

Analyzing the Existence of the Day of the Week Effect in Selected Developed Country Stock Exchanges

Murat Çinko¹, Emin Avcı¹, Aslı Aybars¹ & Mehtap Öner¹

¹ Faculty of Business Administration, Marmara University, Istanbul, Turkey

Correspondence: Aslı Aybars, Faculty of Business Administration, Marmara University, Istanbul, 34810, Turkey.
Tel: 90-212-507-9925-1304. E-mail: asli.aybars@marmara.edu.tr

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Abstract

The presence of asymmetries in stock returns, known as seasonal anomalies, has been rigorously probed in the array of academic literature evaluating the validity of Efficient Market Hypothesis. Even though there is an abundance of studies focusing on the presence of the day of the week effect, no clear-cut findings have been documented in both developed and emerging market stock exchanges. This paper attempts to investigate whether the day of the week effect exists on an initial dataset of 33 developed stock indices in the period between 1999 and 2013. However, the final dataset encompasses 24 indices belonging to 16 countries due to statistical considerations. The significant findings as to negative Monday and positive Friday returns belong to 3 and 6 of the indices, respectively. Whereas none of the markets demonstrates any significant Tuesday returns, only two of the markets show significantly negative Wednesday returns. Additionally, significant and positive Thursday returns are observed in 2 of the indices. Therefore, no systematic pattern has been detected as to the presence of the day of the week effect in selected developed stock indices during the period analyzed.

Keywords: day of the week effect, developed country stock markets, efficient market hypothesis

1. Introduction

The presence of stock market anomalies have been extensively investigated and documented in both emerging and developed markets. Evidence in favor of calendar anomalies has cast doubt upon the validity of the Efficient Market Hypothesis (EMH). The building blocks of this theory emerged in the early 1930s; whereby, the preliminary study of Fields (1931) probes the readjustment of speculative positions on the Dow-Jones daily average of industrials during the period between 1915 and 1930. Saturday index is compared with the arithmetic mean of Friday and Monday indices to examine whether the traders are unwilling to carry their holdings over the uncertainties of a weekend. However, the findings do not provide any clear-cut conclusion on the existence of a relationship between stock price movements and days of the week.

The crucial study of Fama (1970) is the cornerstone of the EMH which states that all available information regarding a security is fully reflected in its price. Therefore, all securities in the market will be appropriately priced providing an adequate return for a given level of risk. There is no possibility for an investor to beat the market and earn abnormal returns. However, numerous studies have documented empirical evidence contrary to the propositions of this theory. A basic area of research in this strand of literature investigates calendar anomalies or seasonal effects; whereby, a stock's past price movements can be qualified to be valid information in estimating that stock's future price movement. One of the mostly explored calendar anomalies is the Day-of-the-week (DoW) effect, which states that stock returns are not identically distributed for all days of the week. This implies that investors can attain abnormal returns by investing in securities on days with lower than average returns and liquidating them on days with higher than average returns.

This study aims to investigate the existence of the DoW effect in selected developed markets during an observation period of 14 years. The structure of the paper is organized in the following manner; the next section provides recent empirical literature on developed market indices. Then, information regarding the study's methodology and model is provided. Empirical findings are documented in the subsequent section. Lastly, concluding remarks are provided together with theoretical and practical implications.

2. Literature Review

Beginning with the initial empirical studies of Fields (1931), Fama (1965), Cross (1973), and French (1980); the DoW phenomenon has been investigated in many stock exchanges of both developed and emerging markets with a focus on various dimensions like different indices, investors and other potential financial market factors. Mostly probed daily abnormal return is the traditional weekend effect which reports significantly negative and positive returns on Monday and last trading day of the week, respectively. Several hypotheses have been proposed as explanations for the difference between daily returns. One of the arguments that have been provided to justify the Monday effect rests upon the information release hypothesis stating that whereas good news are released by the firms immediately, the release of bad news is delayed until the closing of the session on Friday to prevent the reduction of investor demand until Monday. In other words, panic selling is being avoided by keeping negative information until weekend, which is stated in the study of Dellavigna and Pollet (2009). Alternatively, the settlement hypothesis, which is proposed by Gibbons and Hess (1981), states that the differences in daily stock returns may arise due to the timing difference between the transaction and its settlement. This implies that buying on Fridays provides an interest free loan over the weekend until settlement, which results in a higher volume of transactions; thus, a higher price on Fridays (Caporale & Gil-Alana, 2011). Individual investor behavior is also provided as an explanation for the DoW effect in that individuals have more time to evaluate the market other than relying on broker advice and undergo more activity on Mondays usually resulting in net sales; thus, pushing prices downwards. Additionally, the advice provided by brokers, which is biased towards buying securities, is available during the week (Miller, 1988). These two factors lead to the dominance of sell orders on Mondays by individuals.

As the purpose of this study is to evaluate the existence of DoW effect in developed markets, the literature review part mainly focuses on recent studies based on developed country stock indices without regard to the fact that vast amount of studies with respect to this specific market anomaly have been conducted during the last decades. Despite the fact that evidence of DoW effect is found in various security exchanges, the findings differ as to the days on which abnormal returns are significant. One of the earliest and prominent studies performed by Jaffe and Westerfield (1985a) investigates Japanese stock return patterns during an observation period between January 1970 and April 1983. The findings prove the presence of lowest mean returns for Tuesday. Hui (2005) probes the presence of DoW effect during the period of Asian crisis for a sample of Asia-Pacific markets and developed markets of U.S. and Japan. The results as of the date between January 1998 and June 2001 for the markets, which are also included in our dataset can be summarized as follows. Whereas Hong Kong shows higher average stock returns on the last trading day of the week and lower than average returns on the first, the results for U.S. and Japan are contradictory.

Numerous cross country studies related to calendar anomalies have been performed in the international arena just as it is the case in this study. One of the earliest and predominant ones is that of Jaffe and Westerfield (1985b) utilizing a dataset belonging to US, UK, Japan, Canada and Australia. Whereas Japan and Australia demonstrate lowest returns on Tuesday, U.S. shows lowest Monday returns. Contrarily, no significant evidence of DoW effect is detected for the Canadian and UK indices. Another cross country study with a large dataset belonging to 13 European, 2 North American, 6 Pasific Basin countries, and two other indices from Mexico and South Africa aims to provide international evidence on DoW effect during the years between 1985 and 1992. The findings reveal that DoW effect does not exist when sample size or error term adjustments alone are considered in Belgium, Denmark, Germany, and the United States. Contrarily, seven European countries; Canada and Hong Kong show DoW effect, which is robust to individual sample size or error term adjustments. Furthermore, France, Italy, the Netherlands, Spain, and Sweden exhibit DoW effect with the inclusion of both sample size and error term adjustments. Even when DoW effect exists, it is not only uniformly strong in every calendar week (Chang et al., 1993). One other recent cross country study that focuses on Asia-Pacific equity markets detects Monday, Wednesday, and Friday effects in some of the selected markets. However, no significant finding as to the DoW effect is observed for Australia, Japan and Korea (Chandra, 2006). Apolinario et al. (2006) provides evidence on the daily returns of major European stock markets including Germany, Austria, Belgium, Denmark, Spain, France, the Netherlands, Italy, Portugal, UK, the Czech Republic, Sweden and Switzerland during the period between July 2, 1997 and March 22, 2004. The findings reveal that DoW effect is not present in most of the European markets in that a stationary effect is seen on Mondays for the representative indices of France and Sweden since the yields on this day are greater than the rest of the week contrary to most studies in literature. A similar finding is documented for Sweden on Friday as well.

Choudhary and Choudhary (2008) provide evidence on 20 developed and emerging markets with each stock index having a different analysis period between the years 1984 and 2008. When developed market findings are

emphasized, it is seen that Australia, U.S., Japan, Switzerland, and Korea exhibit significant and highest positive returns on Thursday. Furthermore the returns on Friday are positive for Greece and Finland. Whereas Germany and UK produce significant highest positive returns on Tuesday; Wednesday returns are highest for Hong Kong. One other finding relates to Australia, which shows a highest positive return on Monday. An evaluation of the study's overall results shows that 18 out of 20 markets exhibit highest returns on any trading day other than Monday. Another study focusing on a dataset belonging to both developed and emerging markets between March 2002 and May 2008 provides results with reference to the U.S., UK, France, Japan and Hong Kong, which coincide with our dataset. Numerous models have been applied for every market included; however, no specific pattern of the DoW effect has been detected across all models. Accordingly, it is concluded that both the model and the data play a significant role on the results (Nghiem et al., 2012).

There is an abundance of empirical evidence related to U.S. indices with respect to DoW effect. One of the preliminary studies performed by French (1980) provides evidence of a negative and significant return on Monday in the Standard and Poor's (S&P) stock index. A unique study is conducted by Boudreaux et al. (2010) in the U.S. indices including Dow Jones Industrial Average, the S&P 500, and the NASDAQ in that weekend effect is investigated during Bear and non-Bear markets. The findings show the presence of a weekend effect only during non-Bear market orientations and a possible DoW effect during Bear and non-Bear markets. The study of Gonzalez-Perez and Guerro (2013) utilizes data belonging to S&P 500 during the 2004-2011 period. Their findings are supportive of U.S. market efficiency with the absence of DoW effect in the daily S&P 500 returns. Accordingly, they conclude that designing a trading strategy without taking any risk will not lead to attaining abnormal returns as there is no deterministic seasonal pattern. Confirmative results that are opposite to the DoW effect are also documented by Carlucci et al. (2013) for the main stock exchange indices of Canada and U.S. for the 2002-2012 period. Additionally, another research conducted by Puja (2010) shows insignificant results for S&P 500 for the January 1, 1990 to November 30, 2004 period. Brusa and Liu (2004) document the presence of positive Monday returns for the sub-period of 1988-1998 on the indices named as CRSP value-weighted index, the S&P 500, the Dow Jones Industrial Average, the NYSE Composite, and the NASDAQ. This finding is mainly concentrated in the first and the third weeks of the month. The emergence of this reverse Monday effect is related to the trading activities of institutional investors with that of small investors being negatively related to Monday returns.

Studies have been performed in other developed country stock indices as well. Kamath and Chusanachoti (2002) demonstrate evidence with respect to the Korean stock price index by providing a comparison of two periods; namely, 1980-1989; 1990-1998. Whereas, DoW effect is documented during the 1980s, the effect is found to completely disappear during the 1990s. Even though different methodologies are applied, it has been seen that the results are not affected by methodological issues. Evidence with respect to this phenomenon has been extensively probed also in the Greek stock indices. Tsangarakis (2007) investigates the DoW effect in ASE index of Greece during the period between 1981 and 2002. The results of the study are based on regression methodology on the basis of three periods including the full observation period (1981-2002) and two sub-periods (1981-1987 and 1988-2002). Positive Friday effect is observed for the entire period and second sub-period. Furthermore a reverse Monday effect is found in the first sub-period. Another study also conducted in Athens Stock Exchange by Muronidis et al. (2007) shows that a trader buying a well-diversified portfolio of stocks on Thursday and selling on Friday obtains positive returns. They also emphasize that this return is not enough to compensate for all the expenses to be paid. For the Greek case negative and significant abnormal returns have been detected by Aksoy et al. (2012), Borges (2009) and Kenourgios and Samitas (2008). Tuesday is also found to render negative returns in the study of Alexakis and Xanthakis (1995), whereby; they utilize an aggregate index including all stocks listed on ASE during the January 1985 and February 1994 period. However, this negative Tuesday effect tends to get smaller as the DoW effect becomes normalized with the passage of time and the changes in the behavior of the investors, the companies and the authorities. Mills et al. (2000) investigate the DoW effect not only for basket indices but also for each of the constituent stocks during the period between October 1986 and April 1997. They indicate that whereas the general index demonstrates lower returns on Wednesday, the percentages of stocks with significantly lower returns on Tuesday and Wednesday are 15% and 5%, respectively. They explain this contradictory finding by the relatively high contribution made by a few stocks to the General Index with 35% of the index to be made up of only 4 companies. They emphasize that even though bad news are released at weekends, there is a delay in the assimilation of the information as Greek investors are hesitant to react. Högholm and Knif (2009) provide Finnish evidence in their study covering the period between April 2, 1993, and June 30, 2006. They document differing results with respect to the pre-euro and post-euro period. Whereas the pre-euro period is found to be clean from weekly patterns with no DoW effect in mean returns, the post-euro period provides the finding that the DoW effect and asymmetry in mean returns is

partly common to the entire market.

Chia et al. (2007) observe the period between January 2000 and December 2006 for selected East Asian stock markets. The finding related to Hong Kong is supportive of the typical negative Monday and positive Friday effect. However, this traditional weekend effect is found to completely disappear when the model is adjusted for equity risk. Contradictory results are documented for the Dow effect in H-shares index of Hong Kong in the study of Chan and Woo (2012) covering a period between 3 January, 2000 and 1 August, 2008. The findings provide evidence of positive Monday and Friday effects on returns; however, inclusion of market risks varying across days of the week makes Friday effect insignificant. Furthermore, when transaction costs are accounted for, the abnormal return pattern for Monday becomes so small that the presence of EMH remains unchallenged.

Balbina and Martins (2002) provide evidence in favor of weekend effect on the Portuguese stock market based on a dataset belonging to the 1988-2001 period. However, they emphasize that this effect tends to fade away over the sample period implying that as the markets develop, DoW effect is to disappear. Another study, which utilizes data belonging to Portugal, Italy, Greece, Spain, and Ireland during the years between 2006 and 2011, shows the presence of the DoW effect for all indices included. Portugal demonstrates significant returns only for Tuesday and Thursday. In the case of Italy, all days are found to exhibit negative and significant returns with Friday returns being higher than Monday returns. The returns for Greece and Spain are significant only for Monday and Tuesday. Additionally, Ireland shows significant returns only for Tuesday. The reasons for these anomalies are indicated to be portfolio rebalancing, information processing, and lack of information (Aksoy et al., 2012).

Ajayi et al. (2004) focus on eleven Eastern European emerging market stock indices utilizing a dataset, which covers the period between each index's inception and September 2002. The indices which coincide with the dataset used in our study are Czech Republic and Russia. Whereas a positive Monday effect is detected for Russia, no significant DoW effect is detected for Czech Republic. Even though the results of the study conducted by Stavarek and Heryan (2012) are not confirmative with the general expectation regarding the traditional weekend effect, Czech stock market is found to exhibit significantly negative returns for Monday in the pre-crisis and sovereign-debt crisis periods. The only significant finding related to the Czech Republic documented by Guidi et al. (2011) in their study belonging to Central and Eastern Europe (CEE) equity markets reveals a Thursday effect during the period between 1999 and 2009.

Heininen and Puttonen (2008) explore the presence of various calendar anomalies in the 12 Central and Eastern European markets during an overall period between 1997 and 2008. The findings as to the DoW effect reveal positive Friday returns for Russia in the total observation period. However, when sub-periods are taken into account, Russia is found to exhibit positive Tuesday and Thursday returns, and negative Wednesday returns during the years between 2001 and 2004. Additionally, the Czech Republic shows no significant DoW effect in either the overall or the sub-periods. Another study, which focuses on the Russian market for the period that starts with the launch of the market in 1995 to August 2003, indicates the presence of lowest returns on Wednesday and highest returns on Friday. Additionally, all returns are found to be positive for all weekdays except Wednesday (McGowan & Ibrihim, 2009). The recent study of Oprea and Tilica (2014) investigate DoW effect in 18 Post-Communist East European stock markets including the Czech Republic and Russia, which are also in our dataset, during the January 2005 and March 2014 period. The findings indicate the non-existence of DoW effect in these two countries during the observation period.

Borges (2009) utilizes numerous models to test the DoW effect in 17 European stock market indexes covering a period between 1994 and 2007. The days of the week that are found to exhibit statistically significant abnormal returns and respective countries in all models estimated are as follows: negative Mondays in Iceland; positive Tuesdays in Germany; and positive Fridays in Greece, Iceland, Ireland and Norway. Additional models are utilized to demonstrate that DoW effect is highly instable in time. Högholm et al. (2011) finds little evidence of DoW effect for selected 18 European countries during a seven year period starting from January 2000 and ending in December 2006. The findings indicate little evidence of DoW effect in an unconditional setting. However, when conditional tests are applied, DoW effect is found to exist in most of the 18 markets except Austrian, Irish, and Swedish stock exchanges.

As can be seen from the above provided studies, the DoW effect detected is usually in the form of a 'traditional weekend' effect with negative Monday and positive Friday returns. However, the controversial findings with respect to the existence of abnormal returns generate doubts regarding the stability of the DoW effect. Connolly (1989) provides reasoning in that this may be due to the estimation method utilized and sample period selected.

3. The Methodology and Model

The existence of the DoW effect is analyzed in this study by the utilization of an initial dataset encompassing 33 developed country stock exchange indices belonging to a total of 24 countries. OECD categorization is used as the basis for country classification without relying on any other criteria like countries' upper or lower bounds of development levels or geographical positions. The names of the countries and associated stock exchange indices together with the number of observations and time period for each index are demonstrated in Table 1 below. It has to be noted that the period for the analyses is not fixed for all markets. Whereas the starting date of the observations is 01/04/1999 for most markets (with differences in INDEXCF, ITLMS, OMXIGI, and PAX Indices), the ending date is 02.12.2013 (with differences in INDU, NDX, SPTSX, and SPX Indices). This change in period selection occurs due to data availability constraints. The same reasoning is also binding for the differences in the number of observations in each market.

Table 1. Description of initial dataset

No	Stock Code	Country	Name	Obs.	Min	Max
1	AS30 Index	Australia	ALL ORDINARIES INDX	3776	01/04/1999	12/02/2013
2	ASE Index	Greece	Athex Composite Share Pr	3723	01/04/1999	12/02/2013
3	ASX Index	United Kingdom	FTSE ALL-SHARE INDEX	3770	01/04/1999	12/02/2013
4	ATX Index	Austria	AUSTRIAN TRADED ATX INDX	3698	01/04/1999	12/02/2013
5	BEL20 Index	Belgium	BEL 20 INDEX	3811	01/04/1999	12/02/2013
6	BVLX Index	Portugal	PSI All-Share Index GR	3781	01/04/1999	12/02/2013
7	CAC Index	France	CAC 40 INDEX	3814	01/04/1999	12/02/2013
8	DAX Index	Germany	DAX INDEX	3796	01/04/1999	12/02/2013
9	FTSEMIB Index	Italy	FTSE MIB INDEX	3788	01/04/1999	12/02/2013
10	HEX Index	Finland	OMX HELSINKI INDEX	3747	01/04/1999	12/02/2013
11	HEX25 Index	Finland	OMX HELSINKI 25 INDEX	3750	01/04/1999	12/02/2013
12	HSI Index	Hong Kong	HANG SENG INDEX	3678	01/04/1999	12/02/2013
13	IBEX Index	Spain	IBEX 35 INDEX	3775	01/04/1999	12/02/2013
14	INDEXCF Index	Russia	MICEX INDEX	3671	01/05/1999	12/02/2013
15	INDU Index	US	DOW JONES INDUS. AVG	3750	01/04/1999	11/29/2013
16	ISEQ Index	Ireland	IRISH OVERALL INDEX	3771	01/04/1999	12/02/2013
17	ITLMS Index	Italy	FTSE Italia All-Share	2530	01/02/2004	12/02/2013
18	KFX Index	Denmark	OMX COPENHAGEN 20 INDEX	3738	01/04/1999	12/02/2013
19	KOSPI Index	Korea	KOSPI INDEX	3690	01/04/1999	12/02/2013
20	NDX Index	US	NASDAQ 100 STOCK INDX	3744	01/04/1999	11/29/2013
21	NKY Index	Japan	NIKKEI 225	3661	01/04/1999	12/02/2013
22	OBX Index	Norway	OBX STOCK INDEX	3744	01/04/1999	12/02/2013
23	OMX Index	Sweden	OMX STOCKHOLM 30 INDEX	3751	01/04/1999	12/02/2013
24	OMXIGI Index	Iceland	OMX Iceland All-Share TR	2402	04/02/2004	12/02/2013
25	OSEAX Index	Norway	OSE ALL SHARE INDEX	3748	01/04/1999	12/02/2013
26	PAX Index	France	CAC ALLSHARES INDEX	1262	01/02/2009	12/02/2013
27	PSI20 Index	Portugal	PSI 20 INDEX	3790	01/04/1999	12/02/2013
28	PX Index	Czech Republic	PRAGUE STOCK EXCH INDEX	3732	01/04/1999	12/02/2013
29	SAX Index	Sweden	OMX Stockholm All-Share	3751	01/04/1999	12/02/2013
30	SMI Index	Switzerland	SWISS MARKET INDEX	3757	01/04/1999	12/02/2013
31	SPTSX Index	Canada	S&P/TSX COMPOSITE INDEX	3751	01/04/1999	11/29/2013
32	SPX Index	US	S&P 500 INDEX	3750	01/04/1999	11/29/2013
33	UKX Index	United Kingdom	FTSE 100 INDEX	3770	01/04/1999	12/02/2013

The first step in analyzing the day of the week effect deals with the calculation of the returns for each index. Accordingly, the returns are calculated with the following formula, below:

$$r_{t,i} = \ln \left(\frac{y_{t,i}}{y_{t-1,i}} \right) \quad (1)$$

$r_{t,i}$ i^{th} index return at time t ,

$y_{t,i}, y_{t-1,i}$ i^{th} index value for time t and $t-1$ respectively.

After the returns are calculated, the regression model is constructed by the use of daily dummies to investigate the existence of the DoW effect. In line with most of the studies, which utilize Ordinary Least Squares method (OLS), the current study also employs five daily dummy variables (French, 1980; Balaban, 1995; Berument & Kıymaz, 2001). The model utilized in the study is presented in the following equation:

$$r_{t,i} = \beta_1 DM + \beta_2 DT + \beta_3 DW + \beta_4 DTH + \beta_5 DF + e_i \quad (2)$$

Whereas; $r_{t,i}$ represents i^{th} index return at time t ; e_i is the random error term. Additionally, DM , DT , DW , DTH , DF are the dummies for Monday, Thursday, Wednesday, Thursday, and Friday, respectively. This methodology has been applied in numerous studies; namely, Jaffe and Westerfield (1985a), Agrawal and Tandon (1994), Ajayi et al. (2004), Heininen and Puttonen (2008), and Boynton et al. (2009). The use of OLS in testing calendar anomalies should adhere to the assumptions of constant variance and no serial correlation among the error terms. Thus, tests should be performed to control for homoskedasticity, which states that all error terms have the same variance, and for any form of autocorrelation between error terms (Wooldridge, 2009; Verbeek, 2012). Accordingly, Durbin Watson and White's tests are conducted to test for any violation of the above stated assumptions. The findings reveal the presence of autocorrelation in the index denoted by OMXIGI, and the presence of heteroskedasticity in the indices denoted by ASE, HEX, HSI, INDEXCF, KOSPI, NKY, PX and, SMI. Therefore a final dataset of 24 indices belonging to 16 countries is obtained.

The descriptive statistics of daily returns for the overall period including 24 indices are summarized in Appendix 1. For the whole period considered, only one index denoted by AS30 belonging to Australia is found to demonstrate positive returns for all weekdays. Contrary to our expectations 10 out of 24 markets show positive Monday returns. These markets belong to Australia, United Kingdom, Germany, Finland, U.S., Denmark, Sweden, and Norway. Since the dataset includes 3 indices belonging to U.S., it is important to note that the indices denoted by NDX, and SPX demonstrate negative Monday returns, while the index labeled as INDU demonstrates positive Monday returns. The positive and negative signs of the coefficients in terms of Tuesday returns are evenly distributed. An evaluation of Wednesday returns reveals that 15 out of 24 markets demonstrate negative returns with the positive return ones belonging to Australia, Austria, Belgium, Italy, Denmark, U.S., and France. In the case of US, the only index with negative returns out of the 3 indices is that labeled by INDU. Thursday returns are found to be positive except for only 1 index, which is represented by ITLMS of Italy. Furthermore, not all Friday returns are positive which is contrary to the traditional weekend effect. The indices with negative returns are those denoted by INDU, NDX, and SPX belonging to US; FTSEMIB and ITLMS belonging to Italy. While the lowest mean return is observed in ITLMS index of Italy on Monday, highest mean return is observed in the index denoted by OSEAX of Norway on Friday. The market risk measured by standard deviation is highest for NDX of U.S. on all weekdays. Furthermore, lowest standard deviation values are observed in index labeled by AS30 of Australia again for all weekdays.

4. Empirical Findings

Overall findings as to the coefficients and the p-values of the daily dummies can be seen in Appendix 2. However, an additional summary table is provided for the signs of the daily coefficients to attain a snapshot of positive and negative distribution of returns for all indices in Table 2. Whereas negative returns are mostly observed on Monday and Tuesday, positive returns are observed on Thursday and Friday.

Table 2. Summary of daily coefficient signs for all indices

Sign	Monday	Tuesday	Wednesday	Thursday	Friday
Negative	10	12	9	1	5
Positive	14	12	15	23	19

Table 3 below summarizes the results of the study with only the significant findings.

Table 3. Summary of the findings

No	Index Code	Monday	Tuesday	Wednesday	Thursday	Friday
1	AS30 Index					
2	ASX Index			(-)%10		
3	ATX Index					
4	BEL20 Index					
5	BVLX Index					
6	CAC Index					
7	DAX Index					
8	FTSEMIB Index	(-)%5				
9	HEX25 Index					(+)%10
10	IBEX Index	(-)%5				
11	INDU Index					
12	ISEQ Index					(+)%5
13	ITLMS Index	(-)%5				
14	KFX Index					(+)%10
15	NDX Index					
16	OBX Index				(+)%5	(+)%5
17	OMX Index					
18	OSEAX Index				(+)%5	(+)%5
19	PAX Index					
20	PSI20 Index					
21	SAX Index					
22	SPTSX Index					(+)%10
23	SPX Index					
24	UKX Index			(-)%10		

When Monday returns are evaluated, it is seen that 10 of the indices demonstrate negative returns with only 3 of them being significant. However, none of the positive returns turn out to be significant. The negative and significant findings belong to Italy and Spain. It has to be noted that this study encompasses 2 indices for the case of Italy with both of these indices exhibiting supportive results. Parallel results in terms significant and negative Monday returns have been detected by Aksoy et al. (2012) for the stock indices of Italy and Spain. Several explanations have been provided for the existence of the negative Monday effect in stock indices. One of the reasoning relates to the announcement of bad news. As the release of information is delayed until weekend, investors will have sufficient time for evaluation, which will prevent 'panic selling' (French, 1980). Another notion affecting the trading strategies of market participants relates to their different trading patterns. One pattern relates to short selling activity with traders closing their positions on Fridays as weekends are difficult for monitoring. Furthermore, the stocks are sold on Mondays leading to a decline in prices (Cho et al., 2007). It has to be emphasized that a majority of the indices in our dataset exhibit no anomaly in terms of Monday returns during the period analyzed. Thus, no trading strategy based on a predictable pattern of Monday returns can be developed in these indices as the markets are efficient enough to prevent abnormal returns.

On Wednesday, the returns are found to be negative in 9 of the indices and positive in the remaining 15 as can be seen on Table 2. The significant returns are observed in both UK indices utilized with the sign being negative. Even though an anomaly in returns has been detected for London, it is clearly seen that no systematic pattern can be developed throughout the entire week. Empirical evidence has been provided by Arsad and Coutts (1997) for the first major UK share index on the London Stock Exchange during a period of 60 years starting in 1935. They emphasize that no strategy leading to abnormal returns exists when transaction costs are taken into account. This finding is also stressed in the study of Mill and Coutts (1995); whereby they utilize a dataset belonging to U.K and show that even though anomalies exist, costs associated with the implementation of trading rules make the strategies unprofitable. As also documented by Steeley (2001), the DoW effects in the U.K. equity market have disappeared in time with the improvements in market efficiency and assimilation of information.

It has to be noted that the presence of abnormal returns on Thursdays for our dataset is not a dominant phenomenon. The returns on Thursday are documented to be positive in almost all of the market indices with only 1 index denoted by ITLMS showing negative returns. However, the significant findings adhere only to the positive ones belonging to two indices labeled OBX and OSEAX of Norway.

When the findings for Friday returns are analyzed, 19 of the indices present positive returns with the remaining 5 being negative. None of the indices with negative returns are found to be statistically significant. The indices with positive and significant returns belong to Finland, Ireland, Denmark, Norway, and Canada making up a total of 6 indices in 5 countries. It has to be noted that, both of the indices belonging to Norway show affirmative results. Significant and positive Friday returns have been detected in numerous studies, which is in conformity with the traditional weekend effect. Furthermore, the study of Borges (2009) demonstrates significantly positive findings for the cases of Ireland and Norway. The Finnish evidence in our study is supported by Choudhary and Choudhary (2008) in that they demonstrate a positive and significant return for Finland on Friday. Agrawal and Tandon (1994) explore five seasonal patterns including the DoW effect in the stock market indices of 18 countries with Canada and Denmark coinciding with our data set. The findings reveal the existence of significant and positive Friday returns for the aforementioned two countries in line with our results.

An important empirical evidence to emphasize is that 13 out of 24 markets do not demonstrate any statistically significant findings as to the DoW effect. Thus, the nonexistence of any significant daily returns is regarded to be in conformity with EMH in these markets for the period analyzed. Pioneering researches in this array of literature support the presence of abnormal returns based on certain days of the week (French, 1980; Gibbons & Hess, 1981; Jaffe & Westerfield, 1985a, 1985b). However, studies performed more recently document that this phenomenon has either weakened or disappeared since its first documentation in the 1980s majorly in developed country stock indices (Chang et al., 1993; Steeley, 2001; Kohers et al., 2004; Hui, 2005). On the other hand, Dubois and Louvet (1996) evidence that whereas the anomaly recently disappears for the U.S., it is still evident in European countries. Contrarily, Steeley (2001) supports the phenomenon's disappearance in Europe by providing evidence from the U.K. Additionally, Kamath and Chusanachoti (2002) provide confirmative evidence from Korean market. Both studies have emphasized that the effect faded away during the 1990s with the latter stating that the disappearance occurs irrespective of the methodology utilized. Meanwhile, Kohers et al. (2004) holds the argument that the well-documented DoW effect has disappeared majorly due to the advancements in market efficiency. Another interesting finding relates to the Tuesday returns. Even though the findings for Tuesday are evenly distributed in terms of the number and signs of return coefficients, none of the indices show any significant returns.

5. Summary and Conclusion

The inability of investors to beat the market by obtaining abnormal returns through developing certain trading strategies is the rationale behind the efficient market hypothesis. Therefore, the existence of calendar anomalies such as DoW effect is regarded to be contradictory to EMH. This paper contributes to the literature on DoW effect by providing recent international evidence from selected developed countries' stock exchange indices. The final dataset utilized encompasses 24 developed countries during a period of at most 14 years due to issues related to data availability. As the overall findings of our study indicate, there is no single systematic pattern across the days of the week for the complete dataset, which shows that the DoW effect is not a dominant phenomenon. This implies that investors may have improved risk pricing in developed stock market exchanges preventing the existence of any consistent strategy for the attainment of abnormal returns. However, as investors become more experienced in terms of detecting market anomalies and communication networks become more sophisticated, the advantage of any additional information disappears in line with propositions of the EMH.

An evaluation of Monday returns reveals that 3 of the indices exhibit significant and negative returns. The empirical results indicate significant and positive Friday returns in 6 indices of 5 countries. There are no controversial findings in terms of the signs of the Friday returns' significant coefficients. It is important to emphasize that the traditional weekend effect with negative Monday returns and positive Friday returns could not be observed in any of the indices included. A further evaluation of Tuesday returns demonstrates the insignificance of the returns in all of the indices. Both of the indices belonging U.K. demonstrate significantly negative Wednesday returns. It has to be noted that no other day has documented any abnormal returns in terms of U.K. Finally, both indices with significantly positive returns on Thursday belong to Norway.

When insignificant findings are considered, it can be seen that more than half of the indices included in our dataset do not demonstrate any evidence in conformity with the DoW effect. This result is supportive of the recent arguments put forth in literature related to calendar anomalies in that DoW phenomenon has lost its significance in developed country stock exchanges. Our results are supportive of the other previously performed developed market findings showing either weakening or disappearing DoW effect, which is first documented in the 1980s. An obvious reason for the lack of abnormal returns can be stated as the developments in the markets and investor knowledge; and improvements in information technologies.

There is vast amount of academic work focusing on calendar anomalies. As far as our study is concerned, the growing international evidence on the DoW effect has demonstrated mixed results. Even though calendar effects were observed during the 1970s and 1980s; they were found to diminish in the 1990s mainly in developed country stock exchanges. The rationale behind this phenomenon should be further investigated to understand whether it is the markets that are becoming more efficient or it is the statistical methodologies, which are no longer able to detect these anomalies. Thus, studies employing more sophisticated methodological procedure can be conducted. Additionally, further research can be directed towards investigating the existence of calendar anomalies on firm basis rather than focusing on indices of various countries.

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Appendix A. Descriptive Statistics

DoW	Monday					Tuesday					Wednesday				
Stats.	N	Mean	Std. Dev.	Min.	Max	N	Mean	Std. Dev.	Min.	Max	N	Mean	Std. Dev.	Min.	Max
AS30	726	0.025	1.058	-5.855	5.01	760	0.016	0.943	-7.539	5.36	767	0.013	0.956	-5.088	4.193
ASX	704	0.001	1.345	-7.953	8.811	763	0.015	1.143	-5.353	4.64	773	-0.076	1.164	-7.111	7.317
ATX	724	-0.026	1.555	-8.574	8.783	756	0.016	1.442	-9.012	8.263	755	0.029	1.422	-9.111	5.562
BEL20	751	-0.036	1.454	-8.319	9.06	767	-0.036	1.222	-5.61	5.924	770	0.01	1.259	-7.649	6.353
BVLX	748	-0.008	1.132	-6.018	9.744	756	-0.01	1.059	-4.8	5.948	766	-0.026	1.091	-4.603	6.381
CAC	750	-0.023	1.662	-9.472	9.617	767	-0.005	1.45	-7.678	6.727	770	-0.053	1.448	-7.063	8.833
DAX	747	0.015	1.708	-7.434	9.843	763	0.012	1.463	-8.875	6.842	767	-0.05	1.52	-6.713	5.524
FTSEMIB	745	-0.129	1.663	-8.599	7.628	763	-0.011	1.471	-7.867	6.755	763	0.025	1.451	-6.881	9.41

HEX25	746	0.002	1.712	-8.905	8.126	761	-0.038	1.584	-7.403	6.535	763	-0.057	1.604	-7.994	5.624
IBEX	743	-0.125	1.564	-7.839	7.815	762	0.021	1.434	-5.605	5.223	761	-0.045	1.514	-8.517	9.003
INDU	703	0.019	1.267	-8.014	6.612	766	0.024	1.165	-5.242	5.634	772	-0.004	1.187	-8.201	6.155
ISEQ	712	-0.062	1.388	-7.715	7.57	763	-0.02	1.439	-7.411	7.68	769	-0.062	1.454	-7.707	6.131
ITLMS	496	-0.134	1.634	-8.56	9.98	509	0.015	1.365	-6.329	6.34	512	0.073	1.43	-6.267	8.991
KFX	735	0.033	1.397	-6.781	9.496	765	-0.001	1.242	-4.866	7.601	767	0.018	1.35	-6.783	8.208
NDX	702	-0.024	1.902	-8.614	9.621	765	-0.046	2.015	-9.533	9.603	770	0.016	1.918	-9.234	9.102
OBX	729	-0.009	1.677	-9.117	8.32	763	0.018	1.483	-6.33	7.398	765	-0.042	1.575	-9.88	7.188
OMX	741	0.031	1.71	-7.513	9.865	762	-0.009	1.544	-8.527	6.724	763	-0.04	1.618	-6.351	5.734
OSEAX	732	0.004	1.6	-9.252	9.188	763	0.017	1.34	-6.081	7.34	765	-0.051	1.417	-8.586	6.04
PAX	250	-0.008	1.487	-5.016	8.143	253	0.02	1.318	-4.899	5.107	254	0.104	1.291	-4.578	4.002
PSI20	750	-0.035	1.196	-6.013	9.71	759	-0.05	1.15	-5.507	5.887	766	-0.033	1.176	-5.461	6.876
SAX	741	0.024	1.581	-7.382	8.629	762	-0.01	1.421	-8.069	6.273	763	-0.032	1.483	-6.579	5.82
SPTSX	690	-0.012	1.279	-9.788	6.957	763	-0.004	1.234	-4.546	9.37	771	-0.021	1.182	-8.466	3.941
SPX	703	-0.025	1.366	-9.354	6.837	766	0.01	1.297	-5.911	6.172	772	0.001	1.277	-9.47	5.573
UKX	704	0.007	1.419	-8.178	9.384	763	0.018	1.208	-5.885	4.93	773	-0.088	1.23	-7.429	7.744

Continued

DoW	Thursday					Friday				
Stats.	N	Mean	Std. Dev.	Min.	Max	N	Mean	Std. Dev.	Min.	Max
AS30	769	0.022	1.006	-6.888	3.904	754	0.008	0.96	-8.554	4.883
ASX	773	0.032	1.184	-5.534	5.095	757	0.065	1.123	-8.71	8.167
ATX	727	0.031	1.424	-8.72	5.652	736	0.046	1.351	-7.657	6.29
BEL20	768	0.02	1.34	-6.764	9.334	755	0.014	1.259	-5.383	9.221
BVLX	761	0.015	1.08	-5.272	4.428	750	0.046	1.046	-6.171	7.386
CAC	771	0.056	1.527	-6.593	6.13	756	0.023	1.447	-8.048	8.868
DAX	767	0.052	1.567	-7.083	7.086	752	0.026	1.499	-7.27	6.979
FTSEMIB	767	0.023	1.504	-7.023	5.471	750	-0.023	1.474	-7.41	8.271
HEX25	746	0.078	1.644	-6.942	7.231	734	0.104	1.498	-7.08	9.286
IBEX	763	0.065	1.503	-6.473	6.722	746	0.051	1.529	-9.586	8.354
INDU	756	0.041	1.24	-7.616	6.459	753	-0.033	1.104	-5.822	6.338
ISEQ	772	0.033	1.381	-8.746	5.321	755	0.127	1.312	-6.666	9.733
ITLMS	512	-0.008	1.425	-6.648	5.118	501	-0.029	1.383	-7.077	7.595
KFX	739	0.02	1.269	-6.619	5.111	732	0.084	1.206	-6.559	6.592
NDX	755	0.114	1.937	-6.192	8.064	752	-0.043	1.796	-8.135	9.078
OBX	738	0.13	1.591	-8.797	6.732	749	0.131	1.484	-8.631	8.96
OMX	751	0.065	1.593	-6.969	6.604	734	0.037	1.484	-6.095	8.6
OSEAX	738	0.11	1.476	-9.709	5.845	750	0.133	1.37	-9.296	8.181
PAX	256	0.027	1.384	-5.327	5.234	249	0.003	1.233	-4.584	3.953
PSI20	762	0.003	1.145	-5.357	4.491	753	0.046	1.119	-6.127	7.723
SAX	751	0.048	1.451	-6.381	4.794	734	0.072	1.363	-6.275	7.925
SPTSX	770	0.052	1.144	-9.452	4.709	757	0.079	1.068	-6.616	6.796
SPX	756	0.051	1.32	-7.922	6.692	753	-0.016	1.155	-6.005	6.133
UKX	773	0.027	1.25	-5.871	5.904	757	0.053	1.195	-9.266	8.469

Appendix B. Findings

Index Code	Monday	Tuesday	Wednesday	Thursday	Friday
	0.025	0.016	0.013	0.022	0.008
AS30 Index	0.492	0.658	0.721	0.535	0.829
	0.001	0.015	-0.076	0.032	0.065
ASX Index	0.974	0.73	0.076*	0.454	0.134
	-0.026	0.016	0.029	0.031	0.046
ATX Index	0.628	0.757	0.575	0.557	0.384
	-0.036	-0.036	0.01	0.02	0.014
BEL20 Index	0.457	0.451	0.84	0.666	0.771
	-0.008	-0.01	-0.026	0.015	0.046
BVLX Index	0.832	0.799	0.506	0.71	0.24
	-0.023	-0.005	-0.053	0.056	0.023
CAC Index	0.671	0.926	0.327	0.306	0.675
	0.015	0.012	-0.05	0.052	0.026
DAX Index	0.788	0.827	0.37	0.353	0.646
	-0.129	-0.011	0.025	0.023	-0.023
FTSEMIB Index	0.020**	0.844	0.654	0.67	0.677
	0.002	-0.038	-0.057	0.078	0.104
HEX25 Index	0.966	0.518	0.326	0.189	0.080*
	-0.125	0.021	-0.045	0.065	0.051
IBEX Index	0.024**	0.707	0.415	0.238	0.358
	0.019	0.024	-0.004	0.041	-0.033
INDU Index	0.679	0.571	0.934	0.343	0.446
	-0.062	-0.02	-0.062	0.033	0.127
ISEQ Index	0.237	0.694	0.217	0.514	0.013**
	-0.134	0.015	0.073	-0.008	-0.029
ITLMS Index	0.040**	0.816	0.256	0.901	0.658
	0.033	-0.001	0.018	0.02	0.084
KFX Index	0.49	0.977	0.707	0.671	0.081*
	-0.024	-0.046	0.016	0.114	-0.043
NDX Index	0.74	0.506	0.813	0.101	0.541
	-0.009	0.018	-0.042	0.13	0.131
OBX Index	0.875	0.754	0.453	0.024**	0.022**
	0.031	-0.009	-0.04	0.065	0.037
OMX Index	0.591	0.87	0.491	0.261	0.526
	0.004	0.017	-0.051	0.11	0.133
OSEAX Index	0.946	0.738	0.331	0.038**	0.012**
	-0.008	0.02	0.104	0.027	0.003
PAX Index	0.926	0.814	0.218	0.751	0.976
	-0.035	-0.05	-0.033	0.003	0.046
PSI20 Index	0.411	0.235	0.433	0.944	0.277
	0.024	-0.01	-0.032	0.048	0.072
SAX Index	0.651	0.848	0.54	0.366	0.18
	-0.012	-0.004	-0.021	0.052	0.079
SPTSX Index	0.789	0.932	0.63	0.226	0.067*
	-0.025	0.01	0.001	0.051	-0.016
SPX Index	0.6	0.831	0.978	0.276	0.735
	0.007	0.018	-0.088	0.027	0.053
UKX Index	0.879	0.697	0.052*	0.546	0.249

Note. First line regression coefficient, second line p-value (* %10, **%5, *** %1).

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