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MSc Economics & Business
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A LOOPHOLE IN TIME: CALENDAR ANOMALIES IN THE DUTCH STOCK MARKET

A research on the existence of calendar anomalies with the addition of interest in the indexes over time

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Preface and acknowledgements

"The unexamined life is not worth living" – Socrates

During my academic career I have been working towards this point. All the efforts over the last 20 years consolidate into this last year where I finish my master studies. After I finish my master I can look back at a satisfactory education which has prepared me for the next chapter in life. On one side, I am more than relieved to close the schoolbooks and find my place in the world, whilst on the other it is both exciting and daunting to take a step in the world of post-graduation. "An unexamined life is not worth living" – the mind-set with which I will embrace the future.

This thesis has helped me to understand programming language like STATA to a new level. In my current employment I am already working with datasets, but now I have experience on a whole new level. Both the quality of reporting findings and the quality of research in my current job as a Business Controller have increased as a result of this master study and thesis. It was an instructive experience. The fact that I had to make a 180 degree turn and change my thesis subject just as I wanted to start was a setback. In the end I managed to complete my thesis well ahead of the deadline, even though the start was delayed. All in all I can say with pride that I am happy with the research conducted in this paper and the interesting results that come from it.

I want to express my gratitude to my friends and family for their everlasting support during my education. Without their stability this paper would not have been possible. An exceptional recognition of my friend Mr. Erik Strooper for checking the final version of my thesis. A special thanks and appreciation to Mr. Hans Maaskant, the person who has helped me to regain my interest in studying and taught me that hard work will pay off in the end. My sincere gratitude to Dr. Jan Lemmen for helping me finding a new thesis subject, supporting me in the writing of my thesis and coming up with creative ideas. A thanks to all the lecturers and professors who have taught me invaluable classes during my university career at the University of Utrecht and the Erasmus University of Rotterdam.

Abstract

This paper researches the presence or absence of classical and contemporary calendar anomalies in the Dutch stock market, based on daily data. To make this research more inclusive, tests have been conducted on the AEX (prior and post 2000), the AMX and the AScX indices. In addition, proxies for interest have been included to draw a clearer picture of the tables provided. The strongest calendrical effects that have been found are the negative September, the positive December effect, the turn of the month effect and the pre-holiday effects, of which the turn of the month and pre-holidays show the largest daily abnormal returns across the board. Of the indices researched the AScX contained the most calendar effects, followed by the AMX and the AEX.

Keywords: calendar anomalies, Dutch stock market, linear regressions, sentiment

JEL classification: C22, G12, G140, G400

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1. Introduction

Contemporary economic theory states that the stock return in an efficient capital market is unpredictable and follows a random walk (Fama, 1995). In other words, the stock market returns are random and cannot be forecasted if the stock market would be efficient. Numerous studies have been conducted to which extent the capital market could be deemed efficient, for example the study performed by Jegadeesh and Titman in 1993. The researchers argued whether it would have been profitable to buy recent winners and to sell recent losers. The result from this research was, surprisingly, that it was a profitable trading strategy during the time this research was conducted (1965-1989). Consequently, what these researches proved was the fact that stock markets are not as efficient as people might think. In behavioral economics, one of the newest fields of economics, researchers try to combine the field of economics to human psychology. Studies performed under the flag of behavioral economics suggest that agents are subject to major behavioral biases when performing trades. De Bondt and Thaler (1985) suggest that traders tend to overreact to recent and unexpected dramatic events, an indication of herd-behavior and availability bias, which contradicts the random-walk theorem. This overreaction is caused by information sharing on social or web-based platforms, or simply by looking at the candle chart.

Throughout the field of economics several biases and anomalies have been discovered. This paper will focus on one kind of anomaly, namely the calendar anomaly. A calendar anomaly is a testable and replicable pattern in the capital markets based on nothing but time (Jacobs & Levy, 1988). Calendar anomalies have been part of capital markets ever since they were first researched during the 1930's, where researchers discovered that the market returns on Mondays were mostly negative and positive over the rest of the week. After research on calendar anomalies has been dormant for several decades, the paper from Rozeff and Kinney (1976) worked as a catalyst as they proved that the New York Stock Exchange was subject to seasonality since the market showed statistically significant excess returns in the first month of the year, and thus the January effect was born. The most pronounced and researched of them are the January effect and the Monday effect. During the last 30 years, more research has been conducted on more exotic kinds of anomalies like the turn of the month effect and the holiday effect. In contrast, more recent studies suggest that most calendar anomalies show a diminishing presence in the later part of the twentieth century and twenty first century (Tan & Tat, 1998; Wong et al., 2006) whereas others confirm them for still existing (Haugen and Jorion, 1996).

This paper will study the existence of several calendar-based anomalies in the Dutch stock market. The anomalies researched vary from the classical anomalies like the January effect to the newer ones like the daylight savings time effect to provide an all-round answer whether calendar anomalies still exist to this

day in the Dutch stock market. The research question that this paper aims to answer is: *Are calendar effects present in the Dutch stock Markets?*

Since the Dutch stock market only exists since 1983 in its current iteration, the paper will function as a research basis for future research done on calendar anomalies in developed countries in recent years. The calendar anomalies researched in this paper will be the day of the week effect (incorporating the weekend effect), the month-of-the-year effect (incorporating the January effect), the turn of the month effect, the holiday effect (divided into a Christmas, New Year, Easter, Kings Day and Liberation day effect), the Ramadan effect and the daylight saving anomaly.

This paper will conduct its research on the Dutch stock markets since there has not been a lot of academic research done on its calendar anomalies. The Dutch stock market has been mentioned to be susceptible to anomalies like the January effect, as described by Gultekin and Gultekin (1983). However, most research on this subject is dated because it was performed during the period where calendar anomalies were a hype. The hype died down several years later because scientists began to discover that these seasonal anomalies were disappearing from the capital markets as mentioned before. This paper aims to shed some light on the question whether these calendar anomalies have truly disappeared from the market. In order to answer the research question, this paper will not only focus on stock data, but also more contemporary data like Google Trends and Twitter.

Three different indices will be used to research calendar effects in the Dutch stock markets. Naturally, the blue-chip AEX index will be researched since it is the most prominent Dutch index with highest volume and value. It incorporates the 25 largest Dutch companies. Secondly, the Mid-cap AMX which consists of the largest 26 to 50 companies in terms of size. Finally, the small-cap AScX is incorporated as well, consisting of companies 51 until 75 in order of value. The size of the company is determined by share turnover. Since most literature is more than 20 years old, the AEX index will be researched in three ways: anomalies over the whole sample period, over the years prior to 2000 and the years after 2000. The AMX and AScX will be researched over their whole life span.

Naturally, stock returns and sentiment go hand in hand, since more attention leads to more buyers which in turn leads to higher prices. Da et al. (2011) found a similar relation between the Google search index, a proxy for investor attention, and an increase in the short term returns of a certain stock.
Tversky and Kahneman (1973) mentioned that information which is more available, has a higher perceived probability of occurring than information which is not readily available. In order to make this paper's findings more robust, availability of information via either Twitter or Google Trends will be linked to daily and monthly calendar effects. Kahneman (2011) calls this phenomena the availability heuristic, a mental shortcut that relies on immediate examples that come to mind when thinking about a specific topic, concept, method or decision.

2. Literature review

Large amounts of literature have been produced about calendar anomalies in capital markets in the last part of the twentieth century. All this research began with the paper from Rozeff and Kinney (1976) where they argued that capital markets are susceptible to significant seasonality effects. In addition, this was one of the first papers which argued that the random walk theory from Fama (1970) was incorrect, since seasonality is the absolute opposite of a random walk. The survivorship bias could be an explanation for the fact that calendar anomalies exist in the Dutch stock markets. Carhart (1997) found out that the performance of mutual funds is largely overestimated due to the existence of the survivorship bias, which might indirectly also explain the persistence of calendar anomalies. When firms show that their stocks are largely influenced by calendar anomalies, either by their own doing or not, chances are that these effects remain throughout the years. When the same few firms 'survive', this could have large effects on the persistence of calendar anomalies. Rozeff and Kinney found out that the New York Stock Exchange returns in January during the period 1904-1974 (with the exception of 1929-1940) were statistically higher than they should be under the efficient market hypothesis. They argued that the best explanation would be related to tax benefits and costs, namely that traders sold their stock at the end of the year and bought back their stocks during January which would lead to an increase in price. Other explanations could be related to accounting information, since January is the month where announcements concerning the previous calendar year are made.

On the other hand, the January effect was found in Japanese capital markets, where at that time no capital gains taxes were in place (Kato and Schallheim, 1985). Moreover, Gultekin and Gultekin (1983) find out that the January effect is not confined to either the US capital markets or small firms. Haug and Hirschey (2006) performed a similar study on the January effect in the period from 1927-2004. They found out that the returns for small-cap stocks in January were significantly higher than for other months, the effect they found lasted even after the Tax Reform Act of 1986 which weakened the tax based explanation. Neither of the papers fail to give an acceptable explanation for the reason of the existence of the January effect.

The month of the year effect is an effect which found its origins in the January effect. Agrawal and Tandon (1994) found out that monthly returns were highly correlated with the months of the tax-seasonal. They discovered that in countries where the end-year taxes have to be filled in other months (Great-Britain), have a "January effect" in a different month, directly related to the tax seasonal. The Dutch end-year taxes are to be filled in before the first of April. Following this theory, the Dutch "January effect" should actually take place in April.

The weekend effect, also known as the Monday effect, states that during the weekend the stock market falls since the markets are not open during the weekends. This means that the returns on Mondays are substantially lower than on other days. It all started with research performed by Fields (1931) where he

investigated “the unwillingness of traders to carry their holdings over the uncertainties of a week-end leads to a liquidation of long accounts and a consequent decline of security prices on Saturday, particularly just before the close of the market.” Fields found that in his sample (Dow Jones Industrial Average, 1915-1930) prices tended to rise on Saturdays and decline on Mondays. After a long absence in scientific research the weekend effect made its return to the scientific field in a paper written by Cross (1973). He found out that the S&P 500 (1953-1970) had a tendency to rise on Fridays (62%) and a tendency to fall on Mondays (60.5%), with mean returns of 0.12% and -0.18% respectively. In addition, Rogalski (1984) proved that, similar to the January effect, the weekend effect had a larger impact on smaller firms than on bigger firms. Furthermore, the research duo of Coursey and Dyl (1986) took a different approach in finding evidence for the weekend effect with the use of laboratory methods. In their experiments, agents had to trade with assets with uncertain values whilst being subject to trading interruptions. The trading schedule had three trading days, followed by a “weekend” of one day without trading. The results of their research showed that the prices on the day before the interruption were significantly higher than for the other days, which is in line with the observed markets. In contrast, French (1980) argued that returns are only generated on active trading days, which implies that every trading day should have the same returns. However, as Thaler (1987) described in his paper, it sounds quite illogical to make this assumption. He argued that, supposedly, if there was a period during the year where every week had only one trading day it would not make sense that that trading day would have the same returns as the average weekly return taken over the whole year. What we see in practice is that this singular trading day of the week will resemble the weekly average return.

In continuation of monthly calendar anomalies, this paper will take a look at the existence of the turn of the month effect. Ariel (1987) was one of the pioneers in this kind of research. He stated that during his testing period (1963-1981), all of the monthly returns were gained in the first half of the month. He divided the months into two parts, namely the last day of the previous month plus two weeks in the next month as the first part (days -1 to + 13) and the remaining days of the next month as the second part (days +14 until +30) . The reasoning behind this difference might be that companies have a tendency to announce good news in the first half of the month, whilst announcing bad news in the second half of the month (Penman, 1987). Lakonishok and Smidt (1988) only discovered mild support for the statement made by Ariel. What they did, however, was to make the selected area around the turn of the month smaller. This time they only included the last trading day of the prior month and the first three trading days of the new month into their ninety year sample of the Dow Jones Industrial Average (DJIA). What they found was that the cumulative returns on these four days was 0.473%, whereas the average four day return would only be 0.0612%. What they discovered was that the last trading day and the first three trading days combined yield a statistically significant higher return than the rest of the month. Furthermore, Lakonishok and Smidt argue that this increase in prices might be attributed to the seasonalities in cash flows of individuals and

institutions. Agrawal and Tandon (1994) took a closer look at the previous paper and did research whether this was a general pattern over all capital markets and not just the US market. What they discovered was that in 10 out of their 18 sample countries the monthly effect, as described by Lakonishok and Smidt, holds ground.

Fields (1934) discovered that there were irregularities in returns on the day before a holiday. Whilst not doing extensive research on the subject, he was the first to note it. Just like with the January effect, Field's discovery remained dormant for a while. The resurrection of the Holiday effect happened through a working paper written by Robert Ariel in 1985. Ariel found out that the returns on "pre-holidays" (the day before a holiday) were significantly higher than normal in his sample period from 1963-1983, 0.529% and 0.056% respectively. In addition, around 51% of the total gains of the DJIA occurred within these pre-holidays. Lakonishok and Smidt (1988) confirm the previous study by performing extensive research on 90 years of DJIA data. What they discover is that the pre-holiday returns are around 23 times higher than normal daily returns, 0.22% versus 0.0094%, with a positive daily return in 63.9% of the cases. Barone (1989) discovered that the Holiday effect is not solely applicable to US markets since he found a statistically positive return on pre-holidays in Italy, which opens the path for a research done on the Dutch stock market. The reason for the effects that have been found could lie in the same area as the explanation of why returns on Fridays are higher than other days. The last trading day before a non-trading day has a tendency to show positive returns as described by Cross in 1973.

The Ramadan is a holy month of fasting for Muslims all over the world where they cleanse their bodies of impurities and show empathy towards the less fortunate in life. This period occurs always during the ninth month of the Islamic (Hijri) calendar, which is a lunar calendar as opposed to the sun based Gregorian calendar that the Christian world uses. Al-Hajieh et al. (2011) wrote a paper about the performance of the stock markets during the Ramadan in several Arab countries from 1992-2007. They found out that the stock markets in Egypt, Jordan, Kuwait and Turkey displayed statistically significant higher than normal mean returns during the month of the Ramadan. They attributed the positive effect to an increase in good mood and social interaction. However, the Ramadan effect is not found in every Arab country. In the used sample, Bahrain and Saudi-Arabia did not show a statistically significant change in monthly returns. This finding is in line with the research done by Seyyed et al. (2005) where they did extensive research on the Saudi stock market with help of GARCH-models without finding any evidence for increased returns during the Ramadan months.

The daylight saving anomaly was first documented by Kamstra et al. in 2000. He argued that market participants are severely impacted by the change in sleep pattern as a result of daylight savings time. The daylight savings anomaly is not an anomaly by itself, but it works in conjunction with the earlier described Weekend effect. Kamstra discovered an increase in magnitude of 200%-500% of the weekend effect after

the clock changed during that particular weekend. The authors argue that the cause of the anomaly is sleep desynchronosis, which refers to a desynchronization in the biological clock. In reaction of this paper, Pinegar (2002) wrote a commenting paper to debunk the theory that Kamstra et al. presented two years earlier. He argues that they failed to apply correct robustness checks which resulted in heteroskedastic results, which lead to an incorrect analysis. Naturally, Kamstra et al. replied to Pinegar with another paper (Kamstra et al. 2002), stating that the checks they performed were robust and that his statement was false.

Furthermore, some research on anomalies has been conducted on the Dutch stock market. For instance, Agrawal and Tandon (1994) found out that the Netherlands were susceptible to several calendar anomalies at the time. The day of the week effect was present for Tuesdays (-0.072) and Fridays (0.146). The earlier described Monday-effect was not present in the Dutch stock market. What they also found was a positive turn of the month effect as researched in this paper, namely a positive average return on the last day and first two days of the month (-1, 1, 2). In addition, when studying the month of the year effect, they only found a significant positive average return during January, also known as the January effect. McConnel & Xu (2008) wrote a similar paper on calendar anomalies, but this time doubling down on the turn of the month effect. They found out that there was a positive average return in the Dutch stock market during the period between the last day and the first three days of the month (-1,3). Van der Sar (2003) conducted research on calendar effects that were solely present within the Dutch stock market. He found out, similar to Agrawal & Tandon, that the January effect still exists in the Dutch stock markets. Furthermore, he found evidence for statistically different returns in several months. However, Van der Sar did not find any evidence of the pre-holiday effect, nor for the weekend effect. The turn of the month effect yielded statistically significant results, especially for days -1, 1 and 2. The average returns are much larger than the results that Agrawal & Tandon found for the turn of the month effect. The results that other researchers have found can be found in table 1.

In addition to calendar anomalies, this paper also researches the effect of interest in the Dutch stock markets and combines this with the proposed calendrical effects. Preis et al. (2013) were one of the researchers which actively made use of Google Trends when trying to explain trading behavior, which is what this paper tries to do as well. They found out that Google Trends serves as a good indicator for current and future stock performance, outperforming a buy and hold strategy by 300% based on a strategy where the amount of relative searches for “debt”. Furthermore, this paper also incorporates Twitter data to see whether calendar anomalies are related to the amount of tweets mentioning a certain index. Rao and Srivastava (2012) performed research whether Twitter data was useable to predict returns on commodity, forex and stock markets. They found out that Twitter, when serving as a lagged indicator, can predict with up to 94.3% accuracy whether the market is going up or down using the sentiment extracted from the tweets that were researched. Bollen et al. (2011) did a similar research and tried to predict the stock

market with the help of Twitter mood. What was different from other studies was that Bollen et al. incorporated the general mood of the entire Twitter population to predict long term stock changes with the help of Opinion Finder, a tool which can attribute seven different emotions to a piece of text. The tweets labeled "calm" showed the highest correlation with the returns of the DJIA and served well as a 3-4 day lagged indicator.

Table 1: Previous calendar anomaly findings in the Dutch stock Markets

Several researchers have already researched calendar anomalies in the Dutch stock Market. In the following table one can find a collection of them. Naturally, a lot of researchers are left out for sake of conciseness.

Author (year)	**Time period**	**Stock market**	**Anomaly**	**Results (% daily)**
Agrawal & Tandon (1994)	1/1/71 - 12/2/79 & 5/4/83 - 29/6/87	ANP-CBS Industrial	Day of the week	Tuesday: -0.072. Friday: 0.146.
Agrawal & Tandon (1994)	1/1/71 - 12/2/79 & 5/4/83 - 29/6/87	ANP-CBS Industrial	Turn of the month	-1: 0.164 1: 0.240 2: 0.197
Agrawal & Tandon (1994)	1/1/71 - 12/2/79 & 5/4/83 - 29/6/87	ANP-CBS Industrial	Month of the year	Jan: 4.02, 0.127 daily
McConnel & Xu (2008)	1/1/1973 - /1/2006	AEX	Turn of the month	Combined (-1,3): 0.12
Van der Sar (2003)	1/1/1981 -/12/1998	CBSTRI	Month of the year	Jan: 0.142 Mar: 0.167 Apr: 0.125 May: 0.141 Dec: 0.143
Van der Sar (2003)	1/1/1981 - /12/1998	CBSTRI	Turn of the month	-1: 0.321 1: 0.520 2: 0.782

3. Data

3.1. Database

The data used in this paper was collected from Bloomberg terminals located at the Erasmus University in Rotterdam. Weekends and public holidays are not included since the stock market is closed. The first dataset that this paper uses is the daily closing price of the AEX (Amsterdam Exchange Index). The data ranges from 03-01-1983 until 04-04-2018, a total of 8971 trading days. The AEX is a capitalization-weighted index, this indicates that the components of the index are weighted according to the total value of the outstanding shares. The AEX consists of the 25 firms with the largest share turnover present on the Dutch stock market. The share turnover is calculated by multiplying the average trading price multiplied by the average volume over a certain period. Prior to 2008, the AEX was reviewed once a year in March. In the period 2008-2011 the AEX was reviewed twice a year in March and September. From 2011 onwards, the AEX is reviewed four times a year in March, June, September and December according to the rules for the AEX, AMX and AScX (2011).

The second dataset consists of the daily closing prices of the AMX (Amsterdam Midcap Index). The data ranges from 05-10-1995 until 04-04-2018, with a total of 5740 trading days. The AMX consists of the 25 firms with the highest share turnover after the first 25 which are in the AEX index (number 26-50). The AMX is also a capitalization-weighted index. The index is reviewed on a quarterly basis, at the same days as the AEX.

The third and last dataset that is being used in this paper is the AScX (Amsterdam Small Cap Index). The data ranges from 30-06-2000 until 04-04-2018, with a total of 4569 trading days. The AScX consists of the 25 highest share turnover companies after the ones in the AMX, meaning that the firms are ranked from place 51 until 75. Furthermore, the AScX is also capitalization-weighted like the first two indices. In addition, the review of the AScX is at the same days as the previous two indices.

All three indices used in this paper are traded on the Euronext stock exchange which was founded in the year 2000. The Euronext exchange merged all national exchanges seated in Amsterdam, Brussels, London, Lisbon, Dublin and Paris to form one exchange. The Euronext exchange is the leading consolidated European exchange with almost 1300 listed issuers worth €3.6 billion in market capitalization by the end of September 2017 (Equities, 2018).

In addition to stock market data, this paper will also utilize data from Google Trends and Twitter status messages as a proxy for interest and information availability in the Dutch stock market. All data from Google Trends can be found at *https://trends.google.nl/trends* (from January 2004 until May 2018). To scrape information from Twitter, this paper makes use of a marketing tool named “OBI4wan”. This is a paid tool which is used by corporations in order to see their brand’s popularity. The tool has scraped Twitter data

with the following searches: #AEX, #AMX and #AScX. The tool was used to see the daily amount of tweets mentioning one of the three indices, corrected for false positives. The data used to see the daily amount of tweets ranges from 01-01-2015 until 25-05-2018.

3.2. Descriptive statistics

Table 2: Descriptive statistics for the indices that are researched in this paper

	AEX	**AEX<2000**	**AEX>2000**	**AMX**	**AScX**
Observations	8966	4297	4668	5740	4568
Mean (%)	0.027	0.063	-0.005	0.019	0.011
Std. Dev. (%)	1.314	1.185	1.421	1.252	1.238
Min (%)	-12.779	-12.779	-9.590	-9.982	-10.897
Max (%)	11.182	11.182	10.028	7.971	11.602
Skewness	-0.270	-0.520	-0.110	-0.529	-0.062
Kurtosis	11.229	13.982	9.537	7.318	12.925

From table 2 can be seen that the average returns have been positive over all observations except the AEX index after 2000. What is particular, however, is the fact that the average returns are larger for the larger stock indexes. Theory states that there is a positive and significant economic premium associated with investing in small cap stocks, which can be largely attributed to illiquidity (Dimson & Nagel, 2003; Keim, 1999). This is not the case in the Dutch indexes, where the average returns of the large caps is greater than the small cap returns. Notable is the fact that the daily mean percentage change of the AEX index prior to 2000 is relatively high whereas the change after 2000 is negative. This can be attributed to the Dotcom bubble and the housing bubble. Furthermore, the standard deviation of the large caps is higher than the small caps, which indicates more volatility in returns and therefore better investment opportunities. The minimum and maximum daily changes are telling a similar story, although the mid cap stocks are showing the smallest difference between them, where one would expect the smaller stocks to show the largest difference in minimum and maximum returns. All indexes in the sample have a positive skewness, which tells that they are skewed towards the positive side. As seen from graphs 1 to 5, all histograms are edging slightly towards the right. The small cap AScX shows the smallest amount of skew, followed by the AEX and the AMX. When looking at kurtosis, the distribution of returns is very leptokurtic, indicating that the largest amounts of observations are centered around the mode. Furthermore, kurtosis values like these indicate non-normal distributed returns since they fall outside the boundary of -2 to +2 (George, 2011).

4. Methodology

4.1. Returns

In order to calculate the daily returns this paper has used the following formula:

$$R_t = \ln \frac{P_t}{P_{t-1}} * 100\%$$

Where R_t is the daily return and P_t is the daily asset price. This formula makes use of the natural logarithm to continuously compound the returns and make them easier to compare across several assets (Barone-Adesi et al., 1999). Furthermore, it is assumed that the stock returns follow a geometric random walk.

4.2. Regressions

In order to test whether returns are different the regressions in this paper make use of dummy variables. A dummy variable is a variable which is either a 1 or a 0, depending on the underlying factors. For example, the January dummy will be a 1 during the month of January and a 0 during the remainder of the year. Same goes for weekdays, turn of the month, holidays, daylight savings time and the Ramadan. The following regressions were run for the calculation of the calendrical effects:

$$R_t = \alpha_i + \beta_i * dummy_i + \varepsilon_i$$

Where R_t is the daily change in price as calculated in the equation above, α the constant and β the factor of the dummy. The dummy variable will be interchanged with every anomaly that this paper researches. In order to test whether returns are significantly different from the other non-dummies this paper has ran a single regression for every dummy separately against the non-dummy sample. For example, $R_t = \alpha_i + \beta_i * Jan + \varepsilon_i$ tests whether the daily returns in January are significantly different from the daily returns in other months, since the dummy variable will be 1 during January and 0 otherwise. During testing, it became apparent that the regressions suffered from autocorrelation and/or heteroscedasticity. To test for autocorrelation, this paper used the Breusch-Godfrey LM test with a *H0* of no autocorrelation (Godfrey, 1978). To test for heteroscedasticity the Breusch-Pagan test for heteroscedasticity is used (Breusch & Pagan, 1979). Both of these tests are specified for the use in linear regressions. To correct for autocorrelation or heteroscedasticity this paper makes use of the *robust* command, which will therefore lead to robust standard errors and outcomes.

5. Empirical results

5.1. The January and monthly effects

As described in the papers by Thaler (1987), Haugen & Jorion (1996), Barone (1990) and numerous others there should be a case of higher stock returns in January. However, what is seen from the tables is that there is no indication of statistically different returns in January. The differences are mostly positive, but the low t-values tell that the results are not statistically different from zero. What's interesting, however, is that no evidence in particular is found for the AEX index in the period prior to 2000. Most international literature during that period finds evidence for the January effect, but it seems that the Netherlands does not show such things. Agrawal and Tandon (1994) find evidence for the January effect in the Netherlands during the period 1971-1979 and 1983-1987, but it seems the effect has disappeared since then. When looking at other months, three in particular catch the eye: June, September and December. June only shows statistically different negative returns compared to other months for the smaller indices, namely the AMX and the AScX. A reason for this can be that the annual issuance of holiday pay occurs in May, where the smaller companies might experience more negative effects from this extra expense. Cao and Wei (2005) discovered that investors tend to take more risk during warm months. With higher risk leading to lower returns the temperature could make a case for the experienced lower stock returns during the summer months, although not always statistically different from other months. September shows negative returns for every index over the whole sample at a 10 percent level. This could be attributed to the fact that the summer months and holidays are officially over and everyone starts their normal lives again, creating a sense of unhappiness. Baker and Wurgler (2006) wrote that sentiment has statistically significant effects on stock returns. The fact that the holidays are over could be seen as a negative sentiment across the board. In contrast, December shows positive returns for all indexes. December is a period where three major positive events happen in the Netherlands: Saint Nicholas' Day on the 5th of December, Christmas and New Year. This festive month has a positive influence on the mental state and therefore creates a positive sentiment, resulting in positive abnormal stock returns. All in all, table 3.1 shows a clear September and December effect, a case can be made for a June effect. When looking at the summary table 9, the mean return for December on the AEX index is almost five times higher than the mean overall return, which strengthens our previous finding. The same goes for the AEX before and after 2000 in tables 10 and 11, although the mean monthly returns on the AEX index before 2000 are higher in general. In the smaller indexes like the AMX and AScX the December mean returns are less outstanding than on the large index.

In addition to stock data, monthly effects are also researched in a form of interest in the indices. The amount of searches serves as a proxy in the interest in a certain index. Table 3.2 shows that the AEX has received the most attention, on average, during the month October. The explanation for this is found during

the last financial crisis, which happened during October 2007. During this month a spike in interest can be found, which has led to the "October effect" in trend data. The AMX trend data shows that January is the month where AMX is searched most often on Google. This could be an indication for a January effect, although no significantly different returns have been found during this month in table 3.1. The AScX, however, shows a more interesting result. The trend data from Google indicate that February is the month where people search the most for the AScX, whereas it shows a significantly different result from other months in table 3.1. In addition, the top three highest monthly values for the trend data correspond with significant results in table 3.1 (February, June, and September). This discovery suggests that the returns on the AScX are at least somewhat correlated to the amount of searches on Google, which is in line with what Baker and Wurgler wrote in 2006 about sentiment and returns.

Table 3.1: Monthly effect

Regression analysis whether the daily returns in a certain month are significantly different than daily returns in other months. Tested for the AEX as a whole, before 2000, after 2000, the AMX and the AScX indices. Significance levels indicated by * (10%), ** (5%) and *** (1%). Between parentheses are the t-statistics for each regression. Outcomes have been corrected for heteroscedasticity and autocorrelation where present by the use of robust standard errors.

	AEX	**AEX<2000**	**AEX>2000**	**AMX**	**AScX**
Jan	0.009 (0.18)	0.061 (0.83)	-0.037 (-0.55)	0.068 (1.19)	0.081 (1.28)
Feb	-0.002 (-0.06)	0.025 (0.42)	-0.026 (-0.39)	0.085 (1.56)	0.165 ** (2.15)
Mar	0.067 (1.36)	0.112 ** (1.98)	0.028 (0.35)	0.068 (1.19)	0.043 (0.64)
Apr	0.049 (1.09)	0.015 (0.25)	0.082 (1.20)	0.009 (0.15)	0.096 * (1.81)
May	-0.035 (-0.80)	-0.054 (-0.94)	-0.017 (-0.26)	0.024 (0.40)	-0.063 (-0.99)
Jun	-0.010 (-0.24)	0.045 (0.96)	-0.062 (-0.88)	-0.110 * (-1.90)	-0.133 ** (-2.26)
Jul	0.032 (0.70)	0.026 (0.52)	0.037 (0.50)	-0.009 (-0.16)	-0.028 (-0.47)
Aug	-0.085 * (-1.74)	-0.135 ** (-1.98)	-0.040 (-054)	-0.077 (-1.26)	-0.035 (-0.57)
Sep	-0.130 ** (-2.36)	-0.119 * (-1.83)	-0.143 (-1.60)	-0.129 * (-1.95)	-0.126 * (-1.77)
Oct	-0.016 (-0.24)	-0.129 (-1.40)	0.089 (0.94)	0.006 (0.08)	0.105 (1.17)
Nov	0.016 (0.29)	0.016 (0.20)	0.015 (0.20)	0.013 (-0.21)	-0.192 *** (-2.95)
Dec	0.116 ** (2.54)	0.155 *** (2.58)	0.081 (1.20)	0.090* (1.76)	0.009 * (1.84)

Table 3.2: Monthly trends

Relative interest development of the searched words from January 2004 until May 2018. Data has been averaged by month to give an indication of a monthly effect. In bold one can find the highest interest in a certain index in a certain month. Outcomes are singular and not relative to each other because trend data is heavily skewed towards the AEX since it is the most prominent index of the Dutch stock Market.

	AEX	AMX	AScX
Jan	23.1	**43.8**	37.5
Feb	22.9	41.0	**40.0**
Mrt	22.3	40.5	28.3
Apr	19.6	36.3	38.0
Mei	18.9	36.0	39.0
Jun	18.1	32.4	39.3
Jul	19.6	37.4	35.1
Aug	22.9	39.7	30.6
Sep	21.0	32.8	39.1
Oct	**26.3**	38.4	36.7
Nov	22.6	33.6	29.6
Dec	21.6	32.9	27.9

Source: Google Trends (www.google.nl/trends).

5.2. The weekend effect and daily effects

The weekend effect (or Monday effect) is an effect that assumes that the capital markets fall during the weekend. However, most literature about this effect was written quite some time ago. The Dutch indexes show no particular difference on Mondays. If anything, the returns are negative for the AEX, but not to a statistically significant level. Other days show no sign of abnormal returns either, apart from Friday on the AScX index. This is in line with results from Thaler (1987) where he described that Fridays show significant increases in returns. Top-down, the Dutch stock market seems efficient, so it comes as no surprise that only the smaller stocks show inefficiencies on that part. 55% of the daily Friday returns were positive for the AScX, compared to 53% for the AEX and 56% for the AMX. Although the differences in returns are not statistically different from other days, there is a clear indication that Friday returns have a higher probability to be positive. All in all the research conducted gives no reason to believe that daily seasonality is an occurrence in the Dutch stock markets. Reason for this could be that the stock markets are more efficient than thought previously and that, similar to the January effect, classical seasonality effects have disappeared from the Dutch stock market. The summary tables 9 to 13 tell a similar story. The mean returns on Mondays are not negative for every tested index. However, Monday is the most volatile day of the week, which can indicate an increased amount of trading activity after the weekend has passed. For the AMX and AScX

index, Fridays show much higher mean returns than the overall mean returns, although they are only significant on the AScX. Looking at the Twitter data in table 4.2, provided by the marketing tool OBI4wan, one can see a clear distinction between the popularity of the AEX and the other indices. Whereas the AEX is mentioned in around a hundred messages a day, the AMX and the AScX are much less mentioned on Twitter. For this reason the Twitter data on the AMX and AScX is not very useful to use in this research. Thaler (1987) described that Fridays are days with higher returns than other days. From the Twitter data this makes sense, since the average amount of messages mentioning the AEX increases gradually over the week, with a peak on Friday. An economic argument for this phenomena could be that many Dutch citizens only work four days in the week, with Friday as the most popular third free day. One could argue that the people who are free engage in market related activities, with a result in an increase in the interest in the indices on Fridays. Although partly useable, this is also the case for the AMX. In addition, there is a clear difference in the average amount of tweets mentioning #AEX or #AMX on Mondays compared to other trading days. This could be a sign of the weekend effect, since it receives less attention on Monday.

Table 4.1: Daily effect

Regression analysis whether the daily returns on a certain day are significantly different than daily returns on other days. Tested for the AEX as a whole, before 2000, after 2000, the AMX and the AScX indices. Significance levels indicated by * (10%), ** (5%) and *** (1%). Between parentheses are the t-statistics for each regression. Outcomes have been corrected for heteroscedasticity and autocorrelation where present by the use of robust standard errors.

	AEX	**AEX<2000**	**AEX>2000**	**AMX**	**AScX**
Monday	-0.055 (-1.38)	-0.079 (-1.50)	-0.033 (-0.56)	0.001 (0.03)	0.021 (0.43)
Tuesday	0.038 (1.18)	0.047 (1.08)	0.031 (0.63)	0.017 (0.43)	-0.030 (-0.66)
Wednesday	0.012 (0.37)	0.068 (1.30)	-0.039 (-0.79)	-0.008 (-0.19)	-0.018 (-0.39)
Thursday	-0.016 (-0.46)	-0.069 (-1.53)	0.033 (0.65)	-0.054 (-1.29)	-0.056 (-1.26)
Friday	0.019 (0.57)	0.031 (0.75)	0.007 (0.14)	0.043 (1.10)	0.083 * (1.78)

Table 4.2: Daily Twitter messages

The average amount of daily Twitter messages mentioning any of the three researched indices, corrected for false positives. The data ranges from 01-01-15 until 25-05-18, a total of 1240 observations. The days and corresponding data in italic are non-trading days. In bold one can find the highest amount of interest in an index on a certain day.

	#AEX	**#AMX**	**#AScX**
Sunday	21.153	0.164	0.045
Monday	112.220	1.051	0.164
Tuesday	115.893	1.062	0.130
Wednesday	118.571	1.141	0.102
Thursday	116.787	1.056	0.152
Friday	113.011	1.271	0.136
Saturday	21.740	0.209	0.000

Source: OBI4wan marketing tool.

5.3. The turn of the month effect

Being one of the more recently found anomalies, the turn of the month effect has enjoyed less attention than the previous two anomalies. Nevertheless, surprising results have been found in international and Dutch stock markets. Several authors have confirmed that the turn of the month (the last and the first three days of the month) has substantial effect on stock returns and volatility. Ariel (1987) described that the first half of the month contains most of the positive gains, whereas others like Lakonishok and Smidt (1988) performed more extensive research and found that most of the gains happen in the days -1, 1, 2 and 3. This paper will incorporate the research area around the turn of the month as Lakonishok and Smidt did in 1988. In line with Van der Sar (2003) and Cadsby and Ratner (1992), the research conducted in this paper shows positive and significant returns around the turn of the month, which can be found in table 5. Every index that has been researched showed a significant effect. The only point where no turn of the month effect has been found is in the AEX index after 2000. Generally this time period has been a very turbulent one and only one calendrical anomaly has been found. Out of all anomalies that have been researched, the turn of the month effect has been found to be the most persistent of all, since it has been found in four out of five researched indexes. Combining this contemporary knowledge with evidence found by Van der Sar (2003), this paper can confirm that the Dutch stock markets are still susceptible to turn of the month effects across the smaller indexes. The summary tables 9 to 13 indicate a positive return for every tested index, where the daily overall mean return increases from two to four hundred percent. With so many significant outcomes, the summary tables reinforce the idea that the turn of the month effect is strong and persistent in the Dutch stock market.

Table 5: Turn of the Month effect

Regression analysis whether the daily returns during day -1, 1, 2 and 3 of a certain month (last day of previous month and first three days of current month) are statistically different from daily returns outside this boundary. Tested for the AEX as a whole, before 2000, after 2000, the AMX and the AScX indices. Significance levels indicated by * (10%), ** (5%) and *** (1%). Between parentheses are the t-statistics for each regression. Outcomes have been corrected for heteroscedasticity and autocorrelation where present by the use of robust standard errors.

	AEX	**AEX<2000**	**AEX>2000**	**AMX**	**AScX**
Turn of Month	0.027 **	0.150 ***	0.077	0.172 ***	0.086 **
	(1.96)	(3.25)	(1.45)	(4.07)	(1.99)

5.4. The holiday effect

In international markets there exists such a thing as the "pre-holiday" effect where the capital markets have a tendency to rise in value on the day before a public holiday. In the Netherlands there are several public holidays to discuss: Christmas, New Year's Eve, Easter, the King's birthday and Liberation day. In order to test whether the hypothesis stated by Ariel (1990) is true for the Dutch capital markets, this paper calculates and compares the returns on the last trading day before a public holiday with returns that do not occur at the last trading day before a public holiday. Table 6 shows that the traditional international holidays like Christmas, New Year's Eve and Easter show more pronounced effects than holidays specific to the Netherlands. Especially the AMX and the AScX indexes show that they are suffering from the holiday effect. This can indicate that international markets are much more pronounced on the Dutch stock markets. If only Dutch traders would be active on the Dutch stock markets one could expect that local holidays would have had a more pronounced effect. The AEX seems to be too efficient to be suffering from inefficiencies. Interestingly enough, the Friday before Easter shows the largest increase in mean returns of all pre-holidays tested. This can be largely attributed to the fact that Friday returns are generally higher than other daily returns, so the Easter effect can be seen as a combination of the pre-holiday effect and Friday effect. At last, all holidays are combined in a single dummy called the "Pre-Holiday". From this dummy can be inferred that the last trading day before a public holiday has a positive effect on the returns for the AEX<2000, AMX and the AScX indexes. The reasoning behind these effects can be explained by a positive sentiment prior to a festivity, like Christmas or New Year's Eve (Baker and Wurgler, 2006). In table 6 it becomes clear that the traditional international holidays score better for the pre-holiday than the others since the mean values are more often positive and higher than the average overall returns. Overall, it is noted that the average pre-holiday mean return is much higher than the overall mean return.

Table 6: Holiday effect

Regression analysis whether the daily returns on the last trading day before a holiday are significantly different from the daily returns which are not on the last day before a holiday. Tested for the AEX as a whole, before 2000, after 2000, the AMX and the AScX indices. Significance levels indicated by * (10%), ** (5%) and *** (1%). Between parentheses are the t-statistics for each regression. Outcomes have been corrected for heteroscedasticity and autocorrelation where present by the use of robust standard errors.

	AEX	**AEX<2000**	**AEX>2000**	**AMX**	**AScX**
Christmas	0.063 (0.73)	0.131 (1.07)	0.003 (0.03)	0.380 *** (2.84)	0.226 *** (2.71)
New Year	0.145 (1.04)	0.367 (1.28)	-0.066 (-0.35)	0.314 ** (2.15)	0.0633 * (1.84)
Easter	0.333 *** (2.58)	0.301 (1.07)	0.356 * (1.92)	0.441 ** (2.32)	0.216 (1.45)
Kings day	0.022 (0.15)	-0.104 (-0.36)	0.140 (0.70)	-0.047 (-0.32)	0.028 (0.22)
Liberation day	-0.092 (-0.41)	-0.023 (-0.15)	-0.157 (-0.47)	0.121 (0.44)	-0.252 (-0.84)
Pre-holiday	0.097 (1.45)	0.014 * (1.72)	0.059 (0.67)	0.249 *** (2.93)	0.179 * (1.68)

5.5. The Ramadan effect

With Arab countries having more financial power than ever and the Western world being a home to lots of Islamic people, one could reason that the Ramadan could have effects on the Western markets just as it has on Islamic markets, like Al-Hajieh et al. described in 2011. Seyyed et al. (2005) describe the Ramadan month as a month where local trading activity stalls and volatility decreases, which cannot be seen from the volatilities over the indices as described in table 7. The Dutch stock market does not show a significant abnormal effect of the Ramadan on daily stock returns. If anything, the returns would be negative generally. Only the AScX index shows a negative and significant change in returns at the 10% level, which could indicate that the smallest composite index in the Netherlands would be affected by the Ramadan. Naturally, it could be very well the case that the AScX could be negatively affected by the Ramadan. However, logical thought leads more towards the explanation of data mining as explained by Barone in 1990. This would mean that the effect that has been found was a random lucky hit. The summary tables 9 to 13 show no conformity on returns during the Ramadan. This is in line with the previous notion that the Ramadan does not have any significant effect on the Dutch stock market and that the 10 percent significance in the AScX index is a lucky hit rather than empiric evidence.

Table 7: Ramadan effect

Regression analysis whether the daily returns during the Ramadan month, which is the ninth month of the Islamic calendar, are significantly different from the daily returns during periods outside of the Ramadan month. Tested for the AEX as a whole, before 2000, after 2000, the AMX and the AScX indices. Significance levels indicated by * (10%), ** (5%) and *** (1%). Between parentheses are the t-statistics for each regression. Outcomes have been corrected for heteroscedasticity and autocorrelation where present by the use of robust standard errors.

	AEX	**AEX<2000**	**AEX>2000**	**AMX**	**AScX**
Ramadan	-0.013 (-0.26)	0.040 (0.62)	-0.065 (-0.81)	-0.022 (-0.33)	-0.122 * (-1.88)

5.6. The daylight savings time effect

One of the more obscure anomalies in recent years is surely the daylight savings time anomaly (DST). Documented by Kamstra et al. in 2000, it stated that the DST effect is actually a worsened weekend effect. With the knowledge that the weekend effect is not of any significance in the Dutch markets, one could guess that the DST effect is of insignificant importance too. This is the case for the DST effect, it does not show any abnormal returns compared to other days. What is interesting, however, is that the DST effect on mean returns is quite visible, but in opposite directions. Theory suggests that the first Monday after the clock has moved an hour forward results in very negative returns. This is exactly what can be seen on the AEX indices in tables 9, 10 and 11. On the other hand, the DST effect is very positive on the AMX and AScX. One could argue that sleep deprived traders incur more risk and therefore invest in less efficient markets like the AMX and the AScX. In continuation, the volatility on DST-Mondays is the highest of all anomalies tested for four out of five indices. From this can be inferred that the impact on the natural sleep schedule has at least some effect, whether positive or negative.

Table 8: Daylight savings time effect

Regression analysis whether the daily returns during the Ramadan month, which is the ninth month of the Islamic calendar, are significantly different from the daily returns during periods outside of the Ramadan month. Tested for the AEX as a whole, before 2000, after 2000, the AMX and the AScX indices. Significance levels indicated by * (10%), ** (5%) and *** (1%). Between parentheses are the t-statistics for each regression. Outcomes have been corrected for heteroscedasticity and autocorrelation where present by the use of robust standard errors.

	AEX	**AEX<2000**	**AEX>2000**	**AMX**	**AScX**
Daylight Savings Time	-0.178 (-0.71)	-0.093 (-0.28)	-0.249 (-0.43)	0.213 (0.60)	0.355 (1.04)

6. Conclusion

Several calendar anomalies have been tested in this paper, varying from the older classic anomalies to more recently discovered ones. The January effect, as described by Van der Sar (2003), has disappeared from the Dutch stock markets. Internationally it has existed until around the 1990's, thereafter the markets 'knew' of the anomaly and the January effect got priced in. The only significant monthly effects that persisted are the negative returns in June for the smaller AMX and AScX, the negative returns in September and the positive December effect, which was the most significant of all. Furthermore, the weekend effect has proven to not be of any significance anymore in the Dutch stock markets. Overall, the daily effects have proven to not vary by vast amounts over the week. All that can be said is that the AScX shows a significant increase in returns on Fridays. From this one can infer that the Dutch stock markets are very efficient. The most significant effect found in this paper is the turn of the month effect on the last and first three trading days of the month. It showed significant positive returns for all indices, accompanied by high mean returns. In addition, the pre-holiday effect has also been found significant in the Dutch stock markets, especially for the classical international holidays. The Ramadan month has no overall effect on the mean daily returns of Dutch stock markets, nor does the volatility decrease as described by Seyyed et al (2005). Lastly, the daylight savings time effect has no significant effect on the daily returns over the indices. The only thing that can be said about it is that the volatility on the first Monday after the clock has moved forward is arguably the most volatile day of the year, with extremes on both the positive and negative side. The AEX has 5 significant calendar effects, the AMX has 8 and the AScX has a total of 12 significant effects. Thus the smaller the companies, the more prone they are to inefficiencies like calendar anomalies. In general, this paper gives an indication of the correctness of the small firm effect as described by Fama and French (1993), where they indicate that smaller firms are less efficiently priced than the larger ones. In relation to previous research on the Dutch stock market, this paper has found mostly similar significant results. The turn of the month and the December effects are found both in this paper and in previous research as mentioned in Table 1. It appears that the other calendar effects have disappeared from the recent Dutch stock markets.

The evidence found in this paper is only focused on the Dutch stock markets in recent years. What has been found is that most anomalies have disappeared but that a select few still exist. What is indicative on the anomalies that are present on the Dutch stock markets is that they are all relatively new and have not been researched as thoroughly as the January effect, for example. Extrapolating to the future, it can be expected that new anomalies will arise and that that the existing ones will disappear from the markets since they will become public knowledge, like the January effect today. What researchers have to be careful of is that digging for anomalies can lead to data mining. In other words, if one digs deep enough, chances are big that one will find something significant amongst the heaps of financial data that exists these days. The same

has been the case for this paper. The Ramadan effect did show up as significant for the AScX index, but the other indices and the summary tables did not give any reason to believe the effect was truly there. Future research could go even more in detail of the Dutch stock markets. What would be fairly interesting to see is whether certain business sectors are more prone to certain anomalies than others. Furthermore, research could be conducted on singular stocks to see intercompany effects. Another interesting way of thought would be to copy the research done in this paper over to other countries to see the regional differences and economical differences. It could very well be the case that economically weak countries are susceptible to all kinds of anomalies since they are far from efficient, be it from lack of local knowledge or lack of international investments. Future researchers can dig as deep as they like, but have to be careful to not dig their own graves by assuming "lucky-hits" to be indicative of a newly found calendar anomaly. Furthermore, an extended analysis on sentiment could be done. This paper only considers mentions of an index, where one could dig deeper and analyze the sentimental value of the corresponding data with the help of tools like Opinion Finder and the like. Sentimental values could give a clearer indication of the calendar effects found in this paper. If people are happy or unhappy according to the sentimental index during a certain month, one could more precisely argue where the anomaly came from and why it does persist in the current stock market. If future researchers wanted to be even more thorough, they could be taking surveys of traders during certain months to measure the sentiment of the people involved in trading businesses. In continuation, future research could test different trading strategies based on both empirical data and sentimental data to see whether a free lunch could be possible after all.

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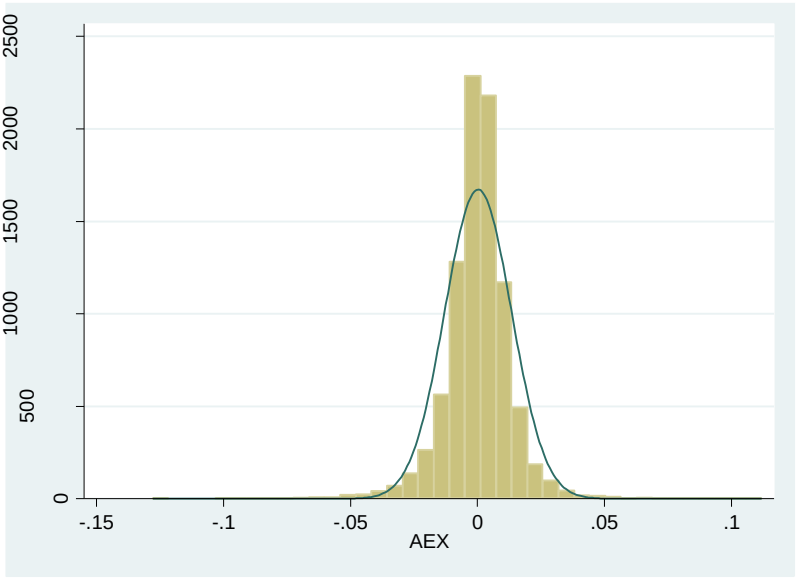
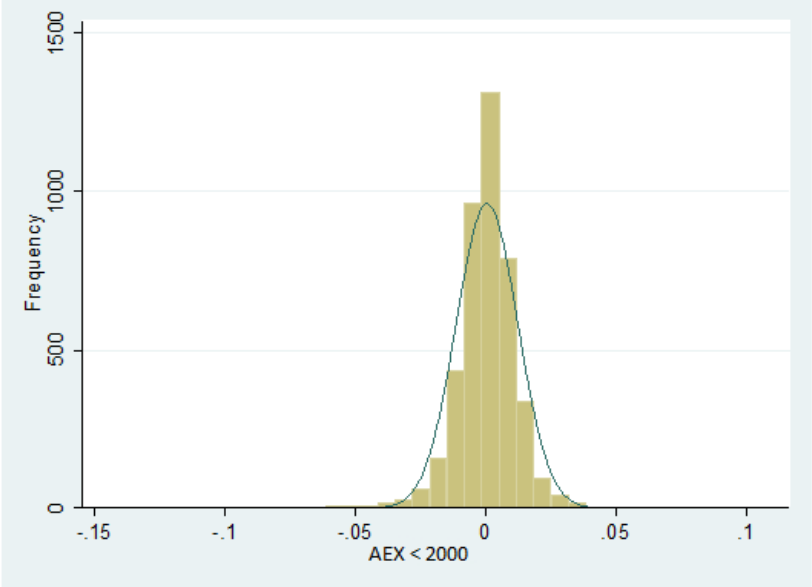
Appendix

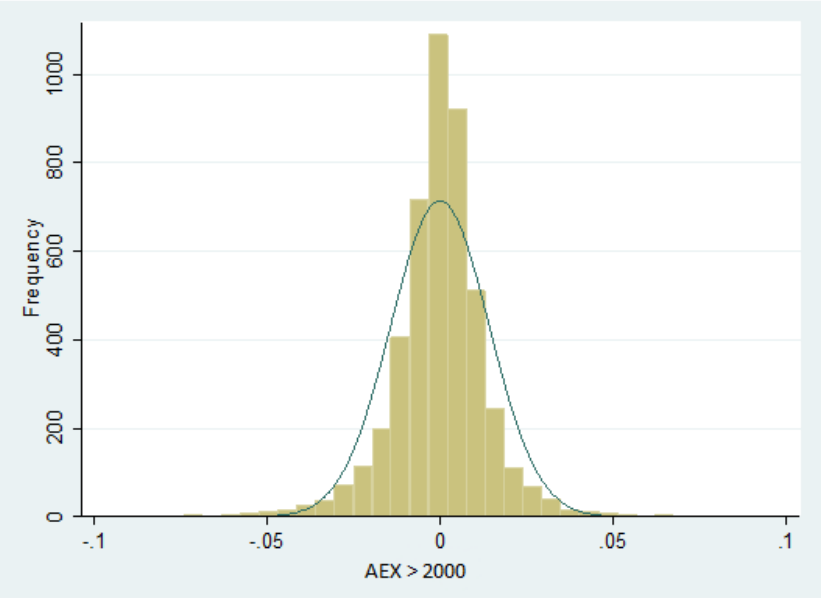
Graph 1: Normal distribution of returns of the AEX



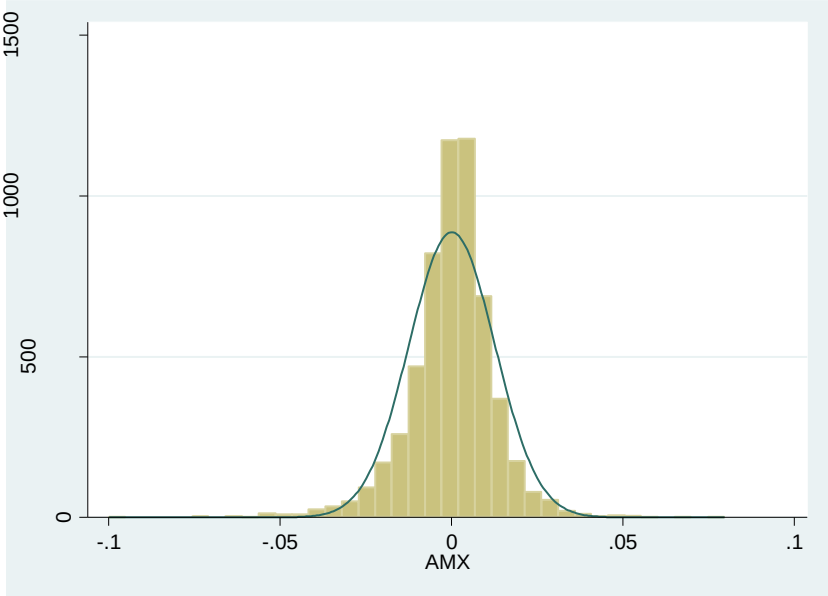
Graph 2: Normal distribution of returns of the AEX before the year 2000



Graph 3: Normal distribution of returns of the AEX after the year 2000



Graph 4: Normal distribution of returns of the AMX



Graph 5: Normal distribution of returns of the AScX

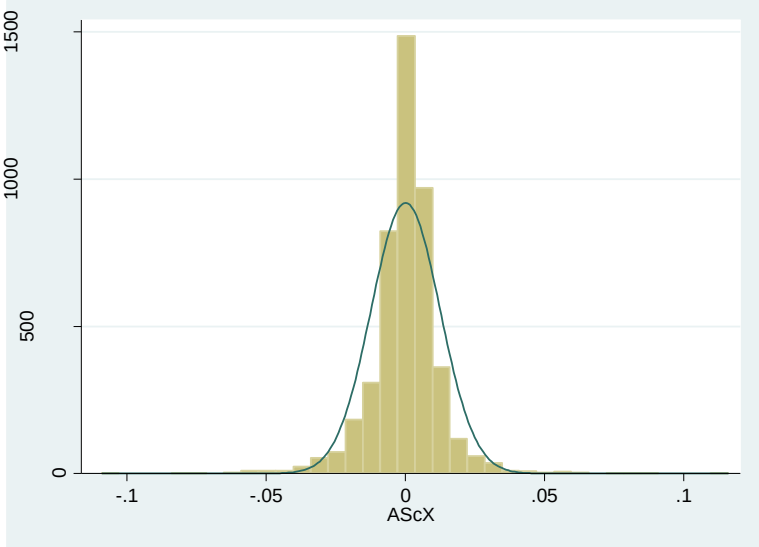


Table 9: Summary statistics for the AEX index

Dummy variable	Observations	Mean (%)	Std. Dev. (%)	Min (%)	Max(%)
Jan	771	0.035	1.320	-6.335	6.745
Feb	727	0.025	1.157	-5.534	3.706
Mar	781	0.088	1.312	-6.596	9.517
Apr	683	0.073	1.118	-5.167	5.522
May	734	-0.005	1.104	-4.994	7.072
Jun	741	0.018	1.098	-5.873	4.799
Jul	774	0.057	1.215	-7.169	7.397
Aug	776	-0.051	1.335	-6.110	4.846
Sep	750	-0.093	1.466	-9.158	8.231
Oct	775	0.013	1.804	-12.779	10.028
Nov	750	0.042	1.451	-7.393	11.182
Dec	704	0.134	1.146	-6.990	7.827
Mon	1759	-0.017	1.552	-12.779	10.028
Tue	1816	0.058	1.220	-7.200	7.453
Wed	1818	0.037	1.252	-7.996	11.182
Thur	1798	0.015	1.297	-7.516	9.517
Fri	1775	0.042	1.227	-8.865	8.231
Turn of month	1693	0.119	1.325	-7.090	6.745
Christmas	34	0.090	0.501	-1.069	1.138
New Year	35	0.171	0.833	-1.249	2.601
Easter	36	0.359	0.783	-1.333	2.505
Kings day	35	0.049	0.840	-1.512	1.702
Liberation day	35	-0.064	1.226	-3.246	4.352
Pre-holiday	175	0.123	0.871	-3.246	4.352
Ramadan	751	0.015	1.320	-9.158	8.231
Daylight Savings Time	28	-0.150	1.871	-5.320	3.732

Table 10: Summary statistics for the AEX index before 2000

Dummy variable	Observations	Mean (%)	Std. Dev. (%)	Min (%)	Max (%)
Jan	363	0.118	1.340	-5.550	6.745
Feb	343	0.086	1.037	-5.116	2.711
Mar	369	0.165	1.028	-3.425	3.399
Apr	326	0.076	0.997	-5.167	2.776
May	345	0.013	1.003	-3.599	5.895
Jun	358	0.104	0.801	-2.601	3.471
Jul	377	0.086	0.910	-3.460	3.096
Aug	376	-0.061	1.272	-5.035	4.008
Sep	365	-0.046	1.167	-6.118	4.791
Oct	376	-0.055	1.748	-12.779	8.811
Nov	364	0.077	1.464	-7.393	11.182
Dec	335	0.206	1.046	-5.589	3.981
Mon	840	-0.001	1.428	-12.779	5.545
Tue	874	0.100	1.116	-6.101	6.745
Wed	874	0.117	1.151	-6.130	11.182
Thur	858	0.007	1.146	-7.516	8.346
Fri	851	0.088	1.056	-5.433	5.447
Turn of month	814	0.184	1.193	-7.090	6.745
Christmas	16	0.193	0.503	-0.799	1.138
New Year	17	0.429	0.777	-0.696	2.601
Easter	17	0.371	0.759	-0.617	2.505
Kings day	17	-0.041	0.833	-1.393	1.109
Liberation day	17	0.040	0.649	-1.123	1.404
Pre-holiday	84	0.198	0.722	-1.393	2.601
Ramadan	362	0.099	1.064	-5.550	5.895
Daylight Savings Time	13	-0.030	1.278	-3.202	1.698

Table 11: Summary statistics for the AEX index after 2000

Dummy variable	Observations	Mean (%)	Std. Dev. (%)	Min (%)	Max (%)
Jan	407	-0.040	1.301	-6.335	6.294
Feb	384	-0.029	1.254	-5.534	3.706
Mar	412	0.020	1.521	-6.596	9.517
Apr	357	0.070	1.219	-4.205	5.522
May	389	-0.021	1.187	-4.994	7.072
Jun	383	-0.063	1.313	-5.873	4.799
Jul	397	0.028	1.446	-7.169	7.397
Aug	400	-0.042	1.393	-6.110	4.846
Sep	385	-0.137	1.703	-9.158	8.231
Oct	399	0.076	1.855	-9.590	10.028
Nov	386	0.008	1.440	-6.976	9.790
Dec	369	0.069	1.228	-6.990	7.827
Mon	918	-0.032	1.658	-9.590	10.028
Tue	942	0.019	1.308	-7.200	7.453
Wed	944	-0.037	1.335	-7.996	8.696
Thur	940	0.021	1.421	-6.976	9.517
Fri	924	0.000	1.365	-8.865	8.231
Turn of month	877	0.057	1.435	-6.990	6.426
Christmas	18	-0.002	0.494	-1.069	0.852
New Year	18	-0.071	0.831	-1.249	2.368
Easter	19	0.349	0.825	-1.333	2.076
Kings day	18	0.134	0.862	-1.512	1.702
Liberation day	18	-0.162	1.609	-3.246	4.352
Pre-holiday	91	0.053	0.987	-3.246	4.352
Ramadan	388	-0.065	1.519	-9.158	8.231
Daylight Savings Time	15	-0.254	2.308	-5.320	3.732

Table 12: Summary statistics for the AMX index

Dummy variable	Observations	Mean (%)	Std. Dev. (%)	Min (%)	Max (%)
Jan	493	0.081	1.216	-6.122	5.553
Feb	465	0.098	1.117	-5.391	3.602
Mar	497	0.068	1.180	-4.745	5.344
Apr	435	0.027	1.156	-4.010	4.545
May	469	0.041	1.252	-6.128	6.615
Jun	467	-0.082	1.193	-6.205	4.840
Jul	488	0.011	1.183	-5.014	4.842
Aug	486	-0.051	1.289	-5.939	4.207
Sep	472	-0.099	1.395	-7.362	5.520
Oct	507	0.024	1.572	-9.982	7.971
Nov	492	0.007	1.305	-6.574	7.841
Dec	469	0.102	1.045	-4.370	4.547
Mon	1130	0.020	1.405	-9.982	7.971
Tue	1160	0.033	1.213	-4.161	7.841
Wed	1161	0.013	1.202	-7.126	5.266
Thur	1153	-0.024	1.267	-6.574	5.162
Fri	1136	0.054	1.163	-6.205	5.520
Turn of month	1081	0.159	1.252	-5.466	7.841
Christmas	23	0.398	0.651	-0.323	2.707
New Year	23	0.332	0.711	-1.296	2.364
Easter	23	0.458	0.930	-1.492	1.985
Kings day	22	-0.027	0.697	-1.899	1.082
Liberation day	22	0.139	1.308	-2.756	2.678
Pre-holiday	113	0.264	0.892	-2.756	2.707
Ramadan	486	-0.001	1.421	-7.134	5.520
Daylight Savings Time	18	0.231	1.542	-3.382	3.029

Table 13: Summary statistics for the AScX index

Dummy variable	Observations	Mean (%)	Std. Dev. (%)	Min (%)	Max (%)
Jan	391	0.085	1.191	-7.253	5.811
Feb	363	0.163	1.419	-5.671	11.602
Mar	390	0.050	1.267	-5.780	5.582
Apr	347	0.100	0.924	-3.666	4.412
May	368	-0.046	1.155	-5.694	4.612
Jun	364	-0.111	1.065	-4.093	3.413
Jul	397	-0.014	1.109	-8.216	3.135
Aug	400	-0.021	1.155	-4.403	5.726
Sep	385	-0.105	1.357	-5.879	6.045
Oct	399	0.107	1.756	-10.897	11.058
Nov	386	-0.165	1.225	-6.228	4.479
Dec	378	0.097	0.916	-3.322	6.340
Mon	904	0.028	1.318	-8.224	7.535
Tue	919	-0.013	1.200	-6.228	11.602
Wed	922	-0.003	1.205	-8.216	8.003
Thur	919	-0.033	1.182	-5.865	6.436
Fri	904	0.078	1.280	-10.897	11.058
Turn of month	854	0.081	1.101	-7.253	6.340
Christmas	18	0.237	0.355	-0.347	1.151
New Year	18	0.641	1.499	-0.307	6.340
Easter	18	0.227	0.645	-1.406	1.086
Kings day	17	0.039	0.533	-1.055	0.929
Liberation day	17	-0.240	1.273	-3.010	2.101
Pre-holiday	88	0.187	0.989	-3.010	6.340
Ramadan	387	-0.100	1.222	-6.228	4.241
Daylight Savings Time	15	0.365	1.362	-1.653	3.252