The holiday effect in the Central and Eastern European financial markets

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2011

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A dissertation submitted to
Auckland University of Technology
in partial fulfillment of the requirements for the degree of
Master of Business (MBus)

2011

Business School

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Attestation of authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Acknowledgements

I dedicate this dissertation to my family in New Zealand and my home country of Belarus who have always been there for me, supported me and inspired me to learn and gain knowledge.

I am grateful to my primary supervisor Olga Dodd, who has taught me and guided me during the writing process. Big thanks to her for timely and beneficial feedback.

Special thanks to my brother Konstantin who has supported me, helped me and proofread my work.

I also want to thank my friend Dihang who has not only given me a great deal of support, but also for proofreading my work and given me additional feedback.

My final thank you goes to the AUT University and its Business school which taught me a great deal and gave me an opportunity to meet many great undergraduate and postgraduate students.

Abstract

The purpose of this study is to investigate the existence of the holiday effect in fourteen developing Central and Eastern European (CEE) financial markets. This study expands the literature on the developing financial markets and the holiday effect in the CEE. The findings show that the holiday effect is present in the CEE region, with a number of countries showing abnormal pre- and post- holiday returns. Contrary to the previous evidence, abnormal post-holiday returns are documented. The holiday effect is most significant during the earlier years of financial market operations. Significance of the anomaly has declined overtime since the opening of the CEE stock markets in the 1990's, nevertheless, it is still present in some of the markets. Diminishing holiday effect suggests improved market efficiencies in the studied financial markets since the opening of stock exchanges. Analysis of the holiday effect by industry reveals that there is industry holiday effect in some of the markets. However, no single industry is driving the significant industry holiday returns. New Year and Christmas are most common holidays and they produce highest returns. Liquidity before holidays goes down. Lower liquidity leads to increased trading costs, suggesting that investors are unable to exploit the anomaly.

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1. Introduction

Abnormal returns around public holidays are known as the holiday effect and have been well documented in the U.S. and many other developed and developing financial markets. Central and Eastern Europe (CEE) has received little attention in the regard of financial anomalies, especially of the holiday effect. In this study the efficiency of fourteen developing CEE financial markets are examined by studying the market behaviour one day before and one day after public holidays. Persistence of the holiday effect overtime is also examined along with the liquidity of stocks which helps to understand market behaviour during holiday periods.

A number of studies document the pre-holiday anomaly. In their seminal work, Lakonishok and Smidt (1988) study returns one day before and one day after holidays. Analysis of the study shows significantly abnormal returns before holidays for eight out of ten studied sub-periods. Post-holiday returns are negative but insignificant until 1952. From 1952 to 1986 the post-holiday returns become positive and significant. Ariel (1990) examines intraday returns during the pre-holiday period. Intraday analysis reveals significant pre-holiday returns at opening of the Down Jones Industrial Average index compared to previous day closing prices. Pre-holiday opening prices on average yield 0.090% return from previous day close price. Over the pre-holiday period, stock prices keep growing and have much higher frequency of positive than negative returns. Last hour returns are especially high compared to the rest of the day. Abnormal pre-holiday returns in both large and small companies are documented by Pettengill (1989). The anomaly is present in but not limited to, U.K. and Japan (Kim and Park, 1994), Hong Kong (McGuiness, 2005) and Spain (Menue & Pardo, 2004).

Unlike some other anomalies, the pre-holiday effect seems to persist over time. Lakahishok and Smidt (1988) research shows abnormal pre-holiday returns in the U.S. stock market from period of 1897 to 1910. The anomaly is not observed in the 1911-1924 period. However, it reappears afterwards and is significant for all other periods from 1924 until 1976. In the last studied sub-period of 1976-1986, the pre-holiday anomaly disappears again.

There is limited literature on the pre-holiday effect in the CEE markets. These markets have only opened up in the 1990s after the collapse of the communism and the Soviet Union in 1991. This means that stock exchanges in these countries have been operating for less than 20 years. Compared to the New York Stock Exchange it is a short period of time, which has been operating since 1792 (NYSE, 2011). This also means that many of the investors in the region had little or no understanding of financial markets as equity trading was new to them.

CEE markets are transitional economies and it is questionable how efficient these markets are. Market inefficiency can arise from poor laws and regulations. Since the transition, CEE countries had minimum protection laws, enforcement laws and only developing financial infrastructure. Over the years, economies and financial markets infrastructure have undergone a considerable improvement which increased number of listed companies, quantity of outstanding shares and liquidity of those stocks. The magnitude and effect of improvements varies by countries, but efficiencies in these countries are still not at the level of Western European nations (Iorgova and Ong, 2008).

Tonchev and Kim (2004) are first to investigate a number of anomalies in the following markets: Czech Republic, Slovakia and Slovenia. They find a weak evidence for some of the market anomalies using four and a half years of data, however, the authors investigate a number of anomalies rather than focusing on the pre-holiday effect.

Daily national price index data for the fourteen CEE countries is used to analyse stock market returns around public holidays. Data is split into three sub-periods to analyse significance of the pre-holiday effect over time. Industry level holiday effect is investigated for six countries to observe if any specific industries contribute to the holiday effect. Trading volume and bid-ask spread are analysed to better understand stock return behaviour before holidays.

The main findings of the study are as follows. There is weak evidence of the pre-holiday effect in the CEE region. Five out of fourteen studied stock indices experience abnormal pre-holiday returns. Proportion of positive returns during pre-holidays is significantly higher for seven studied markets compared to all trading days of those indices.

Post-holiday returns are positive and significant for five of the analysed countries. Only the stock market of Slovakia has significantly negative post-holiday returns.

Documentation of significantly positive post-holiday returns in the CEE financial markets is important contribution to the finance literature on the efficiency of developing financial markets. Also the findings should be of interest to investors as they show that post-holidays should be considered for the analysis and investment decisions.

Only consumer goods and service industries exhibit signs of consistent abnormal returns before holidays across three financial markets. Other industries are unable to predict significant pre-holiday returns. Slovenia has the most industries with significant pre-holiday returns, while Hungarian and Polish industries show higher post-holiday returns rather than pre-holiday returns.

Pre-holiday effect has weakened overtime for all of the countries except for Bulgaria, Lithuania and Romania. This indicates that overall market efficiency has improved in the CEE region since the beginning of operations. This is consistent with previous findings by Iorgova and Ong (2008), who study the market efficiency of the CEE countries. Nevertheless, some of the countries still have higher pre-holiday mean returns than on normal days, potentially creating profitable opportunities for equity investors.

Company specific analysis of stock liquidity before public holidays shows lower stock turnover compared to the normal day turnover for most analysed companies. Lower turnover demonstrates that investors trade less before holidays than on normal days. This is consistent with the gone fishin' effect where investors trade less during summer than other seasons of the year (Hong and Yu, 2009). Public holidays create a similar situation as turnover by volume drops, possibly due to investors taking a trip somewhere for a long weekends.

Most analysed company stocks experience increased relative bid-ask spread during the pre-holiday period. Therefore, lower volume turnover results in higher costs for traders in terms of increased spread. This makes it harder for investors to profit from the pre-holiday anomaly.

This study contributes to the finance literature by showing that the pre-holiday effect still exists in some of the CEE markets. Abnormal post-holiday returns are also documented. Rrecently opened developing stock markets are least efficient, therefore, they are prone to market anomalies such as the pre-holiday effect.

The rest of the paper is as follows. Section 2 provides detailed literature review of the market anomalies and the holiday effect in particular. Section 3 sets out the hypotheses of this study. Section 4 describes the data while section 5 states the methodology used in this study. Section 6 discusses the findings and the last section presents the conclusion.

2. Literature review

2.1 Pre-holiday effect and stock market returns

The efficient market hypothesis (EMH) proposed by Fama (1970) assumes that markets are efficient. According to the theory, efficient markets follow a random walk and past information cannot be used to predict future stock prices. Therefore, returns should not deviate from an average on special occasions such as holidays on frequent bases. According to Fama (1991) it is unlikely that the markets are inefficient but rather the models are unable to capture the seasonalities. The debate of the market efficiency is still going on. However, the existing evidence is that stock returns can be partially predicted in the short run as examined by Richards (1996), Ang and Bekaret (2007) and Campbell and Motohiro (2006).

Kvedaras and Basdevant (2002) analyse the three Baltic stock markets and their efficiency overtime. They only examine the weak form efficiency as they do not believe there can be semi-strong efficiency in the transitional markets. Their findings show that Baltic markets are weak-form inefficient, which indicates absence of random walk and higher predictability from past returns. The findings also show that overtime the efficiency in these markets has increased. Development of the financial markets played a role in reduction in the level of inefficiency.

The first documentation of seasonality is done by Fields (1931) who studied the weekend effect. The research shows that returns on Saturdays tended to be significantly higher than on Fridays and Mondays. When the study was carried out, the markets were

open on Saturdays. Since the first study by Fields, a number of other anomalies have been discovered and analysed.

Discovered anomalies have been studied over the years, testing market efficiency. Some of the anomalies have disappeared or weakened over time in the studied markets. It is possible that academic research and publications improve market efficiency by expanding the knowledge of financial stock markets. After the publications, awareness of an anomaly increases between investors. In turn an anomaly weakens. When a large portion of investors starts to trade on an anomaly for profit, in theory an anomaly should weaken and disappear. In the U.S. market it seems that January effect had disappeared as soon as it was discovered and published (Malkiel, 2003).

Disappearance of some anomalies such as the January effect is firstly documented in the U.S. market. Possible reason is that it has received largest amount of research. Marquering, Nisser and Valla (2006) study the effect of academic publications on anomalies. The study shows significant returns for anomalies prior to the first major publications of an anomaly and decrease in significance after the major publications. Some anomalies have disappeared all together and are no longer significant in the U.S. market. For example, the weekend effect started to decline after the first publication made by Cross in 1973 and declined even further after the publication by French in 1980 (Marquering et al, 2006). The authors also find small firm effect disappearing and reappearing in the U.K. market in 1999 after publication of "Murphy's law and market anomalies" by Ellen and Marsh (1999). Overall, it can be concluded that markets are becoming more sophisticated.

Seminal study documenting significant returns on a day before the U.S. public holidays is done by Lakonishok and Smidt (1988). The U.S. pre-holiday returns are two to five times larger than returns before a weekend. Overall the U.S. pre-holiday returns are 23 times higher than those on normal days and are significant for eight out of ten sub-periods, indicating persistence in the anomaly over the long period of time. Since the anomaly is persisting, authors believe that it is a real anomaly rather than effect of data snooping. Pettengill (1989) also shows significant returns on the day before the holidays. Returns are significant for both large and small firms. In similar vein, Ariel (1990) finds significant returns prior to the U.S. holidays. Equally weighted index mean is nine times higher than the normal returns while value weighted mean is 14 times higher. When the pre-holiday

returns are taken out of the study the monthly arithmetic mean decreases by 30.4% (from 0.79% to 0.55%). The yearly arithmetic mean decreases by 34.7% (from 8.35% to 5.45%). The holiday return variance is actually lower than variance on a normal day.

Significant pre-holiday returns still exist in some financial markets. For example, Meneu and Pardo (2004) document significant pre-holiday effect in Spain for the studied period of 1990 to 2000. Cao, Premachandra, Bharba and Tang (2009) find the pre-holiday effect in the New Zealand market and they believe that the effect is actually increasing. More in-depth findings show that the high returns are driven by small firms. Marrett and Worthington (2009) document pre-holiday effect in the Australia that is driven by retail industry and small size firms. The above studies are focused on the developed financial markets. Empirical evidence on the emerging markets is limited. One example is the study by Alagidede (2008) who finds significant positive pre-holiday returns in the South African financial market.

To investigate whether the pre-holiday effect is a real anomaly and not part of another anomaly, different calendar effects have been used in the literature as control variables. Some of the calendar effects are day of the week and weekend effects investigated by French (1980). As well as the end of the year effect, documented by Lakonishok and Smidt (1988). Ariel (1990) tests significance of pre-holiday returns after controlling separately for the January effect, New Year returns, weekend effect and size effect. After controlling for these variables, the pre-holiday returns are still significant. Kim and Park (1994) provide evidence of significant pre-holiday returns after controlling for the New Year returns and day of the week returns. However, the size effect becomes insignificant.

Several studies investigate the spillover effects of the U.S. public holidays. McGuinness (2005) provides evidence that between 1975 to 1990 U.S. holidays had significant effect on returns in the Hong Kong stock market. In the 1990-2005 sub-period, the U.S. spillover effect has disappeared. Cao et al (2009) in their study of the pre-holiday effect in New Zealand adjust for the time lag between U.S. and NZ trading times. No significant influence of the U.S. market holidays on the returns in New Zealand is found. Meneu and Pardo (2004) look at Spanish pre-holiday returns for manifestation of the U.S. and German holidays. There is no significant influence from either market. Past research shows that the pre-holiday effect is a country specific phenomenon.

The magnitude and statistical significance of pre-holiday returns vary depending on the holiday itself. Returns prior to the religious holidays tend to be higher than returns of other holidays. Chan, Khanthavit and Thomas (1996) show significant pre-holiday effect before the cultural holidays in Asia. More specifically, they show that in India there is a weak pre-holiday effect before Hindu holidays. In Malaysia there are significant returns before Islamic New Year and Vesak. Singapore only has abnormal returns before Chinese New Year. In Thailand small companies have significant abnormal returns before Chinese New Year. In New Zealand most significant returns are before the Easter holidays (Cao et al, 2009). Bley and Saad (2010) show significant returns for the Middle Eastern religious holidays in the Middle East. Eid Al Fitr is a holiday marking the end of Ramadan and produces significant abnormal returns in several countries. This confirms the idea that the pre-holiday effect is a country specific effect due to differences in culture and religion.

Overall, the pre-holiday anomaly is present in many developed and developing markets. Robustness checks by Ariel (1990) prove that the pre-holiday anomaly is a real anomaly. It also has been significant for a long period of time in the U.S. Country specific factors such as culture and religion seem to have large influence on the anomaly.

2.2 Post-holiday returns

Ariel (1990) states a popular belief that short selling positions are closed before holidays. It is possible that investors will reopen their short selling positions first trading day after a holiday. This can lead to lower than normal post-holiday returns. If this is the case, than there will be correction in the market in the first day after holidays resulting in significant negative returns.

A number of studies examine post-holiday effect. Lakonishok and Smidt (1988) find negative but insignificant post-holiday returns until 1952. Sub-periods 1952-1963 and 1952-1986 show significantly positive returns on days after holidays. Kim and Park (1994) observe large negative post-holiday returns for the U.K. stock market. Lee, Pettit and Swankoski (1990) examine Asian financial markets and find significantly negative post-holiday returns in Korea and Singapore. They also find insignificant negative pre-holiday returns in Hong Kong and U.S. and positive in Japan and Taiwan. Tonchev and Kim (2004) show relatively large positive but insignificant post-holiday returns for Czech Republic.

Slovakian and Slovenian markets have negative and insignificant post-holiday returns. Positive post-holiday returns suggest that short selling positions are not reinstated by investors after holidays.

Post-holiday returns can show behaviour of stock markets after a holiday. In theory, post-holiday returns should correct the market for any abnormal market activity before holidays. Evidence provided by Lakonishok and Smidt (1988) show that there is some correction for the significant pre-holiday effect.

2.3 Stock liquidity

Several studies focus on trading strategies based on stock market anomalies and for this purpose examine stock liquidity. Meneu and Pardo (2004) analyse stock turnover and bid-ask spreads of the five most traded company stocks in the Spanish stock market. Value of these five company stocks represent 60 percent of total market capitalisation of all IBEX-35 index (Spanish index). Findings show no significant difference between the pre-holiday and normal day stock trading volumes. Bid-ask spreads are higher prior to holidays but not significantly so. Therefore, there is no relationship between returns and trading volume which could help explain the pre-holiday returns in the Spanish market. The authors also find that cost of buying and selling stock during the pre-holiday period is actually lower than mean pre-holiday returns for three out of five studied companies. Therefore, Trading strategies are possible to benefit from the abnormal returns.

2.4 Behavioural finance, feelings and pre-holiday returns

Behavioural finance is more recent branch of finance. Thaler (1999) believes that behavioural finance importance will grow and eventually integrate with conventional finance. Behavioural finance attempts to better understand investor behaviour and explain how it affects stock market returns. Investor behaviour can be governed by mood which can determine stock market returns and liquidity. It is possible that investors get a positive mood before long weekends and holidays which leads to change in trading patterns and in turn leads to change in returns.

Hong and Yu (2009) study seasonality in stock markets in 51 countries and find a gone fishin' effect. According to their study, the equity turnover falls during the summer period (July to September). The effect is the most pronounced for the countries further away from

the equator. Since some investors go for holidays during summer they do not trade, consequently reducing liquidity. Similar situation can take place before holidays.

The pre-holiday effect has proven itself as a real anomaly which still exists in some financial markets. Certain public holidays show significantly higher pre-holiday returns than the others. Therefore, it seems that the pre-holiday effect is driven by culture and religion. According to Ariel (1990) post-holiday returns should correct markets for any anomalies seen before holidays. Studies on U.S., U.K., Korea, Singapore and Slovakia show that there is some market correction after holidays. Meneu and Pardo (2004) look at pre-holiday liquidity for five largest Spanish company stocks and finds that liquidity does not change significantly before holidays.

3. Hypotheses development

Hypothesis 1

One possible explanation for the abnormal positive returns around public holidays is the behavior of investors. Kavanagh and Bower (1985) study the effect of happiness and sadness on human behavior. One of their findings shows that happier people tend to believe that positive outcome is more likely than a negative one and vice versa. Public holidays can influence investor's mood, giving them happiness and joy. A mood change can lead to altered perception of given information which in turn leads to decision making with more positive outlook. This can influence stock market returns on a day prior to stock market closure.

Hirshleifer and Shumway (2003) provide a useful insight into how financial decisions can be influenced by socio-environmental factors and propose a link between weather and trading patterns. Results show nominal market returns on sunny days of 24.8 percent and 8.7 percent on cloudy days. The authors believe that weather may have a psychological effect on stock holders and, therefore, their judgement and how they perceive given information.

Analysing stock market returns around holidays will help to better understand the behavior of CEE stock markets during a holiday period and show if abnormal returns before holidays are possible. Post-holiday returns can reveal if there is a market correction after holidays for any abnormal returns experienced before holidays. Lakonishok and Smidt (1988) and Cao et al (2009) show some negative market adjustment for the abnormal pre-holiday returns. At the same time, Lee et al (1990) and Tonchev and Kim (2004) shows positive returns after holidays.

Based on efficient market hypothesis, the market returns should not be affected by the holidays in the financial markets of CEE countries. Thus, the null hypothesis is as follows,

H_0 = Stock market returns around public holidays are not significantly different from stock market returns on normal days.

H_A = Stock market returns around public holidays are significantly different from stock market returns on normal days.

Hypothesis 2

The holiday effect can manifests itself as an industry effect, as observed by Marret and Worthington (2009) where the Australian retail industry shows pre-holiday effect. Industries might exhibit the pre-holiday effect even if it does not show up on a market index level.

Holidays create a shopping season which increases sales of the retail industry before and during the holidays. In some countries consumers save for the year-end holidays (Christmas and New Year). Survey in Russia shows 54 percent of people saving money for the New Year holiday ("PMR", 2007[a]). Some products are related to certain holidays, for example, Easter is about eggs and chocolate. In Czech Republic consumers spend 30 percent more before and during the Easter holiday than before normal weekend. Sale of Easter related products is reported to be much higher than on usual days ("PMR", 2007[b]).

Holidays create seasonality in a retail store performance. This seasonality can be a possible explanation for the pre-holiday effect in the Australian retail industry. Expected strong performance of listed companies during the holidays can lead to share price increase.

Investigating returns on the industry level can highlight if the pre-holiday effect is driven by any particular industry. It will also show if it is possible to earn abnormal returns in any of the industries. The null hypothesis assumes that markets are efficient and returns are not significantly different from average normal day returns in an industry.

H_0 = There is no significant industry variation in returns around public holidays.

H_A = Public holidays result in significant industry return variation.

Hypothesis 3

Turnover by volume is one way to measure liquidity of a stock. It is calculated as the number of shares traded on a day and adjusted to number of shares outstanding on that day. Datar, Naik and Radcliffe (1998) carry out cross-sectional study on expected returns and find negative relationship between stock turnover ratio and returns. This means that when equity turnover ratio falls, returns for that equity go up and vice versa. The authors do not provide an explanation for the significant relationship. Lower turnover before holidays might help to explain higher pre-holiday returns.

Stock market closure for a public holiday might result in different trading patterns before the closure. To better understand how turnover is affected by holidays, Cao et al (2009) study the pre-holiday liquidity for five largest and smallest New Zealand stocks. All five largest stocks show lower trading volume, however, only two are significantly different. The bid-ask spreads are higher for two largest stocks. According to McInish and Wood (1992) lighter trading leads to increased bid-ask spread which is the case for only two New Zealand stocks.

Turnover analysis can show if investors trade more, less or the same before holidays in the financial markets of CEE. Bid-ask spread is used as a proxy for cost of trading. When spreads increase, cost of buying and selling equity also increases. Therefore, bid-ask spreads can indicate if there is a possible trading strategy before a holiday. Significant increase in a spread will cover any additional pre-holiday returns, therefore, removing any possibility of making a profit on that day. Meneu and Pardo (2004) results show that it is possible to use trading strategies to profit on the holiday effect in Spain. Three Spanish

companies produce higher pre-holiday returns than the round-trip transaction cost on those stocks. Therefore, investors can buy and sell stock on a pre-holiday and have a profit which covers transaction costs.

H_0 = Pre-holiday volume turnover and bid-ask spreads are not significantly different from the normal day volume turnover and bid-ask spread.

H_A = Pre-holiday volume turnover and bid-ask spreads are significantly different from normal day trading turnover and bid-ask spread.

4. Data

The study sample includes fourteen CEE countries and they are: Bulgaria, Croatia, Czech Republic, Poland, Romania, Russia, Estonia, Hungary, Latvia, Lithuania, Serbia, Slovakia, Slovenia and Ukraine. Price data for national stock indices for the fourteen countries is collected from the Datastream database. The sample period is from January 1, 1991 and to December 31, 2010. Table 1 provides a list of studied countries and dates when index data is available from. First two markets to have data available from 1991 are Hungary and Poland. Slovakia and Czech Republic have data since 1993 and 1994 respectively. Serbia has the least available data, starting from 2007. Other developing CEE financial markets have opened after 1995. The analysis includes all available data for the period specified, since the date it first became available.

Table 1: Sample description

The table reports the list of the countries included in the sample. Specified dates indicated when the Datastream calculated index data is available from.

Market	Data available from	Market	Data available from
Bulgaria	October 20, 2000	Poland	April 16, 1991
Croatia	January 2, 1997	Romania	September 19, 1997
Czech Republic	April 6, 1994	Russia	September 1, 1995
Estonia	June 3, 1996	Serbia	December 25, 2006
Hungary	January 2, 1991	Slovakia	September 14, 1993
Latvia	December 31, 1999	Slovenia	March 31, 2006
Lithuania	December 31, 1999	Ukraine	October 3, 1997

Appendix 1 reports the list of public holidays for which stock markets are closed for. The holiday dates are gathered from a variety of sources. Firstly, 'Time and Date' website[1] is used to create a list of holidays and record their dates over time. The website provides all the public holiday information for eight of the sample markets. For the other countries, national ministry of foreign affairs websites are used to collect the official names and dates of official public holidays. In addition, national stock market exchange websites are used to check the public holidays and market closing dates the for the holidays. Lastly, Q++Studio website[2] provides news on changes and announcement of public holidays. Q++Studio is searched for any changes to public holidays, such as introduction, removal or change of a public holiday. Holiday changes overtime include Russian Constitution Day (December 12) is replaced with Unity Day which is celebrated on 4th of November (BBC News, 2004). Defender's Day (23rd of February) became a public holiday in 2002 (Russia IC, 2008). Czech Republic introduced St. Wencesles as a new public holiday in 2000 (Radio Praha, 2011).

Holidays which follow each other are treated as a single holiday. Such as Easter holidays (Good Friday and Easter Monday), as markets only reopen after both days off. When a public holiday falls on a Monday than last trading day is taken (Friday). If a public holiday falls on a weekend than Monday becomes a day off for some of the holidays. In this case, Friday returns are considered to be pre-holidays and Tuesday returns become post-holiday returns. In some countries such as Slovakia, index closes for a long period during the New Year period. For example, index was closed starting from 22nd December 2003 to 7th of January 2004 (first trading day in 2004). In this case 'post-holiday' return is considered to be 7th of January 2004.

[1] http://www.timeanddate.com/
[2] http://www.qppstudio.net

5. Methodology

5.1 Measurement of the holiday effect

Closing prices of a stock market index are used to calculate stock market returns as seen in formula (1).

$$R = log\left(IndexPI_{i,t}\right) - log(IndexPI_{i,t-1}) \quad (1)$$

Where $indexPI_i$ is a closing price of a market's index *i* at a day *t*.

Stock market price index data does not include dividend yield as there is lack of dividend data for the national indices. Only the Polish index has total return index which does include dividend yield. Tonchev and Kim (2004) use indices without dividends (only one index has dividend yields included) in their study of the three Central European countries. Lakonishok and Smidt (1988) use Dow Jones Industrial Average index which does not include dividend yields either. Additional tests show that dividend omission does not affect their findings. Choy and O'Hanlon (1989) find no significant change in their results in the U.K. market between using indices with or without dividend yield[3].

Public holiday is defined as a day when financial stock markets close and do not trade, excluding weekends. Pre-holiday day is a day before this closure. Post-holiday is a first trading day after a holiday. Normal trading days include all trading days except days immediately before and after holidays.

Previous studies report that percentage of positive pre-holiday returns is significantly higher compared to normal day returns, (Ariel 1990, Chong, Hudson, Keasey and Littler 2005 and Cao et al 2009). Following methodology provided by Ariel (1990), chi-sq statistic is used to test whether a proportion of pre- or post- holiday returns is significantly different from a positive return proportion of an index global returns. Global returns are all returns of an index. Chi-sq statistic is specified in formula 2.

$$\chi^2 = 2(O - E)^2/E \quad (2)$$

[3] The significance of inclusion of dividend yield in an index pricing is tested using three industries in two countries. Results can be found in Appendix 1. There is no significant difference in returns of the pre-holiday and post-holiday results. Overall, unavailability of dividend data does not affect the findings.

where *O* is an actual number of positive pre (post) -holiday returns and *E* is a number of expected positive pre (post) -holiday returns based on a proportion of positive returns of an index.

Following methodology of Cao et al (2009), dummy variables are used to evaluate pre-, post- and individual holiday returns. Normal days include all trading days except a day that precedes or follows a public holiday. Pre-holiday dummy equals to one for last trading day before a holiday and zero otherwise. Post-holiday dummy equals to one for a first trading day after a public holiday and zero otherwise, normal day returns are captured by α_0. Regression specification (3) is estimated with ordinary least squares (OLS). Each stock market is estimated individually with market specific dummy variables.

$$R_t = \alpha_0 + \alpha_1 D_{PRE} + \alpha_2 D_{POST} + \in_t \quad (3)$$

Certain holidays can produce higher returns than others. Using formula (4) individual local holidays of each country are studied. Czech Republic holidays are used as an example in the formula. Other countries have some of their unique national holidays. Even the same holidays such as Easter and New Year, start at different dates in different countries. The model specification will change depending on a country in question. Dummy variables take value of one for the corresponding holidays and zero otherwise. Holidays in formula (4) for Czech Republic are as follows: New Year, Easter, Labour Day, Liberation Day, Day of the Apostles St Cyril and St Methodius, Independence Day, Freedom and Democracy Day and Christmas.

$$R_t = \alpha_0 + \alpha_1 D_{NYR} + \alpha_2 D_{EASTER} + \alpha_3 D_{LABOR} + \alpha_4 D_{LIBD} + \alpha_5 D_{SCSM} + \alpha_6 D_{INDE} + \alpha_7 D_{DEMD} + \alpha_8 D_{XMAS} + \in_t \quad (4)$$

Investigating individual holidays can highlight which holidays produce abnormal returns. Research by Chan et al (1996) and Cao et al (2009) show significantly higher returns for some of the holidays than the others.

5.2 Measurement of the industry holiday effect

Datastream calculated industry returns including dividend yield are used to analyse the industry holiday effect in six countries. The countries are: Czech Republic, Hungary, Poland, Romania, Russia and Slovenia. The number of industries ranges from 8 to 10 between the countries.

Industry indices are analysed using model (3). This is in line with the study done by Marrett and Worthington (2009) who analyse holiday effect on industry level in Australia. Datastream calculated industries are: basic materials, consumer goods, consumer services, financials, health care, industrials, gas and oil, technology, telecom and utilities. Industry data is only available for six countries and has fewer years of data than for their respective stock market indices. Only exception is Slovenia which has additional seven years of data compared to Slovenian index. Even though only six countries have data, the result should highlight if any of the industries have a holiday effect in the CEE region. Results should also help to better understand industry returns in the developing markets.

5.3 Pre-holiday liquidity

Liquidity of indices cannot be analysed as there is no or little data, company level liquidity is investigated. Following methodology outlined by Meneu and Pardo (2004), trading patterns before holidays are analysed. Liquidity of individual stocks is examined using detrended turnover by volume and relative bid-ask spread. Liquidity is analysed for six countries, they are Czech Republic, Hungary, Poland, Russian, Romania and Slovenia. The other countries do not have enough data for analysis. For each country, five companies with largest capitalisations are investigated. Turnover by volume and bid-ask data is collected from the Datastream database.

Turnover by volume is measured by a number of shares traded on a day divided by a number of outstanding shares on that day. Following methodology of Meneu and Pardo (2004), detrended turnover by volume is calculated using formula (5).

$$DV_{it} = V_{it}/AV_i \tag{5}$$

where *DV* is a detrended volume for a stock *i* at a day *t.* V is trading volume for a stock *i* on day *t* and *AV* is average trading volume for the sample period of stock *i*.

Lastly, relative bid-ask spread is calculated by following methodology of Meneu and Pardo (2004). The formula (6) is stated below.

$$S_{it} = (B_{it} - A_{it})/\frac{(B_{it}+A_{it})}{2} \tag{6}$$

Where *S* is a spread for a stock *i* at day *t. B* is a closing bid price for a stock *i* on day *t* and *A* is closing ask price for stock *i* on day *t*.

6. Findings and discussion

6.1 Pre- and post- holiday returns

Table 3 reports descriptive statistics of market returns for the fourteen national stock market indices. More specifically, it reports mean returns, standard deviations and the number of pre-holiday, post-holiday and normal days. Pre-holiday and post-holiday mean returns are compared to normal day mean returns coefficient separately. Lastly, the frequency of positive returns for pre- and post- holidays is compared to a global sample of positive returns. Global sample includes all trading days of an index in question.

Bulgarian, Croatia, Lithuanian, Russian and Serbian markets have significantly higher pre-holiday mean returns compared to normal days. Three of the markets show significance at 5% level, Croatian market is significant at 1% while Serbian market is at 10%. Eight of the countries show significantly higher proportion of positive returns a day before holidays than for global returns, six of them are significantly different at 1%. This is the first indication of presence of the pre-holiday effect in the CEE region.

Czech, Estonian, Hungarian, Polish and Russian stock markets show significantly higher post-holiday mean returns compared to the normal day returns. Only the Slovakian stock market shows significantly negative post-holiday returns. Proportion of positive post-holiday returns compared to global positive index returns is significantly higher for Hungarian, Polish and Russian stock markets.

Table 4 reports the results of regression analysis that is used to evaluate whether the pre-holiday returns are statistically different from returns on the normal days. Regression is carried out according to the OLS model (3). Normal day, pre- and post- holiday returns along with their t-statistic significance levels are reported for each country's stock market index.

Bulgarian, Croatian, Lithuanian, Russian and Serbian stock markets exhibit positive and statistically significant pre-holiday returns. Hungary is the only country with negative but insignificant pre-holiday returns. For all of the countries, except for Hungary the pre-holiday returns are higher than on normal days but not significantly so.

Now looking at the post-holiday returns, Czech, Estonian, Hungarian, Russian and Polish stock markets have positive returns and significant at 1% while Slovakian stock market is negative and significant at 5%. Overall, ten stock market indices show either significant pre- or post- holiday returns. Nine of the indices have significantly positive returns. These results go against the hypothesis 1.

Pre-holiday results for Czech Republic, Slovakia and Slovenia are not significant, which is consistent with the study done by Tonchev and Kim (2004). Czech Republic and Slovakian pre-holiday return coefficient is much higher in both studies compared to normal day returns, however they are not significantly so. Unlike their study, Table 4 of this study shows post-holiday returns for Czech Republic (positive) and Slovakia (negative) are highly significant. Slovenian post-holiday returns are positive but insignificant in this study.

Significant pre- and post- holiday returns suggests that investors can benefit from trading before or after public holidays. For example, Russian pre-holiday returns coefficient is positively significant and 13.25 times[4] higher than normal day return coefficient. Russian post-holiday returns are 18.25 times higher than normal day returns and highly significant. Therefore, it might be possible for investors to earn abnormal returns over the two day period. Ariel (1990) finds that pre-holiday returns keep growing throughout the day. Assuming that this is true in this case, than investors should buy stock early morning during pre-holidays and sell before closing period of post-holidays. Only the Lithuanian and Slovakian stock markets shows negative post-holiday returns.

[4] Pre-holiday coefficient is divided by normal day coefficient. PreHol coefficient / normal day coefficient.

Table 2: Descriptive statistics

The table reports means, standard deviations, proportion of positive returns for national indices of each market for the sample period of 1991-2010. Pre-holiday is the last trading day before a public holiday, post-holiday is the first trading day after a public holiday and normal days are all trading days excluding pre-holiday and post-holiday trading days. χ^2 statistic is used to test significance of proportion of positive pre- and post- holiday returns. χ^2statistic is calculated by following formula (2) $\chi^2 = 2(O - E)^2/E$

	Bulgaria	**Croatia**	**Chez Republic**	**Estonia**	**Hungary**	**Latvia**	**Lithuania**
Total number of days	2660	3651	4367	3804	5219	2869	2870
Mean return	0.00048	0.00029	0.00005	0.00051	0.00059	0.00046	0.00049
Standard Deviation	0.0179	0.0175	0.0141	0.0169	0.0170	0.0161	0.0119
Number of normal days	2506	3357	4090	3605	4892	2718	2646
Mean Return	0.00040	0.00015	-0.00011	0.00035	0.00048	0.00041	0.00043
Standard Deviation	0.0177	0.0177	0.0139	0.0170	0.0170	0.0163	0.0121
Number of pre-holidays	78	150	138	100	164	76	112
Mean Return	0.00492	0.00323	0.00148	0.00155	0.00034	0.00183	0.00246
Standard Deviation	0.0149	0.0118	0.0144	0.0097	0.0131	0.0137	0.0085
t-stat difference of means	-2.629 **	-3.043 ***	-1.274	-1.181	0.137	-0.887	-2.426 **
Number of post-holidays	77	149	138	99	163	76	112
Mean Return	-0.00111	0.00087	0.00334	0.00518	0.00404	0.00108	0.00003
Standard Deviation	0.0254	0.0182	0.0187	0.0183	0.0199	0.0141	0.0103
t-stat difference of means	0.518	-0.472	-2.148 **	-2.592 **	-2.258 **	-0.408	0.399
Frequency of advances	**Bulgaria**	**Croatia**	**Chez Republic**	**Estonia**	**Hungary**	**Latvia**	**Lithuania**
% of positive total days	49.81%	47.17%	48.39%	51.63%	50.11%	49.67%	50.98%
% of positive pre-holidays	58.97%	59.33%	57.25%	66.00%	50.61%	55.26%	66.07%
χ^2-statistic	2.63	9.42	4.48	8.00	0.02	0.96	10.01
p-value	0.10	0.00 ***	0.03 **	0.00 ***	0.90	0.33	0.00 ***
% of positive post-holidays	51.95%	53.69%	55.07%	58.59%	63.80%	52.63%	53.57%
χ^2-statistic	0.1	2.7	2.6	1.9	12.2	0.3	0.3
p-value	0.71	0.10	0.11	0.17	0.00 ***	0.60	0.59

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Table 2 continued.

	Poland	Romania	Russia	Serbia	Slovakia	Slovenia	Ukraine
Total number of days	5143	3465	4000	1049	4513	1240	3434
Mean return	0.00075	0.00048	0.00072	-0.00068	0.00018	-0.00013	0.00068
Standard Deviation	0.0190	0.0187	0.0277	0.0126	0.0154	0.0132	0.0437
Number of normal days	4834	3336	3781	1012	4192	1156	3236
Mean Return	0.00057	0.00036	0.00039	-0.00081	0.00026	-0.00028	0.00037
Standard Deviation	0.0191	0.0186	0.0274	0.0126	0.0151	0.0133	0.0439
Number of pre-holidays	159	65	111	19	164	44	100
Mean Return	0.00207	0.00356	0.00585	0.00451	0.00101	0.00216	0.00620
Standard Deviation	0.0141	0.0169	0.0281	0.0119	0.0185	0.0121	0.0454
t-stat difference of means	-1.31	-1.51	-2.017 **	-1.925 *	-0.51	-1.31	-1.27
Number of post-holidays	158	64	110	18	164	43	99
Mean Return	0.00490	0.00337	0.00778	0.00087	-0.00255	0.00143	0.00400
Standard Deviation	0.0193	0.0243	0.0353	0.0110	0.0184	0.0111	0.0363
t-stat difference of means	-2.767 ***	-0.983	-2.178 **	-0.639	1.931 *	-0.981	-0.973
Frequency of advances	**Poland**	**Romania**	**Russia**	**Serbia**	**Slovakia**	**Slovenia**	**Ukraine**
% of positive total days	45.60%	49.64%	50.85%	43.95%	44.41%	50.00%	50.58%
% of positive pre-holidays	50.31%	66.15%	64.86%	68.42%	55.49%	61.36%	56.00%
χ^2-statistic	1.55	7.14	8.58	5.18	9.07	2.27	1.16
p-value	0.21	0.01 ***	0.00 ***	0.02 **	0.00 ***	0.13	0.28
% of positive post-holidays	63.29%	54.69%	61.82%	50.00%	48.17%	58.14%	57.58%
χ^2-statistic	21.7	0.7	5.2	0.3	1.0	1.1	1.9
p-value	0.00 ***	0.42	0.02 **	0.58	0.31	0.29	0.17

Table 3: Country specific pre- and post- holiday returns

The table reports the output of OLS regression. Regression is carried out according to model (3):
$R_t = \alpha_0 + \alpha_1 D_{PRE} + \alpha_2 D_{POST} + \in_t$
Rt is daily market return on national indices, D_{PRE} and D_{POST} are dummy variables which equal to one for days preceding and immediately following public holidays respectively and equal to zero otherwise.
PreHol and PostHol in the Table are coefficient estimates on the pre- and post- holiday dummy variables. Also the Table reports t-statistics on the pre-, post- and normal day coefficients. R-squared reports goodness of the fit for each regression.

Country	normal days	t-stat	PreHol	t-stat	PostHol	t-stat	R sqrd
Bulgaria	0.0003	0.908	0.0046 **	2.234	0.0007	0.504	0.0020
Czech Republic	-0.0001	-0.502	0.0015	1.248	0.0034 ***	2.819	0.0021
Croatia	0.0001	0.455	0.0031 **	2.107	0.0006	0.430	0.0013
Estonia	0.0004	1.261	0.0012	0.701	0.0048 ***	2.809	0.0022
Hungary	0.0005 **	1.978	-0.0001	-0.107	0.0036 ***	2.636	0.0017
Latvia	0.0004	1.316	0.0014	0.754	0.0007	0.350	0.0002
Lithuania	0.0004 *	1.842	0.0020 *	1.760	-0.0004	-0.346	0.0011
Poland	0.0006 **	2.126	0.0013	0.834	0.0043 ***	2.769	0.0016
Romania	0.0004	1.124	0.0032	1.365	0.0030	1.274	0.0010
Russia	0.0004	0.821	0.0053 **	2.008	0.0073 ***	2.735	0.0028
Serbia	-0.0008 **	-2.049	0.0053 *	1.830	0.0017	0.563	0.0035
Slovakia	0.0003	1.082	0.0009	0.716	-0.0028 **	-2.325	0.0013
Slovenia	-0.0003	-0.686	0.0023	1.145	0.0015	0.747	0.0016
Ukraine	0.0004	0.530	0.0058	1.300	0.0035	0.793	0.0007

Significance levels: *** is 1%, ** is 5% and * is 10% significance.

6.1.1 Pre-holiday returns for individual holidays

To further analyse pre-holiday returns, analysis of individual holidays is carried out. Dummy variables are assigned to each individual public holiday. Each dummy variable is equal to one before that specific holiday and zero otherwise. Regression analysis is carried out according to formula 4 (as an example). The results for the individual holidays for each country can be seen in Table 5. The table reports return coefficient and significance levels for each public holiday.

Two holidays which have significant pre-holiday returns for a number of countries are Christmas and New Year. Both have significant returns for five different countries. Labour Day is significant for Romania, Serbia and Slovakia. Three Kings Day pre-holiday returns are abnormal and significant for Croatia at 1% while Russian Constitution Day is negatively significant at 10%. Only the Ukrainian index shows significant returns before a religious holiday, positive returns are significant at 1% level for the Orthodox Easter. Otherwise, no other public holiday exhibits any significant returns before holidays.

Overall, there seems to be weak evidence for individual holidays generating significant returns. Out of fourteen countries, ten of them exhibit at least one significant holiday. Two common holidays have highest abnormal returns, they are New Year and Christmas. Russia and Slovakia have three significant holidays each. The Russian stock exchange is sometimes closed from 1st of January until the first trading day on 9th of January as see in the year of 2007. Orthodox Christmas is on 7th of January. In this case only the New Year is considered to be a holiday. Orthodox Christmas is only considered to be a separate holiday if there are trading days between 1st and 7th of January. Same methodology applies to the other studied indices. Close proximity of dates of these two holidays can influence each other's returns.

6.1.2 Persistence of the holiday effect

The persistence of the anomaly is tested using univariate analysis. Market returns are analysed for three sub-periods. Bulgarian index only has enough data for two sub-periods. Serbian and Slovenian indices are not reported in the table as they have data only for one sub-period, therefore, the results are the same as in descriptive statistics reported in Table 3.

Table 6 reports the mean returns, standard deviations and number of trading days for normal days, pre- and post- holidays over three sub-periods. The table also reports t-statistic for difference of means of pre-holidays and normal days as well as of post-holiday and normal days. T-statistic for difference of means is calculated following methodology of Ariel (1990). Lastly the table reports proportion of positive returns for pre- and post-holidays for each stock index. Formula 2 is used to compare proportions of positive holiday returns to global positive returns of an index.

For most of the countries, the pre-holiday mean returns have decreases from the period of 1991-2000 compared to 2006-2010. Bulgarian, Lithuanian, Romanian and Serbian (Table 3) stock markets show significantly higher mean pre-holiday returns in the 2006-2010 period. Pre-holiday effect has increased over time for the Bulgarian and Romanian indices.

Table 4: Specific holiday effect

The table reports pre-holiday OLS regression analysis of individual holidays in CEE stock markets. Model (4) acts as an example and uses Czech Republic public holidays.

$R_t = \alpha_0 + \alpha_1 D_{NYR} + \alpha_2 D_{EASTER} + \alpha_3 D_{LABOR} + \alpha_4 D_{LIBD} + \alpha_5 D_{SCSM} + \alpha_6 D_{INDE} + \alpha_7 D_{DEM} + \alpha_8 D_{XMAS} + \in_t$

The dummy variables are represented by D. Dummy variables are equal to one for days before market closure for their respective holidays and zero otherwise. R_t is daily index return for a day t, α_1 to α_8 represent returns for normal day returns and for each holiday.

Return coefficients for each public holiday and normal days are represented by 'returns' column.

Bulgaria			**Czech Republic**		
Holidays	**returns**	**p-value**	**Holidays**	**returns**	**p-value**
Christmas	0.0129 **	0.02	Christmas	0.0069 **	0.05
Easter Orthodox	0.0066	0.25	Democracy Day	0.0068	0.11
Education Day	-0.0035	0.54	Easter	0.0024	0.50
Independence Day	0.0057	0.31	Independence Day	-0.0048	0.17
Labor Day	0.0038	0.53	Labor Day	0.0017	0.62
Liberation day	0.0070	0.20	Liberation Day	0.0002	0.96
New Year	-0.0018	0.84	New Year	0.0028	0.44
St. George Day	0.0007	0.91	Saints Cyril Day	0.0016	0.63
Unification Day	0.0018	0.76	St. Wenceslas Day	-0.0042	0.31
(Normal Days	0.0003	0.32	Normal Days	0.0000	1.00
Croatia			**Estonia**		
Holidays	**returns**	**p-value**	**Holidays**	**returns**	**p-value**
3 Kings Day	0.0146 ***	0.00	Christmas	0.0024	0.58
Assumption Day	-0.0018	0.71	Easter	0.0049	0.28
Christmas	0.0012	0.80	Independence Day	-0.0043	0.34
Corpus Christi	0.0019	0.72	Labor Day	0.0003	0.94
Easter	0.0066	0.16	New Year	0.0025	0.57
Independence Day	-0.0049	0.40	Restoration of Estonia	-0.0008	0.87
Labor Day	0.0073	0.12	Victory Day Estonia	0.0020	0.65
New Year	0.0056	0.23	Normal Days	0.0005 *	0.08
All Saints Day	0.0013	0.78			
Statehood Day	-0.0015	0.78			
Anti Fascist Struggle Day	-0.0001	0.99			
Victory Day	0.0019	0.70			
Normal Days	0.0002	0.59			

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Table 4 continued.

Hungary			Latvia		
Holidays	**returns**	**p-value**	**Holidays**	**returns**	**p-value**
Christmas	0.0021	0.58	Ascension Day	0.0004	0.95
Easter	0.0020	0.63	Christmas	0.0051	0.29
Labor Day	-0.0009	0.81	Easter	-0.0008	0.86
New Year	-0.0007	0.86	Declaration of Independence Day	0.0037	0.53
Republic Day	0.0005	0.89	Independence Day	-0.0031	0.53
All Saints Day	-0.0004	0.94	Labor Day	-0.0011	0.84
St. Stephen Day	0.0006	0.87	Mid Summer Day	-0.0039	0.42
Uprising Anniversary	-0.0024	0.55	New Year	0.0092 *	0.06
Whit Monday	-0.0036	0.39	Normal Days	0.0004	0.16
Normal Days	0.0006 **	0.01			
Lithuania			**Poland**		
Holidays	**returns**	**p-value**	**Holidays**	**returns**	**p-value**
Ascension Day	0.0039	0.48	Assumption Day	-0.0011	0.77
Assumption Day	0.0030	0.40	Christmas	0.0055	0.16
Christmas	0.0017	0.64	Constitution Day	-0.0001	0.98
Declaration of Independence Day	0.0035	0.33	Corpus Christi	-0.0008	0.83
Easter	0.0026	0.48	Easter	0.0035	0.37
Labor Day	0.0026	0.50	Independence Day	-0.0060	0.12
New Year	0.0089 **	0.01	Labor Day	0.0057	0.17
Reestablishment of Independence	0.0012	0.74	New Year	-0.0026	0.51
All Saints Day	-0.0035	0.33	All Saints Day	0.0051	0.19
Statehood Day	0.0002	0.95	Normal Days	0.0004 *	0.10
St. John Day	-0.0015	0.69			
Normal Days	0.0004 *	0.07			
Romania			**Serbia**		
Holidays	**returns**	**p-value**	**Holidays**	**returns**	p-value
Christmas	0.0063	0.21	Christmas Orthodox	-0.0038	0.67
Easter Orthodox	-0.0043	0.43	Constitution Day	-0.0032	0.61
Labor Day	0.0105 *	0.05	Easter	0.0045	0.48
New Year	0.0019	0.89	Labor Day	0.0144 **	0.02
National Day	0.0055	0.27	New Year	0.0091	0.11
Whit Monday Orthodox	-0.0016	0.76	Normal Days	-0.0008 **	0.05
Normal Days	0.0004	0.20			

Table 4 continued.

Russia			Slovakia		
Holidays	**returns**	**p-value**	**Holidays**	**returns**	**p-value**
Defenders of Motherland Day	0.0020	0.83	Christmas	0.0147 ***	0.00
International Women's Day	0.0079	0.27	Constitution Day	0.0012	0.75
Christmas Orthodox	0.0223 **	0.02	Democracy Day	0.0016	0.75
Constitution Day	-0.0159 *	0.06	Easter	-0.0006	0.88
Labor Day	0.0115	0.11	Epiphany	0.0068	0.38
National Unity Day	0.0056	0.59	Labor Day	-0.0091 **	0.01
Russia Day	-0.0001	0.99	New Year	0.0251 ***	0.00
New Year	0.0147 **	0.03	All Saints Day	0.0008	0.82
Victory Day	-0.0042	0.56	St. Cyril Day	-0.0002	0.97
Normal Days	0.0006	0.19	Slovak National Uprising Day	-0.0039	0.30
			Victory Day	-0.0020	0.62
			Our Lady of Sorrows	-0.0004	0.91
			Normal Days	0.0002	0.51
Slovenia			**Ukraine**		
Holidays	**returns**	**p-value**	**Holidays**	**returns**	**p-value**
Assumption Day	0.0029	0.62	International Women's Day	0.0069	0.60
Christmas	0.0037	0.53	Christmas Orthodox	-0.0314	0.15
Easter	-0.0072	0.23	Constitution Day	0.0001	0.99
Labor Day	0.0039	0.51	Easter Orthodox	0.0325 ***	0.01
New Year	0.0008	0.90	Independence Day	-0.0029	0.81
Preseren Day	0.0009	0.89	Labor Day	0.0057	0.66
Resistance Day	0.0052	0.38	New Year	0.0226 *	0.05
All Saints Day	0.0079	0.19	Pentecost Orthodox	-0.0093	0.44
Statehood Day	0.0029	0.62	Victory Day	-0.0080	0.56
Normal Days	-0.0002	0.57	Normal Days	0.0005	0.49

Croatian, Czech, Estonian, Hungarian and Russian stock indices have statistically higher mean pre-holiday returns in the sub-period of 1991-2000. Croatian, Czech, Estonian, Hungarian, Lithuanian, Russian and Slovakian stock markets have significantly higher than normal proportion of positive returns before holidays in at least one the first two sub-periods. Overall, the evidence suggests that magnitude and significance of the pre-holiday returns have decreased over the years in most of the CEE countries.

Now considering post-holiday returns in the first sub-period of 1991 to 2000, Estonian, Hungarian, Polish, Russian and Ukrainian stock markets have significantly abnormal post-holiday returns compared to the normal day returns. During the 2006-2010 period only the Hungarian index exhibit significantly higher post-holiday returns compared to the normal days. Nine of the stock markets show lower mean post-holiday returns for the last sub-period than for the first one. This indicates that there has been decrease in the post-holiday returns over the years as well.

Financial crisis can have an impact on the financial markets and market efficiency. Research by Holden, Thompson and Ruangrit (2005) looks at the Thailand stock market returns before, during and after the Asian financial crisis of 1997. They find that before the crisis, the pre-holiday returns were not significant. During the crisis pre-holiday returns became significant at 10% level and at 5% during post-crisis period. Therefore, it is possible that for a period of time there can be a reversal or reappearance of anomalies after significant events, such as a financial crisis.

Financial markets around the world including Central and Eastern European have been greatly affected by financial crisis of 2008. For example, Hungarian stock index lost around 40% of its index value by the end of October 2008 (Bocian and Sadowski, 2008) and Russian stock index lost over 70% of its index value (Faulconbridge, 2008). This would explain the lower and negative mean normal day and mean pre-holidays returns in the 2006-2010 sub-period.

Table 5: Persistence of the holiday effect

Means, standard deviations, proportion of positive returns are reported for national indices in three sub-periods. Pre-holiday is a trading day right before a public holiday, post-holiday is first trading day after a public holiday and normal days are all trading days which do not include pre-holiday and post-holiday trading days. Proportion of positive pre- and post- holiday returns are compared to positive global returns using chi-square statistic for each market and sub-period individually. The chi-square statistic is computed by following model (2)

$\chi^2 = 2(O - E)^2/E$

	Bulgaria	**Bulgaria**	**Croatia**	**Croatia**	**Croatia**	**Czech**	**Czech**	**Czech**
Sub-period	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**
Total number of days	1305	1305	1041	1305	1305	1757	1305	1305
Number of normal days	1229	1228	973	1195	1189	1660	1215	1215
Mean	0.00151	-0.00074	-0.00058	0.00077	-0.00035	-0.00023	0.00062	0.00000
Standard Deviation	0.0197	0.0152	0.0224	0.0143	0.0163	0.0221	0.0145	0.0185
Number of pre-holidays	38	39	36	55	59	49	45	44
Mean	0.00671	0.00281	0.00688	0.00221	0.00194	0.00291	0.00082	0.00056
Standard Deviation	0.0168	0.0126	0.0145	0.0094	0.0117	0.0128	0.0106	0.0190
t-stat difference of means	-1.864 *	-1.721 *	-2.828 ***	-1.194	-1.214	-1.883 *	-0.033	-0.310
Number of post-holidays	38	39	35	55	59	48	45	45
Mean	-0.00185	-0.00039	0.00590	-0.00105	-0.00032	0.00178	0.00337	0.00497
Standard Deviation	0.0328	0.0156	0.0283	0.0098	0.0162	0.0120	0.0149	0.0266
t-stat difference of means	0.629	-0.137	-1.267	1.206	0.149	-1.343	-1.155	-1.333
Frequency of Advances	**Bulgaria**	**Bulgaria**	**Croatia**	**Croatia**	**Croatia**	**Czech**	**Czech**	**Czech**
% of positive total days	51.95%	48.20%	41.31%	49.43%	49.58%	44.28%	52.87%	49.43%
% of positive pre-holidays	63.16%	53.85%	63.89%	61.82%	54.24%	57.14%	57.78%	45.45%
χ^2-statistic	1.84	0.52	8.89 ***	3.42 *	0.52	3.66 *	0.41	0.28
p-value	0.18	0.47	0.00	0.06	0.47	0.06	0.52	0.60
% of positive post-holidays	57.89%	46.15%	57.14%	45.45%	59.32%	47.92%	60.00%	57.78%
χ^2-statistic	0.52	0.07	4.25 **	0.35	2.26	0.29	0.86	1.27
p-value	0.47	0.79	0.04	0.55	0.13	0.59	0.35	0.26

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Table 5 continued.

	Estonia	Estonia	Estonia	Hungary	Hungary	Hungary	Latvia	Latvia	Latvia
Sub-period	**1991-2000**	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**
Total number of days	1194	1305	1305	2609	1305	1305	259	1305	1305
Number of other days	1135	1235	1235	2462	1215	1215	247	1238	1233
Mean	-0.00010	0.00111	0.00002	0.00058	0.00083	-0.00008	0.00142	0.00107	-0.00045
Standard Deviation	0.0247	0.0097	0.0139	0.0206	0.0131	0.0195	0.0154	0.0166	0.0159
Number of pre-holidays	30	35	35	74	45	45	6	34	36
Mean	0.00505	0.00249	-0.00239	0.00354	-0.00078	-0.00382	-0.00282	0.00388	0.00067
Standard Deviation	0.0117	0.0077	0.0085	0.0122	0.0109	0.0152	0.0117	0.0089	0.0173
t-stat difference of means	-2.289 **	-1.028	1.616	-2.023 **	0.969	1.606	0.870	-1.753 *	-0.386
Number of post-holidays	29	35	35	73	45	45	6	34	36
Mean	0.01003	0.00309	0.00324	0.00494	0.00013	0.00649	0.01089	0.00069	-0.00018
Standard Deviation	0.0298	0.0075	0.0123	0.0192	0.0171	0.0232	0.0178	0.0097	0.0166
t-stat difference of means	-1.818 *	-1.533	-1.524	-1.918 *	0.268	-1.873 *	-1.289	0.220	-0.099
Frequency of Advances	**Estonia**	**Estonia**	**Estonia**	**Hungary**	**Hungary**	**Hungary**	**Latvia**	**Latvia**	**Latvia**
% of positive total days	50.75%	54.71%	49.35%	50.67%	50.04%	49.04%	53.28%	53.56%	45.06%
% of positive pre-holidays	70.00%	80.00%	48.57%	59.46%	48.89%	37.78%	50.00%	58.82%	52.78%
χ^2-statistic	4.38 **	8.18 ***	0.01	2.26	0.02	2.33	0.02	0.35	0.95
p-value	0.04	0.00	0.93	0.13	0.88	0.13	0.88	0.55	0.33
% of positive post-holidays	55.17%	60.00%	60.00%	67.12%	55.56%	66.67%	83.33%	58.82%	41.67%
χ^2-statistic	0.22	0.36	1.61	7.80 ***	0.55	5.70 **	2.03	0.35	0.18
p-value	0.64	0.55	0.20	0.01	0.46	0.02	0.15	0.55	0.67

Table 5 continued.

	Lithuania	Lithuania	Lithuania	Poland	Poland	Poland	Romania	Romania	Romania
Sub-period	**1991-2000**	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**
Total number of days	260	1305	1305	2533	1305	1305	855	1305	1305
Number of normal days	240	1209	1197	2390	1221	1223	822	1261	1253
Mean	-0.00040	0.00115	-0.00013	0.00088	0.00043	0.00011	-0.00076	0.00168	-0.00023
Standard Deviation	0.0101	0.0101	0.0141	0.0188	0.0112	0.0153	0.0214	0.0145	0.0205
Number of pre-holidays	10	48	54	73	44	42	17	22	26
Mean	0.00195	0.00140	0.00349	0.00280	0.00201	0.00087	-0.00130	0.00408	0.00630
Standard Deviation	0.0057	0.0098	0.0077	0.0183	0.0078	0.0105	0.0200	0.0158	0.0155
t-stat difference of means	-1.220	-0.175	-3.239 ***	-0.875	-1.304	-0.455	0.111	-0.707	-2.116 **
Number of post-holidays	10	48	54	72	44	42	16	22	26
Mean	-0.00004	0.00258	-0.00223	0.00780	0.00187	0.00310	0.00220	0.01293	-0.00399
Standard Deviation	0.0072	0.0091	0.0113	0.0230	0.0106	0.0193	0.0152	0.0199	0.0297
t-stat difference of means	-0.150	-1.070	1.312	-2.512 **	-0.884	-0.995	-0.761	-2.638 **	0.643
Frequency of Advances	**Lithuania**	**Lithuania**	**Lithuania**	**Poland**	**Poland**	**Poland**	**Romania**	**Romania**	**Romania**
% of positive total days	48.08%	54.56%	47.97%	40.74%	51.11%	49.50%	45.50%	53.64%	48.35%
% of positive pre-holidays	80.00%	58.33%	70.37%	45.21%	59.09%	50.00%	58.82%	59.09%	76.92%
χ^2-statistic	4.24 **	0.25	11.30 ***	0.71	1.10	0.00	1.33	0.24	8.78 ***
p-value	0.04	0.62	0.00	0.40	0.30	0.95	0.25	0.62	0.00
% of positive post-holidays	50.00%	60.42%	48.15%	59.72%	65.91%	66.67%	43.75%	72.73%	46.15%
χ^2-statistic	0.02	0.60	0.00	12.73 ***	3.77 *	5.00 **	0.02	2.99 *	0.05
p-value	0.90	0.44	0.98	0.00	0.05	0.03	0.88	0.08	0.82

Table 5 continued.

	Russia	Russia	Russia	Slovakia	Slovakia	Slovakia	Ukraine	Ukraine	Ukraine
Sub-period	**1991-2000**	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**	**1991-2000**	**2001-2005**	**2006-2010**
Total number of days	1390	1305	1305	1903	1305	1305	824	1305	1305
Number of normal days	1318	1230	1233	1774	1210	1208	777	1234	1225
Mean	-0.00039	0.00155	0.00005	0.00004	0.00112	-0.00028	-0.00109	0.00080	0.00087
Standard Deviation	0.0354	0.0184	0.0259	0.0135	0.0122	0.0120	0.0328	0.0625	0.0203
Number of pre-holidays	37	38	36	66	48	50	24	36	40
Mean	0.01267	0.00418	0.00059	0.00142	0.00392	-0.00233	0.00425	0.01688	-0.00223
Standard Deviation	0.0390	0.0169	0.0231	0.0245	0.0143	0.0114	0.0172	0.0704	0.0204
t-stat difference of means	-2.010 *	-0.944	-0.137	-0.454	-1.336	1.252	-1.444	-1.354	0.949
Number of post-holidays	36	38	36	66	49	49	23	36	40
Mean	0.01366	0.00000	0.01011	-0.00363	-0.00078	-0.00285	0.00887	0.00429	0.00093
Standard Deviation	0.0394	0.0295	0.0360	0.0202	0.0097	0.0222	0.0246	0.0462	0.0320
t-stat difference of means	-2.114 **	0.323	-1.664	1.453	1.322	0.808	-1.894 *	-0.441	-0.012
Frequency of Advances	**Russia**	**Russia**	**Russia**	**Slovakia**	**Slovakia**	**Slovakia**	**Ukraine**	**Ukraine**	**Ukraine**
% of positive total days	46.98%	53.64%	52.18%	44.98%	49.27%	38.70%	49.76%	49.81%	51.88%
% of positive pre-holidays	64.86%	65.79%	63.89%	60.61%	62.50%	42.00%	62.50%	61.11%	47.50%
χ^2-statistic	5.04 **	2.09	1.89	7.16 ***	3.41 *	0.28	1.57	1.85	0.30
p-value	0.02	0.15	0.17	0.01	0.06	0.60	0.21	0.17	0.59
% of positive post-holidays	66.67%	50.00%	69.44%	45.45%	46.94%	53.06%	60.87%	58.33%	55.00%
χ^2-statistic	5.94 **	0.19	4.11 **	0.01	0.11	5.23 **	1.14	1.05	0.15
p-value	0.01	0.66	0.04	0.94	0.74	0.02	0.29	0.31	0.70

The financial crisis not only has an impact on stock markets but also on the economies, currencies and individuals. It is possible that hard times affect investor behaviour. On average investors have less money during a financial crisis, therefore, in this case they will be investing and trading less than before.

6.1.3 Holiday effect robustness test

Seemingly unrelated regression (SUR) is used as a robustness test for the pre-holiday effect. Lewellen (1999) uses SUR model to adjust for a correlation between industries which is driven by many of the same macroeconomic factors. The author shows that SUR performs better than OLS regressions.

SUR is a system of equations which analyses equations simultaneously and assumes that error terms are correlated across regressions. This is different compared to OLS regression which considers each stock market index separately and does not consider a relationship between regression equations. SUR errors terms of the CEE countries can be correlated as the correlation can be driven by regional economic factors. Results of the SUR model are shown in Table 7. The table reports coefficient estimates and their significance levels as well as standard error for normal days and pre-holidays of each stock market. SUR is a matrix of equations based on the OLS model 3.

The average SUR standard error is only slightly lower than average OLS standard error of normal day and pre-holiday returns. Standard error of the pre-holiday returns went down from 0.001988 to 0.001866 which is a drop of 6.13 percent.

SUR results show abnormal pre-holiday returns only for the Russian stock index, significant at 10%. This suggests that pre-holiday returns in the CEE stock markets are partially driven by each other except for Russian stock market which seems to be driven mostly by its own holidays. This can also mean that Russian stock exchange is the least efficient out of all sample markets.

Table 6: Holiday effect robustness test

The table shows seemingly unrelated regression. SUR is a system of equations which are run simultaneously. The model adjusts for heteroskedasticity and correlation of errors terms between the equations. 'Normal' coefficients represent normal day returns while 'PreHol' coefficients represent pre-holiday returns for each country's stock market.

Country variable	Coefficient	Std. Error	t-Statistic	p-value
Bulgaria Normal	0.0004	0.0003	1.072	0.28
Bulgaria PreHol	0.0031	0.0021	1.478	0.14
Croatia Normal	0.0002	0.0003	0.818	0.41
Croatia PreHol	0.0021	0.0014	1.542	0.12
Czech Normal	0.0001	0.0002	0.342	0.73
Czech PreHol	0.0010	0.0010	1.014	0.31
Estonia Normal	0.0005 *	0.0003	1.906	0.06
Estonia PreHol	0.0002	0.0015	0.124	0.90
Hungary Normal	0.0006 ***	0.0002	2.762	0.01
Hungary PreHol	-0.0009	0.0012	-0.786	0.43
Latvia Normal	0.0004	0.0003	1.412	0.16
Latvia PreHol	0.0006	0.0018	0.356	0.72
Lithuania Normal	0.0004 *	0.0002	1.804	0.07
Lithuania PreHol	0.0016	0.0011	1.530	0.13
Poland Normal	0.0007 ***	0.0003	2.835	0.00
Poland PreHol	0.0008	0.0014	0.541	0.59
Romania Normal	0.0005	0.0003	1.517	0.13
Romania PreHol	0.0019	0.0021	0.930	0.35
Russia Normal	0.0005	0.0004	1.275	0.20
Russia PreHol	0.0045 *	0.0024	1.902	0.06
Serbia Normal	-0.0004	0.0004	-1.087	0.28
Serbia PreHol	0.0035	0.0028	1.278	0.20
Slovakia Normal	0.0002	0.0002	0.667	0.50
Slovakia PreHol	0.0008	0.0012	0.646	0.52
Slovenia Normal	0.0001	0.0004	0.312	0.76
Slovenia PreHol	0.0017	0.0019	0.882	0.38
Ukraine Normal	0.0006	0.0008	0.745	0.46
Ukraine PreHol	0.0053	0.0044	1.216	0.22

Significance levels: *** is 1%, ** is 5% and * is 10% significance

6.1.4 Stock-level pre-holiday robustness test

Table 8 presents the findings on five companies with largest market capitalisations in Czech, Hungarian, Polish, Romanian, Russian and Slovenian markets. More specifically the table presents OLS regression results of normal day and pre-holiday returns. All available data starting from 1991 to 2010 is used for the analysis.

Additionally, Table 9 reports the names of five largest companies for each of the six countries. Also it reports industry of operations, capitalisation measured in local currencies and percentage of index these companies make up.

Table 7: Company returns

Company returns are calculated using OLS regression and following this model
$R_t = \alpha_0 + \alpha_1 D_{PRE} + \in_t$
where D_{PRE} is a dummy variable equal to one before public holidays and zero otherwise; R_t is return for a company at a day t. P-value shows the significance of pre-holiday returns.

Czech Republic					
Company	**CEZ**	**ERS**	**KOM**	**STE**	**NWR**
Normal days	0.0003	0.0004	0.0004	0.0006	-0.0007
Pre-holiday	0.0012	-0.0003	0.0016	0.0010	0.0042
P-value	0.49	0.92	0.48	0.62	0.63
Hungary					
Company	**EGI**	**MMG**	**MTK**	**OTP**	**RIC**
Normal days	0.0005	0.0009	0.0000	0.0010	0.0009
Pre-holiday	0.0016	-0.0019	0.0017	-0.0001	-0.0026
P-value	0.47	0.39	0.37	0.97	0.23
Poland					
Company	**KGH**	**PKA**	**PKB**	**PLK**	**TP**
Normal days	0.0006	0.0005	0.0005	0.0003	0.0000
Pre-holiday	0.0066 **	-0.0025	-0.0008	0.0014	0.0026
P-value	0.02	0.30	0.80	0.53	0.23
Romania					
Company	**BRD**	**TEL**	**TGN**	**TLV**	**SNP**
Normal days	-0.0004	0.0007	-0.0011	0.0034	0.0006
Pre-holiday	0.0133 **	0.0012	0.0060	0.0003	0.0043
P-value	0.02	0.76	0.43	0.98	0.30
Russia					
Company	**GAZ**	**GMK**	**LKO**	**SBE**	**RSF**
Normal days	-0.0001	0.0014	0.0008	0.0013	0.0000
Pre-holiday	-0.0002	0.0005	0.0034	0.0035	0.0018
P-value	0.96	0.90	0.32	0.41	0.77
Slovenia					
Company	**TEL**	**KRK**	**MER**	**NOE**	**PET**
Normal days	-0.0011	0.0005	0.0005	-0.0017	0.0003
Pre-holiday	-0.0014	0.0031 **	0.0045 ***	0.0072 *	0.0035 **
P-value	0.62	0.03	0.01	0.06	0.02

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Some of the analysed stocks have fewer years of information than their analysed indices. However, three Slovenian companies with positive significant pre-holiday returns have data starting at the beginning of 1998. Slovenian index data on the other hand starts in April 2006. Three largest Slovenian companies capture positive significant pre-holiday returns for the earlier periods of the Slovenian stock market. One Polish (positive) and one Romanian (negative) company have significant pre-holiday returns.

Largest companies do not exhibit significant pre-holiday returns except for the Slovenian companies. It is possible that smaller sized companies are driving the abnormal pre-holiday returns in the CEE financial markets. However, smallest companies are not analysed in this study due to limited data. For the future research small capitalisation index should be investigated. This can reveal if the pre-holiday phenomenon is driven by the size effect.

6.2 Industry pre-holiday returns

The results of the industry holiday effect for six countries can be seen at Table 8. Normal day, pre-holiday and post-holiday returns of ten industries for Czech, Hungarian, Polish, Romanian, Russian and Slovenian markets are reported. Regression OLS analysis is carried out according to model 3.

There is some evidence of the pre-holiday effect in the industries. Czech financial market has no significant pre-holiday returns in any of the industry. Industries in Russian financial market have no significant pre-holiday returns and only industry to exhibit statistically significant (5% level) post-holiday returns is 'basic materials'. Hungry exhibits abnormal pre-holiday returns in consumer services and utilities industries. Polish consumer goods industry is significant at 1% and is the only industry to show abnormal returns in Poland. Slovenian market shows five industries which have positively significant returns a day before holidays. Two of them are significant at 1% and other three are at 5%. Slovenian industries have more data compared to its stock index. Larger industry sample captures holiday effect in Slovenian for the earlier periods.

Observed post holiday findings are as follows, Romanian market has no significant post-holiday returns in any of the industries. Czech and Russian financial markets only have one industry with significant positive post-holiday returns. Three industries in Polish and five industries in Hungarian stock markets show abnormal and significant post-holiday returns. Slovenian market shows negative returns after holidays and consumer goods is significantly negative at 1%.

Table 8: Company list

Five companies are chosen from each of the six markets by largest capitalisation. Company capitalisations are listed in domestic currencies. The percentage of index represents the value that company holds in the studied stock market index.

CZK – Czech koruna, HUF – Hungarian forint, PLN – Polish Zloty, RON – Romanian leu, RUR – Russian ruble, EUR – Euro dollar.

Code	Company name	Industry	Capitalisation	% of index
Czech Republic			**CZK (millions)**	
CEZ	ČEZ	Electricity	504,903	33.04%
ERS	Erste Group Bank	Bank	311,239	20.37%
KOM	Komercni Banka	Bank	163,442	10.70%
STE	Telefonica O2 C.R.	Fixed Line Telecommunications	133,667	8.75%
NWR	New World Resources	Mining	75,174	4.92%
Hungary			**HUF (millions)**	
EGI	Egis	Pharmaceuticals & Biotechnology	154,936	2.63%
MMG	MOL	Oil and Gas Producers	2,455,662	41.73%
MTK	Magyar Telekom share	Fixed Line Telecommunications	581,850	9.89%
OTP	OTP Bank	Bank	1,743,000	29.62%
RIC	Richter Gedeon	Pharmaceuticals & Biotechnology	705,429	11.99%
Poland			**PLN (millions)**	
KGH	KGHM	Industrial Metals & Mining	25,086	14.05%
PKA	Pekao	Bank	18,809	10.54%
PKB	PKO Bank	Bank	27,823	15.58%
PLK	PKN Orlen	Oil and Gas producer	16,414	9.19%
TP	Telekomunikacja	Fixed Line Telecommunications	10,856	6.08%
Romania			**RON (millions)**	
SNP	SNP Petrom	Oil & Gas Producers	24,272	48.67%
BRD	BRD Groupe Societe GL.	Banks	10,188	20.43%
TGN	S.N.T.G.N Transgaz	Oil Equipment & Services	2,955	5.93%
TLV	Banca Transilvania Cluj	Banks	2,058	4.13%
TEL	C.N.T.E.E. Transelectrica	Electricity	1,540	3.09%
Russia			**RUR (millions)**	
GAZ	Gazprom	Oil and Gas Producers	4,586,743	15%
GMK	Norilsk Nickel	Industrial Metal and Mining	1,365,864	7.56%
LKO	Lukoil	Oil and Gas Producers	1,476,679	14.02%
SBE	Sberbank	Bank	2,257,563	13.88%
RSF	OC Rosneft	Oil & Gas Producers	2,325,982	7.00%
Slovenia			**EUR (millions)**	
KRK	KRKA	Pharmaceuticals & Biotechnology	485	29.25%
MER	Mercator	General Retailers	350	21.15%
NOE	Nova Kreditna Banka Maribor	Banks	159	9.62%
PET	Petrol Group	Oil & Gas Producers	365	22.01%
TEL	Telekom Slovenije	Fixed Line Telecommunications	170	10.28%

Table 9: Industry holiday effect

The table reports holiday effect in ten industries for six countries. OLS regression according to formula (3) is carried out:

$R_t = \alpha_0 + \alpha_1 D_{PRE} + \alpha_2 D_{POST} + \in_t$

R_t is return on industry index, D_{PRE} is a dummy variable equal to one before public holidays and D_{POST} is a dummy variable equal to first trading day after holidays. PreHol and PostHol represent coefficient estimates on pre-holiday and post-holiday dummy variables.

Czech Republic						
Industry	**normal days**	**p-value**	**PreHol**	**p-value**	**PostHol**	**p-value**
Basic Materials	0.0001	0.71	0.0011	0.39	0.0009	0.50
Consumer Goods	0.0000	0.91	0.0003	0.87	-0.0005	0.77
Consumer Services	0.0001	0.84	0.0041	0.11	-0.0008	0.75
Financials	0.0003	0.31	0.0022	0.22	0.0029	0.10
Health Care	-	-	-	-	-	-
Industrials	0.0004 **	0.02	0.0008	0.38	-0.0007	0.48
Oil and Gas	0.0006 **	0.04	0.0005	0.75	0.0000	0.98
Technology	-	-	-	-	-	-
Telecommunication	0.0002	0.59	0.0015	0.39	0.0022	0.22
Utilities	0.0003	0.17	0.0014	0.32	0.0039 ***	0.01
Hungary						
Industry	**normal days**	**p-value**	**PreHol**	**p-value**	**PostHol**	**p-value**
Basic Materials	0.0003	0.34	0.0030	0.12	0.0032 *	0.10
Consumer Goods	0.0002	0.57	0.0022	0.26	0.0015	0.42
Consumer Services	-0.0001	0.65	0.0040 **	0.02	0.0055 ***	0.00
Financials	0.0008 **	0.05	0.0003	0.87	0.0062 ***	0.00
Health Care	0.0006 *	0.08	-0.0013	0.46	0.0035 *	0.05
Industrials	-0.0003	0.53	0.0030	0.19	0.0005	0.84
Oil and Gas	0.0007 *	0.07	-0.0017	0.43	0.0034	0.12
Technology	-0.0006	0.21	0.0006	0.81	-0.0010	0.71
Telecommunication	-0.0002	0.68	0.0020	0.30	0.0051 ***	0.01
Utilities	0.0002	0.48	0.0050 ***	0.00	0.0010	0.55
Poland						
Industry	**normal days**	**p-value**	**PreHol**	**p-value**	**PostHol**	**p-value**
Basic Materials	0.0005 *	0.07	0.0017	0.29	0.0034 **	0.04
Consumer Goods	0.0002	0.58	0.0044 ***	0.01	0.0024	0.13
Consumer Services	0.0005	0.11	-0.0002	0.91	0.0023	0.21
Financials	0.0004	0.16	0.0011	0.48	0.0034 **	0.03
Health Care	-	-	-	-	-	-
Industrials	0.0000	0.99	0.0011	0.49	0.0020	0.21
Oil and Gas	0.0004	0.30	0.0010	0.63	0.0041 **	0.05
Technology	0.0000	0.94	0.0005	0.83	0.0001	0.96
Telecommunication	0.0000	0.93	0.0011	0.62	0.0026	0.22
Utilities	0.0003	0.49	-0.0038	0.13	0.0032	0.21

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Table 9 continued.

Romania						
Industry	**normal days**	**p-value**	**PreHol**	**p-value**	**PostHol**	**p-value**
Basic Materials	0.0004	0.41	0.0194 ***	0.00	-0.0023	0.49
Consumer Goods	0.0000	0.99	-0.0004	0.94	0.0014	0.80
Consumer Services	0.0007	0.30	0.0049	0.34	0.0003	0.95
Financials	0.0006	0.23	0.0018	0.60	-0.0001	0.98
Health Care	0.0004	0.33	0.0081 ***	0.01	0.0000	0.99
Industrials	0.0009 **	0.02	0.0039	0.18	-0.0005	0.86
Oil and Gas	0.0005	0.26	0.0016	0.64	0.0020	0.56
Technology	-	-	-	-	-	-
Telecommunication	-	-	-	-	-	-
Utilities	0.0001	0.89	0.0021	0.74	-0.0057	0.38
Russia						
Industry	**normal days**	**p-value**	**PreHol**	**p-value**	**PostHol**	**p-value**
Basic Materials	0.0010 *	0.08	0.0007	0.82	0.0069 **	0.03
Consumer Goods	0.0008	0.11	0.0020	0.50	0.0018	0.53
Consumer Services	0.0014	0.59	0.0006	0.97	0.0074	0.62
Financials	0.0011	0.10	0.0040	0.33	0.0033	0.42
Health Care	0.0006	0.64	0.0024	0.74	0.0091	0.22
Industrials	0.0012	0.18	-0.0042	0.44	0.0041	0.47
Oil and Gas	0.0009	0.11	0.0027	0.41	0.0053	0.11
Technology	-	-	-	-	-	-
Telecommunication	0.0007	0.29	0.0001	0.99	0.0067	0.11
Utilities	0.0006	0.38	0.0059	0.16	0.0025	0.55
Slovenia						
Industry	**normal days**	**p-value**	**PreHol**	**p-value**	**PostHol**	**p-value**
Basic Materials	0.0000	0.92	0.0029	0.13	-0.0004	0.83
Consumer Goods	0.0000	0.97	0.0030 **	0.01	-0.0034 ***	0.00
Consumer Services	0.0002	0.34	0.0032 ***	0.01	0.0008	0.50
Financials	0.0001	0.84	0.0040 **	0.04	-0.0019	0.31
Health Care	0.0005 **	0.04	0.0028 **	0.04	-0.0010	0.49
Industrials	-0.0001	0.72	0.0009	0.51	0.0014	0.29
Oil and Gas	0.0001	0.82	0.0041 ***	0.00	-0.0007	0.60
Technology	-	-	-	-	-	-
Telecommunication	-0.0011 **	0.03	-0.0009	0.75	0.0024	0.39
Utilities	-	-	-	-	-	-

Overall, there is some evidence of industries having a holiday effect. Hypothesis 2 cannot be rejected only for Czech and Russian and Romanian stock markets. Slovenian, Hungarian and Polish stock markets show strong evidence of significant returns around holidays, this strongly goes against the hypothesis.

The holiday effect is not limited to the retail industry as previously expected. There is some indication that the retail industry can be expected to yield more significant returns than other industries before holidays. Consumer goods and consumer services industries are related to the retail industry which is found to be significant in Australian stock market

(Marrett and Worthington, 2009). Polish consumer goods, Hungarian consumer services and Slovenian consumer goods/services show significant returns for these industries. So there is some evidence to support the idea that consumer goods and service industries can be expected to produce higher than normal returns. There is no evidence of ability to predict significant returns for any other industry before holidays. Basic materials industry returns have some post-holiday predictability.

6.3 Liquidity

Five largest by market capitalisation companies in Czech, Hungarian, Polish, Romanian, Russian and Slovenian financial markets are used to analyse stock liquidity before holidays. The chosen largest five stocks for each country contribute significant portions to total index capitaliations. The five chosen Polish companies contribute 55 percent of capitalisation to the total Polish index while the Hungarian five companies equal to 96 percent of total index capitalisation. For the Czech Republic, Poland and Romania, one of the largest companies has less than three years of liquidity data, therefore, next largest capitalisation company is chosen.

Table 10 presents the results of trading volume turnover analysis. More specifically detrended volume turnover is reported for normal days and pre-holidays for five largest companies of the six countries. T-statistic is used to test equality of trading volume turnover of normal days and pre-holidays and significance is presented by p-value. The null hypothesis is that volume turnover is equal between normal days and pre-holidays.

The results show that 26 out of 30 companies have lower detrended volume a day before holidays compared to the normal days. This is consistent with the findings of Cao et al (2009) and Meneu and Pardo (2004) that there is lighter trading before holidays. Significantly lower detrended volume can be seen in three Russian, two Polish, two Slovenian and one Romanian company.

Table 11 reports the relative bid-ask spreads for normal days and for pre-holidays and their significance levels are represented by p-values. Equality of bid-ask spreads is tested using t-statistic. There are fewer years of data available on bid and ask prices on the same companies than for the volume turnover data. Czech and Romanian companies do not have any or have less than three year of bid-ask information, therefore, they are not analysed.

For the Hungarian companies, bid-ask spreads are higher before holidays and only significantly so for MTK. Two Russian and one Slovenian company have significantly lower spreads, while Polish company PKB has significantly higher bid-ask spread prior holidays. In total 14 out of 20 companies have higher spreads before holidays.

Table 10: Volume turnover

Table reports detrended volume turnover for normal days and pre-holidays. T-statistic is used to test the equality of means between normals days and pre-holidays. P-value shows significance of the difference between pre-holiday and normal day volume turnover. Detrended volume for each company stock is separately calculated by dividing daily volume turnover by average volume turnover of that company.

			Chez Republic		
Company	**CEZ**	**ERS**	**KOM**	**STE**	**NWR**
Normal days	1.0035	1.0032	1.0033	1.0016	1.0018
Pre-holiday	0.8990	0.9149	0.9044	0.9554	0.9536
P-value	0.16	0.36	0.24	0.70	0.84
			Hungary		
Company	**EGI**	**MMG**	**MTK**	**OTP**	**RIC**
Normal days	1.0012	1.0022	1.0002	1.0024	0.9999
Pre-holiday	0.9604	0.9395	0.9942	0.9326	1.0084
P-value	0.70	0.40	0.94	0.44	0.92
			Poland		
Company	**KGH**	**PKA**	**PKB**	**PLK**	**TP**
Normal days	1.0049	1.0017	0.9861	1.0044	1.0039
Pre-holiday	0.8593	0.9503	1.3823	0.8766	0.8888
P-value	0.08 *	0.62	0.47	0.07 *	0.22
			Romania		
Company	**BRD**	**TEL**	**TGN**	**TLV**	**SNP**
Normal days	1.0009	1.0058	1.0079	1.0004	0.9922
Pre-holiday	0.9781	0.7601	0.6947	0.9827	1.3861
P-value	0.89	0.36	0.02 **	0.90	0.11
			Russia		
Company	**GAZ**	**GMK**	**LKO**	**SBE**	**RSF**
Normal days	1.0064	1.0058	1.0049	1.0040	1.0026
Pre-holiday	0.7764	0.7989	0.8180	0.8509	0.9024
P-value	0.01 ***	0.02 **	0.02 **	0.34	0.41
			Slovenia		
Company	**KRK**	**MER**	**NOE**	**PET**	**TEL**
Normal days	1.0073	0.9943	1.0018	1.0105	1.0037
Pre-holiday	0.7964	1.1598	0.9955	0.7068	0.9031
P-value	0.04 **	0.65	0.98	0.01 **	0.50

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Table 11: Bid-ask spread

Relative bid-ask spread for the five largest companies of four markets is reported. T-statistic is used to test the equality of relative spreads between normal days and pre-holidays. P-value shows the significance of the different between spreads.

			Hungary		
Company	**EGI**	**MMG**	**MTK**	**OTP**	**RIC**
Normal days	0.0334	0.0155	0.0159	0.0154	0.0220
Pre-holiday	0.0358	0.0171	0.0180	0.0175	0.0231
P-value	0.43	0.16	0.07 *	0.15	0.56
			Poland		
Company	**KGH**	**PKA**	**PKB**	**PLK**	**TP**
Normal days	0.0023	0.0038	0.0011	0.0024	0.0029
Pre-holiday	0.0028	0.0037	0.0027	0.0022	0.0038
P-value	0.19	0.71	0.02 **	0.62	0.11
			Russia		
Company	**GAZ**	**GMK**	**LKO**	**SBE**	**RSF**
Normal days	0.0005	0.0014	0.0025	0.0118	0.0009
Pre-holiday	0.0008	0.0015	0.0015	0.0058	0.0010
P-value	0.20	0.63	0.05 *	0.02 **	0.89
			Slovenia		
Company	**KRK**	**MER**	**NOE**	**PET**	**TEL**
Normal days	0.0042	0.0132	0.0127	0.0088	0.0091
Pre-holiday	0.0046	0.0139	0.0101	0.0099	0.0084
P-value	0.55	0.69	0.10 *	0.19	0.58

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Overall, there is little evidence suggesting that trading volume and relative bid-ask spread can help explain the pre-holiday effect. Czech, Hungarian, Romanian and Slovenian companies mostly show equality of volume turnover and spreads between normal days and pre-holidays. Equality of volume turnover and spreads is consistent with hypothesis 3. However, Russian and Polish companies do not hold up to hypothesis 3. Russian companies show most significant differences in the liquidity. Three of the Russian companies have statistically different volumes at least at 10% level. Two polish companies show significantly higher relatives spreads and two other companies have significantly different trading volume, one lower and one higher.

6.3.1 Liquidity: Robustness test

To check the accuracy of the liquidity results, one percent of highest and lowest of volume turnover and relative spread values are removed from the pre-holiday and normal day data. This robustness test checks if the significant liquidity values are really significant or driven by extreme positive or negative values (outliers). Tables 12 and 13 report results of the robustness test. The tables show new volume turnover and relative spread values for normal days and pre-holidays for five largest companies of studied markets.

Volume turnover for two Romanian companies TEL and SNP has become significantly lower after removing outliers. Significance in the different of volume turnover for the Slovenian company KRK has decrease from five percent to ten percent. In total, 23 out of 30 companies have lower trading volume one day prior to holidays. This is similar to previous result of 26 out 30 companies and it is still consistent with the gone fishin' effect.

Additional one Hungarian company shows significantly higher pre-holiday spreads before holidays. Russian company RSF shows significantly lower spread after the test. Bid-ask spreads are higher for 13 out of 20 countries. Higher spreads indicate that trading costs increase before holidays.

In summary, the removal of top and bottom outliers show that the results are consistent with previous findings. Pre-holiday volume turnovers are lower and relative spreads are higher before holidays. After the additional test, Russian and Romanian financial markets do not hold up to hypothesis 3, as at least three companies in these markets show significantly different volume turnover or spreads before holidays.

Table 12: Volume turnover; robustness test

Table reports reduced sample of detrended volume turnover for normal days and pre-holidays. One percent of highest and lowest detrended volume turnover is deleted to remove any outliers. T-statistic is used to test the equality of means between normal days and pre-holidays. P-value shows significance of the difference between pre-holiday and normal day volume turnover.

			Chez Republic		
Company	**CEZ**	**ERS**	**KOM**	**STE**	**NWR**
Normal days	0.9661	0.9715	0.9685	0.9113	0.9708
Pre-holiday	0.8792	0.8874	0.8766	0.8833	0.7821
P-value	0.21	0.34	0.24	0.76	0.11
			Hungary		
Company	**EGI**	**MMG**	**MTK**	**OTP**	**RIC**
Normal days	0.9151	0.9419	0.9732	0.9575	0.9557
Pre-holiday	0.9329	0.9240	0.9786	0.9110	0.9865
P-value	0.85	0.80	0.94	0.59	0.71
			Poland		
Company	**KGH**	**PKA**	**PKB**	**PLK**	**TP**
Normal days	0.9717	0.9577	0.9532	0.9794	0.9683
Pre-holiday	0.8398	0.9168	0.8602	0.8604	0.8425
P-value	0.10 *	0.67	0.33	0.07 *	0.11
			Romania		
Company	**BRD**	**TEL**	**TGN**	**TLV**	**SNP**
Normal days	0.9147	0.8928	0.9075	0.9004	0.8602
Pre-holiday	0.8811	0.5517	0.6689	0.9269	1.2695
P-value	0.78	0.01 **	0.05 **	0.83	0.04 **
			Russia		
Company	**GAZ**	**GMK**	**LKO**	**SBE**	**RSF**
Normal days	0.9954	0.9782	0.9767	0.8984	0.9814
Pre-holiday	0.7654	0.7690	0.7966	0.7947	0.8620
P-value	0.00 ***	0.01 **	0.02 **	0.48	0.25
			Slovenia		
Company	**KRK**	**MER**	**NOE**	**PET**	**TEL**
Normal days	0.8763	0.7197	0.7263	0.7908	0.9288
Pre-holiday	0.7430	0.8911	0.8849	0.6275	0.8455
P-value	0.08 *	0.46	0.47	0.01 **	0.51

Significance levels: *** is 1%, ** is 5% and * is 10% significance

Table 13: Bid-ask spread, robustness test

Reduced relative bid-ask spread for five largest companies of four financial markets is reported. One percent of top and bottom of relative spread data is deleted from the sample to get rid of any outliers. T-statistic is used to test the equality of relative spreads between normal days and pre-holidays. P-value shows the significance of the different between spreads.

			Hungary		
	EGI	**MMG**	**MTK**	**OTP**	**RIC**
Normal days	0.0303	0.0152	0.0156	0.0149	0.0215
Pre-holiday	0.0349	0.0168	0.0178	0.0172	0.0224
P-value	0.08 *	0.11	0.05 *	0.10	0.60
			Poland		
	KGH	**PKA**	**PKB**	**PLK**	**TP**
Normal days	0.0022	0.0037	0.0010	0.0022	0.0028
Pre-holiday	0.0027	0.0035	0.0025	0.0021	0.0036
P-value	0.16	0.71	0.02 **	0.71	0.11
			Russia		
	GAZ	**GMK**	**LKO**	**SBE**	**RSF**
Normal days	0.0005	0.0013	0.0021	0.0072	0.0009
Pre-holiday	0.0007	0.0014	0.0012	0.0044	0.0005
P-value	0.17	0.62	0.03 **	0.06 *	0.08 *
			Slovenia		
	KRK	**MER**	**NOE**	**PET**	**TEL**
Normal days	0.0041	0.0126	0.0124	0.0084	0.0084
Pre-holiday	0.0042	0.0134	0.0097	0.0096	0.0080
P-value	0.78	0.60	0.05 *	0.20	0.59

Significance levels: *** is 1%, ** is 5% and * is 10% significance

7. Conclusion

This study looks at the holiday effect in the developing financial markets of Central and Eastern Europe for the period of 1991 to 2010. Using the sample of fourteen CEE countries, pre-holiday and post-holiday returns are analysed and compared to normal day returns. In addition, stock market returns around individual public holidays are examined. Using the sample of six CEE markets, holiday effect is investigated in a number of industries. Lastly the study looks at the liquidity before holidays.

The study extends the finance literature on the holiday effect in developing financial markets. The contribution of this study is up-to-date analysis of stock market behaviour

around public holidays in the emerging markets of Central and Eastern Europe. The study confirms the presence of the pre-holiday effect and also documents positive and significant post-holiday returns. The former result is in line with the literature by Alagidede (2008), Cao et al (2009) and Meneu and Pardo (2004) who also find significant pre-holiday returns. The latter finding is in contrast to existing empirical evidence of Tonchev and Kim (2004) and Lee et al (1990) as these two studies do not find significantly positive post-holiday returns. The findings of this study can be useful for investors to be able to make more informed investment decisions. More importantly, the findings of this study contribute to the existing empirical evidence on the holiday effect as it provides new evidence on post-holiday stock market returns.

Financial stock markets of the CEE exhibit higher pre-holiday returns and higher proportion of positive returns in the first operating years of these markets. This can be interpreted as that first years of operations are least efficient. Serbian stock market is the latest financial market to open in the region and has abnormal pre-holiday returns. Therefore, the evidence is in line with the arguments that the anomaly is most significant in the new financial markets which still have weak financial infrastructure.

Overall, there is weak evidence of the presence of the pre-holiday effect. Significance of the pre-holiday returns has decreased over time for the most of the studied markets. Possible interpretation of the findings is that the developing CEE markets are becoming more efficient over time. It is possible that capitalisation growth of the indices, new listed companies, increased number of trading participants in the markets and improvements in financial regulations have improved market efficiency over the time. It is also possible that investors are becoming more educated on the topic of equity trading. Nevertheless, the Bulgarian, Lithuanian, Romanian and Serbian stock indices show significant pre-holiday returns in the 2006-2010 period. Serbia has the youngest stock market out of the fourteen analysed countries, which could explain the significant pre-holiday returns. On the other hand, Bulgarian, Lithuanian and Romanian stock markets are neither the youngest nor the smallest. It is possible that these three countries have the least developed financial infrastructure along with Serbia during the later years.

This study provides some evidence to support the hypothesis that ‘retail industry’ is more significant than other industries as found by Marrett and Worthington (2009). Three

studied countries show abnormal pre-holiday returns for consumer goods and services industries which are related to the retail industry. Slovenian market shows most significant industry pre-holiday returns. There is some post-holiday adjustment in Slovenian industries for the abnormal returns before holidays as five out of eight industries have negative returns after holidays. Hungarian market has most industries with abnormal post-holiday returns. Overall, there is weak holiday effect in the industries and only the consumer goods and service industry returns have some predictive power before holidays.

Stock-level analysis of liquidity showed that during the pre-holiday period, volume turnover is lower than on normal trading days. In turn the relative bid-ask spreads are higher compared to normal days. This suggests that investors do not trade as much during pre-holidays as they normally do. Bid-ask spread is used as a trading cost proxy and according to the results, trading becomes more expensive for investors before holidays.

Overall this study helps to better understand the pre- and post- holiday returns in the CEE financial markets. There is limited explanation what is driving the abnormal pre-holiday returns. Investor behaviour does seem to play some role in the pre-holiday effect as seen from lower turnover volumes before holidays. Although there are abnormal pre-holiday returns, increase in relative spreads suggests that investors will have harder time making a profit on the anomaly.

One of the limitations of this study is the availability of data. For some of the stock indices, data is only available few years after the stock exchanges started operating. This includes countries such as Bulgaria and Slovenia. The study gives a good indication of the pre-holiday effect in these countries, however, the missing data of earlier operating years results in less accurate findings. Also, with lesser amount of years the earlier sub-periods of Slovenian and Bulgarian stock indices cannot be analysed. Turnover by volume, bid and ask prices only capture liquidity for the later years due to lack of earlier years of data.

Although this study provides evidence on the holiday effect in CEE markets, still there are unanswered questions that could be addressed in the future research. Firstly, only five largest by capitalisation companies are considered in the analysis of stock liquidity. For the future research, small capitalisation index or a selection of smallest by capitalisation

companies should be researched. This can reveal if the pre-holiday phenomenon in the CEE is driven by the size effect. Liquidity of the smaller companies should also be considered.

Another extension can be to investigate holiday effect significance by controlling for other market anomalies besides the size effect. Other anomalies include: turn of the month, January effect and day of the week effect. This will not only test the significance of the holiday effect but also reveal if there are other anomalies present in the CEE region. However, previously in literature the regression adjustments only were made to test significance of the pre-holiday effect. In the future research, adjustments for post-holidays should also be done.

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Appendix 1: List of public holidays in sample markets

The listed public holidays result in stock market closure in their respective markets.

Bulgaria	
Holidays	**Date**
Christmas	25 December
Easter Orthodox	Varies
Education Day	24 May
Independence Day	22 September
Labor Day	01 May
Liberation Day	3 March
New Year	31 December
St. George Day	6 May
Unification Day	06 September

Czech Republic	
Holidays	**Date**
Christmas	25 December
Democracy Day	17 November
Easter	Varies
Independence Day	28 October
Labor Day	01 May
Liberation Day	08 May
New Year	31 December
Saints Cyril Day	5 July
St. Wenceslas Day	28 September

Croatia	
Holidays	**Date**
All Saints Day	1 November
Anti Fascist Struggle Day	22 June
Assumption Day	15 August
Christmas	25 December
Corpus Christi	Varies
Easter	Varies
Independence Day	8 October
Labor Day	01 May
New Year	1 January
Statehood Day	25 June
Three Kings Day	6 January
Victory Day	5 August

Estonia	
Holidays	**Date**
Christmas	25 December
Easter	Varies
Independence Day	24 February
Labor Day	01 May
New Year	31 December
Restoration of Estonia	20 August
Victory Day Estonia	23 June

Hungary	
Holidays	**Date**
All Saints Day	01 November
Christmas	25 December
Easter	Varies
Labor Day	01 May
New Year	1 January
Republic Day	23 October
St. Stephen Day	20 August
Uprising Anniversary	15 March
Whit Monday	Varies

Latvia	
Holidays	**Date**
Ascension Day	Varies
Christmas	25 December
Declaration of Independence	04 May
Easter	Varies
Independence Day	18 November
Labor Day	01 May
Mid Summer Day	23 June
New Year	31 December

Appendix 1 continued

Lithuania	
Holidays	**Date**
All Saints Day	01 November
Ascension Day	Varies
Assumption Day	15 August
Christmas	25 December
Declaration of Independence Day	16 February
Easter	Varies
Labor Day	01 May
New Year	31 December
Reestablishment of Independence	11 March
St. John's Day	24 June
Statehood Day	6 July

Poland	
Holidays	**Date**
All Saints Day	01 November
Assumption Day	15 August
Christmas	25 December
Constitution Day	May 3
Corpus Christi	Varies
Easter	Varies
Independence Day	11 November
Labor Day	01 May
New Year	1 January

Romania	
Holidays	**Date**
Christmas	25 December
Easter Orthodox	Varies
Labor Day	01 May
National Day	1 December
New Year	31 December
Whit Monday Orthodox	Varies

Serbia	
Holidays	**Date**
Christmas - Orthodox	7 January
Constitution Day	15 February
Easter	Varies
Labor Day	01 May
New Year	1 January

Russia	
Holidays	**Date**
Christmas - Orthodox	7 January
Constitution Day	12 December
Defenders of Motherland Day	23 February
International Women's Day	8 March
Labor Day	01 May
National Unity Day	4 November
New Year	1 January
Russia Day	12 June
Victory Day	9 May

Slovakia	
Holidays	**Date**
All Saints Day	1 November
Christmas	25 December
Constitution Day	1 September
Democracy Day	17 November
Easter	Varies
Epiphany	6 January
Labor Day	01 May
New Year	1 January
Our Lady of Sorrows	15 September
Slovak National Uprising Day	29 August
St. Cyril Day	5 July
Victory Day	8 May

Slovenia	
Holidays	**Date**
All Saints Day	1 November
Assumption Day	15 August
Christmas	25 December
Easter	Varies
Labor Day	01 May
New Year	31 December
Preseren Day	8 February
Resistance Day	27 April
Statehood Day	25 June

Ukraine	
Holidays	**Date**
Christmas Orthodox	7 January
Constitution Day	28 June
Easter - Orthodox	Varies
Independence Day	24 August
International Women's Day	8 March
Labor Day	01 May
New Year	1 January
Pentecost Orthodox	Varies
Victory Day	9 May

Appendix 2: Dividend adjusted indices vs. non adjusted indices

The table reports results of a test on significance of inclusion of dividend yield into index prices. OLS regression according to formula (3) is carried out:

$R_t = \alpha_0 + \alpha_1 D_{PRE} + \alpha_2 D_{POST} + \in_t$

R_t is return on industry index, D_{PRE} is a dummy variable equal to one before public holidays and D_{POST} is a dummy variable equal to first trading day after holidays. PreHol and PostHol represent coefficient estimates on pre-holiday and post-holiday dummy variables.

Country	**Czech Republic**			**Poland**		
Industry	**Basic materials**	**Financials**	**Oil & gas**	**Basic materials**	**Financials**	**Oil & gas**
Return Index						
Pre-holiday mean	0.00111	0.00216	0.00050	0.00171	0.00109	0.00098
t-stat	0.857	1.226	0.327	1.047	0.706	0.483
p-value	0.3915	0.2204	0.7437	0.2952	0.4803	0.6292
Post-holiday mean	0.00088	0.00289	-0.00003	0.00342	0.00346	0.00406
t-stat	0.674	1.636	-0.018	2.082	2.233	2.004
p-value	0.5005	0.102	0.986	0.0374 **	0.0256 **	0.0451 **
Normal day mean	0.00001	0.00018	0.00042	0.00038	0.00031	0.00030
t-stat	0.061	0.550	1.521	1.274	1.088	0.819
p-value	0.9515	0.5822	0.1283	0.2026	0.2765	0.4127
Total Return Index						
Pre-holiday mean	0.00111	0.00215	0.00049	0.00173	0.00109	0.00097
t-stat	0.852	1.222	0.324	1.055	0.705	0.479
p-value	0.3942	0.2217	0.7462	0.2916	0.4811	0.632
Post-holiday mean	0.00088	0.00289	-0.00003	0.00343	0.00345	0.00405
t-stat	0.675	1.638	-0.020	2.088	2.226	2.000
p-value	0.4995	0.1015	0.9844	0.0369 **	0.0260 **	0.0455 **
Normal day mean	0.00009	0.00032	0.00057	0.00053	0.00039	0.00038
t-stat	0.375	1.009	2.073	1.784	1.402	1.035
p-value	0.7077	0.3131	0.0382 **	0.0745 *	0.161	0.3007

Significance levels: *** is 1%, ** is 5% and * is 10% significance.