to shifts in regional and worldwide portfolio adjustments of market participants, which mean it may be more volatile than well-established stock markets.

4 Data and Methodology

Daily stock market index level from the nine selected countries are used to demonstrate the day of

the week effect and the month of the year effect on the selected exchanges, precisely in calculating the daily returns. The model used for this study is applied over the entire period and to sub-period (depending on the year of UE integration). For Czech Republic, Hungary, Poland, Slovakia and Slovenia the accession year is 2004, for Romania and Bulgaria the accession year is 2007, and for Croatia and Macedonia the EU accession negotiations started in 2005.

The stock indices that represent these seven markets are: PX Index for Prague Stock Exchange, BUX Index for Budapest Stock Exchange, WIG20 for Warsaw Stock Exchange, SAX for Bratislava Stock Exchange, SBI20 (LJSE Composite) for Ljubljana Stock Exchange, Bucharest Exchange Trading (BET-C) for Bucharest Stock Exchange, SOFIX for Bulgarian Stock Exchange-Sofia, MBI10 for Macedonian Stock Exchange, CROBEX taken for Zagreb Stock Exchange. The entire sample period is from January 1, 2000 to December 31, 2010, with the exception of Macedonia. The data sets were collected from each stock exchange website.

4.1 Day-of-the-week effect
The daily returns are calculated as:

$R_t = ln (Pt/Pt-1) * 100$ (1)

where: Rt refers to the daily return; P_t refers to index price on day t; P_{t-1} refers to index price on day t-1.
First, the model used is: $R_t = \alpha_0 + \alpha_{it} d_1 + u_t$ (2)

where: R_t is the daily return in month t; a_0 expected Monday return; a_{it}, difference between the expected return for Monday and the other days of the month; d_{it}, dummy variable for months of the year and are 0 or 1 ($d_{2t} =1$ for Tuesday and 0 otherwise and so on).

We check the hypothesis below for the whole sample for each day.

The null hypothesis: H_0: $a_0=0$

The second hypothesis: H_1 : $a_0 \neq 0$

If the null hypothesis is rejected, it would imply that the mean daily returns a_i are significantly different from each other, i.e. there is seasonality in returns across different days of the week.

For the second hypothesis, we tested each a_i for significance (difference from zero).

Model:

$R_t = \alpha_1 d_1 + \alpha_2 d_2 + \alpha_3 d_3 + \alpha_4 d_4 + \alpha_5 d_5 + u_t$
(3)

where: R_t is the return on day t; a_i is the mean return for each day-of-the-week; d_1 through d_5 are day-of-

the-week dummies that are either 0 or 1 (d1 ¼ 1 for Monday and 0 otherwise and so on); u_t is the random error term for day t.

To test the significance, the null hypothesis is: $H_0= a_1=a_2=a_3=a_4=a_5=0$

The alternative hypothesis H_1: at least two off variables are different from zero.

If this hypothesis is rejected, it would imply that the mean daily returns a_i are significantly different from each other, i.e. there is seasonality in returns across different days of the week. We used the Ordinary Least Squares (OLS) method for the sample 1998-2010 and the dependent variables are the return of the trading days.

4.2 Month-of-the-year Effect. January Effect
First, the test of a January effect is also a simply test of significance of the estimated coefficient a_1 in a second regression of the form:

$$R_t = \alpha_0 + \alpha_i d_{it} + u_t \text{ (4)}$$

where: R_t is the monthly return in month t; a_0 expected January return; a_{it}, difference between the expected return for January and the other months of the year; d_{it}, dummy variable for months of the year and are 0 or 1 ($d_{2t} =1$ for February and 0 otherwise and so on).

The null hypothesis: H_0: $a_0=0$

The second hypothesis: H_1 : $a_0 \neq 0$

If this hypothesis is rejected, it implies that January returns are significantly different from other months of the year. The signs of coefficients a_2 to a_{12} indicate whether the difference is positive or negative, namely if the return is greater or not.

Model: $R_t = \sum_{i=1}^{12} a_i D_{it} + u_t \ (i = 1, 2 ... 12)$ (5)

where: R_t is the return of index on day t; D_{it} takes the value 1 if the return at time t belongs to month i, and 0 if it belongs to any other month; a_i is the mean return in month i; u_t is an error term assumed to be independent and identically distributed (IID).

Secondly, to test the significance, the null hypothesis to be tested is: $H_0= a_2=a_3=...=a_{12}=0$ and the alternative hypothesis H_1 is: at least two off variables are different from zero. If the null hypothesis is rejected, then the coefficients of the model we used are significantly different from zero.

Although none of the countries here considered is a Euro area member, with except for Slovenia and Slovakia, we want to detect if their accession to the European Union as new member states influenced our empirical results. In order to verify this hypothesis, we split our sample in two sub-samples: the first one covers the period before the accession

to the European Union, while the other one covers the post accession period.

5 Empirical Results

5.1 Day-of-the-week Effect

The results indicate that the variation in return depending on weekdays between 2000-2010 is not significant at 5% level (the null hypothesis is not rejected) in some cases on the one hand and there are some exceptions in which this anomaly is present, on the other hand. First, by applying the model it results that Thursday and Friday register significance threshold, which means registration of the anomalies in these days in CEE studied index. In addition, Thursday effect features predominantly among indices in the full sample. This result complements Francesco et al. (2010) study, which stated that Friday effect feature predominantly. Most of the analyzed indices have the anomaly mentioned above (the value being significant and positive at 5% level), with the exception of PX Index, WIG-20 and BUX. However, some reason of why these anomalies are not registered in this case, are the fact that investors are attracted by better and stronger stock issuers, and also by the fact that this exchanges are the biggest in the aria.

Moreover, in the case of almost all the indices (except Sofix and BUX), the significance threshold for Wednesday is smaller than five percent, which means that the coefficient is significant. The difference from Wednesday and the other day are positive, that means that there are higher returns in this day than in the other days of the week. So, the mention is that Thursday return is smaller than the one from Wednesday. The F-value for the all coefficients confirms that they are not all zero and again we can reject the null hypothesis for all coefficients being equal at 5% risk level for the analyzed indexes.

In addition, Monday returns are negative and significant in this period only in the cases of Czech Republic, Croatia and Slovenia. However, the independent variable (day) explains in very small proportions the daily return trend, other factors being more important in this volatility of return (due to r-square's pretty small).

The analysis of the day of the week effect by sub periods leads to the registration of other values. So, in the first sub-period, the one that corresponds to the pre-accession period, the results are indicating the presence of these anomalies in more states. This can be attributed to the fact that the capital market were at the beginning, and implied volatility. These

results are in contradiction with Patev (2003) that highlights the existence of negative returns on Mondays in Romania and the inexistence of this in Slovenia in this period.

Table 1 Summary of the Day of the week effect in CEE stock exchanges

	2000/2010	Pre-accession	Post-accession
Mo	Czech (-) Croatia(-) Slovenia(-)	Bulgaria(-) Czech (-) Croatia(-) Slovenia(-)	Romania(-) Czech (-) Croatia(-) Slovenia(-)
Tue	Bulgaria(+) Poland(-) Romania (+) Hungary(-)	Bulgaria(+) Poland(-) Romania (+) Slovakia (+) Hungary(-)	Romania (+)
Wed	All (+), except Bulgaria, Hungary	All (+), except Bulgaria	Romania (+) Croatia (+)
Thu	Bulgaria(+) Croatia (+) Macedonia (+) Romania (+) Slovakia (+) Slovenia(+)	All (+), Except Poland, Hungary	Bulgaria(+) Croatia (+) Slovenia(+)
Fri	Czech (+) Croatia (-) Hungary(+)	Croatia (-) Poland(+) Romania (+) Slovakia (-) Slovenia(-)	Bulgaria(-) Czech (+) Croatia (-) Romania (-) Hungary(+)

Notes: (+) stands for positive and (-) for negative daily mean returns. Statistical significance for multiple hypotheses F-test at the 5%.

In the second sub period, the post-accession one, the null hypotheses are rejected in some cases, which mean that there are seasonal anomalies during this period. In this case we can observe that a much smaller number of states are registering the calendar effects. This indicates that after joining the EU, CEE stock markets improved their efficiency, conclusion that comes to support Francesco et al. research. Also, the confirmation of these anomalies comes in addition to the research of Kourkoumelis and Hourvouliades (2009) that demonstrate the existence of those anomalies in the second sub-period (2007-2009) in Romania and Bulgaria. Also, the registration of day of the week effect in some cases may be due to the financial crisis act on the national stock exchange in conjunction with the lack of mature capital market and lack of capital market efficiency.

Also, the results designate that Slovenia, Bulgaria and Croatia are most inclined in violating the weak form of the model. For that reason weekday returns, to some extent, could be predicted on the basis of past performance. Though, after the accession to the EU the day of the week effect on these markets began to diminish.

Because the discovered day of the week effects are not robust to different time periods and they are not persistent in a long-run with some exception, we conclude that examined countries do not provide consistent evidence to support the presence of any significant daily patterns in stock market returns of the CEE-countries. The obtained results are corresponding to those reported by Ajayi et al. (2004) and to Heininen et al. (2008).

So, if we consider separately the two sub periods, we can conclude that EU membership has led to the reduction of calendar anomalies, but the unpleasant experience recorded in the last sub period (on the background of financial crisis) has lead to the registration of day of the week anomalies in some of the stock exchanges. This assumption, that the calendar effects is becoming smaller after accession to the EU come to support the research conducted by Francesco et al. (2010).

5.2 Month-of-the-year Effect

The analysis of the CEE indices demonstrates the January effect on some markets, namely Czech Republic, Croatia, Macedonia, Romania, Slovenia and Hungary over the entire period. The anomalies registered in this sense are significant but still the largest returns (although it is positive in January) are not recorded in that month. So, for example in Czech Republic and Romania, the highest value of month return (and also significant) is in December, in Macedonia this value is registered August, for Slovenia is April's return and for Hungary is July's return.

But if we apply the OLS model over sub periods, the situation is changing. In pre-accession period, the highest returns are recorded in the indices analyzed in the following months, on February in Bulgaria, on December in Czech Republic and Romania, and on September in Croatia, Macedonia, Slovakia and Slovenia. In instance, in other months, in most states during this period, the test values are not significant. This is because in this analyze we take the years from the beginning of this stock exchanges, years that are characterized by low transactions, few local investors, few foreign investors and weak correlation to the global markets.

In the post-accession period, the highest returns are recorded in the indices analyzed in the same month, with the exception of Bulgaria, which registered this value in August, comparative with the other sub-period. For these months, mentioned above the null hypothesis is rejected, there is a month of the year anomaly, although the r-square coefficient is relatively small, which means a relatively small-scale explanation of the independent variable (month) in the evolution of return. In this sub period are not so many month that register these anomalies, but the coefficient is negative in the most of the case that have significance threshold. This is because the indexes have dropped drastically due to global financial crisis and resulted implicit negative return. In this period, due to the investors' uncertainty there were few sales and much more purchase made by investors.

The lowest returns over the entire period analyzed is registered on February in Bulgaria, Poland and Hungary, on November in Czech Republic, on October in Croatia, Romania and Slovakia, on September in Macedonia and on May in Slovenia.

These validations are in addition to the study prepared by Borges (2009) on a total of seventeen European countries. It demonstrates the existence of January effect only in four analyzed states (Hungary, Iceland, Poland and Portugal). Unlike our study, in the mentioned one, the largest returns occur in December, November and October, in all states, and lowest in August and September.

There are much more months that register this kind of calendar anomalies that in the case that we calculate for sub-period. This is due to the fact that in the first years the CEE stock exchanges were at the beginning of their develop, being affected by other shortcomings, and in the last years they had a greater degree of development and integration in the global financial markets.

6 Conclusions

Following the analysis performed on the nine indices from CEE we have validated in the period 2000-2010, the days in the week effect following assumptions: a Friday effect in Czech Republic, Croatia and Hungary, positive and significant yields on Thursday in the majority of the cases, and a recording of a higher return on Wednesday. The register of positive yields clusters towards the end of the week supports the study developed by Heininen et al. (2008).

In day of the week effect, these considerations are valid for the entire period analyzed, but if this interval is divided into sub-periods, pre and post-accession to the EU, it leads to the registration of other results, and namely a much smaller number of states that are registering the day of the week effects, after joining the EU.

However, the r-square value in both models is relatively small, which means that independent variables do not fully explain the manifestation of abnormalities. So the variable day is not the main reason for recording these anomalies, other considerations such as the information inefficiency, manipulation of the capital market, high volatilities of the prices, investors' nature are being most important.

Regarding the month of the year effect in the period 2000-2010, we confirmed the following assumptions: the existence of month of the year effect and the existence of January effect in Czech Republic, Croatia, Macedonia, Romania, Slovenia and Hungary. The anomalies registered in January are significant but still the largest returns (although it is positive in January) are not recorded in that month. And within these anomalies the r-square coefficient is real small, meaning that the independent variables explain in a small scale the developments of the daily returns, another factors being more important. If we calculate the month of the year effect on sub periods we register not so many months that register these anomalies.

Thus, the analysis of calendar anomalies on sub periods shows a phasing out of these abnormalities and correction of the CEE capital markets to efficiency. However, the general economic and the fact that is still feeling the effects of financial crises in recent years should not be overlooked, the results achieved are also posted on its account. The registering of a coefficient with a relatively decreasing trend means that the calendar anomalies have an increasingly less influence on the CEE stock markets. So the recording of these results are posted on the account of other major factors such as gaps in legislation, national and international rumours and manipulation, speculative attitude of investors, lack of mature capital market etc.

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