# ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

**Bachelor's Thesis (International Bachelor Economics and Business Economics):**

*Calendar anomalies and their prevalence across years and markets*

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Date Final Version: 19 August, 2018

*Abstract*

This paper examines the presence of calendar anomalies during the period of 1990-2018 and across developed, emerging and frontier markets. The anomalies examined are the Day of the Week effect, the Monday effect, the Twist on the Monday effect and the Halloween effect. The results of this paper show that both the Monday effect and the Twist on the Monday effect are still prominent across markets and periods while there is a lack of evidence for the existence of the Day of the Week effect and the Halloween effect.

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## 1. Introduction

Market anomalies can be defined as distortions in security prices such that their rates of return differ significantly from the average. More specifically, calendar effect market anomalies are characterised by their presence being related to certain calendar events or dates. While these anomalies have been studied and identified before, no prior research compares their prevalence between economies in different stages of development.

These effects seem to continually captivate the attention of those in the financial sector, with news articles frequently citing these effects along with a discussion of the Efficient Market Hypothesis. The common theme of these articles is that anomalies represent an easy way to exploit the market. An article which appeared in the Financial Times (Harford, 2012) states that "researchers keep discovering predictable patterns in the data, and such patterns amount to big piles of money being left on the sidewalk". These effects have also been discussed in The Wall Street Journal with one article (Hulbert, 2013) even being entitled "How to Play the Halloween Indicator".

The central question that this paper addresses is the extent to which these calendar effect market anomalies are present in economies in different stages of development. The calendar effects this paper analyses are the Day of the Week effect, the Monday effect (also called the Weekend effect), the Twist on the Monday effect and the Sell in May effect while the economies studied will fall into the category of developed markets, emerging markets or frontier markets.

These effects are chosen as they represent some of the first calendar anomalies discovered and the anomalies which have been the most broadly researched, even when this research produces conflicting results. This paper adds to previous research with the use of a more recent dataset of returns data. Furthermore, the prevalence of anomalies in markets at different stages of development is analysed.

To understand the analysis performed in this paper it is important to understand what is suggested by each of the effects. The Day of the Week effect posits that average stock returns differ according to the day of the week. A more specific effect, the Monday effect suggests that stock returns on a Monday are on average lower than those on all other days. The conditions for the Monday effect are extended by the Twist on the Monday effect which states that the return for stocks on a Monday is on average negative if the stock market has declined in the previous week. The Halloween effect follows the saying 'sell in May and go away'. Namely, the highest returns in a year are exhibited in the months from November to April with May marking the beginning of a period of weaker stock returns.

In addition to the individual effects, analysis is performed according to countries with markets in different stages of development, namely developed markets, emerging markets and frontier markets. Developed market countries include those in the Group of 7 (G7) – Canada, France, Germany, Italy, Japan, the United Kingdom and the United States of America. BRICS nations are taken as a representative sample of emerging markets (Brazil, Russia, India, China and South Africa) while the five most developed economies in frontier markets are used as a sample for those (Argentina, Kuwait, Vietnam, Morocco and Nigeria).

These calendar anomalies have been documented and studied in previous research. French (1980) coined the term Weekend Effect in his seminal paper while the Twist on the

Monday effect is first analysed by Jaffe, Westerfield and Ma (1989). An additional study by Gibbons and Hess (1981) finds that stock returns are not identically distributed across the days of the week in support of the Day of the Week effect. Finally, anomalies that span months are investigated when Bouman and Jacobsen (2002) Investigate the Halloween Effect.

The papers discussed above are some of the most significant papers pertaining to calendar anomalies and each effect. A more comprehensive analysis follows in the literature review, however, it should be noted that no papers currently investigate such a broad spectrum of effects across different types of markets.

This paper investigates the extent to which these anomalies are present in the aforementioned markets. In addition, the paper examines whether the anomalies become more or less prevalent over different time periods. This paper contributes to current literature by analysing calendar effects across a wide array of markets in different stages of development to determine whether these effects may be more pronounced in certain types of markets. Furthermore this paper utilises data from a more recent time period (1990 – 2018) than that which has previously been utilised.

Results of the analysis performed in this paper indicate that the Day of the Week effect and the Halloween effect are not present across any market or period in the dataset which is used, however, significant evidence is found in favour of the existence of the Monday effect and the Twist on the Monday effect. Despite this, there is no discernible pattern for the effects being more or less pronounced across different markets or periods and in certain instances there is evidence of a reversal of the effects.

The results of this study are relevant for both academia and industry. Within the academic world the Efficient Market Hypothesis states that asset prices fully reflect all available information (Fama, 1998). If anomalies are found to exist, this would form the basis for the rejection of the Efficient Market Hypothesis. An extension of the hypothesis is that it is not possible to outperform the market. This leads on to industry relevance, whereby investment strategies may be formulated in accordance with anomalies in order to outperform the market.

This paper proceeds with a review of current literature pertaining to calendar anomalies. Subsequently the data which is used is discussed along with descriptive statistics. Methodology details follow wherein models are defined and calculations are presented. This leads to the results and a discussion of their implications. Finally a conclusion is presented alongside limitations and suggestions for future research.

## 2. Literature Review

All anomalies being studied in this paper have been previously researched to some extent. The purpose of this literature review is to provide an overview of the most recent and the most relevant results pertaining to each effect. Recent literature pertaining to the Day of the Week effect is reviewed first followed by the Monday effect. Research on the Twist on the Monday effect is analysed next and finally, papers on the Halloween effect are summarised.

The Day of the Week effect has been researched in developed markets with Dubois and Louvet (1996) analysing indices from the most significant markets of America, the Pacific Basin and Europe for the period of 1969-1992. They find that returns are lower at the beginning of the week for the entire period and that Wednesdays exhibit abnormal positive returns. An additional finding is that the anomaly disappears for more recent periods in the USA, although it remains present in European countries. Similarly, another paper (Kohers, Kohers, Pandey, & Kohers, 2004) analyses the Day of the Week effect in the world's largest developed equity markets. The findings are that the effect is prevalent during the 1980s, however, it becomes less apparent from the 1990s.

Other papers investigate the prevalence of the anomaly in emerging markets. Aggarwal and Rivoli (1989) analyse emerging markets from 1976 until 1988 and find that a robust Day of the Week Effect is present. A more recent paper by Basher and Sadorsky (2006) also investigates emerging markets but in the years from 1992 until 2003. They find that the Day of the Week effect is present only in a small proportion of emerging markets, however, within these markets the effects are significant even after accounting for conditional market risk.

Another anomaly which has received much attention is the Monday effect. Literature pertaining to this effect overlaps with literature on the Day of the Week effect owing to the Monday effect being seen as one specific instance of the Day of the Week effect. Research on developed markets incudes an analysis by Lakonishok and Smidt (1988) on the Dow Jones Industrial Average from 1897 until 1986. They find that Monday returns are significantly negative although small in magnitude. Despite the small magnitude they justify the significance by referencing the persistence of the anomaly throughout the years. A more recent period of the US market is analysed by Mehdian and Perry (2001). Their analysis covers major US indices for the period of 1964-1998. In the period before 1987 Monday returns are found to be significantly negative, while the post-1987 period exhibits significantly positive Monday returns. These positive returns, however, are only present in large cap indices. The Monday effect is also found to be disappearing in the UK market. An analysis of UK equity markets in the 1990s finds that the Monday effect and more broadly, Day of the Week effects, have disappeared (Steeley, 2001).

In addition to developed markets, the Monday effect has also been analysed within emerging markets. Research on emerging markets in Asia has found that Monday exhibits abnormally low mean returns (Wong, Hui, & Chan, 2006). Eastern European emerging markets have also been researched by Ajayi, Mehdian and Perry (2014). Their results indicate that there is no consistent evidence in favour of the Monday effect as significantly negative returns are only present in two of the eleven markets which were analysed.

While the Day of the Week and Monday Effects have been researched in depth, there is a significantly smaller amount of academic literature pertaining to the Twist on the Monday

effect. It is of note, however, that the Twist on the Monday effect may be seen as a subsequent robustness test of the Monday effect. Agrawal and Tandon (1994) analyse stock returns for some of the world's largest stock markets from 1971-1987. They find evidence which strongly supports the Twist on the Monday Effect in a large proportion of countries. A more recent analysis of this effect for major stock markets has been performed by Doyle and Chen (2009). They extend their definition of anomalies to allow for inconsistent (yet predictable) findings, hence making that the expected outcome. In this case, the Twist on the Monday effect is neither significant nor diminishing throughout the period being analysed (1993-2007).

Further research has been performed by Lim and Chia (2010) on the prevalence of the anomaly in Asian emerging markets. Over the period of 2002 until 2009 the Twist on the Monday effect was found to be present in three of the five markets which were examined.

Finally, the Halloween effect has been researched, however, different studies have produced different results. Several papers find that the effect is either not significant or non-existent. Maberly and Pierce (2004) find that the effect is not significant when they re-examine Bouman and Jacobsen's findings in the U.S. stock market. They find that the effect disappears when outlying data points are taken into account. Similarly, Lucey and Zhao (2008) examine U.S. equity returns from 1926 until 2002 and conclude that the Halloween effect may be a reflection of the January effect. An additional finding is that this effect is becoming smaller both in terms of significance and size. Further research which contests the existence of a Halloween effect was performed by Dichtl and Drobetz (2014). Their paper analyses developed markets and finds that when applied to a liquid fund, the effect vanishes.

While it may appear that the Halloween effect does not exist as previously thought, prior research has found continuing evidence for the Halloween effect. Haggard and Witte (2010) look at U.S. stock returns and find that the effect is significant in the period of 1954-2008, but not before. Their results are robust to outliers, transaction costs and the January effect. Another study by Jacobsen and Zhang (2012) investigates the effect for 108 countries for all years of available data. Their findings indicate that the effect is stronger in developed and emerging markets compared to frontier markets.

This paper extends prior research in several ways. A more recent dataset is used than that which has been used in prior research. The data used in this paper, in the majority of instances, extends back to 1990 with the most recent data being from 2018. Furthermore, many previous papers investigate a single effect in a single market. This paper will investigate several anomalies across several different market types. This allows conclusions to be drawn pertaining to the prevalence of different anomalies in different markets. Finally, much of the prior research performed has not addressed the issue as to whether the calendar anomalies being investigated have become more or less pronounced in more recent years.

Two hypotheses are formulated and applicable to each anomaly being studied. The first hypothesis posits that the magnitude and significance of effects differ per market type while the second hypothesis asserts that the calendar anomalies become less prevalent in more recent periods.

## 3. Data

Data used in the analysis in this paper were downloaded from Datastream. The data take the form of daily, monthly and weekly (closing) price levels of countries' stock market indices, denominated in that country's local currency. A description of the countries used and their corresponding indices is found in Table 1.

Table 1: Countries and their corresponding stock market indices organised by market type

| Country | Index |
|---|---|
| Developed Markets | |
| United States | S&P 500 Composite |
| United Kingdom | FTSE 100 |
| Japan | NIKKEI 225 |
| Germany | DAX |
| Italy | FTSE MIB |
| France | CAC 40 |
| Canada | S&P/TSX Composite |
| Emerging Markets | |
| Brazil | MSCI Brazil Index |
| Russia | MOEX Russia Index |
| India | NIFTY 500 |
| China | Shanghai Composite |
| South Africa | JSE FTSE All-Share Index |
| Frontier Markets | |
| Argentina | MERVAL |
| Kuwait | KIC |
| Vietnam | Ho Chi Minh Stock Index |
| Morocco | MSCI Morocco Index |
| Nigeria | S&P Nigeria BMI |

Countries are selected to represent economies from developed markets, emerging markets and frontier markets. Countries in developed markets are chosen as they form the Group of Seven (G7) – a representative sample of the most developed economies around the world. Emerging markets consist of BRICS countries and the frontier markets are chosen as they represent the largest markets in the MSCI Frontier Market Index.

The indices are selected according to criteria of economic representativeness, data reliability and market coverage. For each index, data for the period from 1990 until 2018 is downloaded. This period is chosen as it includes recent years while extending far enough into the past to be able to compare how calendar effects may vary over time. The dataset is somewhat limited, however, as some indices do not have data available for the desired period. Table A1 in the appendix lists the period for which data are available for each index.

Data cleaning involves the deletion of several return observations for periods when an index did not yet exist or when an index had been delisted.

Closing price variables for the indices are transformed to return variables according to the equation:

$$Return = ln\left(\frac{P_t}{P_{t-1}}\right)$$

Additional variables are generated in the dataset to assist with statistical analysis. A categorical variable which indicates the day of the week to which each observation pertains is generated alongside a dummy variable to indicate whether the day of the observation is a Monday or not. These variables assist in analysis pertaining to the Day of the Week effect and the Monday effect.

Categorical variables for type of market (developed, emerging or frontier) and period are generated. The period variable is defined as a range of five years starting from 1990 and there are, therefore, six periods. It should be noted, however, that the final period is from 2015 until midway through 2018 and, therefore, only includes three and a half years of observations. These variables assist in distinguishing whether effects differ by country or year range.

To assist with analysis of the Twist on the Monday effect, a dummy variable is created which indicates whether, if on a Monday, the prior week's return is negative or not. Two additional dummy variables are generated to assist with analysis of the Halloween effect. The first is a dummy variable for the period of November until April while the second is a dummy variable which indicates if a monthly return pertains to January. The second dummy variable is used for robustness tests.

Descriptive statistics for return data are computed for each index. These are reported in Table 2. Table 3 reports mean returns for each index grouped by day of the week. These mean returns are further grouped by period and are reported in Table A2 in the Appendix. Mean monthly returns for each index grouped by November to April and May to April month ranges are shown in Table 4. Table A3 further groups these returns by period, as previously defined.

Table 2: Descriptive statistics (x$10^4$ except for observations) of daily returns for each index for the period of 1990-2018

| | Minimum | Maximum | Mean | Median | Std. Dev. | Obs. |
|---|---|---|---|---|---|---|
| S&P 500 | -946.95 | 1095.72 | 2.76 | 2.24 | 108.96 | 7414 |
| FTSE 100 | -926.56 | 938.43 | 1.56 | 0.36 | 107.92 | 7414 |
| NIKKEI 225 | -1211.10 | 1323.46 | -0.76 | 0.00 | 147.30 | 7414 |
| DAX | -987.07 | 1079.75 | 2.65 | 4.25 | 139.23 | 7414 |
| FTSE MIB | -1333.14 | 1087.69 | -0.19 | 1.99 | 153.27 | 5327 |
| CAC 40 | -947.15 | 1059.46 | 1.36 | 0.00 | 135.30 | 7414 |
| S&P/TSX | -978.80 | 937.03 | 1.88 | 3.14 | 96.52 | 7414 |
| MSCI Brazil | -2173.56 | 2465.64 | 21.11 | 5.46 | 219.45 | 7414 |
| MOEX | -2333.56 | 2750.05 | 5.80 | 0.00 | 251.51 | 5399 |
| NIFTY 500 | -1431.81 | 1503.40 | 4.57 | 0.00 | 149.92 | 7152 |
| Shanghai | -1790.51 | 7191.52 | 4.44 | 0.00 | 223.30 | 7152 |
| JSE FTSE | -1269.00 | 742.30 | 4.12 | 2.22 | 117.75 | 5980 |
| MERVAL | -7571.31 | 2619.18 | 8.95 | 0.00 | 264.94 | 7414 |
| KIC | -12558.72 | 12506.20 | 2.75 | 0.00 | 379.70 | 4698 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ho Chi Minh | -765.57 | 665.61 | 4.93 | 0.00 | 146.44 | 4655 |
| MSCI Morocco | -588.40 | 568.09 | 1.94 | 0.00 | 82.13 | 6110 |
| S&P Nigeria | -550.69 | 870.21 | 4.63 | 0.00 | 109.18 | 5980 |

Table 3: Mean daily returns ($x10^4$) of each index grouped by day

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| S&P 500 | 3.07 | 5.24 | 3.60 | 1.21 | 0.68 |
| FTSE 100 | -0.39 | 4.31 | -1.51 | 1.88 | 3.50 |
| NIKKEI 225 | -6.52 | 0.85 | 1.38 | 4.55 | -4.06 |
| DAX | 4.56 | 3.23 | 2.85 | 1.85 | 0.74 |
| FTSE MIB | -8.79 | 3.43 | 4.40 | 0.85 | -0.81 |
| CAC 40 | -3.83 | 3.88 | 1.49 | 3.93 | 1.31 |
| S&P/TSX | -1.01 | 2.58 | 1.51 | 1.58 | 4.75 |
| MSCI Brazil | 5.76 | 29.01 | 22.55 | 18.10 | 30.15 |
| MOEX | 13.67 | 5.36 | -3.00 | 2.96 | 10.04 |
| NIFTY 500 | 5.62 | -3.06 | 13.34 | 1.02 | 5.91 |
| Shanghai | 2.81 | -7.92 | 12.01 | -0.84 | 16.11 |
| JSE FTSE | 7.96 | 2.91 | 3.37 | 6.47 | -0.13 |
| MERVAL | -16.12 | 7.53 | 22.46 | 15.20 | 15.68 |
| KIC | -12.02 | 5.36 | 1.77 | 28.41 | -9.78 |
| Ho Chi Minh | -4.03 | -7.82 | 10.38 | 6.00 | 20.13 |
| MSCI Morocco | -0.08 | -1.59 | 3.32 | 4.65 | 3.40 |
| S&P Nigeria | 0.22 | -1.98 | 4.12 | 6.21 | 14.59 |

Table 1: Mean monthly returns ($x10^4$) of each index grouped by months

| | November – April | May – October |
|---|---|---|
| S&P 500 | 100.46 | 19.32 |
| FTSE 100 | 67.69 | -0.06 |
| NIKKEI 225 | 17.58 | -50.78 |
| DAX | 145.66 | -31.16 |
| FTSE MIB | 98.98 | -107.88 |
| CAC 40 | 117.09 | -58.68 |
| S&P/TSX | 84.69 | -3.04 |
| MSCI Brazil | 538.41 | 379.28 |
| MOEX | 306.24 | -60.42 |
| NIFTY 500 | 108.47 | 89.64 |
| Shanghai | 117.15 | 75.98 |
| JSE FTSE | 146.19 | 33.24 |
| MERVAL | 299.90 | 88.76 |
| KIC | -10.10 | 129.73 |
| Ho Chi Minh | 185.00 | 26.61 |
| MSCI Morocco | 102.93 | -18.93 |

| | | |
|---|---|---|
| S&P Nigeria | 67.63 | 133.19 |

Reviewing the descriptive statistics we find an abnormally high mean return for the MSCI Brazil index. The reason for this is that Brazil was subject to extremely high inflation rates from the late 1980's extending through the mid 1990's. The MSCI Brazil index has not been rebased to account for this, and returns may, therefore, be artificially inflated. The number of differing observations for each index is explained by differing data availability, with a value of 7414 corresponding to data available for the full period of 1990 – 2018.

A brief review of Table 3 indicates that Monday does initially appear to present a larger proportion of indices with negative returns than any other day, however, it is not possible to say anything about the presence of the Day of the Week effect at this point.

Table 4 provides an initial overview of statistics which may indicate the existence of a Halloween effect. Returns from November until April frequently appear to be greater than those from May until October, which is an early indication of the prevalence of the effect.

## 4. Methodology

The methodology used in the analysis of each effect follows a similar structure. Regression models are used to detect each anomaly. First, a model is used which detects whether an anomaly is present across all observations. A subsequent model detects whether the prevalence of an anomaly differs by region and a final model checks whether the effect differs by period. This final model controls for market types as well to take into account differing data availability across market types which may skew any results. All regression models use robust standard errors.

Additional tests on coefficients are performed to determine if any difference exists, namely the Wald test for equality of coefficients. In all tests on coefficients two-tailed tests are employed because stock returns are not fundamentally limited to being influenced in only one direction by a certain factor.

In attempting to explain any anomalous returns, variances will be calculated to check whether the risk-return trade off holds. These variances are compared using Bartlett's test for equality of variances.

### *4.1 Day of the Week Effect*

In testing for the Day of the Week effect, three regression models are employed. Equation 1 tests for the existence of the effect across all markets and periods, with a null hypothesis ($H_0 1$) being used to assess whether the effect exists. $R_t$ represents a daily return variable and $Day_i$ is a dummy variable which indicates the day on which an observation falls. Monday is taken as the base condition. Because the Day of the Week effect posits that returns for different days of the week follow a non-uniform distribution, the null hypothesis to be tested states that the coefficients of the Day variable are jointly equal to 0.

$$R_t = \propto + \sum_{i=1}^{4} \beta_i Day_i + \varepsilon_t \quad (1)$$

$$H_0 1: \beta_{Tuesday} = \beta_{Wednesday} = \beta_{Thursday} = \beta_{Friday} = 0$$

Equation 2 tests whether for each market type (developed, emerging or frontier) the return on different days is different. $Market_i$ is a dummy variable which indicates the market to which a return observation belongs with Frontier markets being the base condition. The interaction term of the two variables indicates whether a return will differ according to both market and day. Similar to before, the null hypothesis to be tested states that the coefficients of the days for each market type are jointly equal to 0:

$$R_t = \propto + \sum_{i=1}^{2} \beta_i Market_i + \sum_{j=1}^{4} \gamma_j Day_j + \sum_{i=1}^{2} \sum_{j=1}^{4} \lambda_{ij} Market_i Day_j + \varepsilon_t \quad (2)$$

$H_0 2: \lambda_{i1} = \lambda_{i2} = \lambda_{i3} = \lambda_{i4} = 0$ for each i = 1, 2

Equation 3 keeps the Market variable to control for differing data availability across market types and introduces a variable for period. The Period variable groups years into ranges of five years starting from 1990 (except for the most recent period which only has three and a half years of observations) and the period of 1990-1994 is taken to be the base condition. The interaction between Period and Day is used to observe whether a particular return distribution is becoming more or less pronounced throughout the years. Again, the null hypothesis to be tested states that the coefficients of the days for each period are jointly equal to 0.

$$R_t = \propto + \sum_{i=1}^{2} \beta_i Market_i + \sum_{i=2}^{6} \varphi_i Period_i + \sum_{j=1}^{4} \gamma_j Day_j + \sum_{i=2}^{6}\sum_{j=1}^{4} \lambda_{ij} Period_i Day_j + \varepsilon_t \quad (3)$$

$H_0 3: \lambda_{i1} = \lambda_{i2} = \lambda_{i3} = \lambda_{i4} = 0$ for each i = 2, …, 6

$H_0 1$, $H_0 2$ and $H_0 3$ imply that when estimating returns, it is not necessary to adjust estimations according to the day of the week. Additionally, because each market type and period are tested separately it is possible to see whether the effect is becoming more or less prominent by period or by market type.

*4.2 Monday Effect*

The Monday Effect is also tested for using regression models. Equation 3 checks whether the effect exists across all observations with the Monday variable being a dummy variable which takes on a value of 1 if the day of an observation is a Monday and a value of 0 otherwise. Although the Monday effect states that returns on a Monday are lower than other days of the week, it remains possible for them to be higher as well. For this reason, a 2-tailed null hypothesis is formulated.

$$R_t = \propto + \beta_1 Monday + \varepsilon_t \quad (4)$$

$H_0 4: \beta_1 = 0$

Equation 4 tests whether the prevalence of the Monday effect differs by market type with an interaction term between Market and Monday which indicates whether the effect differs per market type. It is expected that the coefficients for both Monday and the interaction term are negative in accordance with the effect.

$$R_t = \propto + \sum_{i=1}^{2} \beta_i Market_i + \gamma_1 Monday + \sum_{i=1}^{2} \lambda_i Market_i Monday + \varepsilon_t \quad (5)$$

$H_0 5: \lambda_i = 0$ for each i = 1, 2

Equation 5 keeps the Market variable to control for differing data availability across market types and introduces a variable for Period. The interaction between Period and Monday will indicate whether the effect is changing in prevalence across the periods. In testing for whether the effect differs by period, hypothesis 5 is formulated:

$$R_t = \propto + \sum_{i=1}^{2} \beta_i Market_i + \sum_{i=2}^{6} \varphi_i Period_i + \gamma_1 Monday + \sum_{i=2}^{6} \lambda_i Period_i Monday + \varepsilon_t \quad (6)$$

$H_0 6: \lambda_i = 0$ for each i = 2, …, 6

Rejecting any hypothesis for any market type or region can be considered as evidence for the existence of the Monday effect.

*4.3 Twist on the Monday Effect*

The Twist on the Monday effect can be seen as a further robustness test for the Monday effect which leads to the regression equations being the same as those for the Monday effect except for the addition of an extra variable which includes an interaction term. It is important to note, however, that the Twist on the Monday effect solely asserts that the abnormal negative returns expected by the Monday effect are more prominent if the stock market has declined in the previous week. Because of this, it is not necessary to compare Monday returns with those of other days of the week.

The existence of the Twist on the Monday effect across all observations is tested with equation 6. The extra variable, $Prior_{Negative}$, takes on a value of 1 if the previous week's return is negative and 0 otherwise. The null hypothesis to test for the existence of the Twist on the Monday effect checks whether including a variable for prior week's return implies that return estimates should be adjusted. Again, although the Twist on the Monday effect is implicit of negative Monday returns, it is still possible for these returns to be positive which is why a 2-tailed test is employed.

$$R_t = \propto + \lambda_1 Monday + \beta_1 Prior_{Negative} + \theta_1 Prior_{Negative} Monday + \varepsilon_t \quad (7)$$

$H_0 7: \theta_1 = 0$

Testing for differences in the effect by region is done with equation 7. The interaction term $MarketPrior_{Negative}Monday$ is the term of interest which will indicate whether the return on Monday differs depending on the previous week's return and furthermore, whether this return differs by region. The null hypothesis to test for the existence of the Twist on the Monday effect (and whether it differs by region) checks whether including a variable for prior week's return means that return estimates should be adjusted. Again, although the Twist on the

Monday effect is implicit of negative Monday returns, it is still possible for these returns to be positive which is why a 2-tailed test is employed.

$$R_t = \propto + \sum_{i=1}^{2} \gamma_i Market_i + \lambda_1 Monday + \beta_1 Prior_{Negative} + \sum_{i=1}^{2} \phi_i Market_i Monday + \sum_{i=1}^{2} \varphi_i Market_i Prior_{Negative} + \delta_1 Prior_{Negative} Monday + \sum_{i=1}^{2} \theta_i Market_i Prior_{Negative} Monday + \varepsilon_t \quad (8)$$

$H_0 8: \theta_i = 0$ for each i = 1, 2

Equation 8 tests for the existence of the effect and if it differs by period with $Period Prior_{Negative} Monday$ being the variable of interest. Hypothesis 8 is formulated to detect whether this effect may differ by region.

$$R_t = \propto + \sum_{i=1}^{2} \beta_i Market_i + \sum_{i=2}^{6} \gamma_i Period_i + \lambda_1 Monday + \varphi_1 Prior_{Negative} + \sum_{i=2}^{6} \phi_i Period_i Monday + \sum_{i=2}^{6} \varphi_i Period_i Prior_{Negative} + \delta_1 Prior_{Negative} Monday + \sum_{i=2}^{6} \theta_i Period_i Prior_{Negative} Monday + \varepsilon_t \quad (9)$$

$H_0 9: \theta_i = 0$ for each i = 2, …, 6

*4.4 Halloween Effect*

Testing for the Halloween effect involves a similar structure to that which is previously used in testing for anomalies, however, in both equations a dummy variable for whether a monthly return is in January or not is included. This is done as previous literature has shown that the inclusion of this dummy variable can often lead to the effect disappearing (Lucey & Zhao, 2008). An additional change is that the return variable, $R_t$, now represents monthly returns as opposed to daily returns. The dummy variable NovApr takes on a value of 1 if the return observation falls in any month from November until April, and takes on a value of 0 otherwise.

Equation 10 checks whether the Halloween effect exists with January returns controlled for as a robustness test. Furthermore, it checks whether the effect differs by region with the inclusion of an interaction term. Testing for the existence of the effect is done by setting the

(two-tailed) null hypothesis to state that returns in the months from November until April differ from those in other months.

$$R_t = \propto + \gamma_1 January + \phi_1 NovApr + \varepsilon \quad (10)$$

$H_0 10: \phi_i = 0$ for each i = 1, 2

Checking whether the effect differs by market is done with the inclusion of a variable for market and an interaction term for Market and NovApr. The null hypothesis states that returns in the months from November until April differ from those in other months for each market type.

$$R_t = \propto + \sum_{i=1}^{2} \beta_i Market_i + \gamma_1 January + \lambda_1 NovApr + \sum_{i=1}^{2} \phi_i Market_i NovApr + \varepsilon \quad (11)$$

$H_0 11: \phi_i = 0$ for each i = 1, 2

Similar to before, Equation 12 checks whether the effect may vary by period and a null hypothesis is formulated.

$$R_t = \propto + \sum_{i=1}^{2} \beta_i Market_i + \sum_{i=2}^{6} \varphi_i Period_i + \gamma_1 January + \lambda_1 NovApr + \sum_{i=2}^{6} \phi_j Period_j NovApr + \varepsilon \quad (12)$$

$H_0 12: \phi_i = 0$ for each i = 2, …, 6

## 5. Results

### *5.1 Day of the Week Effect*

The regression outputs used in testing for a Day of the Week effect are shown in the table A4. With no fixed effects being taken into consideration the evidence for the day of the week effect is weak. It is observed that the inclusion of variables for days does not add significant explanatory power at the 5% level for mean daily return, except for the case of Monday and Tuesday. This initial observation indicates that the Day of the Week effect may not be present in the data being used.

Table 5 summarises F-values in testing whether the coefficients significantly differ from 0. The values reported indicate that the coefficient does differ significantly at the 5%

level, however, this cannot be taken as evidence for the existence of the effect due to the lack of significance in the regression coefficients.

When analysing the effect by market, we again only observe significant coefficients for Monday and Tuesday across only developed and frontier markets. Although Wald test results indicate that an effect may be present across developed and emerging markets, the lack of consistent significant coefficients detracts from the viability of an effect.

Table A4 also displays outputs in testing whether the effect exists and differs by period. No discernible pattern exists which indicates that the effect does not exist or change by period. There is, however a somewhat persistent significant coefficient for Mondays which may be evidence for the existence of a Monday effect which will be analysed in the next subsection. Similar to before, the Wald test results indicate that the effect may exist for each period but in combination with the lack of significant results from regression analysis this cannot be taken to imply that the effect does exist. It is notable that the p-value for period 3 is further evidence of a lack of variation in daily returns.

Table 5: Post-estimation Wald test results for the Day of the Week effect ($H_0$1, $H_0$2 and $H_0$3)

| Group | F-Value | Prob>F |
|---|---|---|
| Overall | 5.66 | 0.0001 |
| Developed Markets | 4.82 | 0.0007 |
| Emerging Markets | 2.96 | 0.0187 |
| Period 1995-1999 | 7.13 | 0.0000 |
| Period 2000-2004 | 1.79 | 0.1267 |
| Period 2005-2009 | 3.70 | 0.0052 |
| Period 2010-2014 | 4.28 | 0.0018 |
| Period 2015-2018 | 2.86 | 0.0220 |

In summary, we find a lack of evidence for the existence of a Day of the Week effect across markets and periods and, therefore, a lack of significant change in the effect across markets and periods. These findings pertaining to emerging markets may extend what Aggarwal and Rivoli (1989) find and show that emerging markets no longer display a significant Day of the Week effect however, they somewhat contradict findings by Basher and Sadorsky (2006) who find a robust effect in emerging markets for more recent years in the range analysed. The lack of evidence for the existence of the effect across both markets and periods may be evidence that the effect has been arbitraged away or that market types and periods simply do not influence the effect.

*5.2 Monday Effect*

The output of the regression model used in detecting the Monday effect is shown in Table A5 and Table 6 provides the F-Values for Wald tests performed on the coefficients.
The initial model used which does not differentiate between markets or periods contains a significant negative coefficient for a Monday dummy variable. This, in conjunction with the significant F-value reported in table 6, indicates that the effect may exist.

Further evidence for the existence of the Monday effect is found in the model with market fixed effects where significant negative coefficients for interaction terms between Market and Monday are found. Wald tests shown in Table 6 provide further evidence for the existence of the effect in all markets by showing that the coefficients differ significantly from 0 for each market.

A similar result is found in testing for the existence of the Monday effect across periods: Significant interaction terms between Monday and period are found for each period which indicates that average returns on Monday do differ significantly from other days of the week in all periods. Further Wald tests indicate that the effect coefficients differ significantly from 0 which provides further evidence for the existence of the effect in each period.

One final observation is that the coefficients indicate that the effect is more pronounced in frontier markets than in developed markets. An explanation for this may be the lack of liquidity in frontier markets which in turn may lead to fewer anomalies being arbitraged away.

It is important to note that within the period fixed effects model the total calculated returns on a Monday are not strictly negative, which is unexpected owing to the initial definition of the Monday effect that returns are expected to be negative. From these results, it is not possible to infer whether the effect is more prominent across markets or periods owing to the high significance for all interaction terms and a lack of trends in coefficients. This inconsistently positive or negative significant coefficient is in contradiction with all papers discussed in the literature review pertaining to the Monday effect, except for that of Mehdian and Perry (2001), which found a reversed Monday effect (positive returns) in the post-1987 US stock market. The existence of this effect across all markets and periods can form part of an argument against the Efficient Market Hypothesis as Monday returns do, on average, differ in either direction. One explanation for this significant difference in returns is that Monday represents the first trading opportunity after two days of not being able to utilise financial markets. Therefore, there is an excess of accumulated information which will have to be incorporated into asset prices.

Table 6: Table of post-estimation Wald test results for the Monday effect ($H_0$4, $H_0$5 and $H_0$6)

| Group | F-Value | Prob>F |
|---|---|---|
| Overall | 17.30 | 0.0000 |
| Developed Markets | 7.67 | 0.0056 |
| Emerging Markets | 7.36 | 0.0067 |
| Period 1995-1999 | 12.79 | 0.0003 |
| Period 2000-2004 | 4.85 | 0.0277 |
| Period 2005-2009 | 11.33 | 0.0008 |
| Period 2010-2014 | 9.19 | 0.0024 |
| Period 2015-2018 | 5.46 | 0.0195 |

*5.3 Twist on the Monday Effect*

Table A6 is initially used to test for the Twist on the Monday effect, similar to testing for the Monday effect. The term of interest is the interaction term between Prior Negative and Monday

in the first model with no fixed effects. Both the positive significant coefficient for Monday and the negative significant coefficient for the interaction term provide strong evidence in support of the existence of the Twist on the Monday effect. Table 7 provides F-values of Wald tests on coefficients and the highly significant F-value is a further indication that the effect is prevalent in returns.

Additional significant effects are found for coefficients of interaction terms between market, prior return and Monday for each market which is an indication of a Twist on the Monday effect, however, similar to the Monday effect the total returns for Mondays following a market decline are not strictly negative as expected with the total return on Mondays for developed markets following a market decline being positive. Wald tests provide further evidence that for the effect, with significant F-values. Both regressions and F-tests can be seen as pointing towards an effect for frontier and emerging markets, with negative Monday returns being observed after a negative return in a prior week.

In analysing the effect by period, we see mostly significant coefficients, however, they are not strictly negative. Period 2, however, does not exhibit a significant coefficient and this is reinforced by the insignificant F-value for that period. The remaining F-values are all significant which indicates that the coefficients differ at the 5% level.

These findings for each period are similar to findings by Doyle and Chen (2009) who find that the Twist on the Monday effect is both insignificant and unchanging by period for more recent decades, however, the findings above do illustrate the existence of a reversal of the effect in some instances. In cases where the Monday effect is prevalent, a potential explanation is that it is because of momentum which has been observed to be a significant factor in predicting asset returns (Assness, Moskowitz, & Pedersen, 2013). Momentum, however, is also a reason for the effect's recent disappearance: Once literature pertaining to momentum strategies is published it can be used to arbitrage away anomalous returns which may be present.

Table 7: Table of post-estimation Wald test results for the Twist on the Monday effect ($H_0$7, $H_0$8 and $H_0$9)

| Group | F-Value | Prob>F |
|---|---|---|
| Overall | 107.12 | 0.0000 |
| Developed Markets | 20.28 | 0.0000 |
| Emerging Markets | 5.40 | 0.0201 |
| Period 1995-1999 | 0.61 | 0.4346 |
| Period 2000-2004 | 8.46 | 0.0036 |
| Period 2005-2009 | 2.70 | 0.1003 |
| Period 2010-2014 | 14.42 | 0.0001 |
| Period 2015-2018 | 12.46 | 0.0004 |

*5.4 Halloween Effect*

Similar to previous effects, the Halloween effect is analysed by initially employing regression models (as seen in table A8), the first of which indicates that the effect does exist with a

significant and positive coefficient for returns in the months of November until April. The relevant Wald test statistic found in Table 8 indicates that the coefficient does differ significantly from 0 and is further evidence in favour of the existence of the anomaly.

While this initial model appears to be favourable for the existence of the effect, when including interaction terms for markets significance is lost. Insignificant coefficients for interaction terms between market and NovAp are evidence for the effect not existing in any market. There is, however, a significant coefficient for the January variable which indicates that January monthly returns may be responsible for a perceived Halloween effect. This has also been proposed in all other papers which have dealt with this effect. Further evidence that the effect does not exist or differ by market is found in Table 8 where all F-values for markets are insignificant indicating that the coefficients, and therefore, mean monthly returns do not differ from each other for each period of months excluding January.

A similar pattern is seen in analysing the effect by period. All interaction coefficients are insignificant except for that of period of 2005-2004, however, the F-value for testing coefficients is still insignificant. As before, the remaining F-values are also insignificant indicating that the effect does not exist.

These findings are similar to those by the majority of other papers such as Maberly and Pierce (2004) and Lucey and Zhao (2008), who both find that the Halloween effect may be a reflection of the January effect.

Table 8: Table of post-estimation Wald test results for the Halloween effect ($H_0$10, $H_0$11 and $H_0$12)

| Group | F-Value | Prob>F |
|---|---|---|
| Overall | 12.39 | 0.0004 |
| Developed Markets | 0.77 | 0.3800 |
| Emerging Markets | 0.57 | 0.4487 |
| Period 1995-1999 | 0.03 | 0.8739 |
| Period 2000-2004 | 0.48 | 0.4906 |
| Period 2005-2009 | 3.86 | 0.0496 |
| Period 2010-2014 | 0.16 | 0.6937 |
| Period 2015-2018 | 0.32 | 0.5722 |

*5.5 Risk an as Explanatory Factor for Anomalous Returns*

Tables A8-A11 in the appendix summarise means and standard deviations for each effect by market and period. Table 9 summarises the $\chi 2$ statistics for Bartlett's test for equal variances. The most important effects and groupings are those for which evidence of a significant effect was found in both regression models and Wald tests.

No conclusive evidence was found in support of the Day of the Week effect which makes a test on variances of returns of days of the week irrelevant.

Regression models and Wald tests provided significant evidence for the existence of a (reversal) of the Monday effect. All tests for equality of variance show that the variances for Mondays differ significantly from those of other days of the week. Table A9 does not indicate

that lower returns on Mondays or any other day are correlated with lower risk measured as standard deviation. This in itself is an unexpected finding as it indicates that the risk-return trade off does not in fact hold on average and creates arbitrage opportunities.

Similar to the Monday effect, evidence was found for the existence of a (reversal) of a Twist on the Monday effect. Again, tests on equality of variances show that the volatilities of returns on Mondays after positive and negative prior weeks' returns differ significantly. When reviewing Table A10, we see that the negative or lower returns exhibited by Monday's after a week of negative returns are not always compensated with lower risk. One possible explanation for this is that the opportunity to short a stock and profit from its downturn still presents an opportunity for market participants to make a profit. Because of this, negative returns may not always be associated with lowered risk.

While the results for the Halloween effect in Table A11 may be tempting to attempt to interpret, one must keep in mind the prior highly insignificant regression and Wald test results. These initial results showing the lack of significance in the effect indicate that any further results we may see or attempt to infer may in fact be spurious as opposed to systematic, and therefore cannot be reliably interpreted.

Table 9: Table of results of Bartlett's test for equal variances for each effect grouped by market and period

| Effect | Category | $\chi 2$ | Prob>$\chi 2$ |
|---|---|---|---|
| Day of the Week | Developed Markets | 223.6753 | 0.000 |
| | Emerging Markets | 284.3618 | 0.000 |
| | Frontier Markets | 2700.0000 | 0.000 |
| | Period 1990-1994 | 552.8309 | 0.000 |
| | Period 1995-1999 | 46.1265 | 0.000 |
| | Period 2000-2004 | 3300.0000 | 0.000 |
| | Period 2005-2009 | 207.8302 | 0.000 |
| | Period 2010-2014 | 85.1069 | 0.000 |
| | Period 2015-2018 | 36.1092 | 0.000 |
| Monday | Developed Markets | 205.3812 | 0.000 |
| | Emerging Markets | 105.6730 | 0.000 |
| | Frontier Markets | 312.2168 | 0.000 |
| | Period 1990-1994 | 280.3973 | 0.000 |
| | Period 1995-1999 | 13.4297 | 0.000 |
| | Period 2000-2004 | 93.4388 | 0.000 |
| | Period 2005-2009 | 182.8602 | 0.000 |
| | Period 2010-2014 | 31.6684 | 0.000 |
| | Period 2015-2018 | 31.0595 | 0.000 |
| Twist on Monday | Developed Markets | 553.1899 | 0.000 |
| | Emerging Markets | 149.6505 | 0.000 |
| | Frontier Markets | 887.5665 | 0.000 |
| | Period 1990-1994 | 97.5287 | 0.000 |

| | | | |
|---|---|---|---|
| | Period 1995-1999 | 94.2790 | 0.000 |
| | Period 2000-2004 | 625.4497 | 0.000 |
| | Period 2005-2009 | 322.1580 | 0.000 |
| | Period 2010-2014 | 159.1316 | 0.000 |
| | Period 2015-2018 | 135.0050 | 0.000 |
| Halloween | Developed Markets | 0.2323 | 0.630 |
| | Emerging Markets | 0.7773 | 0.378 |
| | Frontier Markets | 44.9148 | 0.000 |
| | Period 1990-1994 | 13.6874 | 0.000 |
| | Period 1995-1999 | 0.8281 | 0.363 |
| | Period 2000-2004 | 0.5319 | 0.466 |
| | Period 2005-2009 | 15.9420 | 0.000 |
| | Period 2010-2014 | 8.8499 | 0.003 |
| | Period 2015-2018 | 7.7206 | 0.005 |

*5.6 Trading Strategies*

Trading strategies pertaining to anomalies tend to be difficult to employ owing to the small percentages by which anomalies reflect returns, if at all. Barriers to the practical application of anomalies present themselves in trading costs and liquidity concerns, especially when the anomalous returns present themselves as such a small percentage. This section will make the naive assumption that transaction costs do not exist and there are no liquidity concerns pertaining to portfolio construction.

Similar to the previous section, regression models are first employed to determine whether an effect exists and if this is at high enough significance level to warrant a trading strategy. As trading only occurs on present day prices, the most significant interactions are those for markets and those for period 2015-2018. Analysis of the Day of the Week effect provides no significant results and, therefore, no viable trading opportunities.

Regressions on the Monday effect for both market and period indicate that a profit could be earned by purchasing assets on a day other than a Monday and reselling them on a Monday at a fractionally higher mean price owing to the fractionally higher mean return. The Monday effect does not display any consistent risk-return anomalies which makes it difficult to create arbitrage opportunities stemming from risk.

Trading on the Twist on the Monday effect may be possible, however, it may also be more difficult to accomplish. One potential strategy would involve shorting a security at the end of the week if a trader expects the market to post a negative return. Subsequently, on the coming Monday the security should decline more than would be otherwise expected which will produce a profit for the trader. Discrepancies between risk and return do not appear to be observable and, therefore, cannot be exploited.

Finally, regression models on the Halloween effect failed to produce significant results which implies few trading opportunities or opportunities with exceedingly high risk. One

notable opportunity revolves around the control variable for January: This variable had a significant positive return, which indicates that a profitable trade can be made by purchasing a security before January and subsequently liquidating at the end of the month.

## 6. Conclusion

The anomalies analysed in this paper are the Day of the Week Effect, the Monday Effect, the Twist on the Monday Effect and the Halloween effect. The return data are for the period form 1990-2018 and pertain to developed, emerging and frontier markets. First, regression models are estimated which test for the existence of an effect across all observations. Next, terms are added to determine whether an effect differs by market type and finally, terms are added to determine whether an effect differs by period. A subsequent Wald test on coefficients serves to reinforce regression findings.

In analysing the Day of The Week effect, none of the models find evidence for the existence of the effect and it is, therefore, not found to be differing by market or period. The models do, however, already lead to an indication of the existence of a Monday Effect with significant coefficients for Mondays.

While there is a notable lack of evidence for the existence of a Day of the Week effect, the Monday effect is found to be prominent among all observations. The prevalence of this anomaly remains when taking into account different markets and periods. Despite this significance, however, no discernible trend is found and while the return may differ significantly, it is not always negative as the effect implies.

Similar to the Monday effect, the Twist on the Monday effect is found to be prominent amongst the return observations. This prominence remains across markets and mostly across periods. Again, it is notable that the Monday returns following a market decline are not strictly negative as the effect suggests.

Finally, the Halloween effect at first appears to be present in stock returns, however, when analysing the effect across both markets and periods it becomes insignificant.

Using risk to explain any anomalous returns proves to be difficult to do. The risk-return trade-off is expected to hold, however, in the majority of instances this is not the case. It is notable, though, that the lack of this relationship can imply the presence of arbitrage opportunities and a rejection of the efficient market hypothesis.

The practical application of these findings pertains to trading strategies, however, its implementation would be difficult to achieve owing to transaction costs reducing actual returns and the lack of consistence in anomalies.

This paper contributes to prior literature by analysing a more recent dataset of index returns (1990-2018). In addition to this, anomalies are compared between both markets and periods in an attempt to distinguish a trend in the presence of calendar effects.

The importance and relevance of the findings in this paper pertain to both academia and industry. From the academia point of view, the existence of anomalies may lead to a rejection of the efficient market hypothesis, while from an industry point of view the presence of anomalies may present opportunities for profitable trading and investment strategies.

Limitations of this paper cannot be ignored, however, they also provide the basis for future research. One of the most evident limitations is that the paper does not analyse how

effects differ by both market and period at the same time. An analysis of this can be combined with a prediction of which markets may have a higher prevalence of these calendar effects. The dataset may also be expanded to include returns for additional countries which will lead to the results for each market type being more representative. Finally, while the subsection on trading strategies provides a brief overview of how these anomalies may be exploited further research is needed to determine the financial viability of such strategies and the actual return they may generate.

Calendar anomalies have lacked attention in recent years and for this reason there is a wealth of additional research to be performed on the subject. One further line of research would be to analyse the effects by both market and period to determine whether effect are more prominent in certain markets and time periods. A different approach would involve the implementation of unsupervised machine learning algorithms to reveal anomalies which humans would otherwise be unable to detect.

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**Appendix**

Table A1: Years of data available for each index

| Index | Years Available |
|---|---|
| S&P 500 | 1990 – 2018 |
| FTSE 100 | 1990 – 2018 |
| NIKKEI 225 | 1990 – 2018 |
| DAX | 1990 – 2018 |
| FTSE MIB | 1998 – 2018 |
| CAC 40 | 1990 – 2018 |
| S&P/TSX | 1990 – 2018 |
| MSCI Brazil | 1990 – 2018 |
| MOEX | 1997 – 2018 |
| NIFTY 500 | 1991 – 2018 |
| Shanghai | 1991 – 2018 |
| JSE FTSE | 1995 – 2018 |
| MERVAL | 1990 – 2018 |
| KIC | 1995 - 2013 |
| Ho Chi Minh | 2000 – 2018 |
| MSCI Morocco | 1995 – 2018 |
| S&P Nigeria | 1995 – 2018 |

Table A2: Mean returns ($x10^4$) of each index grouped by day and period

| | | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|---|
| 1990-1994 | S&P 500 | 11.51 | -0.73 | 6.16 | -2.45 | -4.40 |
| | FTSE 100 | -3.93 | 5.06 | 0.15 | 7.11 | 0.61 |
| | NIKKEI 225 | -28.13 | -2.94 | -6.04 | 15.91 | -4.95 |
| | DAX | -0.59 | -6.95 | -2.10 | 10.70 | 5.17 |
| | FTSE MIB | | | | | |
| | CAC 40 | -16.88 | 1.01 | -2.12 | 12.26 | 3.30 |
| | S&P/TSX | 0.26 | 1.10 | 1.82 | 2.11 | -2.99 |
| | MSCI Brazil | 70.92 | 120.52 | 83.10 | 117.87 | 116.63 |
| | MOEX | | | | | |
| | NIFTY 500 | 15.91 | -4.40 | -5.70 | 3.11 | 39.61 |
| | Shanghai | -29.36 | -17.79 | 9.56 | 58.09 | 56.60 |
| | JSE FTSE | | | | | |
| | MERVAL | -63.69 | 7.06 | 83.15 | 57.40 | 12.17 |
| | KIC | | | | 0.00 | 0.00 |
| | Ho Chi Minh | | | | | |
| | MSCI Morocco | | | | | |
| | S&P Nigeria | | | | | |
| 1995-1999 | S&P 500 | 9.53 | 12.98 | 10.60 | -4.06 | 15.50 |
| | FTSE 100 | 9.60 | 9.02 | 9.10 | -0.75 | 4.28 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | NIKKEI 225 | -5.56 | 16.09 | 6.79 | -5.03 | -13.84 |
| | DAX | 20.66 | 13.55 | 23.20 | -14.71 | 3.07 |
| | FTSE MIB | 45.19 | 16.00 | 1.72 | -19.37 | 10.13 |
| | CAC 40 | 10.70 | 18.53 | 17.57 | -5.70 | 3.08 |
| | S&P/TSX | 7.06 | 3.41 | 8.92 | -7.02 | 14.13 |
| | MSCI Brazil | -13.16 | 26.28 | 9.27 | -22.94 | 36.72 |
| | MOEX | 40.83 | 37.22 | -14.27 | -7.72 | -20.60 |
| | NIFTY 500 | 5.05 | -14.76 | 37.19 | -4.96 | -14.36 |
| | Shanghai | 10.38 | -32.83 | 30.31 | -12.35 | 33.08 |
| | JSE FTSE | 11.00 | 1.74 | 11.75 | -3.56 | 1.93 |
| | MERVAL | -12.69 | 17.04 | -7.19 | -20.93 | 30.61 |
| | KIC | -1.91 | 5.19 | -4.41 | 20.37 | -10.03 |
| | Ho Chi Minh | | | | | |
| | MSCI Morocco | 2.34 | 5.19 | 2.76 | 9.89 | 14.81 |
| | S&P Nigeria | -0.03 | 5.16 | 6.71 | 6.36 | 6.39 |
| 2000-2004 | S&P 500 | 0.29 | -0.92 | -4.59 | 8.51 | -10.66 |
| | FTSE 100 | -5.16 | -4.36 | -16.71 | 6.14 | 6.13 |
| | NIKKEI 225 | -5.82 | -3.14 | -4.23 | -8.11 | 2.16 |
| | DAX | -4.06 | -3.90 | -20.89 | 11.33 | -1.31 |
| | FTSE MIB | -11.46 | 0.65 | -7.50 | 6.38 | -0.37 |
| | CAC 40 | -5.94 | -6.34 | -20.97 | 13.99 | 2.25 |
| | S&P/TSX | 9.42 | -3.93 | -13.34 | 8.94 | 2.53 |
| | MSCI Brazil | -14.91 | 10.46 | 8.39 | 4.50 | 12.59 |
| | MOEX | 18.89 | 6.79 | -21.56 | 11.09 | 33.99 |
| | NIFTY 500 | -5.19 | -1.79 | 21.93 | 4.07 | -3.54 |
| | Shanghai | -6.18 | 16.54 | -1.91 | -7.74 | -3.64 |
| | JSE FTSE | 6.77 | 9.23 | -9.50 | 8.73 | 0.67 |
| | MERVAL | -1.95 | -3.15 | 14.72 | 19.30 | 6.17 |
| | KIC | -34.38 | 14.33 | 2.33 | 68.64 | -7.88 |
| | Ho Chi Minh | -9.67 | -6.81 | 19.48 | 7.29 | 27.49 |
| | MSCI Morocco | -6.42 | -10.95 | 2.37 | 6.95 | -2.51 |
| | S&P Nigeria | 8.47 | 13.24 | 10.56 | 11.49 | 20.44 |
| 2005-2009 | S&P 500 | -6.03 | 5.80 | -0.42 | -1.41 | -1.14 |
| | FTSE 100 | 4.39 | 2.90 | -4.42 | -5.20 | 6.84 |
| | NIKKEI 225 | -1.76 | 1.02 | -3.86 | 9.89 | -8.61 |
| | DAX | 9.91 | 5.36 | 1.65 | -4.07 | 0.04 |
| | FTSE MIB | -6.22 | -3.09 | 10.35 | -7.09 | -4.88 |
| | CAC 40 | -0.09 | 3.41 | 4.34 | -8.47 | 1.96 |
| | S&P/TSX | -13.15 | 3.41 | 4.97 | 1.85 | 12.13 |
| | MSCI Brazil | -2.87 | 5.06 | 15.28 | 3.80 | 10.22 |
| | MOEX | 15.61 | -15.34 | 8.39 | 6.35 | 20.14 |
| | NIFTY 500 | 2.87 | 3.99 | 10.07 | 1.53 | 15.11 |
| | Shanghai | 33.20 | -16.28 | 23.39 | -7.91 | 4.05 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | JSE FTSE | 7.98 | -0.97 | 5.15 | 13.59 | 4.22 |
| | MERVAL | -12.35 | 1.60 | 4.53 | 8.17 | 18.16 |
| | KIC | -6.99 | -4.59 | 8.88 | 11.11 | -9.07 |
| | Ho Chi Minh | 3.20 | -16.00 | 6.86 | 8.61 | 25.26 |
| | MSCI Morocco | 7.81 | 6.27 | -1.36 | 6.85 | 5.98 |
| | S&P Nigeria | 6.21 | -14.04 | -7.47 | -0.71 | 17.86 |
| 2010-2014 | S&P 500 | 0.58 | 12.05 | 1.75 | 5.04 | 4.09 |
| | FTSE 100 | -2.47 | 13.02 | -6.29 | 2.87 | 0.29 |
| | NIKKEI 225 | -0.76 | -3.63 | 14.33 | 5.39 | 3.98 |
| | DAX | -3.18 | 11.87 | 7.11 | 4.93 | -1.62 |
| | FTSE MIB | -20.26 | 6.78 | 4.64 | 0.45 | 0.68 |
| | CAC 40 | -5.44 | 6.43 | 0.31 | 3.41 | -1.56 |
| | S&P/TSX | -6.17 | 10.75 | 1.61 | 0.05 | 2.18 |
| | MSCI Brazil | -1.60 | -5.62 | -2.84 | -0.38 | 0.47 |
| | MOEX | 4.63 | 1.14 | 4.25 | -11.51 | 2.18 |
| | NIFTY 500 | 10.19 | 1.27 | 6.87 | -1.78 | 0.61 |
| | Shanghai | 0.44 | -5.55 | 6.96 | -17.29 | 14.88 |
| | JSE FTSE | 7.44 | 6.70 | 6.82 | 4.92 | -3.36 |
| | MERVAL | 4.72 | 9.81 | 12.09 | 5.57 | 17.93 |
| | KIC | -0.01 | 7.25 | -0.75 | 3.71 | -13.74 |
| | Ho Chi Minh | -3.22 | -13.69 | 4.17 | 3.74 | 12.75 |
| | MSCI Morocco | -3.44 | -5.03 | 11.50 | -3.21 | -9.86 |
| | S&P Nigeria | -4.27 | 0.43 | 7.95 | -1.21 | 10.19 |
| 2015-2018 | S&P 500 | 2.59 | 1.93 | 9.95 | 3.37 | -1.11 |
| | FTSE 100 | -6.47 | -0.52 | 14.25 | 1.43 | 1.40 |
| | NIKKEI 225 | 6.52 | -4.91 | 7.65 | 8.04 | -0.30 |
| | DAX | 4.67 | -1.85 | 11.59 | 4.78 | -1.54 |
| | FTSE MIB | -23.89 | 6.71 | 14.03 | 16.53 | -4.53 |
| | CAC 40 | -7.15 | -0.48 | 15.19 | 8.97 | -2.60 |
| | S&P/TSX | -5.49 | 0.83 | 6.82 | 5.29 | -0.92 |
| | MSCI Brazil | -1.49 | 9.84 | 20.09 | -0.68 | -7.18 |
| | MOEX | 3.20 | 17.21 | 1.89 | 12.36 | -8.24 |
| | NIFTY 500 | 5.11 | -2.09 | 6.01 | 5.10 | 7.41 |
| | Shanghai | -0.38 | 13.02 | 4.14 | -11.75 | -3.50 |
| | JSE FTSE | 7.35 | -4.59 | 6.66 | 9.07 | -7.05 |
| | MERVAL | -3.66 | 19.94 | 24.05 | 25.99 | 13.81 |
| | KIC | | | | | |
| | Ho Chi Minh | -10.27 | 11.07 | 16.54 | 9.25 | 11.08 |
| | MSCI Morocco | 1.19 | -3.17 | 2.14 | 0.61 | 10.20 |
| | S&P Nigeria | -13.58 | -18.23 | 0.82 | 18.35 | 20.97 |

Table A3: Mean returns ($x10^4$) of each index grouped by months and period

| | November – April | May – October |
|---|---|---|

| | | | |
|---|---|---|---|
| 1990-1994 | S&P 500 | 60.75 | 21.02 |
| | FTSE 100 | 53.88 | 23.53 |
| | NIKKEI 225 | -116.50 | -126.13 |
| | DAX | 155.04 | -105.29 |
| | FTSE MIB | | |
| | CAC 40 | 121.27 | -123.47 |
| | S&P/TSX | 42.23 | -31.50 |
| | MSCI Brazil | 2426.79 | 2098.88 |
| | MOEX | | |
| | NIFTY 500 | 343.46 | 123.17 |
| | Shanghai | 265.27 | 449.21 |
| | JSE FTSE | | |
| | MERVAL | 607.33 | 292.13 |
| | KIC | | |
| | Ho Chi Minh | | |
| | MSCI Morocco | | |
| | S&P Nigeria | | |
| 1995-1999 | S&P 500 | 276.99 | 101.59 |
| | FTSE 100 | 211.90 | 48.87 |
| | NIKKEI 225 | -12.68 | 3.48 |
| | DAX | 260.61 | 94.22 |
| | FTSE MIB | 709.75 | -307.46 |
| | CAC 40 | 341.83 | -5.83 |
| | S&P/TSX | 202.86 | 3.96 |
| | MSCI Brazil | 179.68 | 62.59 |
| | MOEX | 958.30 | -978.12 |
| | NIFTY 500 | -6.65 | 13.31 |
| | Shanghai | 19.24 | 231.38 |
| | JSE FTSE | 241.10 | -71.11 |
| | MERVAL | 53.96 | -39.88 |
| | KIC | -74.41 | 151.38 |
| | Ho Chi Minh | | |
| | MSCI Morocco | 217.93 | 96.80 |
| | S&P Nigeria | 108.26 | 95.51 |
| 2000-2004 | S&P 500 | 39.23 | -92.48 |
| | FTSE 100 | -0.31 | -112.65 |
| | NIKKEI 225 | -9.14 | -170.68 |
| | DAX | 115.26 | -231.56 |
| | FTSE MIB | 120.20 | -189.53 |
| | CAC 40 | 58.95 | -175.23 |
| | S&P/TSX | 81.05 | -21.98 |
| | MSCI Brazil | 263.06 | -43.83 |
| | MOEX | 442.75 | 71.34 |

| | | | |
|---|---|---|---|
| | NIFTY 500 | 228.30 | -75.40 |
| | Shanghai | 133.62 | -160.52 |
| | JSE FTSE | 128.17 | 45.81 |
| | MERVAL | 447.07 | -177.30 |
| | KIC | 193.43 | 183.91 |
| | Ho Chi Minh | 432.70 | -114.81 |
| | MSCI Morocco | -47.37 | -82.32 |
| | S&P Nigeria | 367.28 | 198.20 |
| 2005-2009 | S&P 500 | -99.26 | 75.33 |
| | FTSE 100 | -31.66 | 69.95 |
| | NIKKEI 225 | -85.92 | 46.18 |
| | DAX | -35.56 | 142.92 |
| | FTSE MIB | -148.67 | 54.53 |
| | CAC 40 | -79.42 | 77.57 |
| | S&P/TSX | 2.46 | 82.82 |
| | MSCI Brazil | 138.95 | 156.07 |
| | MOEX | 141.90 | 143.95 |
| | NIFTY 500 | -4.84 | 315.82 |
| | Shanghai | 117.65 | 177.44 |
| | JSE FTSE | 143.81 | 114.23 |
| | MERVAL | 43.90 | 153.91 |
| | KIC | -176.81 | 157.46 |
| | Ho Chi Minh | 20.77 | 244.88 |
| | MSCI Morocco | 207.17 | 41.44 |
| | S&P Nigeria | -210.08 | 225.85 |
| 2010-2014 | S&P 500 | 234.98 | -29.59 |
| | FTSE 100 | 145.86 | -70.67 |
| | NIKKEI 225 | 264.43 | -61.61 |
| | DAX | 238.48 | -56.78 |
| | FTSE MIB | 108.00 | -153.36 |
| | CAC 40 | 155.68 | -106.40 |
| | S&P/TSX | 134.33 | -60.15 |
| | MSCI Brazil | 53.41 | -128.98 |
| | MOEX | 161.62 | -101.86 |
| | NIFTY 500 | 88.89 | 75.19 |
| | Shanghai | 58.55 | -121.30 |
| | JSE FTSE | 158.73 | 35.57 |
| | MERVAL | 294.25 | 187.12 |
| | KIC | 29.93 | -42.85 |
| | Ho Chi Minh | 138.83 | -106.12 |
| | MSCI Morocco | 49.41 | -118.07 |
| | S&P Nigeria | 138.10 | -14.15 |
| 2015-2018 | S&P 500 | 84.44 | 50.35 |

| | | |
|---|---|---|
| FTSE 100 | 10.90 | 60.95 |
| NIKKEI 225 | 76.55 | 31.52 |
| DAX | 138.57 | -30.14 |
| FTSE MIB | 90.09 | -41.06 |
| CAC 40 | 99.76 | 1.28 |
| S&P/TSX | 28.96 | 14.42 |
| MSCI Brazil | 119.92 | 6.76 |
| MOEX | 126.44 | 48.16 |
| NIFTY 500 | 48.31 | 93.84 |
| Shanghai | 159.31 | -106.50 |
| JSE FTSE | 44.77 | 30.28 |
| MERVAL | 386.15 | 130.50 |
| KIC | | |
| Ho Chi Minh | 179.15 | 82.16 |
| MSCI Morocco | 87.12 | -39.32 |
| S&P Nigeria | -106.39 | 168.54 |

Table A4: Regression table for the Day of the Week effect where the dependent variable is daily return

| | No Fixed Effects | Market Fixed Effects | Period Fixed Effects |
|---|---|---|---|
| Developed Markets | | -0.00085** | -0.0005*** |
| | | (-2.23) | (-3.37) |
| Emerging Markets | | 0.00037 | 0.00027 |
| | | (0.87) | (1.59) |
| Monday | -0.00072*** | -0.00161*** | -0.00254*** |
| | (-3.92) | (-3.29) | (-3.74) |
| Tuesday | -0.00034** | -0.00086** | -0.00100* |
| | (-2.07) | (-2.06) | (-1.75) |
| Wednesday | -0.00004 | -0.00001 | -0.00037 |
| | (-0.22) | (-0.03) | (-0.64) |
| Thursday | -0.0001 | 0.00023 | 0.00070 |
| | (-0.55) | (0.50) | (1.11) |
| Developed*Monday | | 0.00137*** | |
| | | (2.60) | |
| Developed*Tuesday | | 0.00110** | |
| | | (2.43) | |
| Developed*Wednesday | | 0.00011 | |
| | | (0.23) | |
| Developed*Thursday | | -0.00010 | |
| | | (-0.19) | |
| Emerging*Monday | | 0.00098* | |
| | | (1.63) | |

| | | |
|---|---|---|
| Emerging*Tuesday | 0.00010 | |
| | (0.19) | |
| Emerging*Wednesday | -0.00023 | |
| | (-0.44) | |
| Emerging*Thursday | -0.00097* | |
| | (-1.67) | |
| Period 1995-1999 | | -0.0013*** |
| | | (-3.05) |
| Period 2000-2004 | | -0.00174*** |
| | | (-2.99) |
| Period 2005-2009 | | -0.00153*** |
| | | (-3.46) |
| Period 2010-2014 | | -0.00194*** |
| | | (-4.73) |
| Period 2015-2018 | | -0.00211*** |
| | | (-4.89) |
| Period 1995-1999*Monday | | 0.00233*** |
| | | (2.98) |
| Period 1995-1999*Tuesday | | 0.00093 |
| | | (1.35) |
| Period 1995-1999*Wednesday | | 0.00061 |
| | | (0.90) |
| Period 1995-1999*Thursday | | -0.00204*** |
| | | (-2.76) |
| Period 2000-2004*Monday | | 0.00167* |
| | | (1.85) |
| Period 2000-2004*Tuesday | | 0.00068 |
| | | (0.88) |
| Period 2000-2004*Wednesday | | -0.00037 |
| | | (-0.49) |
| Period 2000-2004*Thursday | | -0.00011 |
| | | (-0.13) |
| Period 2005-2009*Monday | | 0.00209*** |
| | | (2.70) |
| Period 2005-2009*Tuesday | | 0.00012 |
| | | (0.18) |
| Period 2005-2009*Wednesday | | 0.00018 |
| | | (0.27) |
| Period 2005-2009*Thursday | | -0.00118* |
| | | (-1.64) |
| Period 2010-2014*Monday | | 0.00213*** |
| | | (2.92) |
| Period 2010-2014*Tuesday | | 0.00103* |

| | | | |
|---|---|---|---|
| | | | (1.65) |
| Period 2010-2014*Wednesday | | | 0.00058* |
| | | | (0.93) |
| Period 2010-2014*Thursday | | | -0.00096 |
| | | | (-1.40) |
| Period 2015-2018*Monday | | | 0.00211*** |
| | | | (2.81) |
| Period 2015-2018*Tuesday | | | 0.00112* |
| | | | (1.72) |
| Period 2015-2018*Wednesday | | | 0.00119* |
| | | | (1.84) |
| Period 2015-2018*Thursday | | | -0.00006 |
| | | | (-0.09) |
| Constant | 0.00067*** | 0.00094*** | 0.00211*** |
| | (5.33) | 2.61 | (5.70) |

***Significant at the 0.01 level. **Significant at the 0.05 level. *Significant at the 0.10 level.

Table A5: Regression table for the Monday effect where the dependent variable is daily return

| | No Fixed Effects | Market Fixed Effects | Period Fixed Effects |
|---|---|---|---|
| Developed Markets | | -0.00057*** | -0.0005*** |
| | | (-3.73) | (-3.37) |
| Emerging Markets | | 0.00009 | -0.00027 |
| | | (0.51) | (1.59) |
| Monday | -0.0006*** | -0.00145*** | -0.00237*** |
| | (-4.16) | (-4.02) | (-3.89) |
| Developed*Monday | | 0.00109*** | |
| | | (2.77) | |
| Emerging*Monday | | 0.00126*** | |
| | | (2.71) | |
| Period 1995-1999 | | | -0.00152*** |
| | | | (-5.74) |
| Period 2000-2004 | | | -0.00169*** |
| | | | (-6.08) |
| Period 2005-2009 | | | -0.00175*** |
| | | | (-6.69) |
| Period 2010-2014 | | | -0.00178*** |
| | | | (-7.20) |
| Period 2015-2018 | | | -0.00155*** |
| | | | (-6.15) |
| Period 1995-1999*Monday | | | 0.00245*** |
| | | | (3.58) |

| | | | |
|---|---|---|---|
| Period 2000-2004*Monday | | | 0.00162** |
| | | | (2.20) |
| Period 2005-2009*Monday | | | 0.00231*** |
| | | | (3.37) |
| Period 2010-2014*Monday | | | 0.00196*** |
| | | | (3.03) |
| Period 2015-2018*Monday | | | 0.00155** |
| | | | (2.34) |
| Constant | 0.00056*** | 0.00078*** | 0.00218*** |
| | (9.65) | (5.60) | (7.96) |

***Significant at the 0.01 level. **Significant at the 0.05 level. *Significant at the 0.10 level.

Table A6: Regression table for the Twist on the Monday effect where the dependent variable is daily return

| | No Effects | Market Effects | Period Effects |
|---|---|---|---|
| Developed Markets | | -0.0012*** | -0.00049*** |
| | | (-6.58) | (-3.32) |
| Emerging Markets | | -0.00033* | 0.00024 |
| | | (-1.46) | (1.44) |
| Monday | 0.00074*** | -0.00012 | 0.00038 |
| | (3.80) | (-0.21) | (0.42) |
| Prior Negative | -0.0001 | -0.00098*** | -0.00105** |
| | (-0.81) | (-3.42) | (-2.39) |
| Developed*Monday | | 0.0002 | |
| | | (0.45) | |
| Emerging*Monday | | 0.00245*** | |
| | | (3.67) | |
| Prior Negative*Monday | -0.00298*** | -0.00292*** | -0.00594*** |
| | (-10.35) | (-4.17) | (-4.96) |
| Developed*Prior Negative | | 0.00138*** | |
| | | (4.41) | |
| Emerging*Prior Negative | | 0.00092** | |
| | | (2.44) | |
| Developed*Prior Negative*Monday | | 0.00316*** | |
| | | (4.50) | |
| Emerging*Prior Negative*Monday | | -0.00194** | |
| | | (-2.32) | |
| Period 1995-1999 | | | -0.00204*** |
| | | | (-5.67) |
| Period 2000-2004 | | | -0.00207*** |
| | | | (-5.51) |
| Period 2005-2009 | | | -0.00226*** |
| | | | (-6.40) |

| | | | |
|---|---|---|---|
| Period 2010-2014 | | | -0.0023*** |
| | | | (-6.72) |
| Period 2015-2018 | | | -0.00217*** |
| | | | (-6.24) |
| Period 1995-1999*Monday | | | 0.00184* |
| | | | (1.85) |
| Period 2000-2004*Monday | | | -0.00032 |
| | | | (-0.28) |
| Period 2005-2009*Monday | | | 0.00117 |
| | | | (1.19) |
| Period 2010-2014*Monday | | | -0.00029 |
| | | | (-0.30) |
| Period 2015-2018*Monday | | | -0.00063 |
| | | | (-0.65) |
| Period 1995-1999*Prior Negative | | | 0.00111** |
| | | | (2.15) |
| Period 2000-2004*Prior Negative | | | 0.0008 |
| | | | (1.43) |
| Period 2005-2009*Prior Negative | | | 0.0011** |
| | | | (2.33) |
| Period 2010-2014*Prior Negative | | | 0.0011*** |
| | | | (2.33) |
| Period 2015-2018*Prior Negative | | | 0.00133*** |
| | | | (2.70) |
| Period 1995-1999*Prior | | | 0.00106 |
| Negative*Monday | | | (0.78) |
| Period 2000-2004*Prior | | | 0.00418*** |
| Negative*Monday | | | (2.91) |
| Period 2005-2009*Prior | | | 0.00224*** |
| Negative*Monday | | | (1.64) |
| Period 2010-2014*Prior | | | 0.00484*** |
| Negative*Monday | | | (3.80) |
| Period 2015-2018*Prior | | | 0.00463*** |
| Negative*Monday | | | (3.53) |
| Constant | 0.0006*** | 0.00123*** | 0.00268*** |
| | (8.52) | (7.37) | (7.48) |

***Significant at the 0.01 level. **Significant at the 0.05 level. *Significant at the 0.10 level.

Table A7: Regression table for the Halloween effect where the dependent variable is monthly return

| | No Effects | Market Effects | Period Effects |
|---|---|---|---|
| Developed Markets | | -0.01019*** | -0.01091*** |

| | | | |
|---|---|---|---|
| | | (-2.74) | (-3.44) |
| Emerging Markets | | 0.00454 | 0.0059 |
| | | (0.87) | (1.53) |
| January | 0.01126*** | 0.01132*** | 0.01205*** |
| | (2.76) | (2.76) | (2.97) |
| November-April | 0.00909*** | 0.00506 | 0.01238 |
| | (3.52) | (0.92) | (0.92) |
| Developed*November-April | | 0.00509 | |
| | | (0.88) | |
| Emerging*November-April | | 0.00596 | |
| | | (0.76) | |
| Period 1995-1999 | | | -0.02645*** |
| | | | (-2.81) |
| Period 2000-2004 | | | -0.03528*** |
| | | | (-3.87) |
| Period 2005-2009 | | | -0.01517* |
| | | | (-1.66) |
| Period 2010-2014 | | | -0.033368*** |
| | | | (-3.79) |
| Period 2015-2018 | | | -0.02527*** |
| | | | (-2.84) |
| Period 1995-1999*November-April | | | 0.0023 |
| | | | (0.16) |
| Period 2000-2004*November-April | | | 0.00975 |
| | | | (0.69) |
| Period 2005-2009*November-April | | | -0.02813** |
| | | | (-1.96) |
| Period 2010-2014*November-April | | | 0.00543 |
| | | | (0.39) |
| Period 2015-2018*November-April | | | -0.00787 |
| | | | (-0.56) |
| Constant | 0.00399** | 0.00719** | 0.03134*** |
| | (2.42) | (2.15) | (3.48) |

***Significant at the 0.01 level. **Significant at the 0.05 level. *Significant at the 0.10 level.

Table A8: Mean and standard deviation values ($x10^4$) for daily returns of different days of the week grouped by both market and period

| Grouping | Day | Mean | Standard Deviation |
|---|---|---|---|
| Developed Markets | Monday | -1.55 | 138.98 |
| | Tuesday | 3.36 | 125.25 |
| | Wednesday | 1.86 | 122.83 |
| | Thursday | 2.32 | 127.01 |
| | Friday | 0.94 | 122.33 |

| | | | |
|---|---|---|---|
| Emerging Markets | Monday | 6.78 | 214.04 |
| | Tuesday | 5.53 | 193.08 |
| | Wednesday | 10.65 | 189.04 |
| | Thursday | 5.74 | 211.78 |
| | Friday | 13.13 | 180.93 |
| Frontier Markets | Monday | -6.72 | 253.36 |
| | Tuesday | 0.8 | 162.69 |
| | Wednesday | 9.29 | 161.03 |
| | Thursday | 11.77 | 228.94 |
| | Friday | 9.43 | 274.05 |
| Period 1990-1994 | Monday | -4.3 | 284.69 |
| | Tuesday | 11.1 | 218.1 |
| | Wednesday | 17.43 | 217.2 |
| | Thursday | 28.1 | 257.73 |
| | Friday | 21.09 | 185.41 |
| Period 1995-1999 | Monday | 6.03 | 174.21 |
| | Tuesday | 7.45 | 171.33 |
| | Wednesday | 10.57 | 158.1 |
| | Thursday | -5.25 | 170.75 |
| | Friday | 8.13 | 164.31 |
| Period 2000-2004 | Monday | -3.92 | 247.42 |
| | Tuesday | 1.58 | 148.2 |
| | Wednesday | -2.58 | 152.56 |
| | Thursday | 10.7 | 241 |
| | Friday | 4.82 | 303.49 |
| Period 2005-2009 | Monday | 2.45 | 191.43 |
| | Tuesday | -1.85 | 167.39 |
| | Wednesday | 5.08 | 166.91 |
| | Thursday | 2.17 | 164.04 |
| | Friday | 6.96 | 156.62 |
| Period 2010-2014 | Monday | -1.37 | 128.14 |
| | Tuesday | 3.08 | 122.29 |
| | Wednesday | 4.87 | 116.95 |
| | Thursday | 0.19 | 126.05 |
| | Friday | 2.74 | 113.86 |
| Period 2015-2018 | Monday | -3.29 | 124.87 |
| | Tuesday | 2.2 | 115.98 |
| | Wednesday | 9.24 | 114.01 |
| | Thursday | 7.38 | 113.03 |
| | Friday | 1.00 | 117.31 |

Table A9: Mean and standard deviation values ($x10^4$) for daily returns based on whether a day is a Monday or not grouped by both market and period

| Grouping | Monday | Mean | Standard Deviation |
|---|---|---|---|
| Developed Markets | Yes | -1.55 | 138.98 |
| | No | 2.12 | 124.37 |
| Emerging Markets | Yes | 6.78 | 214.04 |
| | No | 8.76 | 194.05 |
| Frontier Markets | Yes | -6.72 | 253.36 |
| | No | 7.82 | 212.11 |
| Period 1990-1994 | Yes | -4.30 | 284.69 |
| | No | 19.43 | 221.16 |
| Period 1995-1999 | Yes | 6.03 | 174.21 |
| | No | 5.23 | 166.31 |
| Period 2000-2004 | Yes | -3.92 | 247.42 |
| | No | 3.63 | 221.07 |
| Period 2005-2009 | Yes | 2.45 | 191.43 |
| | No | 3.09 | 163.82 |
| Period 2010-2014 | Yes | 2.72 | 119.87 |
| | No | -1.37 | 128.14 |
| Period 2015-2018 | Yes | -3.29 | 124.87 |
| | No | 4.95 | 115.13 |

Table A10: Mean and standard deviation values ($x10^4$) for daily Monday returns according to the previous week's return and grouped by both market and period

| Grouping | Prior Return | Mean | Standard Deviation |
|---|---|---|---|
| Developed Markets | Positive | 1.80 | 116.44 |
| | Negative | -5.57 | 161.79 |
| Emerging Markets | Positive | 32.40 | 190.95 |
| | Negative | -25.96 | 236.35 |
| Frontier Markets | Positive | 11.12 | 305.17 |
| | Negative | -27.80 | 170.85 |
| Period 1990-1994 | Positive | 28.49 | 316.35 |
| | Negative | -41.96 | 238.11 |
| Period 1995-1999 | Positive | 27.10 | 154.58 |
| | Negative | -20.81 | 193.14 |
| Period 2000-2004 | Positive | 5.52 | 298.17 |
| | Negative | -14.71 | 171.44 |
| Period 2005-2009 | Positive | 18.44 | 155.49 |
| | Negative | -18.14 | 227.99 |
| Period 2010-2014 | Positive | 3.28 | 111.03 |
| | Negative | -6.90 | 145.69 |
| Period 2015-2018 | Positive | 1.25 | 106.27 |
| | Negative | -8.99 | 144.73 |

Table A11: Mean and standard deviation values ($x10^4$) of monthly returns based on whether a month falls in the range of November until April (excluding January) or not and grouped by both market and period

| Category | November – April | Mean | Standard Deviation |
|---|---|---|---|
| Developed Markets | Yes | 74.0097 | 536.4934 |
| | No | -30.0435 | 544.5661 |
| Emerging Markets | Yes | 224.3651 | 1150.0898 |
| | No | 117.3326 | 1112.1693 |
| Frontier Markets | Yes | 121.4418 | 1131.3413 |
| | No | 71.8872 | 861.4154 |
| Period 1990-1994 | Yes | 354.5410 | 1804.6221 |
| | No | 261.1544 | 1435.0361 |
| Period 1995-1999 | Yes | 184.6550 | 819.6398 |
| | No | 18.4655 | 857.9891 |
| Period 2000-2004 | Yes | 141.0530 | 726.2699 |
| | No | -67.2155 | 751.4554 |
| Period 2005-2009 | Yes | -74.8299 | 931.8104 |
| | No | 134.1375 | 774.2624 |
| Period 2010-2014 | Yes | 139.0310 | 506.8462 |
| | No | -51.618 | 583.5216 |
| Period 2015-2018 | Yes | 114.1904 | 561.0819 |
| | No | 31.3588 | 478.1836 |