Aalto University
School of Business

Does the Settlement Cycle of a Market Predict the Timing of the Turn-of-the-Month Return Reversal?

Evidence from Settlement Cycle changes.

Master's Thesis
Otso H. Konttinen
Aalto University School of Business
Finance
Fall 2018

Author Otso H. Konttinen

Title of thesis Does the Settlement Cycle of a Market Predict the Timing of the Turn-of-the-Month Return Reversal? Evidence from Settlement Cycle changes.

Degree Master of Science in Economics and Business Administration

Degree programme Finance

Thesis advisor(s) Peter Nyberg

Year of approval 2018 **Number of pages** 82 **Language** English

PURPOSE OF THIS THESIS

The purpose of this thesis is to determine if the settlement cycle of a market predicts the timing of the turn-of-the-month return reversal. I use settlement cycle changes in developed countries and study the behaviour of daily average returns around month ends. My main hypotheses are that the turn-of-the-month effect exists in the markets I study, and that the settlement cycle of a market determines the timing of the positive return reversal before month end.

DATA AND METHODOLOGY

I use benchmark stock index data from developed countries that have had a settlement cycle change during the last three decades. To determine the daily average returns of the turn-of-the-month days during different settlement cycle periods, I run dummy variable regressions. To test the differences in daily average returns during different periods, I run difference-in-means tests.

FINDINGS

First, I find that more recent the subsample, the weaker the turn-of-the-month effect is in all of the markets I study. In many markets, the turn-of-the-month effect has disappeared completely. I do not find strong evidence to support my hypothesis that the settlement cycle of a market predicts the timing of the turn of the month return reversal. My findings imply that markets are, or have become, more efficient than many studies suggest.

Keywords anomalies, seasonal anomalies, the turn of the month effect, return reversals

Tekijä Otso H. Konttinen

Työn nimi Ennustaako markkinakohtainen maksuperiodi tuottojen kääntymisen ajankohdan kuun vaihteessa?

Tutkinto Kauppatieteiden maisteri

Koulutusohjelma Rahoitus

Työn ohjaaja(t) Peter Nyberg

Hyväksymisvuosi 2018 **Sivumäärä** 82 **Kieli** Englanti

TUTKIELMAN TAVOITTEET

Tämän tutkielman tavoitteena on selvittää, ennustaako markkinakohtainen maksuperiodi tuottojen kääntymisen ajankohdan kuun vaihteessa. Tuottojen kääntyminen ennen kuun loppua liittyy useissa tutkimuksissa löydettyyn kuunvaihdeilmiöön. Tutkin, kuinka keskimääräiset päivittäiset tuotot käyttäytyvät kuun vaihteessa, kun maksuperiodia muutetaan. Tätä varten tutkin kehittyneissä talouksissa tapahtuneita maksuperiodin muutoksia viimeisen 30 vuoden aikana. Hypoteesini ovat, että tutkimissani talouksissa tapahtuu kuunvaihdeilmiö, ja että markkinakohtainen maksuperiodi ennustaa tuottojen kääntymisen ajankohdan kuun vaihteessa.

LÄHDEAINEISTO JA METODIT

Lähdeaineistona käytän osakeindeksejä kehittyneistä maista, joissa on ollut maksuperiodin muutos viimeisen 30 vuoden aikana. Määrittääkseni keskimääräiset päivittäiset tuotot kuunvaihteessa, ajan binäärimuuttujaregressioita. Keskimääräisten päivittäisten tuottojen erojen merkitsevyyden eri otoksissa määritän tilastollisin menetelmin.

TULOKSET

Tulokseni osoittavat, että mitä uudempaa otosta tarkastelen, sitä heikompi on kuunvaihdeilmiö. Useilla markkinoilla se on hävinnyt kokonaan ajan myötä. En löydä vahvoja todisteita siitä, että markkinakohtainen maksuperiodi ennustaisi tuottojen kääntymisen ajankohdan kuun vaihteessa. Tulosteni perusteella näyttää siltä, että markkinat ovat tehokkaammat, tai niistä on ajan myötä tullut tehokkaammat, kuin useat tutkimukset antavat ymmärtää.

Avainsanat anomaliat, kausianomaliat, kuunvaihdeilmiö, tuottojen kääntyminen

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1 Introduction

Seasonal patterns in stock returns have been extensively studied since 1980s. The term "seasonal pattern" refers to predictable, higher or lower than average returns in particular time periods. These patterns include, for instance, time of the day effect (Harris, 1986), the day of the week effect (French, 1980), the holiday effect (Lakonishok & Smidt, 1988), the turn of the month effect (Lakonishok & Smidt, 1988; Ogden, 1990), and the turn of the year effect (Lakonishok & Smidt, 1988). According to a multitude of studies on the seasonal patterns, one is able to predict future stock returns by analyzing past stock return data. Seasonal patterns are remarkable violations of the Efficient Market Hypothesis (EMH). According to the weak for of EMH (Fama, 1970), stock markets are efficient and reflect all current market information, and past stock returns do not affect future returns. No abnormal profits can be made by technical analysis of past stock returns. In this thesis, I will concentrate on the turn of the month effect, which seems to be one of the most persistent stock market anomalies.

1.1 The turn of the month effect

The turn of the month effect refers to a phenomenon where stocks experience above average returns around month-ends. To my knowledge, Ariel (1987) was the first to document the turn of the month effect. Analyzing a 19-year period from 1963 to 1981 he finds that all cumulative US stock market returns occurred during the first half of the trading months. In addition, Ariel finds that January or small firm effects cannot explain the phenomenon.

After Ariel (1987), several studies research the turn of the month effect. An important paper was Lakonishok & Smidt (1988), in which authors analyze daily returns of Dow Jones Industrial Average index around the turn of the month during 90-year period from 1897 to 1986. Similar to Ariel, they find higher than average stock returns around the turn of the month. Ogden (1990) confirms Lakonishok & Smidt's findings by studying US value- and equal-weighted stock index returns. He argues that the standardized payment system in the US is at least partially the reason behind the turn of the month effect ("payday hypothesis"). The standardized payment system causes investors to receive a large part of their monthly

cash receipts at the turn of the month, and especially at the turn of the year. The reinvestment of those cash receipts increases investors' demand for stocks, increasing stock prices.

In addition to the studies on the US market, the turn of the month effect has been studied internationally. The first appears to be Jaffe & Westerfield (1988), who study the turn of the month effect in US, Japan, UK, Canada, and Australia. They find an effect similar to US in Australia, and reverse effect in Japan. They argue that the effect might be country unique, instead of universal. Cadsby & Ratner (1992) find a significant turn of the month effect on Canada, UK, Australia, Switzerland, and West Germany. However, the pattern is non-universal in these countries. Therefore, they argue that the effect seems to be linked to country-specific institutions and practices. Martikainen, Perttunen and Ziemba (1994) study 24 stock markets and 12 regional indices and find that it exists in most of the countries and regions, except in some small markets (Finland, Mexico, New Zealand, Australia). However, Martikainen, Perttunen and Puttonen (1995) find the effect also in Finland, when using longer turn of the month time-window (11 days compared to four days). McConnell and Xu (2008) find the turn of the month effect in the US as well as in 30 out of 34 non-US countries.

The turn of the month effect seems to be persistent and internationally present. What may be the reasons behind the turn of the month effect?

1.2 Explanations for the turn of the month effect

There are several studies documenting the turn of the month effect, but less studies attempting to explain the phenomenon. Lakonishok & Smidt (1988) hypothesize that the turn of the month effect could be due to pension fund managers concentrating their trading activity to month-ends in attempt to make estimated returns look better. As discussed above, Ogden (1990) explained the effect with "payday hypothesis". Ziemba (1991) finds evidence to support Ogden. He finds that the turn of the month effect appears several days earlier in Japan than in the US and explains this with the fact that in Japan salaries are paid five days before month-end. Supporting the findings of Ogden (1990) and Ziemba (1991), Booth, Kallunki and Martikainen (2001) study the Finnish stock market and find that higher returns at the turn of the month are associated with higher trading activity. It seems that both institutional and individual investment might be concentrated on the month-ends, appreciating stock prices. Wiley & Zumpano (2008) test the impact of the level of

institutional investment to the turn of the month effect and find there is an impact but it is not as large as some have hypothesized. Therefore, they argue that turn of the month effect would not be caused exclusively by institutional investors.

In a recent study, Etula, Rinne, Suominen and Vaittinen (2016) show extensive evidence that the monthly payment cycle would cause the turn of the month return patterns around the world. They document that many of the largest non-bank payment transfers, such as dividends and pensions, are heavily concentrated around the end of the month. These payments require cash, and thus there is large systemic need for liquidity by institutions making these payments at month-ends. Authors find that this excess demand of cash is associated with not only increased short-term borrowing cost, but also increased stock and bond yields.

In essence, institutional investors mostly own securities, but need to sell a part of the securities to obtain cash to make the month-end payments. Etula et al. (2016) call this liquidity-motivated trading. They link the timing of the liquidity-motivated trading to market-specific settlement cycles. The settlement cycle means the time between the security transaction and cash settlement. For example, until September 5, 2017, in the US equity and corporate bond markets, the settlement cycle was TD+3[1], meaning that investor would have the cash three days after the security transaction. For an institution facing cash needs at the last day of the month (T), this means that it has to sell the needed amount of securities at least four business days before the month-end (T-4). Combining their own hypothesis of institutional liquidity-motivated trading with Ogden's (1990) "payday hypothesis", authors define two return reversals around month-ends. First, there is "selling pressure" period from T-8 to T-4. During this period, institutions execute their liquidity motivated selling, depreciating stock prices. From T-3 to T-1, there is "positive reversal" period, where stock prices are elevated as selling pressure subsides. From T+1 to T+3, there is "buying pressure" period, where obtained cash receipts are reinvested to the stock market, elevating the prices. Finally, from T+4 to T+8, there is negative reversal, when reinvestment of new money

[1] Even though the standard way to denote settlement cycle is T+X, in this thesis, the settlement cycle is denoted as TD+X. TD refers to the transaction date, and X to the amount of days after the transaction before cash settlement. TD+X is used in this thesis to avoid confusion with the notation of the turn of the month days. Turn of the month days are denoted as T+/-X, where T refers to the last day of the month, and X to the amount of days before/after T.

subsides. Authors document these kinds of return patterns reversals in US value- and equal-weighted stock indices, bonds and in 22 out of 25 international equity indices.

In addition, Etula et al. (2016) link the institutional liquidity-motivated trading to the turn of the month effect by studying trade-level observations for hundreds of institutional investors. They find that there are notable seasonalities on institutions' trading behavior. Also, they find that stocks that are more widely held by mutual funds show more pronounced turn of the month effect. Moreover, authors explain the perseverance of the turn of the month effect with research on limits to arbitrage.

1.3 The research problem

Motivated by Etula et al. (2016), I study the effect of the settlement cycle to the turn of the month effect. Etula et al. argue that the timing of institutional investors' liquidity motivated trading is driven by market-specific settlement cycles. Therefore, the timing of the positive return reversal before the month-end should be located according to the settlement cycle. As authors argued, when the settlement rule is TD+3, the positive reversal should take place between T-4 and T-3.

To study if the market-specific settlement cycle drives the turn of the month return patterns and reversals, I consider six stock market settlement cycle changes in the developed economies:

1)

   a) On June 1st, 1995, the US and Canada transitioned from TD+5 settlement cycle to TD+3 settlement cycle.

   b) On September 5th, 2017, the US and Canada transitioned from TD+3 settlement cycle to TD+2 settlement cycle.

2) On January 5th, 2009, Taiwan transitioned from TD+1 settlement cycle to TD+2 settlement cycle.

3) On October 6th, 2014 a group of European countries containing Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal,

Sweden, Switzerland and UK transitioned from TD+3 settlement cycle to TD+2 settlement cycle.

4) On March 7th, 2016, Australia and New Zealand transitioned from TD+3 settlement cycle to TD+2 settlement cycle.

5) On September 29th, 2016, Spain transitioned from TD+3 settlement cycle to TD+2 settlement cycle.

First, by studying the average daily returns of benchmark stock indices from these countries, I provide an updated look on the turn of the month effect and its strength. Second, and most importantly, by dividing each index dataset in subsets according to the different settlement cycles, I determine whether the market-specific settlement cycle drives the timing of the liquidity-related selling and the timing of the positive turn of the month return reversal.

1.4 Contribution to the literature

To my knowledge, I am the first to extensively study the effect of settlement cycle changes to the timing of the turn of the month positive return reversals.

Etula et al. (2016) perform a quasi-natural experiment on the European group settlement cycle transition. They study the difference in daily market return autocorrelation on T-2 (difference in differences test), that they expect to decrease as the return reversal should move towards the end of the month. They find that the autocorrelation decreased on T-2 in statistically and economically significant way and provide evidence that the market-specific settlement rule together with institutional investors' liquidity-motivated selling drive the timing of the positive turn of the month-return reversal.

I add to the test of Etula et al. by studying also other settlement cycle changes than the European group transition. For the European group, I present detailed results country by country, instead of just pooled results. In addition to studying each country separately, I pool the countries that have had a settlement cycle change at the same time and study the effect on the pooled returns to minimize noise.

In addition, I provide the most recent look on the turn of the month effect in developed economies.

1.5 Main findings

My results do not conclusively support my hypotheses. First, the turn of the month has significantly attenuated or disappeared in all of the countries in my sample. Second, my results do not confirm that the settlement cycle of a market would dictate the month end return reversal. In many countries, there is no such return reversal to begin with. In countries where such reversal is found, it is weakly significant or insignificant. However, there are some hints in my results that there may be something to my hypotheses. Still, my results suggest that stock markets around the world are more efficient that some studies suggest, and that they have become more efficient over time.

1.6 Structure

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature on the seasonal patterns, the turn of the month effect, return reversals and limits to arbitrage, and builds the hypotheses for this thesis. Section 3 describes the data and the methodology used in this paper. Section 4 presents the empirical results and Section 5 discusses them. Finally, Section 6 concludes the main findings and implications.

2 Literature review and hypothesis development

In this section, I review the relevant literature on seasonal patterns, the turn of the month effect, return reversals, and limits to arbitrage. Based on this literature I build a theoretical framework for this thesis, and finally build my hypotheses.

2.1 Anomalies and seasonal patterns

The Efficient Market Hypothesis (EMH) by Fama (1970) states that stock market is efficient and thus current share prices reflect all relevant information. Therefore, it should not be possible to time the market or gain excess returns by analyzing past stock prices. EMH is the basis for the modern finance theory, but it is often questioned. When a phenomenon contradicts EMH, it is typically called an anomaly or stock market inefficiency. Research has found many different anomalies, although there is typically evidence both for and against a phenomenon. Lakonishok & Smidt (1988) note, that selection bias, noise and data snooping may create an anomaly even though it does not actually exist. Therefore, one has to be extremely careful in interpreting results.

Seasonal patterns, or calendar anomalies, are one important category of stock market anomalies and have been in the interests of researchers for a long time. Jacobs & Levy (1988) note that research on the day-of-the-week, holiday and January effects already began in 1930s. Persistent but mixed evidence on seasonal patterns' existence still keeps researchers engaged. Another plausible explanation for the keen interest of researchers is that data on seasonal patterns is relatively easily available. Simple market index data can be used to study them, and it is available for extensive periods of time. However, as Jacobs & Levy (1988) remind, this also increases the possibility of data snooping.

Seasonal patterns typically occur at the turns of time – the turn of the day, the week, the month, and the year (Jacobs & Levy, 1988). Often the effects have significant economic impact, even though they should not according to the EMH. In addition, Jacobs & Levy note that seasonal patterns are often related to the other return effects. They argue that some seasonalities are more pronounced for small stocks that for large stocks, for example. As seasonal patterns are very well known and documented, it is peculiar that they have not been arbitraged away. Next, I will introduce five most important seasonalities. First, I will briefly describe the January, the holiday, the day-of-the-week and the time-of-the-day effects.

One of the most famous seasonal patterns is January effect. Rozeff & Kinney (1976) document abnormally high mean stock returns in January compared to other months. In addition, they find relatively high returns in July, November and December. Later, several studies confirm and extend the findings, for example Keim (1983) and Roll (1983). According to Jacobs & Levy (1988), most popular explanation for January effect is tax-loss-selling rebound. When in December investors sell losers, in January selling pressure subsides and returns are abnormally high. Another explanation is "window dressing" – fund managers sell losers at the end of the year to make their annual reports look better. After the year end, similar stocks are bought back, inducing the January effect. Increased liquidity of investors may also be the reason behind the January effect. Bonuses, holiday gifts and year-end pension plan contributions invested in the stock market may cause the January effect.

Holiday effect is another famous seasonal pattern, in part related to January effect. It is manifested in abnormally high mean stock returns before holidays, such as Christmas of New Year. Ariel (1990) shows that over the third of the market return in his 20-year sample period is gained on eight trading days before holidays. Holiday effect has mostly been explained by psychological reasons, such as "holiday euphoria" (Jacobs & Levy, 1988). Authors note that on holidays which do not include stock market closing, such as St. Patrick's Day, holiday effect does not seem to exist. Thus, holiday effect might be related to stock market closing, similarly to weekend effect. However, holiday effect is much stronger than the weekend effect, implying that just stock market closing is not the reason behind it.

The day-of-the-week and the time-of-the-day are well-known seasonalities as well. The day-of-the-week effect is also known as weekend effect, and it refers mainly to substantially high returns on Friday and significantly lower returns on Monday than on other weekdays (Jacobs & Levy, 1988). The effect seems to be both economically and statistically significant. According to the authors, the most plausible explanation for the weekend effect is the tendency of humans to announce good news quickly and defer bad news. Often bad news is announced after market close on Friday, and thus the first opportunity to trade according to the new information is Monday. The time-of-the-day effect refers to high returns at the beginning and the end of the trading day, expect Monday, where returns are negative at the beginning. The other times during the day, returns are rather flat. Higher volatility at the beginning and at the end of the day is proposed as an explanation for the effect (Admati &

Pfleiderer, 1988). However, according to Jacobs & Levy (1988), the risk increase is not large enough to explain the magnitude of the effect, and in addition negative returns on the beginning of Monday contradicts to this hypothesis. Authors argue that most plausible explanation might be similar to the holiday and the weekend effects – the closed market. According to them, psychological research suggests that there is behavioral tendency to bid up prices before the market close.

Finally, the fifth seasonality that is very famous is the turn-of-the-month effect. It is in the special interest of this thesis, and therefore I will describe it in detail. The rest of this Section is devoted to the turn-of-the-month effect, the reasons behind it, and hypothesis development for this thesis.

2.2 The turn-of-the-month effect in the US

To my knowledge, Ariel (1987) is the first to document the turn-of-the-month effect, which he calls "a monthly effect in stock returns". He finds that stocks gain positive returns only on the first half on the month, and zero returns on the second half. All of the cumulative gain comes from the first halves of the months. Ariel uses CRSP (Center for Research in Security Prices) value- and equal-weighted stock index returns from 1963 to 1981 and calculates the arithmetic mean daily returns. The last day of the previous month and the first half of the new month show positive returns. For the second half, returns are mainly negative. Ariel defines "trading month" so that it includes the last day of the previous month and excludes the last day of the current month. He divides these "trading months" in halves and finds that the average daily return in the first half is statistically significantly higher than the average daily return in the second half, for both value- and equal-weighted indices. Furthermore, the average daily return in the second half is statistically not different from zero.

Ariel (1987) discusses possible reasons behind the differing mean returns. He states it could be possible that in his sample period this effect "just happened". However, he shows that outliers are not the causing the difference in mean returns. Shift in the distribution of the two return populations is the cause of the differing means. Ariel notes that data mining could be the reason for the results, but rules also this explanation out. He argues that as practitioners have found the effect in 1976 by "mining" past data, and he has one subperiod in his sample that dates after 1976, his test can be seen as out-of-sample test. Thus, data mining is not

behind the found effect. Ariel also considers his data quality. CRSP daily index return data is calculated the same way on all of the days, and stock weights are recalculated daily. He argues that thus data is not biased and cannot be behind the effect. Furthermore, Ariel argues that mismatch between calendar and trading time cannot cause the effect, as he divides the months so that there is equal number of trading days in both halves. Finally, Ariel considers if dividend or January effect might cause the monthly effect. He rules out the dividend effect, with most convincing evidence against it being that its magnitude is not large enough to cause the monthly effect. Ariel examines the effect of the January effect by excluding the Januaries from his sample. Even without Januaries, the monthly effect still exists, however the mean returns are lower.

Soon after Ariel (1987), Lakonishok & Smidt (1988) study several different seasonalities. To my knowledge, they were the first to call the "monthly effect in stock returns" turn-of-the-month effect. They use 90 years (1897 – 1986) of daily index data on the Dow Jones Industrial Average to test for anomalies around the turn of the week, around the turn of the month, around the turn of the year and around holidays. Authors note that even though anomalies in security returns have been found by many researchers, but one should be skeptical about their existence. The anomalies can be a result of selection bias, noise, or data snooping. Selection bias refers to the notion that studies that support current beliefs are typically less likely to be published than the ones that contradict them. Thus, by reading the published research on anomalies, one can easily overestimate the amount of evidence in favor of the anomalies. Noise may be a problem when estimating abnormal returns. If one underestimates the level of noise, one is likely to find anomalies where there is actually just noise. Data snooping is the same problem Ariel (1987) mentions – forming and testing hypotheses with the same data is not statistically appropriate. To avoid sampling bias and data snooping, Lakonishok & Smidt use data sample that is different from the one the turn-of-the-month effect was found in.

Lakonishok & Smidt (1988) criticize the Ariel's (1987) definition that the first part of the month includes the last day of the previous month. Ariel argues that he includes the last day of the previous month in the first part because the mean return on the last day of the month is high. According to Lakonishok & Smidt, this is questionable, because Ariel's justification is made based on examination of his data. Lakonishok & Smidt define the first half of the

month as from the first to fifteenth calendar day of the month. The second half consists of the remaining days. Authors divide their sample in 10 different, in some cases overlapping, subsamples. Their results are different from Ariel's. The difference in mean daily returns between the first and the second half of the month is way lower, and the mean return is positive for both halves. Authors cannot reject the hypothesis that both halves of the month have the same average return in any of the subsamples, including the subsample that includes Ariel's sample period. Studying the difference between halves of the month on the month-by-month basis, they find significant differences only for April, where the first half performs better, and in December, where the last half performs better. Thus, authors have only very weak support for Ariel's results. They claim that Ariel's results are due to unique characteristics of his sample period and inclusion of the last day of the previous month to the first half of the current month.

Lakonishok & Smidt (1988) also study turn-of-the-month effect by calculating the daily mean returns for eight days around the month and find a significant turn-of-the-month effect. In the total sample, daily mean returns are especially high from day -1 to 3, -1 being the last trading day of the month. Cumulative return for the four-day period from -1 to 3 is 0.473 whereas for an average four-day period it is 0.0612. Cumulative turn-of-the-month return also exceeds the average monthly return, meaning that on the other days of the month, DJIA returns are on average negative. Authors' results were similar across their subsamples and remained when controlling for the January effect by excluding the last day of December and three first days of January. They also show that the turn-of-the-month returns are not due to dividend effect. Among others, authors offer seasonal patterns in cash flows, tax-induced trading, and "window dressing" by fund managers as explanations for the turn-of-the-month effect. However, they do not study the reasons further.

Not long after Ariel (1987) and Lakonishok & Smidt (1988), Ogden (1990) studies the turn of the month effect and reasons behind it. He argues that the standardization of payment systems in the US causes the regular monthly patterns in stock returns and that this effect is related to monetary policy. Based on Ogden (1987), he argues that the turn of each calendar month is common payment date for salaries, interests, principal payments, dividends and other liabilities by large economic entities. Therefore, for short term investment, those entities prefer securities that mature at the end of a calendar month over the securities that

mature before or after that time. As demand for securities maturing at the month end is increased, their price ends up higher, and their yield lower, compared to the other securities. In addition, Ogden (1987) shows that greater stringency in monetary policy amplifies this effect, as cost of liquidity to meet the turn of the month obligations is increased.

Ogden (1990) argues that because of the standardized payment system, most of investors' monthly income is concentrated in the turn of the month. However, as the monthly cash expenditures are divided throughout the month, investors are able to invest part of the cash receipts in securities, among them stocks. Therefore, the demand for stocks by investors is greatest at the turn of the month, increasing stock prices. Furthermore, Ogden argues that in months in which aggregate liquid profits are high, investors will invest in the stock market and bid up the prices. On the contrary, in month in which aggregate liquid profits are low, investors do not invest and bid up the prices. Fed's monetary policy affects the growth of liquidity in the economy, and thus liquid profits, and through liquid profits the turn of the month effect. Therefore, Ogden expects an easy monetary policy to increase liquid profits and thus amplify the turn of the month effect. Correspondingly, stringent monetary policy should decrease liquid profits and dampen the turn of the month effect. Ogden adds that this should be true to the extent that monetary policy affects liquid profits.

To inspect whether his hypothesis is true, Ogden (1990) uses CRSP value- and equal-weighted daily stock index returns from 1969 to 1986. To measure monetary policy stringency, Ogden uses the monthly Fed funds spread. Ogden confirms Lakonishok & Smidt's (1988) findings that the daily mean stock returns are statistically significant for days from -1 to 3, for both value- and equal-weighted indices. Results are consistent with his turn of the month liquidity hypothesis. Ogden argues that this does not necessarily mean that the stock market is inefficient. Using an estimate of transaction cost in NYSE by Berkowitz, Logue and Noser (1988), he calculates that the mean cumulative turn of the month return is insufficient to provide substantial profits after transaction costs. Therefore, arbitrageurs are not likely to be tempted to trade against the turn of the month effect. Furthermore, Ogden finds that monetary policy stringency is inversely related to the turn of the month returns, consistent with his turn of the month liquidity hypothesis.

2.3 The turn-of-the-month effect internationally

There is extensive evidence about the turn of the month effect in the US, but also in other countries. Next, I review some of the most important papers on the turn of the month effect internationally.

Jaffe & Westerfield (1989) study the monthly patterns in US stock returns found by Ariel (1987) in four other countries. They find only weak evidence to support Ariel – the effect seems to be present only in Australia, and Japan shows a reverse effect. However, as authors' method is based on Ariel's study, they inspect the difference between average daily mean returns in the first and the second half of the month. When studying the daily mean returns separately, they find some evidence on "the last day of the month effect", significantly high returns in the last day of the month.

Cadsby & Ratner (1992) study the turn of the month effect in the US, Canada, Japan, Hong Kong, UK, Australia, Italy, Switzerland, West Germany and France. They use stock index data from each of the countries. Similar to Lakonishok & Smidt (1988), they define the turn of the month days as days from -1 to 3, and compare the daily mean returns between turn-of-the-month and non-turn-of-the-month days. They find that in the US value- and equal-weighted indices, Canada, Switzerland, West Germany, UK and Australia the effect is significant. For the other countries there is no significant turn of the month effect. In addition, authors test if the turn of the month effect is just another manifestation of the turn of the year effect by studying the turn of the year and other turns of the month separately. They find that the turn of the year returns are higher than other turn of the month returns. However, when controlling for the turn of the year effect, the turn of the month effect only disappears in Australia. Authors conclude that in general the turn of the month effect is not created by the turn of the year effect. Furthermore, Cadsby & Ratner study turns of the quarters and other turns of the month separately. This way they attempt to control for "window dressing" by fund managers – it is anticipated to take place in quarter ends. Results show that the turn of the month effect does not seem to be caused by window dressing. Authors argue that as the turn of the month effect is found also outside the US, it cannot be a result of "mining" the US data. Still, as the effects are not exactly similar between countries, they hypothesize that they might be strongly related to local institutions and practices.

Ziemba (1991) presents evidence supporting Cadsby & Ratner's (1992) hypothesis that the turn of the month effect is caused by country-specific reasons and Ogden's (1990) payday hypothesis. He studies Japanese NSA and TOPIX index returns from 1949-1988 and finds a significant turn of the month effect. However, it does not take place from day -1 to 3 like in the US and some other countries, but from day -5 to 2. Ziemba notes that in Japan, salaries are typically paid on the 25th day of the month, and thus the timing of the turn of the month effect would be logical in the sense on Ogden's payday hypothesis.

Martikainen, Perttunen and Ziemba (1994) use extensive non-US data to study the turn of the month effect in 24 stock markets and 12 different regional indices, and find that the effect exists for most of the countries and regions. However, they did not find the effect in some smaller markets such as Finland, Mexico, New Zealand and Australia. Martikainen, Perttunen and Puttonen (1995) continue this study and try to find out why did not Martikainen, Perttunen and Ziemba find turn of the month effect in Finland. They use derivatives and cash market data, a longer estimation period (1988-1993), and define the turn of the month period as the last five and the first five days of the month. Authors find a significant turn of the month effect in Finnish stock index futures and cash markets, especially strong in the last trading week of the month.

2.4 Evidence for and against the persistence of the turn-of-the-month effect

Despite many studies that have found the turn of the month effect around the world, there is also critical research on the phenomenon. Maberly & Waggoner (2000) study S&P 500 futures contracts to see whether the turn of the month effect still exists. They use data from two subperiods, from 1982 to 1990 and from 1991 to 1999. This way they attempt to conduct an out-of-sample test – most of the research that has found a significant turn of the month effect is predates 1991. First, they use method Ariel (1987) uses and compare the mean daily returns in the first and the second half of the month. They do not find a monthly effect in the subsamples. Furthermore, in 1991-1999 subsample they find negative mean return on the last day of the month, not positive like Ariel. Second, they compare mean daily returns in the turn of the month days and other days the same way as Ogden (1990). This way, they find a significant turn of the month effect in 1982-1990 sample. However, in their out-of-sample study on 1991-1999 data, they do not find a significant turn of the month effect. This

holds for both S&P 500 futures and S&P 500 spot index. Therefore, they conclude that after 1990, the turn of the month effect has disappeared as researchers have published research showing a significant effect. They argue that their result supports the efficient markets theory and remind that researchers should be careful when making out-of-sample inferences from research on past data.

Still, there are many studies contradicting Maberly & Waggoner's (2000) findings. Kunkel, Compton and Beyer (2003) examine 19 country stock indices from 1988 to 2000. They inspect 18 trading days around the turn of the month for any significantly positive or negative returns and conduct several parametric and non-parametric statistical tests. Authors find that the turn of the month effect is present in 16 of the 19 countries and that the four-day turn of the month period accounts for 87% of the monthly return. They conclude that the turn of the month effect is indeed international, as it is present in Europe, the Far East, North America and South Africa. Furthermore, the turn of the month effect does not seem to be caused by US markets, as it is present in other countries also during the time period it is not present in the US.

Supporting the findings of Kunkel, Compton and Beyer (2000), McConnell & Xu (2008) find that the turn of the month effect is present in the US and internationally. They use CRSP value- and equal-weighted data from 1926 to 2005 for US and Thomson Datastream data for the other 34 countries. Their findings show a significant turn of the month effect in US in both small- and large-cap stocks, however more pronounced in small-cap stocks. They show that the effect is not confined turns of the year or turns of the quarter, ruling out the window dressing hypothesis. Furthermore, authors show that the turn of the month effect is not caused by higher turn of the month volatility, or, surprisingly, higher turn of the month trading volume. Internationally, they find a significant turn of the month effect in 30 out of 34 countries they examine. Authors thus conclude that factors unique to US cannot explain the turn of the month effect.

2.5 Reasons behind the turn-of-the-month effect

After 1990s, several studies were devoted to understanding the reasons behind the turn of the month effect instead of just documenting the effect.

Booth, Kallunki and Martikainen (2001) study the impact of liquidity on the turn of the month effect. They use data including returns of 148 Finnish stocks from 1991 to 1997 and measure liquidity by FIM volume, share volume and number of trades. Authors find that the turn of the month stock returns are positively correlated with the measures of liquidity. In addition, they find an increase in the number of bid quotes and internalized trades at the turn of the month. Thus, the results support Ogden's (1990) payday hypothesis – higher turn of the month stock returns seem to be associated with liquidity at the month end, and the liquidity is related to large cash flows of (large) investors at the month ends. However, authors remind that these results cannot necessarily be generalized to other markets. This is because cash flows are not concentrated on the last trading day of the month everywhere. Moreover, different market structures of countries may affect results.

Nikkinen, Sahlström and Äijö (2007a) explain the turn of the month returns with macroeconomic news announcement at the month end. They argue that according to empirical evidence, macroeconomic news announcements affect the aggregate risk on the stock market, implying that the systematic risk of the stock market varies over time instead of being constant. As the most important economic news announcement take place at the beginning of the month, authors argue that they may cause the high turn of the month returns. To study if this hypothesis is true, authors use S&P 100 stock and VIX volatility index data from 1995 to 2003 and a sample of scheduled US macroeconomic news announcements. Their results imply that their hypothesis is true. They do find a significant turn of the month effect similar to several previous papers, but when macroeconomic news announcements are taken into account, the significance of the effect disappears. In addition, they show that risk premiums are higher on important announcement days. Therefore, authors conclude that their explanation is economically plausible and consistent with traditional finance theory – the returns are higher at the beginning of the month, because the risk is higher. In another study, Nikkinen, Sahlström and Äijö (2007b) study if the US macroeconomic news announcements also explain the turn of the month effect in European markets. They use main stock index data from Germany (DAX-30), France (CAC-40) and UK (FTSE-100) from 1998 to 2006 and find the turn of the month effect. However, when accounting for the US macroeconomic announcements, the effect disappears from those markets, similar to what happened in the US. Therefore, authors conclude that the concentration of US

macroeconomic news announcement at the beginning of the month drives the turn of the month effect internationally.

Gerlach (2007) finds evidence supporting Nikkinen, Sahlström and Äijö (2007a, 2007b). He uses S&P 500 and CRSP equal-weighted stock returns from 1980 to 2003 to study effect of macroeconomic news announcements on calendar and weather anomalies. He finds that along with the other anomalies, the turn of the month effect does not exist on trading days on which no macroeconomic news announcements were made. Furthermore, the relation between macroeconomic news announcements and anomalies is robust to different combinations of announcements and exists in both subperiods when the sample is divided in two. Markets do not seem to reply to macroeconomic announcements differently during anomaly and non-anomaly periods. Gerlach concludes that institutions and market psychology are unlikely to be the main explanation for calendar and weather anomalies.

Haggard & Witte (2009) do not find evidence supporting studies by Gerlach (2007) and Nikkinen, Sahlström and Äijö (2007a, 2007b). They find that five of the six anomalies tested remain after accounting for macroeconomic news announcements, among them the turn of the month effect. Authors argue that Gerlach's results are likely to be due to lost statistical power from discarding data and ignoring the interaction between macroeconomic news announcements and calendar anomalies. Evidence on whether the turn of the month effect is due to macroeconomic news announcements or not remains mixed.

Wiley & Zumpano (2008) note that several studies have suggested that the turn of the month effect is caused by systematic trading patterns of large institutional investors. The explanations for these systematic patterns are, as discussed earlier, month end window dressing by fund managers (Lakonishok & Smidt, 1988), and the reception and reinvestment of cash at the turn of the month (Ogden, 1990). Wiley & Zumpano study the effect of the level of institutional investment on the turn of the month effect. They use daily stock returns from 238 REITs (Real Estate Investment Trust) from 1980 to 2004. Authors argue that REITs are useful to test the effect of the level of institutional investment because in 1993, there was a tax law change that resulted in an explosion of institutional investment in REITs. They find evidence that stock returns at the turn of the month are indeed affected by the level of institutional investment, supporting the payday and window dressing hypotheses.

However, authors claim that institutional investors are not the only ones behind the turn of the month effect. They find some limited evidence that higher levels of institutional investors may mitigate the returns on the last trading day of the month, when the largest returns typically occur. Authors argue that this can be either because institutions are deliberately "trading against" the turn of the month effect or because higher level of institutional investment reduces the effect of individual investors. Furthermore, Wiley & Zumpano find that the turn of the month effect does not seem to diminish over time but has shifted its timing. Traditionally, the effect has been found from day -1 to 4, but authors find that more recently it seems to appear from -4 to 1. Authors argue their evidence shows that, at least partly, this shift can be attributed to the increase in the level of institutional investment following the tax law change in 1993.

Dzhabarov & Ziemba (2010) support the findings of Wiley & Zumpano (2008). They argue that reasons for the turn of the month effect are mainly based on cash flows and institutional investment. Authors use S&P 500 and Russell 2000 futures data from periods 1993-2009 and 2004-2009 and find that the turn of the month effect still exists. For instance, for S&P 500, the effect seems to be strongest from -5 to 2. Authors conclude that the turn of the month effect still exists, however its timing has changed.

2.6 The turn-of-the-month effect, liquidity, and institutional investors

So far, increased liquidity and institutional investment at the turn of the month seems to be the most promising explanation for the turn of the month effect. In a recent paper, Etula, Rinne, Suominen and Vaittinen (2016) study extensively the effect of institutional trading on the turn of the month effect. This paper is the main motivation for this thesis.

Etula et al. (2016) start from the notion that many of the repeated non-bank payment transfers by institutions, such as dividends and pensions, are concentrated around the turn of the month. The value of non-bank payment transfers in the US alone is huge, over 170 trillion dollars annually. Most of the institutions' wealth is invested in different securities, but the payments require cash. Authors argue this creates a large systemic need for cash, or liquidity, at the end of the month, which in turn leads to selling pressure in security markets before month end. Etula et al. call this "liquidity-related selling".

Etula et al. (2016) link the timing of institutions' liquidity-related selling to market-specific settlement cycles. Settlement cycle is a rule that defines the time between a security transaction and the cash settlement. For example, before September 5 2017, US stock and corporate bond market used TD+3 settlement cycle – the cash settlement takes place three days after the transaction. Thus, authors argue, the settlement cycle of a market defines the timing of the liquidity-related selling. When an institution needs to make cash payments on the last day of the month, it needs to sell the needed amount of securities early enough. In the US example, an institution would need to sell the securities at last four days before month end (day T-4) to have the cash at the month end. Authors combine this hypothesis with Ogden's (1990) payday hypothesis and define two return reversals around the turn of the month. First, as institutions need to sell securities to cover their month end cash needs, there is "selling pressure" from day T-8 to T-4. After that, the selling pressure subsides, there is a "positive reversal" – returns are positive from day T-3 to T-1. From day T+1 to T+3, there is "buying pressure", as the cash acquired at the month end is reinvested in the markets. Finally, from day T+4 to T+8, there is a "negative reversal" as the buying pressure subsides. Notable is that the timing of the periods with above-average return, positive reversal and buying pressure periods, is consistent with most previous literature on the turn of the month effect. However, to my knowledge, previous research has not identified the below-average return periods, the selling pressure and the negative reversal.

Indeed, Etula et al. (2016) find evidence supporting their hypothesis in the US. They use CRSP value-weighted index and show that average stock returns are low from T-8 to T-4 and high from T-3 to T-1. From T to T+3, returns are still high, and furthermore low from T+4 to T+8. The return differences are economically meaningful. In addition, authors get similar results from 24 developed non-US equity markets. Furthermore, they find evidence from 22 out of 25 markets investigated suggesting that below-average returns during the selling pressure periods are associated with above-average returns after return reversals. To study further the effect of the market-specific settlement cycle on the first return reversal, they study a recent settlement cycle change in Europe. In October 6, 2014, Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and UK transitioned from TD+3 settlement cycle to TD+2 settlement cycle. If authors' hypothesis is true, the return reversal should move closer to month end

after this change. Indeed, authors find evidence that the return reversal moves closer to the month end and that the magnitude of the change is economically meaningful. Authors argue that this supports the hypothesis that market-specific settlement cycle together with institutional investors' liquidity-related selling at the month end drives the return reversal patterns at the month end.

In addition to evidence from stock index data, Etula et al. (2016) present direct evidence from institutional investors' trades. They use ANcerno dataset containing trades of hundreds of hedge funds, mutual funds, pension funds and other money managers. Authors find significant intra-month variation in institutions trading behavior. Institutions seem to submit more sell than buy orders from T-8 to T-4, whereas from T-1 to T+3 they seem to submit more buy than sell orders. Selling pressure seems to be the strongest on day T-4. Furthermore, they find that the market impact of institutional selling pressure is economically meaningful and that institutions in their sample lose significant amount of money due to turn of the month trading.

On top of the direct evidence, Etula et al. (2016) provide some indirect evidence to support their hypothesis. They show that stocks more widely held by mutual funds seem to experience more pronounced turn of the month effect and return reversals. In addition, they find that the turn of the month return reversals seem to be more pronounced in countries where mutual funds are more prevalent. Furthermore, authors hypothesize that mutual funds would be likely to try to minimize the transaction costs and trade the most liquid stock to cover the month end cash needs. Indeed, they find that return reversals are largest for liquid and large-cap stocks.

Etula et al. (2016) provide extensive evidence that institutional investors are behind the turn of the month return patterns and reversals, and that market-specific settlement cycle defines the timing of first return reversal. Next, to better understand arguments by Etula et al. and turn of the month return reversals, I will shortly review some of the literature on return reversals.

2.7 Return reversals

In their classic study, Grossmann & Miller (1988) study liquidity and market structure. They model market liquidity as being determined by the demand and supply of immediacy. Often

in financial markets, sellers and buyers of a security arrive at different times. In these cases, market makers carry the risk temporarily so that the market clears. If the seller arrives first, market maker will buy the securities. However, market maker will only buy at discount to the fundamental price, because it needs to carry the risk while it seeks for the buyer for the securities. Therefore, the price is temporarily decreased. Later, when the final buyer arrives, market maker will sell for a higher price and gets compensation for carrying risk. Thus, also the price is recovered. Conversely, if buyer arrives first, market maker will sell at a price higher than the fundamental price, and the price is temporarily elevated. For example, in fire sales by mutual funds (Coval & Stafford, 2007) and index deletions (Harris & Gurel, 1986), stock prices first plunge due to selling activity, but are later reverted back near the initial level. In the case of turn of the month return reversals, sellers, the institutional investors, arrive first. Market makers buy the securities but at discounted prices, which leads to depressed prices from T-8 to T-4. Later, from T-1 to T+3, buyers arrive, and market makers sell the securities to them at increased prices. In addition to Etula et al. (2016), also for example Jegadeesh (1990), Lehmann (1990), and Avramov, Chordia and Goyal (2006) find extensive evidence of systematic short-term return reversals. Several papers in addition to Grossmann & Miller, such as Jegadeesh & Titman (1993) and Hendershott & Menkveld (2010) relate the reversals to illiquidity.

2.8 Limits to arbitrage - why is the turn-of-the-month effect not arbitraged away?

Strong evidence exists on the turn of the month effect, and it has been found a long time ago. Both academics and practitioners are fully aware of this phenomenon. Speculators, such as hedge funds, should be eager to trade against the turn of the month effect. Why does it seem that it has not been arbitraged away?

Etula et al. (2016) study the behavior of hedge funds around the turn of the month. They hypothesize that hedge funds should attempt to exploit the turn of the month effect and thus provide liquidity at the turn of the month – buy the securities other investors are selling at a discount and later selling them at premium. However, they find that an average hedge fund seems to act similarly to mutual funds and does not provide liquidity at the turn of the month. Authors argue that this may be because typically hedge funds' reporting and redemption dates are set at the month end, and thus they face similar liquidity needs as other institutions.

They find that both mutual and hedge funds seem to reduce risk at the month end, and that therefore stock market trading volume is lower during the last few trading days of the month.

However, Etula et al. (2016) find that a subset of hedge funds does systematically provide liquidity at the month end. Global Macro and Managed Futures funds seem to have abnormally large positive market exposures on T-3. In addition, hedge funds' liquidity provision at the end of the month seems to be strongly time varying. When hedge funds' funding liquidity, measured by TED spread, is high, hedge funds on average seem to provide liquidity. During times the funding liquidity is low, they seem to demand liquidity, on average. Specifically, when funding liquidity is high, hedge funds seem to buy stocks at T-4 or the morning of T-3, which, according to authors, is historically the best time to buy when trading on the turn of the month effect. Authors find evidence that the month end return reversals are more pronounced during periods funding liquidity is high, implying that funding constraints contribute to the return reversals.

With above arguments, Etula et al. (2016) importantly tie the turn of the month effect to the literature on the limits of arbitrage. Gromb & Vayanos (2010) offer a useful survey on the literature on the limits to arbitrage and argue that it can may be able to explain market anomalies. Unlike in pure theory, arbitrage is costly and risky. Arbitrageurs face fundamental and non-fundamental risk, short-selling costs, leverage and margin constrains and constraints on equity capital. Even though arbitrageurs detect mispricing and would want to provide liquidity to other investors, it may not be profitable or even possible for them due to the costs and constraints. Further complicating arbitrage, Brunnermeier & Pedersen (2009) find that market liquidity and funding liquidity are mutually reinforcing. Therefore, when market liquidity is low and there is need for liquidity providers, funding liquidity is also lower, making it more difficult to provide liquidity. The turn of the month is one of the times when the demand for liquidity is high. It may very well be that due to funding constraints and liquidity needs by arbitrageurs, the turn of the month effect cannot be arbitraged away.

2.9 Hypothesis development

In this thesis, I investigate the effect of the market-specific settlement cycle on the timing of return reversal before month end. Etula et al. (2016) provide a quick test on this but studying

the matter in detail would provide more information on the nature of the turn of the month effect and on the role of institutional investors' liquidity-related selling before month ends. In addition, I will update previous results on the existence of the turn of the month effect in developed markets.

As several studies before have found the turn of the month effect, I hypothesize that the turn of the month effect exists in markets that I study in this thesis:

H1: The turn of the month effect, abnormally high stock returns before and after month end, exists in stock markets.

Etula et al. (2016) argue, as reviewed before, that the market-specific settlement cycle dictates the timing of the return reversal before month end. I take this as a starting point for my analysis as well:

H2: In a market, the market-specific settlement cycle dictates the timing of the return reversal before month end.

The changes in market-specific settlement cycles provide an interesting opportunity to study if the timing of the return reversal before month end behaves like *H2* predicts. If the settlement cycle changes, also the timing of the return reversal should change. For instance, if the settlement cycle is TD+3, the return reversal should take place between days T-4 and T-3. If the settlement cycle is changed to TD+2, The return reversal should move to between days T+3 and T+2.

H3: If the market-specific settlement cycle is changed, the timing of the return reversal changes accordingly.

3 Data and methodology

In this section, I present the data and methodology I use in this thesis.

3.1 Data

To study the effect of the market-specific settlement cycle on the timing of the return reversal before month end, I investigate developed countries that have had changes in their stock market settlement cycles during the last three decades. From these countries, I use benchmark stock index level and volume data. Data is obtained from Thomson Datastream, except US data, which is obtained from CRSP. The country, index used, and the size of the sample are summarized in Table 1.

Table 1. Data

This table presents the data used in this thesis. Stock index shows the code for the stock index or indices used. Index type TRI refers to Total Return Index, whereas PI refers to price index. Sample size refers to the amount of daily index level/volume observations.

Country	Stock Index	Index type	Sample begins	Sample ends	Sample size
Australia	S&P/ASX 200	TRI	May 29, 1992	Dec 29, 2017	6676
Austria	ATX	TRI	Jan 2, 1991	Dec 29, 2017	7043
Belgium	BEL 20	TRI	Jan 2, 1990	Dec 29, 2017	7304
Canada	S&P/TSX COMPOSITE	TRI	Dec 31, 1985	Dec 29, 2017	8349
Denmark	OMXC 20	PI, TRI	Dec 4, 1989 / Nov 28, 2011	Dec 29, 2017	7325
Finland	OMXH 25	TRI	Jan 2, 1991	Dec 29, 2017	7043
France	CAC 40	TRI	Dec 31, 1987	Dec 29, 2017	7827
Ireland	ISEQ OVERALL	TRI	Jan 4, 1988	Dec 29, 2017	7825
Italy	FTSE MIB	TRI	Dec 31, 1997	Dec 29, 2017	5218
Luxembourg	LUXX	TRI	Jan 4, 1999	Dec 29, 2017	4955
Netherlands	AEX	TRI	Jan 3, 1983	Dec 29, 2017	9130
New Zealand	S&P/NZX 50	TRI	Dec 29, 2000	Dec 29, 2017	4436
Norway	OSEAX	TRI	Jan 3, 1983	Dec 29, 2017	9130
Portugal	PSI-20	TRI	Sep 20, 2001	Dec 29, 2017	4247
Spain	IBEX 35	TRI	Jan 15, 1992	Dec 29, 2017	6773
Sweden	OMXS 30	TRI	Jan 2, 2002	Dec 29, 2017	4173
Switzerland	SMI	TRI	Apr 30, 1993	Dec 29, 2017	6436
Taiwan	TAIEX	TRI	Jan 2, 2003	Dec 29, 2017	3912
United Kingdom	FTSE 100	TRI	Dec 31, 1985	Dec 29, 2017	8349
United States	CRSP VW / CRSP EW	TRI	Jan 2, 1926	Dec 29, 2017	24289

Whenever possible, I use total return index (TRI) data, because it takes into account dividends and other distributions. If the sample of total return index is small, I complete it with price index (PI) data, which is appropriate because correlation between total return and price index data is high. In my dataset, for other countries than Denmark there is a large sample of total return index data. For Denmark, I complete total return index with price index data for period from December 4, 1989 to November 28, 2011.

The data on settlement cycle changes is collected from various sources online, mainly from the websites of the stock exchanges. Table 2 summarizes the settlement cycle changes investigated in this thesis.

Table 2. The settlement cycle changes

This table summarizes the settlement cycle changes inspected in this thesis. Settlement cycle is defined as TD+X, TD refers to the transaction date and X the amount of days after the transaction the cash settlement takes place. Change date is the first date the new settlement cycle is used.

Country	Settlement cycle before	Settlement cycle after	Change date
United States, Canada	TD+5	TD+3	Jun 2, 1995
Taiwan	TD+1	TD+2	Jan 5, 2009
European Group*	TD+3	TD+2	Oct 6, 2014
Australia, New Zealand	TD+3	TD+2	Mar 7, 2016
Spain	TD+3	TD+2	Sep 29, 2016
United States, Canada	TD+3	TD+2	Sep 5, 2017

*Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and UK

3.2 Methodology

First, I delete non-trading days from my data. I define non-trading days as days in which the trading volume is zero. Second, I calculate daily logarithmic stock index returns from the stock index levels with the following formula:

$$r_t = ln\left(\frac{TRI_t}{TRI_{t-1}}\right) \quad (1)$$

where r_t is the daily return, TRI_t is the total return index level on the trading day and TRI_{t-1} the total return index level on the previous trading day. When the total return index is not available, I substitute it with the price index.

Settlement cycle changes in different countries offer an interesting opportunity to study the effect of the market-specific settlement cycle to the return reversal before the turn of the month. For settlement cycle changes, typical motivations are to increase safety and efficiency of the settlements, and to harmonize the settlement cycles around the world. As Etula et al. (2016) argue, because the motivations are not related to the magnitude of the turn of the month effect, it is appropriate to use settlement cycle changes to study the effect. In this thesis I compare the difference between the daily average returns in the turn of the month days under different settlement cycle periods.

For each country, I divide the acquired sample of return data in two subsamples, before and after the settlement cycle change. Furthermore, I have two additional subsamples, five years before and five years after the settlement cycle change. If the change happened less than five years before December 29, 2017, the latter subsample is as large as possible. For US and Canada, I have a double amount of subsamples, because in those countries there has been two settlement cycle changes. In addition to inspecting each country individually, to reduce noise, whenever there is more than one country conducting the same settlement cycle change at the same time, I will inspect the pooled effect in those countries. I pool the daily returns by taking the equal-weighted daily average of the returns in the countries.

For the European group, Australia, New Zealand, Spain and Taiwan, I define the turn of the month days as trading days from T-5 to T+5, where T is the last day of the month, and investigate the daily average returns. I estimate the daily average returns with the following regression model:

$$r_t = \alpha_0 + \sum_{i=-5}^{5} \alpha_i D_{i,t} + \varepsilon_t \quad (2)$$

where r_t is the daily return, α_0 is the intercept that captures the effect of days other than the turn of the month days, α_i is a coefficient that captures the effect of day i, $D_{i,t}$ is a dummy variable that takes a value of 1 on day i, otherwise zero, and ε_t is the random error term.

In US and Canada, settlement cycle was TD+5 before June 1995. Therefore, inspecting the turn of the month days from T-5 to T+5 is not enough to notice the possible changes around

T-5. Therefore, for the US and Canada, I define the turn of the month period as from T-7 to T+7. I estimate the daily average return with the following regression model:

$$r_t = \alpha_0 + \sum_{i=-7}^{7} \alpha_i D_{i,t} + \varepsilon_t \quad (3)$$

where r_t is the daily return, α_0 is the intercept that captures the effect of days other than the turn of the month days, α_i is a coefficient that captures the effect of day i, $D_{i,t}$ is a dummy variable that takes a value of 1 on day i, otherwise zero, and ε_t is the random error term.

Definitions of the turn of the month period from five to nine days before and after the month end are typical in the turn of the month literature. I try to keep the turn of the month period as short as possible to avoid overfitting the model. If the turn of the month period is defined as nine days before and nine days after the last day of the month, 19 days are used to explain the daily return, whereas an average month in 2018 in the US has only 21 trading days[2].

[2] http://www.swingtradesystems.com/trading-days-calendars.html

4 Results

In this section, I present and analyze my empirical results. I begin with both of the settlement cycle changes in the US and Canada and continue with results from Taiwan, European group country by country, Australia and New Zealand, and Spain. Finally, I present and analyze pooled effect of changes in the US and Canada, in European group, and in Australia and New Zealand.

4.1 United States and Canada

US and Canada changed their settlement cycle from TD+5 to TD+3 in 1995, and from T+3 to T+2 in 2017. I present the results for US and Canada separately. Even though for the US data is available from January 1926, I will only present results from January 1980 onwards. This is because I was not able to confirm which settlement cycles have prevailed in the US before 1980s.

4.1.1 United States equal-weighted index

Figure 1. Average daily returns during TD+5, TD+3 and TD+2 periods for US equal-weighted index

This figure shows the daily average returns of the US equal-weighted index eight days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+5 settlement period, grey bars during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

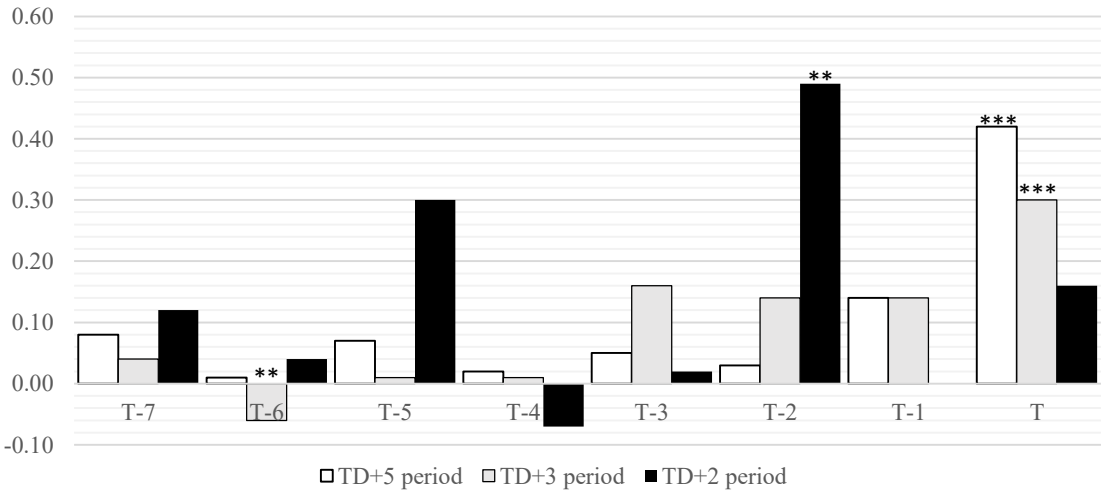


Figure 1 presents the returns of the US equal-weighted index for eight days before month end during TD+5, TD+3 and TD+2 periods. Complete, tabulated results for the whole turn of the month period, the differences between periods, and results for the 5-year periods around changes can be found in Appendix A. On TD+5 period, a significant turn of the month effect is found, returns are significantly high on T, T+1 and T+3. There is no return reversal between T-6 and T-5. On TD+3 period, the turn of the month effect is weaker, as the returns are only significantly positive on T. There seems to be a return reversal between T-6 and T-5, as returns are significantly negative on T-6 and insignificantly positive on T-5. However, the timing of the reversal is different than expected. On TD+2 period, returns are significantly positive on T-2, as expected. However, this is not a proper reversal, as returns on T-3 are insignificantly positive. Otherwise, there is no significant turn of the month effect. The results are similar when inspecting the 5-year periods around the changes – reversals do not behave as expected, and the turn of the month effect attenuates over time. The results from the US equal-weighted index do not strongly support my hypotheses.

4.1.2 United States value-weighted index

Figure 2. Average daily returns during TD+5, TD+3 and TD+2 periods for US value-weighted index

This figure shows the daily average returns of the US value-weighted index eight days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+5 settlement period, grey bars during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

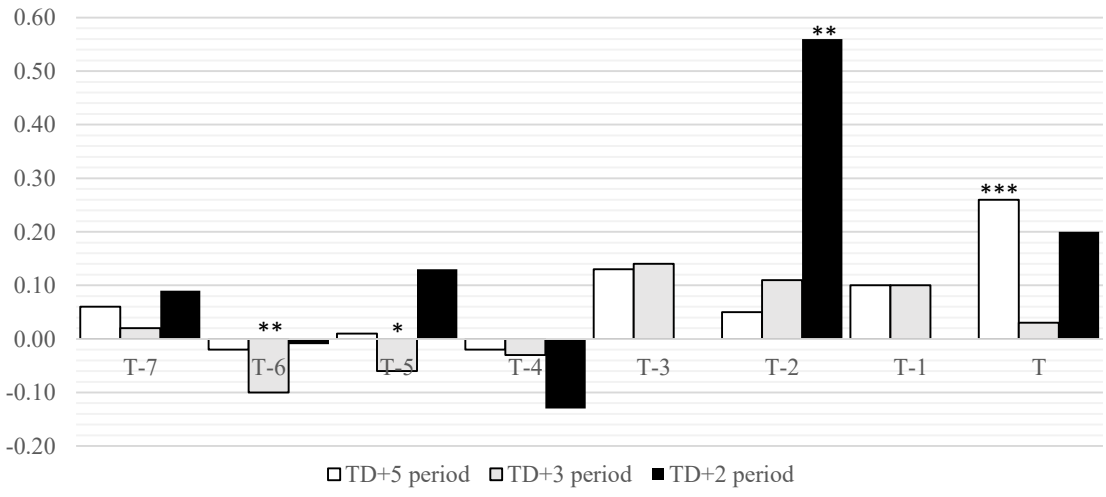


Figure 2 presents the returns of the US value-weighted index for eight days before month end during TD+5, TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix B. On TD+5 period, there are significant returns on T and T+2, but no evidence of return reversals. On TD+3 period, there is evidence of return reversal, and the timing is as hypothesized. Returns are significantly negative on T-6 and T-5, and negative, but insignificant, on T-4. From T-3, returns are positive, however insignificant. On TD+2 period, similarly to equal-weighted index, returns are significantly high on T-2. This provides some proof that there is a return reversal between T-3 and T-2, as anticipated. However, the returns before T-2 are insignificant. In addition, after T-2 and on the other days of the month, returns are insignificant.

For 5-year periods around changes, results are somewhat different. On TD+5 period five years before the change, there seems to be a return reversal between T-6 and T-5, as anticipated. On T-6, returns are significantly negative. On TD+3 period five years after the change, there is no evidence of return reversal before the month end. On TD+3 period five years before change to TD+2 settlement cycle, return reversal seems to take place between T-4 and T-3, as returns are significantly negative on T-4. On TD+2 period, return reversal seems to take place between T-3 and T-2, as on T-2 returns are significantly positive. However, the changes on these important days are not significant. Furthermore, the sample size of the T+2 period is very small.

Similar to the equal-weighted index, the value weighted index does not provide clear evidence to support my hypotheses. More recent the sample, less significant returns on the turn of the month it shows. Again, the difference in average returns between TD+3 and TD+2 period provides some support for my hypotheses, although not very strong.

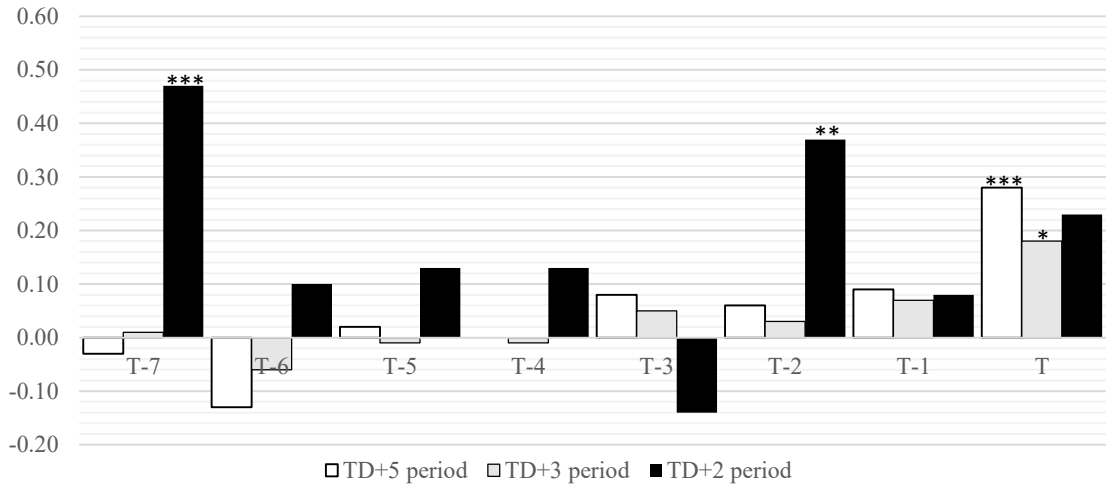
4.1.3 Canada

Figure 3 presents the returns of the Canadian S&P/TSX Composite index for eight days before month end during TD+5, TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix C. On TD+5 period, the return reversal from negative to positive returns seems to take place between T-6 and T-5, as anticipated, but returns are not significant. TD+5 period shows the traditionally defined turn of the month effect from T to T+3. On TD+3 period, the timing of the return reversal seems to have moved to between T-

4 and T-3, but, again, returns are not significant. This period shows significantly positive returns only on T and other than turn of the month days, and thus it seems that the turn of the month effect has weakened. On TD+2 period, the return reversal seems to take place between T-3 and T-2, as the return on T-2 is significantly positive. The differences between TD+5 and TD+3 periods, and TD+3 and TD+2 periods, are not significant on the days of anticipated return reversals.

Figure 3. Average daily returns during TD+5, TD+3 and TD+2 periods for Canadian S&P/TSX Composite index

This figure shows the daily average returns of the S&P/TSX Composite index eight days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+5 settlement period, grey bars during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



On TD+5 period five years before change, the return reversal between T-6 and T-5 becomes more significant, as on T-6 the return is significantly negative. However, the same is true for TD+3 period five years after the change, which is not anticipated. On TD+3 period five years before change to TD+2 settlement cycle, there are no significant returns on the turn of the month period, but the returns on other than turn of the month days are significantly positive. Also here, the differences between TD+5 and TD+3 periods, and TD+3 and TD+2 periods, are not significant on the days of anticipated return reversals.

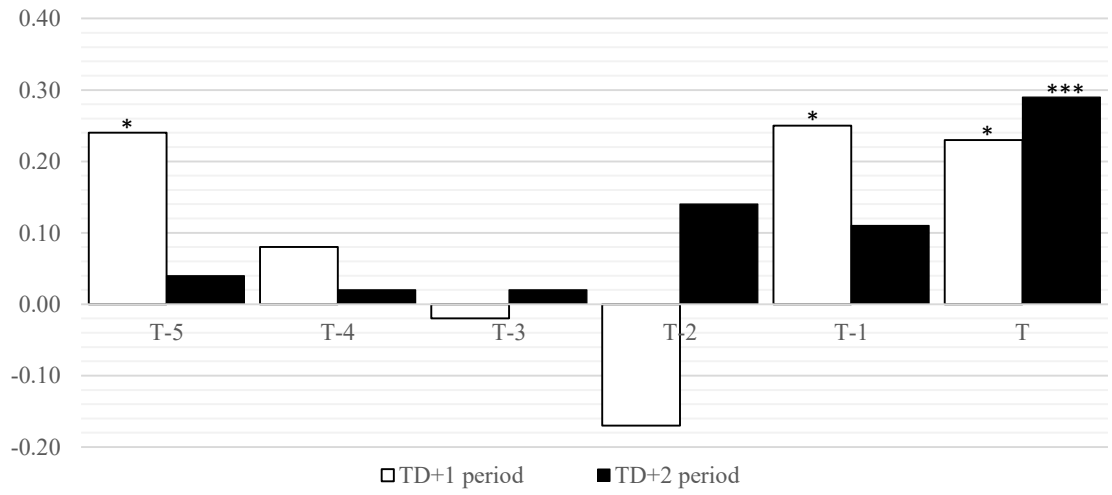
Canadian stock returns do not offer conclusive evidence to support my hypotheses. There is some evidence on the return reversals before month end, however weak. Similar to US, the more recent the sample, the weaker the turn of the month effect seems to be.

4.2 Taiwan

In January 5, 2009 Taiwan changed the settlement cycle for equities from TD+1 to TD+2. Figure 4 presents the returns of the Taiwanese TAIEX index for six days before month end during TD+1 and TD+2 periods. Complete, tabulated results can be found in Appendix D.

Figure 4. Average daily returns during TD+1 and TD+2 periods for Taiwanese TAIEX index

This figure shows the daily average returns of the TAIEX index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+1 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



During TD+1 period in Taiwan, return patterns are largely as hypothesized. There is a return reversal between T-2 and T-1, as in T-2 returns are negative, although insignificantly, and in T-1 returns are significantly positive. Significantly positive returns continue until T+2. Thus, returns also show a traditionally defined turn of the month effect. However, on the TD+2 period, the return reversal before month end has not changed timing but disappeared. Returns are significantly positive on T and T+1 and revert to significantly negative in T+4. Thus, the turn of the month effect still exists, but the time-window is shorter. The differences between periods in the expected return reversal days are not significant. When inspecting

the periods closer to the settlement cycle change, the results are very similar. Taiwanese data show some support for my hypotheses on the TD+1 period, but not on the TD+2 period.

4.3 European group

European group consists of Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and UK. These countries changed their settlement cycle from TD+3 to TD+2 on October 6, 2014. I present the results from each country separately.

4.3.1 Austria

Figure 5. Average daily returns during TD+3 and TD+2 periods for Austrian ATX index

This figure shows the daily average returns of the ATX index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

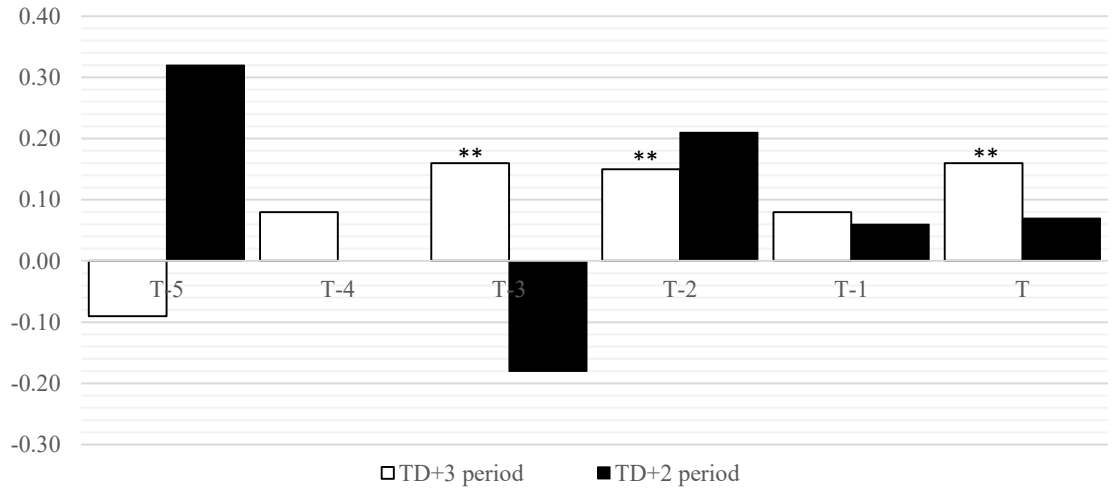


Figure 5 presents the returns of the Austrian ATX index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix E. On TD+3 period, return reversal seems to take place between T-5 and T-4, which is one day before hypothesized. However, returns are not significant on those days. On T-3 and T-2, returns are significantly positive, and thus it seems that the return reversal takes place somewhere between T-5 and T-3, which is close to hypothesized timing. In addition, there is significant turn of the month effect, as returns are also significantly positive on T, T+1 and T+2. On

TD+2 period, there is no significant returns at all. There can be seen a return reversal between T-3 and T-2, which is the hypothesized timing, as returns turn from negative to positive, but those returns are not significant. However, when looking at the differences between periods, on T-3, returns have decreased 0.35 percentage points, and that difference is significant. Thus, there is some evidence of the movement of return reversal. Still, it is notable that there does not seem to be any significant turn of the month effect on TD+2 period. When looking at TD+3 period five years before change, there is no significant return reversal, and returns are only significant on T+1. More recent the sample, the weaker the turn of the month effect seems to be.

4.3.2 Belgium

Figure 6. Average daily returns during TD+3 and TD+2 periods for Belgian Bel 20 index

This figure shows the daily average returns of the Bel 20 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

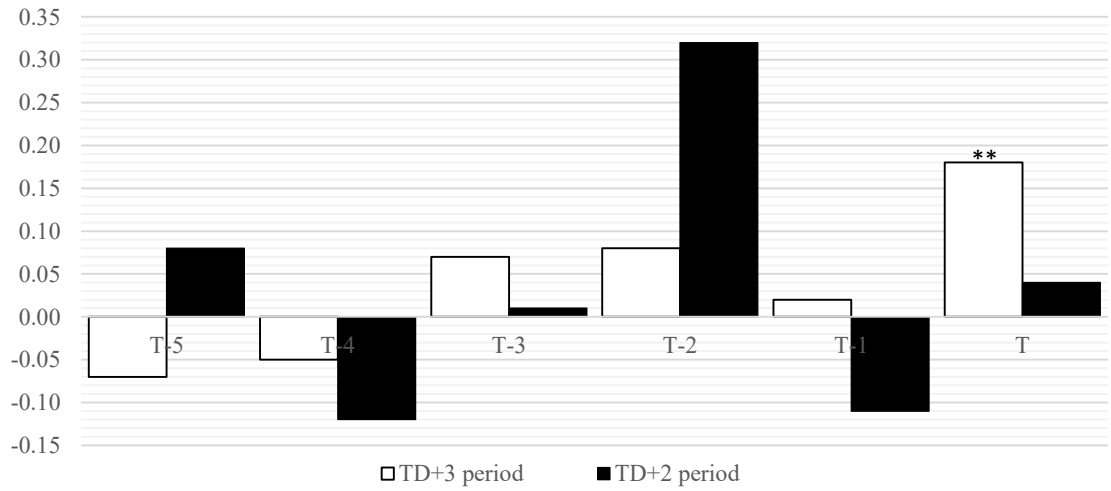


Figure 6 presents the returns of the Belgian Bel 20 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix F. On TD+3 period, there seems to be a reversal from negative to positive returns between T-4 and T-3, as expected, but returns are insignificant. Otherwise, the period shows significant turn of the month effect from T to T+2. On TD+2 period, all the returns are insignificant. Similarly, on TD+3 period five years before the settlement cycle change, all the returns are

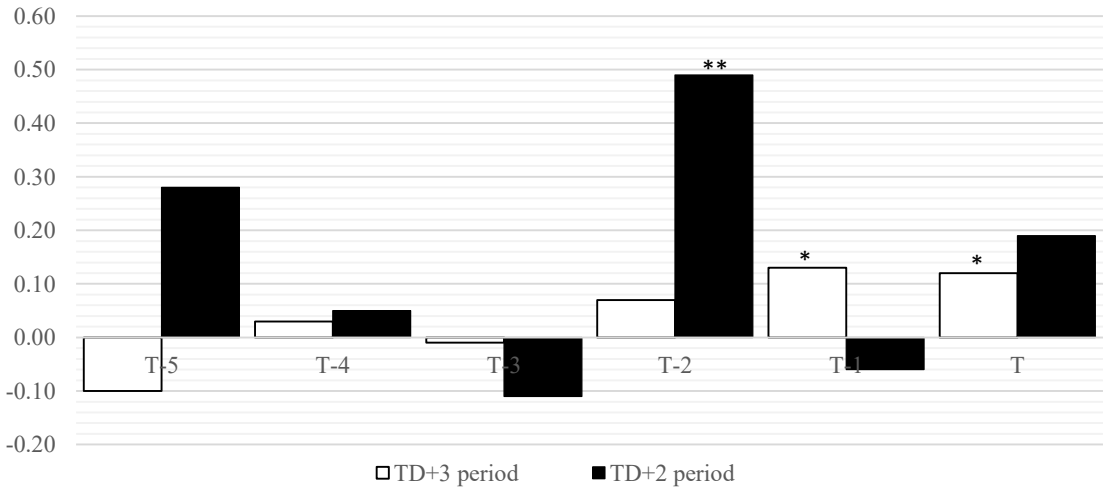
insignificant. In addition, all of the differences between different periods are insignificant. In Belgium, the turn of the month effect seems to have disappeared at last after 2009. In addition, there is no significant evidence of return reversals before month end.

4.3.3 Denmark

Figure 7 presents the returns of the Danish OMXC 20 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix G. TD+3 period shows significant turn of the month effect from T-1 to T+2, but not significant return reversal before month end. On TD+2 period, there is evidence of return reversal between T-3 and T-2, as hypothesized – returns turn from insignificantly negative to significantly positive. The difference in T-2 returns between TD+3 and TD+2 periods is significant. Otherwise, TD+2 period does not show significant turn of the month effect. On TD+3 period five years before change, significant turn of the month effect has largely disappeared, despite on day T+1. There is evidence of return reversal between T-5 and T-4, one day before hypothesized.

Figure 7. Average daily returns during TD+3 and TD+2 periods for Danish OMXC 20 index

This figure shows the daily average returns of the OMXC 20 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

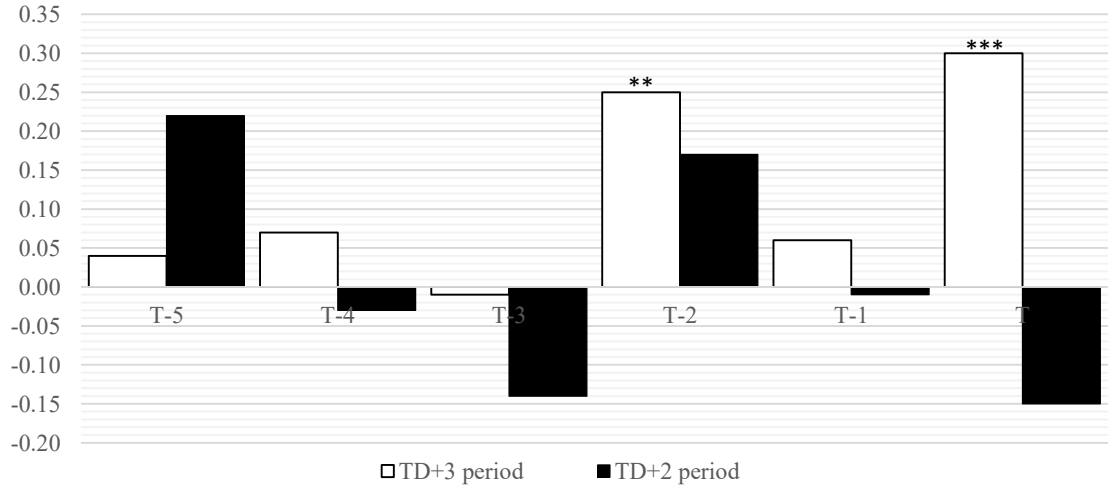


4.3.4 Finland

Figure 8 presents the returns of the Finnish OMXH 25 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix H. On TD+3 period, the turn of the month effect is significant on T-2, T and T+1. In addition, there is evidence on return reversal between T-3 and T-2 – the returns turn from insignificantly negative to significantly positive. However, the timing is earlier than anticipated. On TD+2 period, the returns turn from negative to positive between T-3 and T-2. However, returns turn back to negative immediately after this, and none of the TD+2 period returns are significant. On TD+3 period five years before change, returns are only significant on T+1. Return reversal can be seen between T-4 and T-3, but returns are insignificant. The turn of the month effect seems to have disappeared from Finland, and evidence on hypothesized reversals is weak.

Figure 8. Average daily returns during TD+3 and TD+2 periods for Finnish OMXH 25 index

This figure shows the daily average returns of the OMXH 25 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



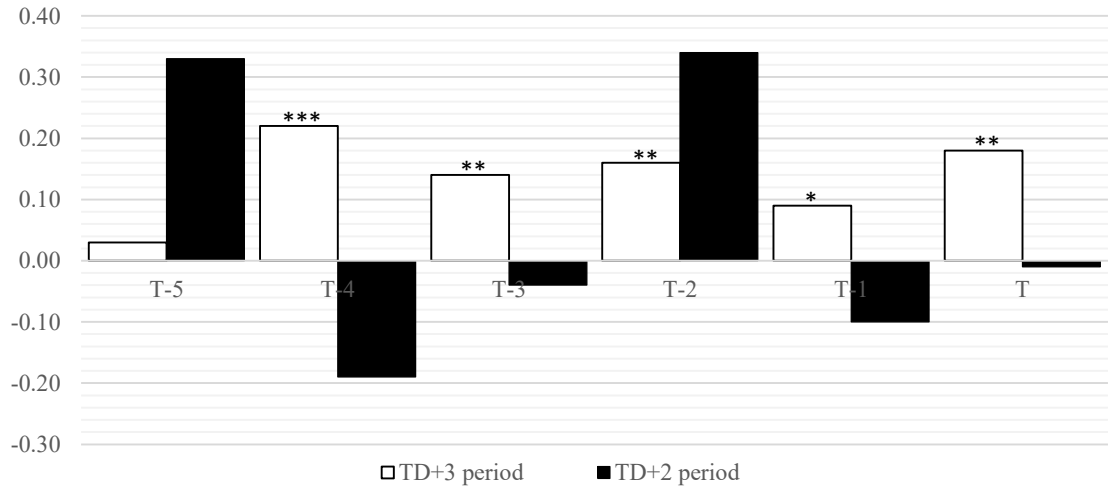
4.3.5 France

Figure 9 presents the returns of the French CAC 40 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix I.

TD+3 period shows significant turn of the month effect all the way from T-4 to T+2, but no return reversal before month end. TD+2 period does not show any significant turn of the month effect or return reversal. Also, from TD+3 period five years before change, the turn of the month effect has largely disappeared. However, there is a reversal from significantly positive to significantly negative returns between T+2 and T+3. The turn of the month effect seems to have disappeared from France, and no evidence on return reversal before month end is found.

Figure 9. Average daily returns during TD+3 and TD+2 periods for French CAC 40 index

This figure shows the daily average returns of the CAC 40 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



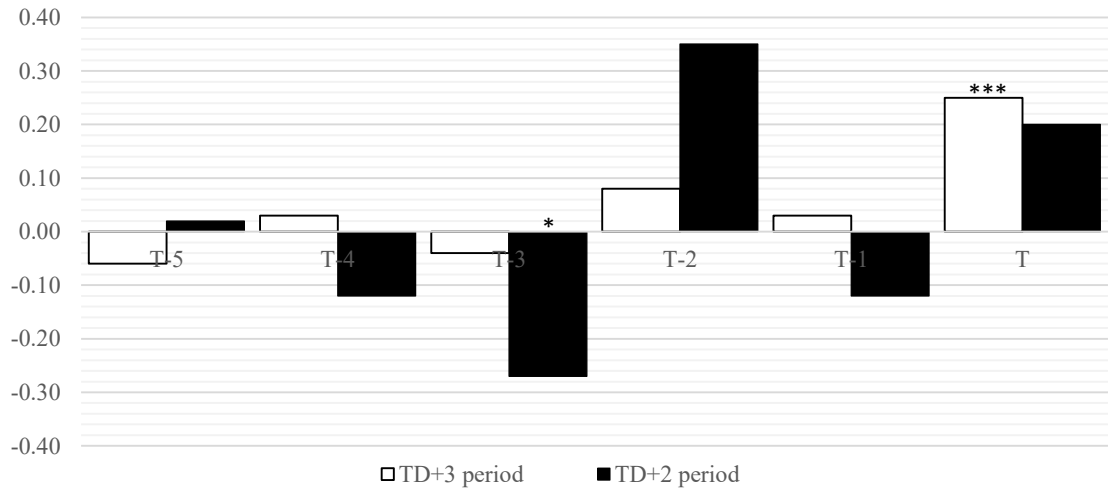
4.3.6 Ireland

Figure 10 presents the returns of the Irish ISEQ OVERALL index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix J. TD+3 period shows turn of the month effect on T, T+1 and T+3, but no significant return reversal before month end. On TD+2 period, there seems to be a return reversal between T-3 and T-2 – returns revert from significantly negative to insignificantly positive. Otherwise, there is no significant turn of the month effect. On TD+3 period five years before change, there is no significant turn of the month effect expect on T+1. In Ireland, the turn of the

month effect seems to have almost disappeared, but still there is some evidence on hypothesized reversal on TD+2 period.

Figure 10. Average daily returns during TD+3 and TD+2 periods for Irish ISEQ OVERALL index

This figure shows the daily average returns of the ISEQ OVERALL index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

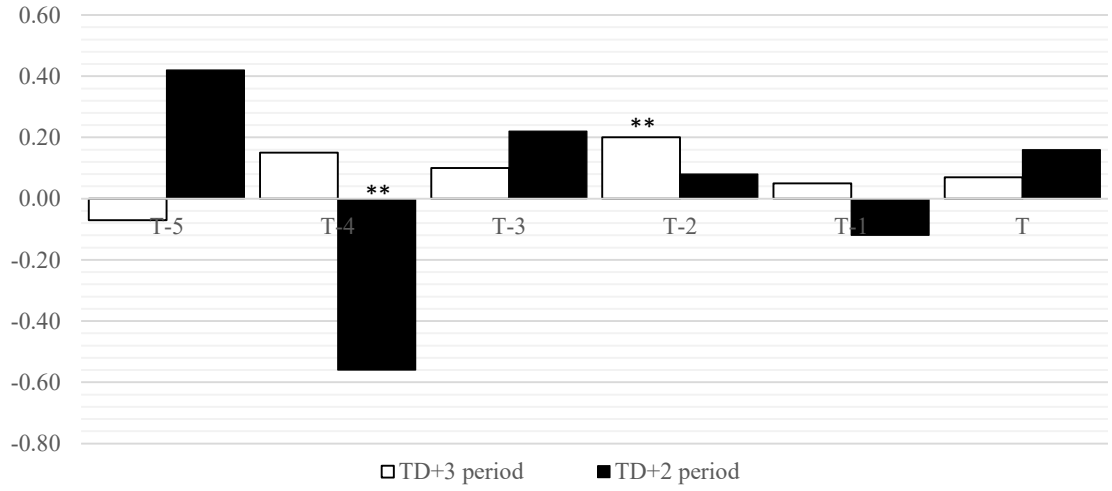


4.3.7 Italy

Figure 10 presents the returns of the Italian FTSE MIB index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix K. For TD+3 period, returns are significantly high in T-2 and T+1. There is no significant return reversal. On TD+2 period, there seems to be a reversal from significantly negative returns to significantly positive between T-4 and T-3, a day earlier than hypothesized. Otherwise, there is no significant turn of the month effect. On TD+3 period five years before the change, there is no significant turn of the month effect at all. In Italy, the already rather weak turn of the month effect seems to have disappeared, and there is not compelling evidence of the return reversal before month end.

Figure 11. Average daily returns during TD+3 and TD+2 periods for Italian FTSE MIB index

This figure shows the daily average returns of the FTSE MIB index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



4.3.8 Luxembourg

Figure 12. Average daily returns during TD+3 and TD+2 periods for Luxembourgian LUXX index

This figure shows the daily average returns of the LUXX index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

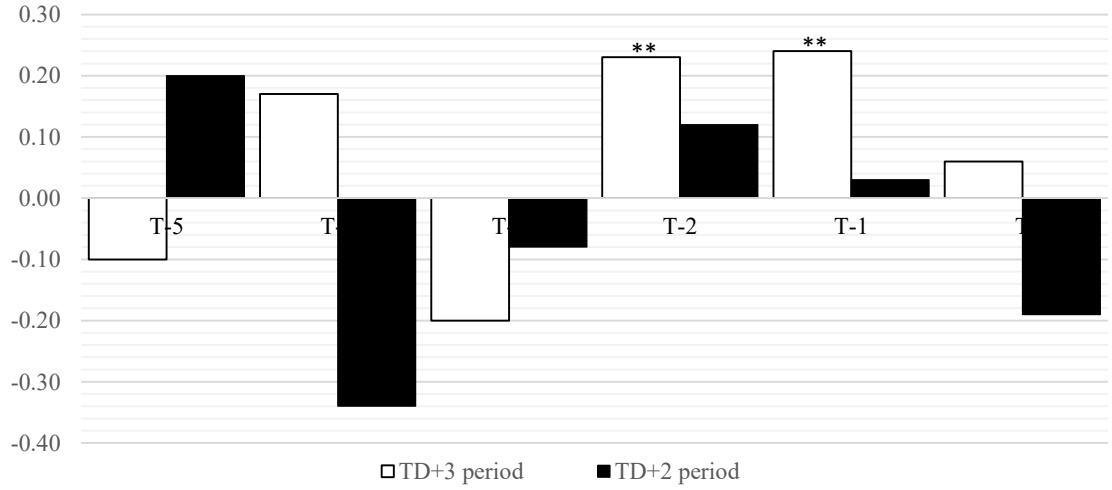


Figure 12 presents the returns of the Luxembourgian LUXX index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix L. On TD+3 period, there seems to be a reversal between T-3 and T-2, as returns revert from insignificantly negative to significantly positive. The reversal takes place one day after hypothesized. In addition, T-1 and T+1 show significantly high returns. On TD+2 period, the reversal still seems to take place between T-3 and T-2, this time as anticipated, but the returns are not significant. There is no significant turn of the month effect on this period. The effect seems to have largely disappeared at least five years before the settlement cycle change, as on TD+3 period five years before change, returns are only significant on T+1.

4.3.9 The Netherlands

Figure 13. Average daily returns during TD+3 and TD+2 periods for the Dutch AEX index

This figure shows the daily average returns of the AEX index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

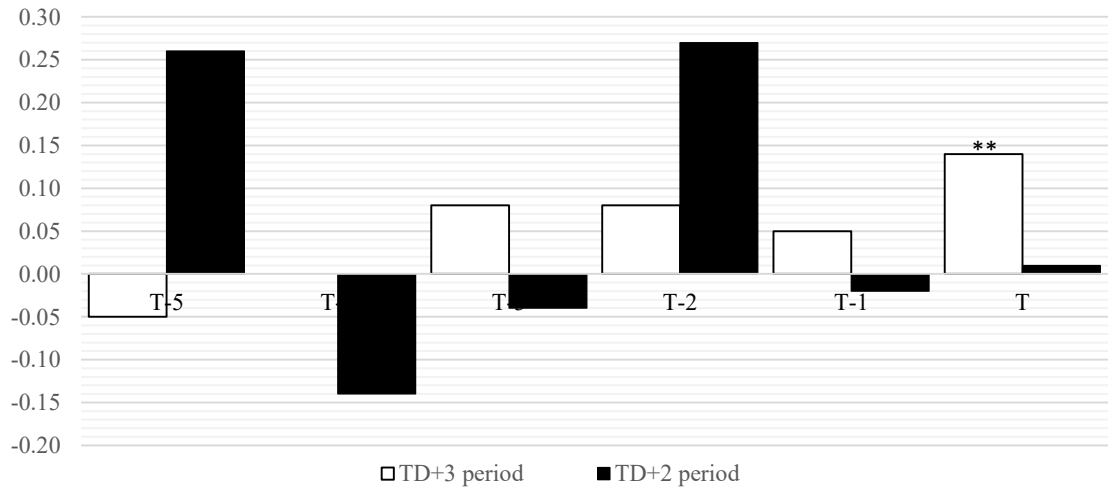


Figure 13 presents the returns of the Dutch AEX index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix M. TD+3 period does not show any significant return reversal, but significant turn of the month effect from T to T+2. On TD+2 period, no returns are significant anymore. There seems to be a reversal from negative to positive returns between T-3 and T-2, but the returns are

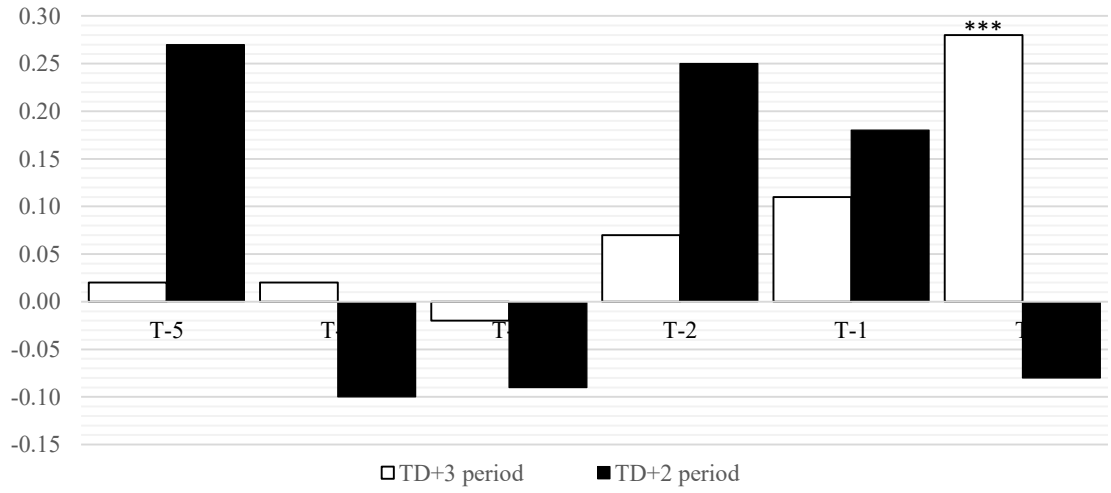
insignificant. On TD+3 period five years before change, there is no evidence of return reversal before month end. Returns are only significantly positive on T+1.

4.3.10 Norway

Figure 14 presents the returns of the Norwegian OSEAX index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix N. TD+3 period does not show any significant return reversals, but there is significant turn of the month effect on T and T+1. TD+2 period seems to have a return reversal between T-3 and T-2, as anticipated. However, returns for those days, as for all other days, are insignificant. The turn of the month effect seems to have largely already disappeared on TD+3 period five years before change – on that period returns are significantly high only on T+1.

Figure 14. Average daily returns during TD+3 and TD+2 periods for the Norwegian OSEAX index

This figure shows the daily average returns of the OSEAX index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



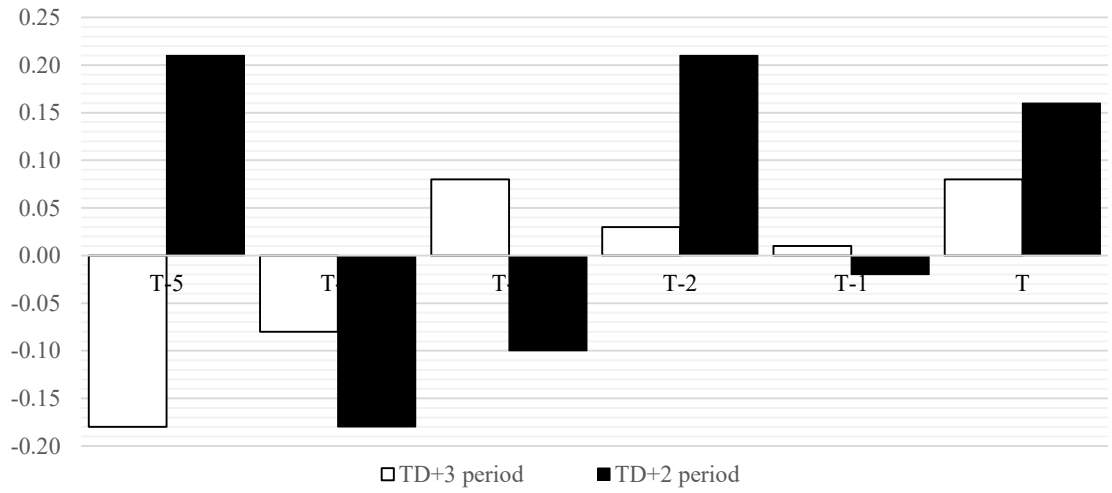
4.3.11 Portugal

Figure 15 presents the returns of the Portuguese PSI-20 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix O.

Any of the periods does not show significant turn of the month effect, despite day T+1 in TD+3 period. On TD+3 period, there seems to be a positive reversal between T-4 and T-3, as anticipated, but returns are insignificant. TD+2 period shows positive reversal between T-3 and T-2, as anticipated, but also these returns are insignificant. TD+3 period five years before change also shows positive reversal, although insignificant, between T-4 and T-3. In Portugal, already very weak turn of the month effect seems to have disappeared, and no significant evidence of return reversals before month end is found.

Figure 15. Average daily returns during TD+3 and TD+2 periods for the Portuguese PSI-20 index

This figure shows the daily average returns of the PSI-20 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



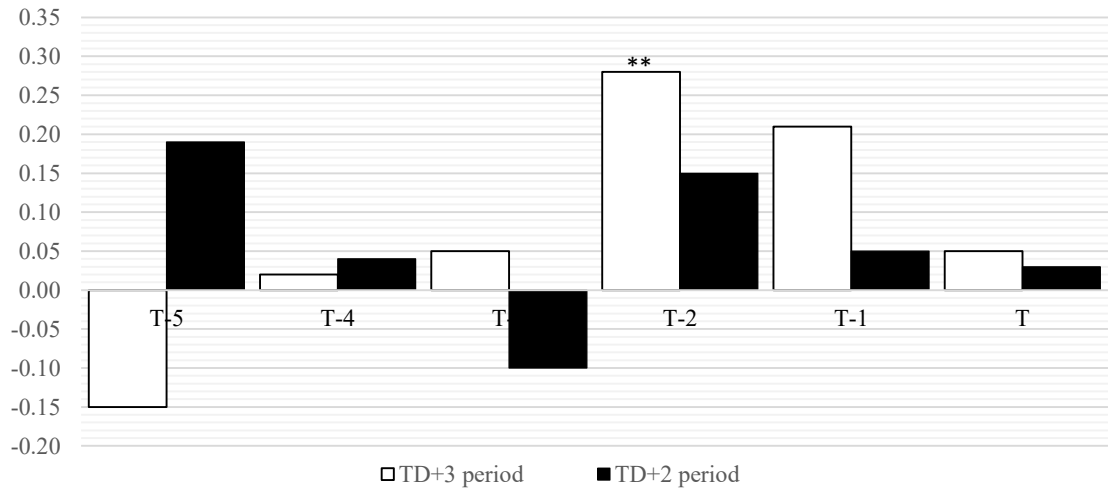
4.3.12 Sweden

Figure 16 presents the returns of the Swedish OMXS 30 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix P. TD+3 period shows a positive reversal between T-5 and T-4. It happens one day earlier than anticipated and is, in addition, insignificant. Otherwise, the period shows significant turn of the month effect on T-2 and T+1. TD+2 period shown first negative reversal between T-4 and t-3, and then positive reversal between T-3 and T-2. However, all the returns during this

period are insignificant. Similarly, on TD+3 period five years before change, all returns are insignificant. The turn of the month effect seems to have disappeared a last after 2009.

Figure 16. Average daily returns during TD+3 and TD+2 periods for the Swedish OMXS 30 index

This figure shows the daily average returns of the OMXS 30 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

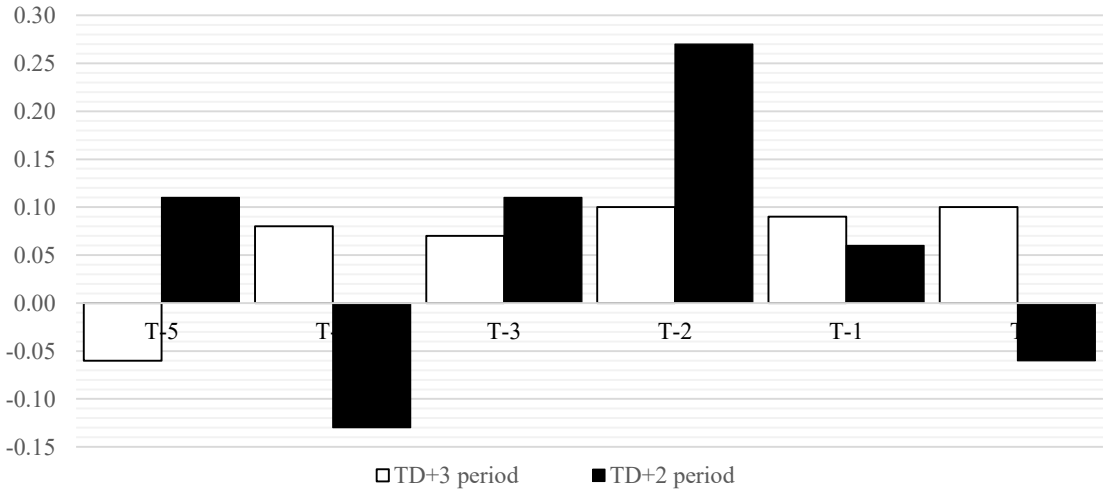


4.3.13 Switzerland

Figure 17 presents the returns of the Swiss SMI index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix Q. Any of the periods do not show significant return reversals that would support my hypotheses. On TD+3 period, both the complete period and period five years before change, T+1 shows significantly positive returns. On TD+2 period, the significant returns have disappeared completely.

Figure 17. Average daily returns during TD+3 and TD+2 periods for the Swiss SMI index

This figure shows the daily average returns of the SMI index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



4.3.14 UK

Figure 18. Average daily returns during TD+3 and TD+2 periods for the British FTSE 100 index

This figure shows the daily average returns of the FTSE 100 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

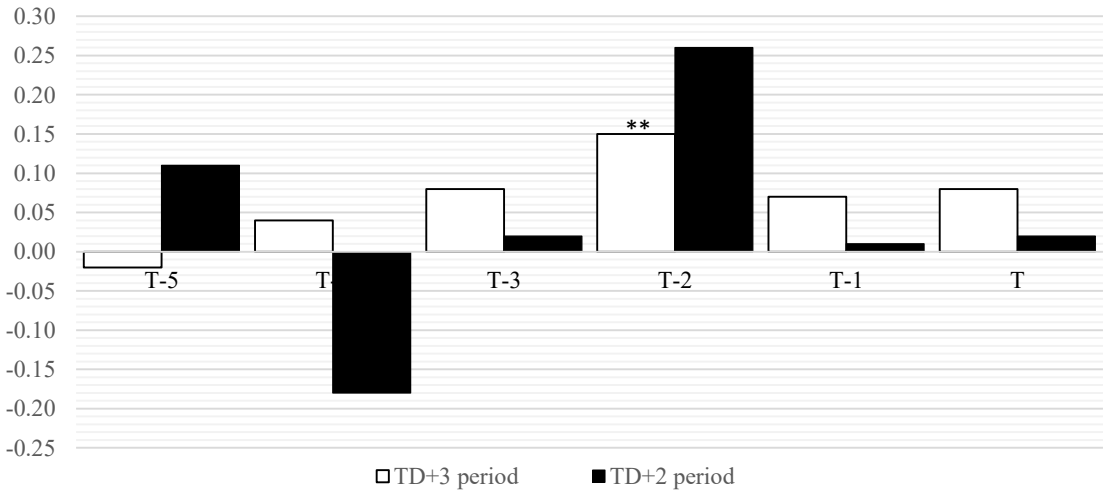


Figure 18 presents the returns of the British FTSE 100 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix R. None of the periods shows return reversals that would support my hypotheses. On TD+3 period, there is significant turn of the month effect in T-2, T+1 and T+3. The turn of the month effect has substantially mitigated on TD+3 period five years before change, with significantly positive returns only in T+1. In TD+2 period, all significant returns have disappeared. On day T+2, the change from significantly high returns to insignificant returns on T+1 is significant when comparing TD+2 period and TD+3 period five years before change.

4.4 Australia and New Zealand

Australia and New Zealand changed their settlement cycles from TD+3 to TD+2 on March 7, 2016. I present the results from both countries separately.

4.4.1 Australia

Figure 19. Average daily returns during TD+3 and TD+2 periods for the Australian S&P/ASX 200 index

This figure shows the daily average returns of the S&P/ASX 200 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.

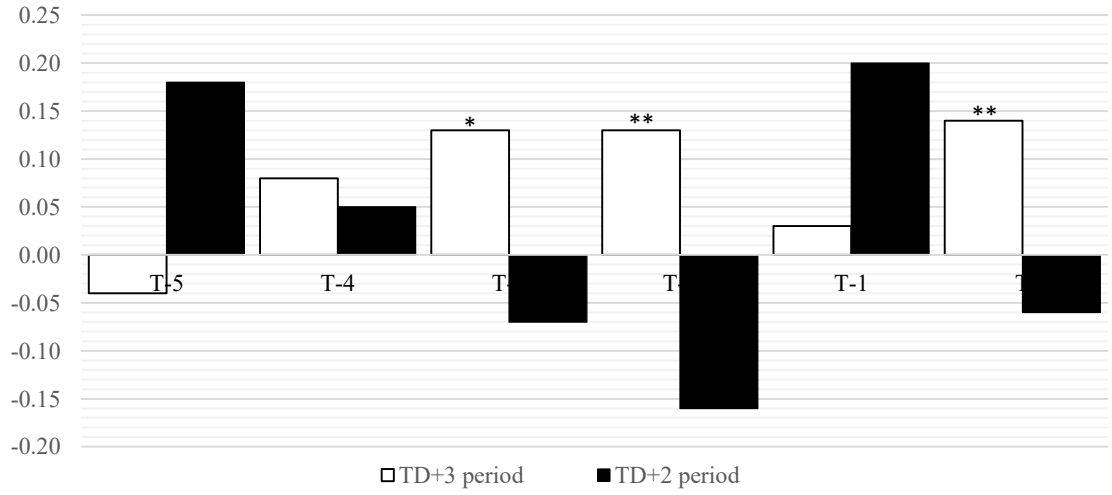


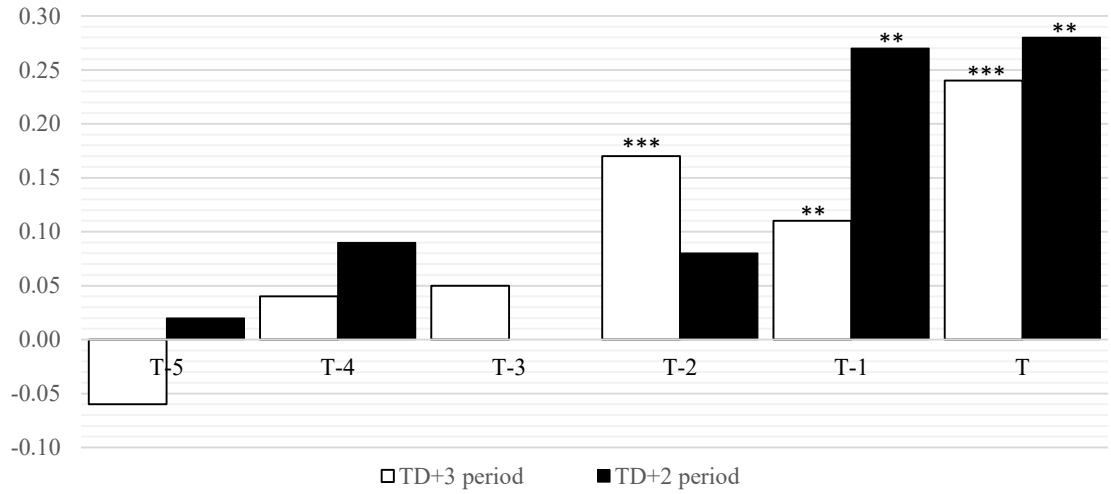
Figure 19 presents the returns of the Australian S&P/ASX 200 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix S. TD+3 period seems to have a positive reversal between T-5 and T-4, but the returns are insignificant. However, on T-3 and T-2, returns are significantly positive. Furthermore, the period shows significant turn of the month effect on T and T+2. On TD+2 period, there seems to be a positive reversal between T-2 and T-1, one day later than hypothesized, but the returns are insignificant. Otherwise, TD+2 period shows significantly positive returns on other than the turn of the month days and significantly negative returns on T+3. TD+3 period five years before change has significantly positive returns on T-3 and T-2, which is consistent with my hypotheses. However, because returns are insignificantly positive on T-4, this cannot be considered as reversal. When comparing the returns between TD+2 period and TD+3 period five years before change, returns have decreased significantly on T-3 and T-2. This may imply that the selling pressure have strengthened on those days following the change, However, the returns are not significantly negative on TD+2 period on T-3 and T-2.

4.4.2 New Zealand

Figure 20 presents the returns of the New Zealand S&P/NZX 50 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix T. Any of the periods do not show significant return reversals before month end to support my hypotheses. The turn of the month effect, however, seems to be more persistent in New Zealand than in other countries analyzed. On both TD+3 period and TD+3 period five years before change, returns significantly positive returns from T-2 to T and on T+2. Still, on TD+2 period, returns are significantly positive on T-1 and T.

Figure 20. Average daily returns during TD+3 and TD+2 periods for the New Zealand S&P/NZX 50 index

This figure shows the daily average returns of the S&P/NZX 50 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



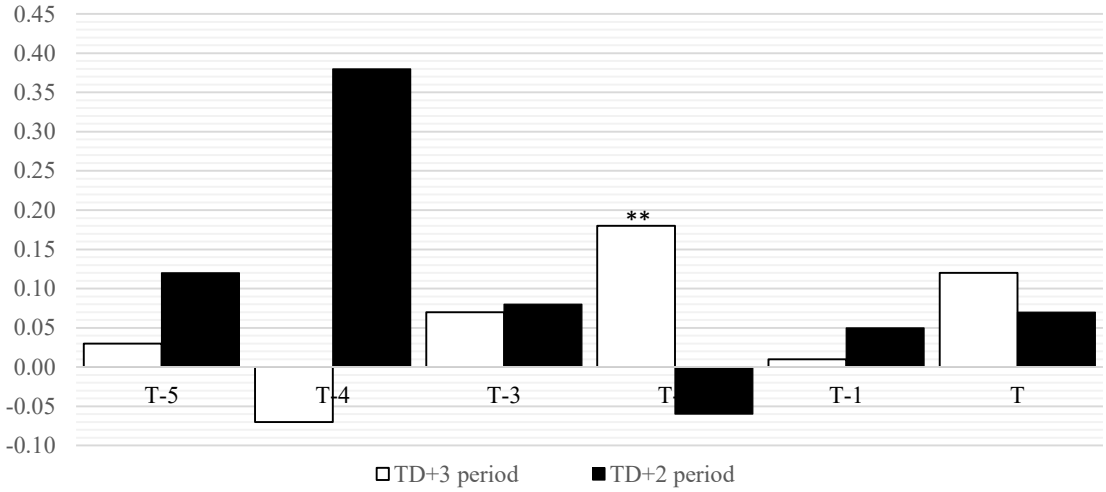
4.5 Spain

Spain followed the European group on September 29, 2016 and changed its settlement cycle from T+3 to T+2. Figure 21 presents the returns of the Spanish IBEX 35 index for six days before month end during TD+3 and TD+2 periods. Complete, tabulated results can be found in Appendix U.

On both TD+3 period and TD+3 period five years before change, there seems to be a positive return reversal between T-4 and T-3, as anticipated, but the returns are not significant. On TD+2 period, there is a decrease in returns on T-2, but none of the returns are significant. In Spain, the turn of the month effect has disappeared over time – it is only significant on the complete TD+3 period and only on two days.

Figure 21. Average daily returns during TD+3 and TD+2 periods for the Spanish IBEX 35 index

This figure shows the daily average returns of the IBEX 35 index six days before month end in percentages. T denotes the last day of the month. White bars represent returns during TD+3 settlement period, and black bars during TD+2 settlement period. The t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively.



4.6 Pooled effects

To reduce noise from the samples and to see the bigger picture, I take the settlement cycle changes that involved more than one country, pool the returns of the affected countries and study the effects. Pooling is made by simply taking equal-weighted average of the returns. I study the pooled effect in the US and Canada in both changes, in European group, and in Australia and New Zealand.

4.6.1 United States and Canada

Sample starts from January 1986, when the Canadian sample begins. Tabulated results can be found in Appendix V. On TD+5 period, there seems to be a positive reversal between T-6 and T-5 as anticipated, but the returns are insignificant. Returns are significantly high on T-3, T-1, T, T+2 and T+3, and thus the turn of the month effect is significant. On TD+3 period, there still seems to be a positive reversal between T-6 and T-5, and the return on T-6 is significantly negative. However, the timing of the reversal is not anticipated. Otherwise,

significant turn of the month effect only shows on T+1. On TD+2 period, the positive return reversal seems to take place between T-3 and T-2 as anticipated. Returns on T-2 are significantly positive. Otherwise there is no significant turn of the month effect.

Average returns on periods closer to changes show similar results. On TD+5 period five years before change, the positive reversal seems to take place between T-6 and T-5. Returns are significantly negative on T-7 and T-6, insignificantly positive on T-5 and T-4, and significantly positive on T-3 and T. There also seems to be a negative reversal between T+3 and T+4, as Etula et al. (2016) hypothesize. On TD+3 period five years after the change, the positive reversal still seems to take place between T-6 and T-5, even though there is insignificant reversal between T-4 and T-3 too. Otherwise there is significant turn of the month effect only on T+1.

The results are largely similar as when inspecting the countries separately, but the reversal on TD+5 period is stronger. There is some evidence to support my hypotheses on the positive reversal, but it is not conclusive. Also here, evidence suggests that the turn of the month effect has substantially mitigated over time.

4.6.2 European group

Sample starts from 2000, when return data from most of the countries is available. Only Portuguese and Swedish data begin later. Tabulated results can be found in Appendix W. On TD+3 period, there does not seem to be a hypothesized reversal before month end, but there is a significant turn of the month effect from T-2, T and T+1.

On TD+2 period, there seems to be a positive reversal between T-3 and T-2. Returns are not significant on those days, but they are significantly negative on T-4, giving some support to the return reversal hypothesis. In addition, when comparing TD+3 and TD+2 periods, returns on T-4 have decreased significantly. On TD+3 period five years before change, positive return reversal seems to take place between T-4 and T-3 as hypothesized, but returns are again insignificant. On this period, returns are only significant on T+1. Turn of the month effect seems to have disappeared over time, and there is only weak evidence about hypothesized return reversals.

4.6.3 Australia and New Zealand

The sample starts from January 2001, when the sample from New Zealand begins. Tabulated results can be found in Appendix X. On TD+3 period, significantly positive returns begin from T-3, as hypothesized. However, this is not a proper reversal as returns are insignificantly positive on T-4. Turn of the month effect is also significant on T-1, T and T-2. On TD+2 period, there is no significant return reversal before month end. Traditional turn of the month effect does not seem to exists, however returns are significantly negative on T+3 and significantly positive on T+5. On TD+3 period five years before change, the turn of the month effect has already begun to disappear. Returns are significantly high on T-2 and T. There are no signs of hypothesized return reversal before month end. Pooled results remain very similar to individual results from Australia and New Zealand – the turn of the month effect has mitigated or almost disappeared and signs of return reversals are very weak.

5 Discussion

In this section, I discuss my findings and how they relate to my hypotheses. In addition, I discuss possible reasons for the results that contradict my hypotheses

5.1 Existence and persistence of the turn-of-the-month effect

Evidence on the existence and persistence of the turn of the month effect is very consistent. In all of the countries I study, the oldest subsample shows significant turn of the month effect for more than one day, expect in Portugal and Switzerland. Therefore, I can confirm the results for several earlier studies that find the turn of the month effect in international stock markets. However, interesting is that in all countries, the more recent the subsample, the weaker the turn of the month effect. In many countries, significantly positive returns have entirely disappeared in the latest sample, especially in the European group. Notable is, that especially in subsamples that date after the global financial crisis, after 2009, the turn of the month effect has attenuated substantially or disappeared. This result was unexpected, but it is not very surprising after all. According to the Efficient Market Hypothesis, there should not be a predictable turn of the month effect.

Broad academic literature documenting turn of the month effect is likely to be one reasons behind the attenuation of the effect. McLean & Pontiff (2016) study if academic research destroys stock return predictability. They find that returns from stock price predictors decrease 26-58% after research finding the predictor is published. Thus, they argue that investors learn about stock market anomalies and mispricing from academic literature and use this information in trading. It is likely that most if not all sophisticated investors are aware that many studies have found the turn of the month effect, and thus the attenuation of the effect is consistent with findings of McLean & Pontiff.

Another reason for the attenuation of the turn of the month effect is the general attenuation of equity return anomalies. Chordia, Subrahmanyam and Tong (2014) find that the majority of anomalies they study have attenuated and the returns of anomaly based strategies have declined over time. They provide evidence that this decline of profits is caused by arbitrage activity, that they measure by hedge fund assets under management, short interest and aggregate share turnover. They conclude that the recent regime of increased liquidity and trading activity have improved capital market efficiency. Even though the turn of the month

effect was not among the anomalies authors studied, it is likely that it is similarly affected by increase in liquidity and trading activity.

Supporting the findings by Chordia, Subrahmanyam and Tong (2014), Kokkonen & Suominen (2015) find that hedge funds correct market prices and make the market more efficient. They present evidence implying that more the hedge funds have assets under management, and more they trade, the smaller is the misvaluation spread on the market. Even though the turn of the month effect is unlikely to due to misvaluation, but more due to mismatch of supply and demand, it is likely that hedge funds attempt to exploit it too. Etula et al. (2016) find that hedge funds' ability to mitigate turn of the month return patterns depends on the market-wide funding conditions. During tight funding conditions, hedge funds on average are not able to mitigate the patterns. However, when there is enough funding available, hedge funds on average do mitigate the turn of the month patterns.

This research is consistent with my finding that the turn of the month effect has substantially attenuated, or even disappeared, especially after the global financial crisis. After the crisis, funding conditions have been easy and interest rates exceptionally low, making it easier for hedge funds and other arbitrageurs to get funding and trade on anomalies, among them the turn of the month effect. In addition, hedge funds' assets under management has been continuously growing[3], which, as Chordia, Subrahmanyam and Tong (2014) and Kokkonen & Suominen (2015) find, is correlated with attenuated equity price anomalies and decreased misvaluation.

5.2 Does the market-specific settlement cycle dictate the timing of the return reversal before month end?

The main goal of this thesis is to determine whether the market-specific settlement cycle dictates the timing of the return reversal before month end. But is there such a reversal to begin with? My evidence is not conclusive on this. Based on arguments by Etula et al. (2016), the positive return reversal should take place X days before month end, when the settlement cycle is TD-X. So, for instance, when settlement cycle is TD+3, the reversal should take place three days before month end, between days T-4 and T-3. In most of the countries, at least on some subperiod, there are hints that this would be true. On TD+2

[3] https://www.statista.com/statistics/271771/assets-of-the-hedge-funds-worldwide/

periods, which is the most recent subperiod for all of the countries, evidence in favor of my hypothesis is typically the strongest. However, very often, the returns on the critical days are not significant. None of the countries has a reversal on which both of the returns were significant – it was always either a reversal from significantly negative to insignificantly positive, or vice versa. In addition, returns are often negative only for one day before the expected reversal. In many countries, there were expected changes on the timing of the reversal between different settlement cycle subperiods. Again, the reversals were not strongly significant, nor were the differences between daily returns. Therefore, I cannot accept my hypotheses that the market-specific settlement cycle dictates the timing of the return reversal before month end, or that the timing would change accordingly when the settlement cycle is changed. However, there are hints in my data that there is might something to my hypotheses.

The results do not support my hypothesis, but they are consistent with traditional finance theory – predictable return reversals should not exist. My hypotheses are based on Etula et al. (2016), who base their hypotheses on payment conventions in the US. However, payment conventions may be different around the world. As Ziemba (1991) notes, in Japan, salaries are paid on 25th day of the month, not on the last or on the first day of the month. Etula et al. (2016) note that in Finland, until 2013, pension payments were not concentrated on the month end, but made throughout the month in alphabetical order. Therefore, the timing liquidity-related reversal, if any, could be very different in different countries. However, the evidence was not conclusive in US either, even though the hypotheses are based on the American system. Like in the case of existence and persistence of the turn of the month effect, it seems that the stock markets around the world are more efficient than some studies have suggested.

6 Conclusion

In this thesis, I study if the settlement rule of a market dictates the timing of the month end return reversal. This return reversal is part of the turn of the month effect. I study this using equity index returns in 20 developed countries, which have had one or more settlement cycle changes after 1980.

My results show that first of all, the turn of the month effect is not as persistent as some studies have suggested. The effect has significantly attenuated or completely disappeared over time in all of the countries in my sample. However, in older samples, the turn of the month effect is significant.

I do not find conclusive evidence that the settlement cycle of a market would dictate the timing of the month end return reversal. In many of the countries, there is no hypothesized return reversal before month end to begin with. In some countries, I find the expected reversal, but it is either weakly significant or insignificant. However, there are some hints in my results, that suggest that there could be something to my hypotheses.

This thesis has important practical implications. The stock markets around the world seem to have become more efficient over time, possibly due to increasing amount of arbitrageurs, as the turn of the month return patterns have considerably attenuated. For both professional and retail investors, it is important to note that the turn of the month effect is very weak nowadays. Trading strategies based on it may not provide lucrative returns anymore.

For further research, it would be interesting to study the monthly payment patterns in different markets and relate them to possible return reversals throughout the month. This would provide further information whether the liquidity-related reversals exist and whether the settlement cycles dictate their timing.

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Appendices

Appendix A. Average daily returns and differences between different settlement cycle periods for the US equal-weighted index

This table presents average daily returns of CRSP equal-weighted index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-7	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	T+7	Other days
Complete periods																
A. TD+5 period (January 2, 1980 - June 1, 1995)																
Average return	0.08	0.01	0.07	0.02	0.05	0.03	0.14	**0.42**	0.11	**0.21**	**0.17**	0.08	0.04	0.05	0.10	**0.06**
t-statistic	0.41	-0.82	0.25	-0.68	-0.05	-0.55	1.61	**7.18*****	1.01	**2.99*****	**2.3****	0.43	-0.26	-0.14	0.94	**2.91*****
B. TD+3 period (June 2, 1995 - September 1, 2017)																
Average return	0.04	**-0.06**	0.01	0.01	0.16	0.14	0.14	**0.30**	0.13	0.11	0.06	0.07	0.00	-0.02	-0.01	**0.07**
t-statistic	-0.46	**-2.00****	-0.90	-0.99	1.27	0.98	0.94	**3.32*****	0.90	0.59	-0.16	0.00	-1.06	-1.32	-1.18	**2.84*****
C. TD+2 period (September 5, 2017 - December 29, 2017)																
Average return	0.12	0.04	0.30	-0.07	0.02	**0.49**	0.00	0.16	0.14	-0.10	0.02	0.08	-0.08	0.26	0.19	0.11
t-statistic	0.06	-0.35	0.88	-0.85	-0.41	**1.77***	-0.51	0.23	0.11	-0.99	-0.44	-0.15	-0.87	0.71	0.38	1.34
D. Difference between TD+5 and TD+3 periods																
Difference	-0.04	-0.07	-0.06	-0.01	0.11	0.11	0.00	-0.12	0.02	-0.10	-0.11	-0.01	-0.04	-0.07	-0.11	0.01
t-statistic	-0.57	-1.02	-0.81	-0.35	0.96	1.03	-0.20	-1.55	0.11	-1.23	-1.40	-0.24	-0.63	-0.90	-1.39	0.49
E. Difference between TD+3 and TD+2 periods																
Difference	0.08	0.10	0.29	-0.08	-0.14	0.36	-0.13	-0.13	0.00	-0.21	-0.05	0.01	-0.08	0.28	0.20	0.04
t-statistic	0.08	0.11	0.45	-0.21	-0.32	0.57	-0.31	-0.31	-0.06	-0.46	-0.15	-0.06	-0.21	0.44	0.29	0.18
Periods around changes																
F. TD+5 period five years before change (June 1, 1990 - June 1, 1995)																
Average return	**-0.02**	0.03	0.14	0.14	0.14	0.16	0.22	**0.56**	0.15	**0.26**	0.17	0.07	0.01	0.12	0.16	**0.11**
t-statistic	**-1.79***	-1.06	0.46	0.54	0.50	0.75	1.63	**6.48*****	0.64	**2.24****	0.87	-0.47	-1.31	0.26	0.78	**3.99*****
G. TD+3 period five years after change (June 2, 1995 - June 2, 2000)																
Average return	0.19	0.01	0.10	-0.05	0.00	0.04	0.19	**0.46**	0.24	0.14	0.15	0.25	0.23	-0.04	-0.01	**0.10**
t-statistic	0.87	-0.83	0.07	-1.32	-0.88	-0.53	0.90	**3.4*****	1.31	0.40	0.45	1.47	1.23	-1.23	-1.03	**2.38****
H. TD+3 period five years before change (September 1, 2012 - September 1, 2017)																
Average return	0.01	0.04	0.09	-0.09	-0.02	0.13	0.10	0.04	0.10	0.01	0.01	0.10	-0.01	0.03	0.07	**0.07**
t-statistic	-0.63	-0.30	0.13	-1.60	-0.93	0.60	0.23	-0.31	0.26	-0.61	-0.65	0.29	-0.79	-0.40	-0.07	**1.88***
I. Difference between TD+5 period five years before change and TD+3 period five years after change																
Difference	**0.21**	-0.02	-0.03	-0.19	-0.14	-0.12	-0.03	-0.10	0.09	-0.12	-0.02	0.18	0.22	-0.16	-0.18	-0.01
t-statistic	**1.71***	-0.12	-0.19	-1.40	-1.01	-0.86	-0.15	-0.71	0.76	-0.89	-0.10	1.48	1.75	-1.17	-1.29	-0.20
J. Difference between TD+3 period five years before change and TD+2 period																
Difference	0.11	-0.01	0.21	0.02	0.04	0.36	-0.09	0.12	0.04	-0.11	0.01	-0.02	-0.07	0.23	0.13	0.04
t-statistic	0.19	-0.11	0.44	-0.05	0.02	0.80	-0.33	0.20	0.00	-0.38	-0.07	-0.15	-0.27	0.48	0.22	0.25

Appendix B. Average daily returns and differences between different settlement cycle periods for the US value-weighted index

This table presents average daily returns of CRSP value-weighted index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-7	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	T+7	Other days
Complete periods																
A. TD+5 period (January 2, 1980 - June 1, 1995)																
Average return	0.06	-0.02	0.01	-0.02	0.13	0.05	0.10	**0.26**	0.11	**0.20**	0.09	-0.03	-0.05	0.05	0.10	0.03
t-statistic	0.54	-0.70	-0.32	-0.67	1.51	0.34	1.02	***3.38	1.22	**2.56****	0.92	-0.89	-1.17	0.29	1.02	1.07
B. TD+3 period (June 2, 1995 - September 1, 2017)																
Average return	0.02	**-0.10**	**-0.06**	-0.03	0.14	0.11	0.10	0.03	**0.21**	0.06	0.05	0.03	-0.01	-0.04	**-0.08**	**0.08**
t-statistic	-0.67	**-2.32****	**-1.81***	-1.34	0.87	0.39	0.30	-0.62	**1.66***	-0.22	-0.33	-0.63	-1.12	-1.56	**-2.05****	**2.6*****
C. TD+2 period (September 5, 2017 - December 29, 2017)																
Average return	0.09	-0.01	0.13	-0.13	0.00	**0.56**	0.00	0.20	0.14	-0.16	0.07	0.14	0.00	0.37	0.14	0.09
t-statistic	-0.01	-0.52	0.22	-1.19	-0.48	**2.5****	-0.48	0.57	0.24	-1.35	-0.12	0.25	-0.49	1.49	0.25	1.24
D. Difference between TD+5 and TD+3 periods																
Difference	-0.04	-0.08	-0.07	-0.01	0.01	0.06	0.00	**-0.23**	0.09	**-0.14**	-0.04	0.06	0.04	-0.09	**-0.18**	0.05
t-statistic	-0.81	-1.21	-1.09	-0.53	-0.33	0.06	-0.42	**-2.56****	0.41	**-1.76***	-0.81	0.11	-0.06	-1.29	**-2.1****	1.19
E. Difference between TD+3 and TD+2 periods																
Difference	0.06	0.10	0.19	-0.10	-0.15	0.45	-0.10	0.17	-0.07	-0.22	0.02	0.11	0.01	0.41	0.22	0.01
t-statistic	0.08	0.13	0.29	-0.18	-0.25	0.68	-0.18	0.24	-0.11	-0.37	0.01	0.15	-0.01	0.62	0.32	0.05
Periods around changes																
F. TD+5 period five years before change (June 1, 1990 - June 1, 1995)																
Average return	-0.11	**-0.13**	0.01	0.09	0.18	0.11	0.18	**0.22**	0.14	0.11	-0.03	**-0.13**	**-0.14**	0.07	0.14	0.04
t-statistic	-1.62	**-1.82***	-0.27	0.54	1.52	0.78	1.51	**1.99****	1.10	0.79	-0.70	**-1.87***	**-1.97****	0.34	1.10	1.11
G. TD+3 period five years after change (June 2, 1995 - June 2, 2000)																
Average return	0.25	-0.10	0.01	0.00	-0.07	0.04	0.15	0.01	**0.39**	0.11	0.20	0.17	0.28	**-0.14**	-0.09	**0.11**
t-statistic	1.02	-1.36	-0.66	-0.69	-1.22	-0.42	0.32	-0.67	**1.96***	0.05	0.67	0.41	1.16	**-1.65***	-1.34	**1.90***
H. TD+3 period five years before change (September 1, 2012 - September 1, 2017)																
Average return	0.04	-0.01	0.04	**-0.13**	0.01	0.14	0.09	-0.05	0.14	0.02	0.00	0.11	-0.01	0.04	0.08	**0.09**
t-statistic	-0.48	-0.91	-0.50	**-2.04****	-0.76	0.49	-0.02	-1.29	0.48	-0.71	-0.82	0.21	-0.92	-0.51	-0.10	**2.25****
I. Difference between TD+5 period five years before change and TD+3 period five years after change																
Difference	**0.37**	0.03	-0.01	-0.08	**-0.25**	-0.07	-0.03	-0.22	0.25	0.00	0.23	0.30	**0.42**	-0.21	**-0.23**	0.07
t-statistic	**1.72***	-0.18	-0.41	-0.87	**-1.84***	-0.78	-0.54	-1.62	1.06	-0.39	0.94	1.35	**2.03****	-1.58	**-1.72***	1.01
J. Difference between TD+3 period five years before change and TD+2 period																
Difference	0.05	0.00	0.09	-0.01	-0.01	0.41	-0.09	0.24	0.00	-0.18	0.06	0.02	0.01	0.33	0.06	0.00
t-statistic	0.12	0.00	0.22	-0.01	-0.02	0.99	-0.21	0.58	0.00	-0.42	0.15	0.06	0.02	0.79	0.14	-0.01

Appendix C. Average daily returns and differences between different settlement cycle periods for the Canadian S&P/TSX Composite index

This table presents average daily returns of S&P/TSX Composite index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-7	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	T+7	Other days
Complete periods																
A. TD+5 period (January 2, 1986 - June 1, 1995)																
Average return	-0.03	-0.13	0.02	0.00	0.08	0.06	0.09	**0.28**	0.06	**0.14**	**0.13**	0.06	-0.02	0.02	0.06	-0.03
t-statistic	0.00	-1.41	0.59	0.31	1.40	1.20	1.60	**4.13*****	1.16	**2.25****	**2.08****	1.21	0.14	0.66	1.22	-0.99
B. TD+3 period (June 2, 1995 - September 1, 2017)																
Average return	0.01	-0.06	-0.01	-0.01	0.05	0.03	0.07	**0.18**	0.14	0.10	-0.02	0.01	-0.03	-0.04	-0.07	**0.05**
t-statistic	-0.48	-1.57	-0.78	-0.80	0.02	-0.19	0.26	**1.86***	1.33	0.71	-0.99	-0.48	-1.04	-1.27	-1.64	**1.8***
C. TD+2 period (September 5, 2017 - December 29, 2017)																
Average return	**0.47**	0.10	0.13	0.13	-0.14	**0.37**	0.08	0.23	0.11	**-0.26**	-0.14	0.15	0.09	0.25	0.20	0.02
t-statistic	**2.67*****	0.48	0.62	0.62	-0.93	**2.06****	0.36	1.21	0.47	**-1.67***	-0.94	0.78	0.43	1.34	1.04	0.33
D. Difference between TD+5 and TD+3 periods																
Difference	0.04	0.07	-0.02	0.00	-0.03	-0.03	-0.02	-0.09	0.09	-0.04	**-0.15**	-0.05	-0.01	-0.06	**-0.13**	0.08
t-statistic	-0.29	-0.07	-0.83	-0.67	-0.86	-0.85	-0.83	-1.43	0.07	-0.96	**-1.87***	-1.04	-0.71	-1.16	**-1.73***	1.68
E. Difference between TD+3 and TD+2 periods																
Difference	0.46	0.17	0.13	0.13	-0.19	0.34	0.02	0.05	-0.03	-0.36	-0.12	0.14	0.12	0.29	0.27	-0.03
t-statistic	0.83	0.33	0.28	0.28	-0.27	0.62	0.07	0.13	-0.01	-0.57	-0.15	0.29	0.25	0.54	0.50	-0.12
Periods around changes																
F. TD+5 period five years before change (June 1, 1990 - June 1, 1995)																
Average return	-0.09	**-0.12**	0.01	0.11	0.13	0.01	0.10	**0.25**	0.01	0.04	0.09	-0.05	-0.11	0.01	**0.16**	0.01
t-statistic	-1.25	**-1.65***	0.01	1.33	1.60	-0.01	1.13	**3.12*****	0.06	0.37	1.09	-0.83	-1.57	-0.01	**2.02****	0.34
G. TD+3 period five years after change (June 2, 1995 - June 2, 2000)																
Average return	0.07	**-0.16**	0.19	-0.02	0.06	-0.10	-0.08	-0.04	**0.31**	**0.34**	0.06	**0.36**	0.21	**-0.20**	0.04	0.07
t-statistic	0.01	**-1.65***	0.90	-0.67	-0.06	-1.27	-1.08	-0.78	**1.74***	**1.97****	-0.03	**2.14****	1.06	**1.99****	-0.22	1.33
H. TD+3 period five years before change (September 1, 2012 - September 1, 2017)																
Average return	0.13	0.06	0.01	-0.06	-0.05	0.13	0.05	0.06	0.07	-0.08	-0.03	-0.05	0.10	-0.09	0.04	**0.06**
t-statistic	0.67	-0.06	-0.57	-1.26	-1.10	0.67	-0.10	-0.08	0.09	-1.45	-0.97	-1.12	0.35	-1.54	-0.26	**1.66***
I. Difference between TD+5 period five years before change and TD+3 period five years after change																
Difference	0.16	-0.04	0.18	-0.13	-0.07	-0.11	-0.17	**-0.29**	0.29	0.30	-0.03	**0.41**	**0.32**	**-0.21**	-0.13	0.06
t-statistic	0.62	-0.64	0.78	-1.23	-0.83	-1.10	-1.49	**-2.2****	1.45	1.54	-0.56	**2.27****	**1.69***	**-1.74***	-1.18	0.99
J. Difference between TD+3 five years period before change and TD+2 period																
Difference	0.34	0.05	0.12	0.19	-0.09	0.24	0.03	0.17	0.04	-0.18	-0.10	0.20	0.00	0.34	0.16	-0.04
t-statistic	0.98	0.22	0.41	0.59	-0.12	0.72	0.18	0.54	0.19	-0.35	-0.16	0.62	0.10	0.97	0.52	-0.27

Appendix D. Average daily returns and differences between different settlement cycle periods for the Taiwanese TAIEX index

This table presents average daily returns of TAIEX index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+1 period (January 3, 2003 - December 31, 2008)												
Average return	**0.24**	0.08	-0.02	-0.17	**0.25**	**0.23**	**0.21**	**0.21**	-0.14	0.18	0.12	-0.09
t-statistic	**1.84***	0.93	0.36	-0.45	**1.9***	**1.79***	**1.69***	**1.68***	-0.33	1.51	1.16	-1.61
B. TD+1 period (January 5, 2009 - December 29, 2017)												
Average return	0.04	0.02	0.02	0.14	0.11	**0.29**	**0.25**	-0.01	0.15	**-0.17**	0.11	0.01
t-statistic	0.23	0.01	0.02	1.24	0.92	**2.68*****	**2.25****	-0.20	1.28	**-1.82***	0.88	0.46
C. Difference between TD+1 and TD+2 periods												
Difference	-0.20	-0.06	0.04	0.31	-0.14	0.06	0.04	**-0.21**	0.29	**-0.35**	-0.01	**0.10**
t-statistic	-1.57	-0.85	-0.32	1.08	-1.25	-0.20	-0.34	**-1.65***	0.99	**-2.37****	-0.59	**1.73***
Periods around changes												
D. TD+1 period five years before change (December 31, 2003 - December 31, 2008)												
Average return	**0.24**	0.11	-0.04	-0.05	**0.32**	**0.32**	0.05	**0.20**	-0.13	0.11	0.06	**-0.13**
t-statistic	**1.9***	1.22	0.47	0.44	**2.34****	**2.32****	0.96	**1.7***	0.00	1.24	0.99	**-2.21****
E. TD+2 period five years after change (January 5, 2009 - January 6, 2016)												
Average return	0.03	-0.10	0.04	0.14	0.10	**0.49**	**0.39**	0.06	0.13	-0.18	0.04	0.02
t-statistic	0.10	-0.71	0.18	0.79	0.51	**2.97*****	**2.35****	0.26	0.69	-1.23	0.15	0.34
F. Difference between TD+3 period five years before change and TD+2 period five years after change												
Difference	-0.21	-0.20	0.08	0.19	-0.22	0.17	0.33	-0.14	0.26	**-0.29**	-0.02	**0.15**
t-statistic	-1.41	-1.40	-0.26	0.16	-1.49	0.09	0.74	-1.16	0.43	**-1.74***	-0.67	**1.93***

Appendix E. Average daily returns and differences between different settlement cycle periods for the Austrian ATX index

This table presents average daily returns of ATX index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 3, 1992 - October 3, 2014)												
Average return	-0.09	0.08	**0.16**	**0.15**	0.08	**0.16**	**0.31**	**0.12**	0.06	-0.08	-0.04	-0.05
t-statistic	-0.47	1.55	**2.49****	**2.29****	1.58	**2.42****	**4.24*****	**2****	1.31	-0.34	0.12	-1.89
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.32	0.00	-0.18	0.21	0.06	0.07	0.27	-0.05	-0.21	0.09	0.19	0.06
t-statistic	1.31	-0.33	-1.25	0.73	0.00	0.03	1.04	-0.59	-1.39	0.14	0.66	1.04
C. Difference between TD+3 and TD+2 periods												
Difference	0.41	-0.08	**-0.35**	0.06	-0.02	-0.09	-0.04	-0.17	-0.28	0.17	0.23	0.11
t-statistic	1.24	-0.82	**-1.9***	-0.21	-0.56	-0.83	-0.62	-1.18	-1.60	0.23	0.50	1.53
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.19	0.04	0.14	0.13	0.04	-0.10	**0.46**	-0.27	0.08	-0.19	-0.11	-0.01
t-statistic	-0.96	0.26	0.74	0.69	0.23	-0.47	**2.39****	-1.37	0.47	-0.93	-0.55	-0.13
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.52	-0.04	-0.32	0.08	0.03	0.17	-0.18	0.22	-0.30	0.28	0.31	0.07
t-statistic	1.54	-0.40	-1.35	0.04	-0.16	0.34	-0.87	0.50	-1.27	0.72	0.82	0.80

Appendix F. Average daily returns and differences between different settlement cycle periods for the Belgian Bel 20 index

This table presents average daily returns of Bel 20 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 3, 1990 - October 3, 2014)												
Average return	-0.07	-0.05	0.07	0.08	0.02	**0.18**	**0.16**	**0.13**	0.10	-0.02	-0.01	0.00
t-statistic	-1.04	-0.69	1.12	1.15	0.35	**2.57****	**2.40****	**1.96****	1.41	-0.22	-0.08	-0.11
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.08	-0.12	0.01	0.32	-0.11	0.04	0.11	-0.08	-0.01	-0.12	0.08	0.06
t-statistic	0.12	-1.06	-0.29	1.56	-1.00	-0.11	0.31	-0.82	-0.45	-1.06	0.14	1.23
C. Difference between TD+3 and TD+2 periods												
Difference	0.15	-0.07	-0.06	0.24	-0.13	-0.13	-0.05	-0.21	-0.11	-0.10	0.09	0.06
t-statistic	0.46	-0.64	-0.63	0.90	-0.95	-0.98	-0.56	-1.35	-0.85	-0.80	0.14	1.06
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.06	-0.11	0.13	0.06	0.08	-0.04	0.29	-0.10	0.04	0.01	-0.10	0.05
t-statistic	-0.71	-1.06	0.48	0.03	0.19	-0.57	1.55	-0.98	-0.08	-0.25	-1.00	1.15
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.14	0.00	-0.11	0.26	-0.19	0.08	-0.18	0.02	-0.05	-0.13	0.19	0.01
t-statistic	0.55	-0.05	-0.52	1.08	-0.83	0.30	-0.80	0.05	-0.26	-0.59	0.76	0.11

Appendix G. Average daily returns and differences between different settlement cycle periods for the Danish OMXC 20 index

This table presents average daily returns of OMXC 20 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (December 5, 1989 - October 3, 2014)												
Average return	-0.10	0.03	-0.01	0.07	**0.13**	**0.12**	**0.31**	**0.23**	-0.08	-0.01	-0.02	0.00
t-statistic	-1.34	0.49	-0.07	1.05	**1.84***	**1.77***	**4.38*****	**3.3*****	-1.08	-0.09	-0.27	-0.10
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.28	0.05	-0.11	**0.49**	-0.06	0.19	0.22	-0.14	-0.22	-0.15	-0.05	0.05
t-statistic	1.18	0.00	-0.79	**2.26****	-0.55	0.72	0.86	-0.90	-1.32	-0.97	-0.48	0.75
C. Difference between TD+3 and TD+2 periods												
Difference	0.38	0.01	-0.10	**0.42**	-0.19	0.06	-0.09	**-0.37**	-0.14	-0.14	-0.03	0.05
t-statistic	1.56	-0.17	-0.72	**1.78***	-1.14	0.08	-0.66	**-1.96***	-0.88	-0.89	-0.37	0.74
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	**-0.22**	0.08	0.12	0.17	0.12	0.12	**0.54**	0.00	0.07	0.08	-0.11	0.05
t-statistic	**-1.80***	0.22	0.51	0.84	0.51	0.50	**3.25*****	-0.33	0.15	0.22	-1.02	1.05
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	**0.50**	-0.04	-0.24	0.32	-0.19	0.07	-0.32	-0.14	-0.29	-0.23	0.05	0.00
t-statistic	**2.05****	-0.13	-0.95	1.32	-0.75	0.28	-1.28	-0.54	-1.16	-0.92	0.24	-0.04

Appendix H. Average daily returns and differences between different settlement cycle periods for the Finnish OMXH 25 index

This table presents average daily returns of OMXH 25 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 3, 1991 - October 3, 2014)												
Average return	0.04	0.07	-0.01	**0.25**	0.06	**0.30**	**0.27**	0.06	0.08	0.10	-0.08	-0.02
t-statistic	0.52	0.78	0.10	**2.42****	0.67	**2.93*****	**2.67*****	0.69	0.94	1.08	-0.56	-0.52
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.22	-0.03	-0.14	0.17	-0.01	-0.15	0.09	-0.09	-0.05	0.11	0.07	0.07
t-statistic	0.80	-0.57	-1.20	0.56	-0.44	-1.21	0.12	-0.90	-0.68	0.23	-0.04	1.32
C. Difference between TD+3 and TD+2 periods												
Difference	0.18	-0.10	-0.14	-0.07	-0.06	**-0.45**	-0.18	-0.15	-0.14	0.01	0.14	0.09
t-statistic	0.30	-0.63	-0.75	-0.54	-0.51	**-1.79***	-0.88	-0.78	-0.74	-0.25	0.18	0.98
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.04	-0.01	0.10	0.07	0.21	-0.08	**0.46**	-0.18	0.05	0.05	-0.14	0.02
t-statistic	-0.32	-0.16	0.50	0.27	1.11	-0.55	**2.58****	-1.15	0.16	0.18	-0.90	0.35
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.25	-0.02	-0.25	0.11	-0.22	-0.07	-0.37	0.09	-0.10	0.06	0.20	0.05
t-statistic	0.77	-0.29	-1.17	0.21	-1.05	-0.48	-1.62	0.13	-0.58	0.04	0.57	0.69

Appendix I. Average daily returns and differences between different settlement cycle periods for the French CAC 40 index

This table presents average daily returns of CAC 40 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 4, 1988 - October 3, 2014)												
Average return	0.03	**0.22**	**0.14**	**0.16**	**0.09**	**0.18**	**0.21**	**0.10**	0.05	-0.07	0.05	-0.05
t-statistic	0.96	**3.35*** **	**2.25** **	**2.55** **	**1.71***	**2.8*** **	**3.19*** **	**1.76***	1.22	-0.26	1.17	-1.87
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.33	-0.19	-0.04	0.34	-0.10	-0.01	0.03	-0.24	0.05	-0.10	0.14	0.06
t-statistic	1.37	-1.22	-0.49	1.43	-0.78	-0.31	-0.14	-1.44	-0.02	-0.80	0.40	0.96
C. Difference between TD+3 and TD+2 periods												
Difference	0.30	**-0.41**	-0.18	0.18	-0.19	-0.19	-0.18	**-0.33**	0.00	-0.04	0.09	0.10
t-statistic	0.82	**-2.13** **	-1.16	0.34	-1.22	-1.19	-1.17	**-1.78***	-0.42	-0.58	-0.06	1.43
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.11	0.06	0.18	0.16	-0.02	0.01	**0.39**	**-0.35**	0.08	0.03	-0.10	0.02
t-statistic	-0.71	0.21	0.88	0.75	-0.24	-0.08	**2.00** **	**-2.03** **	0.30	0.05	-0.67	0.41
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.44	-0.25	-0.22	0.18	-0.08	-0.01	-0.36	0.11	-0.02	-0.13	0.24	0.04
t-statistic	1.45	-1.02	-0.93	0.54	-0.41	-0.17	-1.40	0.27	-0.21	-0.61	0.73	0.43

Appendix J. Average daily returns and differences between different settlement cycle periods for the Irish ISEQ OVERALL index

This table presents average daily returns of ISEQ OVERALL index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 5, 1988 - October 3, 2014)												
Average return	-0.06	0.03	-0.04	0.08	0.03	**0.25**	**0.24**	0.11	**0.13**	0.03	**-0.13**	0.00
t-statistic	-0.84	0.44	-0.59	1.13	0.44	**3.51*** **	**3.33*** **	1.50	**1.80***	0.37	**-1.83***	0.09
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.02	-0.12	**-0.27**	0.35	-0.12	0.20	0.22	0.01	0.09	-0.12	0.00	0.09
t-statistic	-0.36	-1.07	**-1.84***	1.35	-1.04	0.61	0.70	-0.41	0.03	-1.05	-0.44	1.48
C. Difference between TD+3 and TD+2 periods												
Difference	0.07	-0.16	-0.23	0.27	-0.15	-0.05	-0.02	-0.10	-0.04	-0.15	0.13	0.08
t-statistic	-0.04	-1.11	-1.45	0.84	-1.08	-0.61	-0.46	-0.86	-0.56	-1.06	0.21	1.29
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.12	0.02	0.12	-0.03	0.06	0.26	**0.37**	-0.21	0.25	0.20	-0.02	-0.01
t-statistic	-0.68	0.19	0.78	-0.12	0.41	1.61	**2.26****	-1.23	1.55	1.23	-0.07	-0.18
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.14	-0.14	**-0.39**	0.38	-0.17	-0.06	-0.15	0.22	-0.16	-0.31	0.02	0.10
t-statistic	0.17	-0.92	**-1.88***	1.08	-1.04	-0.58	-0.92	0.47	-0.97	-1.57	-0.29	1.22

Appendix K. Average daily returns and differences between different settlement cycle periods for the Italian FTSE MIB index

This table presents average daily returns of FTSE MIB index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 2, 1998 - October 3, 2014)												
Average return	-0.07	0.15	0.10	**0.20**	0.05	0.07	**0.19**	-0.07	0.12	-0.15	-0.02	-0.04
t-statistic	-0.28	1.61	1.15	**2.03****	0.78	0.93	**1.95***	-0.33	1.33	-1.03	0.18	-1.07
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.42	**-0.56**	0.22	0.08	-0.12	0.16	-0.06	**-0.43**	0.04	-0.23	0.10	0.08
t-statistic	1.32	**-2.44****	0.55	-0.02	-0.75	0.32	-0.51	**-1.93***	-0.15	-1.18	0.09	1.02
C. Difference between TD+3 and TD+2 periods												
Difference	0.49	**-0.71**	0.13	-0.12	-0.17	0.09	-0.24	-0.36	-0.08	-0.07	0.12	0.12
t-statistic	1.32	**-2.88*****	0.04	-0.83	-1.00	-0.08	-1.25	-1.64	-0.67	-0.67	0.01	1.36
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.21	0.02	0.16	0.05	0.04	0.03	0.28	-0.32	0.11	-0.10	-0.03	0.01
t-statistic	-0.98	0.06	0.69	0.21	0.16	0.09	1.21	-1.46	0.45	-0.50	-0.18	0.10
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.63	**-0.58**	0.06	0.02	-0.16	0.14	-0.33	-0.11	-0.06	-0.13	0.14	0.07
t-statistic	1.62	**-1.88***	-0.03	-0.15	-0.67	0.18	-1.15	-0.54	-0.40	-0.57	0.18	0.70

Appendix L. Average daily returns and differences between different settlement cycle periods for the Luxembourgian LUXX index

This table presents average daily returns of LUXX index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 5, 1999 - October 3, 2014)												
Average return	-0.10	0.17	-0.20	**0.23**	**0.24**	0.06	**0.38**	-0.23	-0.05	0.03	0.03	-0.05
t-statistic	-0.38	1.64	-1.18	**2.04****	**2.11****	0.80	**3.2*****	-1.36	-0.01	0.59	0.58	-1.14
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.20	-0.34	-0.08	0.12	0.03	-0.19	0.26	0.10	0.09	-0.19	0.15	0.00
t-statistic	0.97	-1.62	-0.34	0.59	0.15	-0.88	1.26	0.50	0.43	-0.88	0.73	-0.07
C. Difference between TD+3 and TD+2 periods												
Difference	0.30	-0.52	0.13	-0.11	-0.21	-0.25	-0.12	0.33	0.13	-0.22	0.12	0.04
t-statistic	0.82	-1.81*	0.28	-0.48	-0.81	-0.95	-0.51	0.92	0.29	-0.85	0.24	0.46
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	0.01	-0.20	-0.02	-0.04	0.12	-0.02	**0.45**	-0.33	-0.06	0.08	0.07	-0.01
t-statistic	0.07	-0.97	-0.05	-0.18	0.61	-0.07	**2.24****	-1.61	-0.25	0.44	0.36	-0.11
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.19	-0.14	-0.06	0.16	-0.09	-0.17	-0.19	0.43	0.14	-0.27	0.08	0.00
t-statistic	0.62	-0.47	-0.20	0.53	-0.31	-0.56	-0.62	1.41	0.47	-0.90	0.26	0.03

Appendix M. Average daily returns and differences between different settlement cycle periods for the Dutch AEX index

This table presents average daily returns of AEX index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 4, 1983 - October 3, 2014)												
Average return	-0.05	0.00	0.08	0.08	0.05	**0.14**	**0.23**	**0.14**	0.12	0.02	0.03	0.00
t-statistic	-0.63	0.05	1.16	1.17	0.63	**1.98****	**3.23*****	**1.92***	1.61	0.28	0.42	0.02
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.26	-0.14	-0.04	0.27	-0.02	0.01	0.06	-0.20	0.03	-0.11	0.15	0.07
t-statistic	1.02	-1.16	-0.62	1.05	-0.50	-0.35	-0.08	-1.48	-0.21	-0.99	0.45	1.30
C. Difference between TD+3 and TD+2 periods												
Difference	0.30	-0.15	-0.13	0.18	-0.07	-0.14	-0.18	**-0.34**	-0.08	-0.13	0.12	0.07
t-statistic	1.01	-0.94	-0.85	0.48	-0.59	-0.89	-1.05	**-1.76***	-0.66	-0.87	0.23	1.03
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.08	0.00	0.11	0.07	0.03	0.03	**0.40**	**-0.22**	0.01	0.13	-0.08	0.04
t-statistic	-0.77	-0.21	0.47	0.22	-0.05	-0.06	**2.46****	**-1.69***	-0.18	0.61	-0.76	0.80
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.34	-0.15	-0.15	0.20	-0.05	-0.02	-0.35	0.01	0.02	-0.24	0.23	0.04
t-statistic	1.28	-0.77	-0.78	0.68	-0.36	-0.23	-1.60	-0.10	-0.06	-1.15	0.83	0.50

Appendix N. Average daily returns and differences between different settlement cycle periods for the Norwegian OSEAX index

This table presents average daily returns of OSEAX index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 4, 1983 - October 3, 2014)												
Average return	0.02	0.02	-0.02	0.07	0.11	**0.28**	**0.26**	0.09	0.05	0.05	0.02	0.01
t-statistic	0.17	0.20	-0.31	0.91	1.51	**3.84*** **	**3.57*** **	1.16	0.60	0.59	0.21	0.27
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.27	-0.10	-0.09	0.25	0.18	-0.08	0.21	-0.11	0.08	-0.03	0.24	0.00
t-statistic	1.45	-0.57	-0.50	1.34	0.98	-0.46	1.10	-0.64	0.43	-0.17	1.29	0.07
C. Difference between TD+3 and TD+2 periods												
Difference	0.25	-0.12	-0.07	0.18	0.07	-0.36	-0.05	-0.20	0.03	-0.08	0.22	0.00
t-statistic	1.11	-0.52	-0.30	0.79	0.31	-1.56	-0.22	-0.87	0.16	-0.32	0.96	-0.03
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.10	0.01	0.19	0.13	0.04	0.08	**0.37**	-0.16	-0.02	0.08	-0.06	0.04
t-statistic	-0.92	-0.18	0.98	0.56	-0.04	0.26	**2.13****	-1.29	-0.41	0.27	-0.63	0.86
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	**0.37**	-0.11	-0.28	0.12	0.15	-0.16	-0.17	0.05	0.11	-0.11	0.30	-0.04
t-statistic	**1.68***	-0.31	-1.01	0.65	0.76	-0.51	-0.53	0.34	0.58	-0.30	1.38	-0.50

Appendix O. Average daily returns and differences between different settlement cycle periods for the Portuguese PSI-20 index

This table presents average daily returns of PSI-20 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (September 29, 2001 - October 3, 2014)												
Average return	-0.18	-0.08	0.08	0.03	0.01	0.08	**0.23**	0.08	0.09	-0.11	0.11	-0.02
t-statistic	-1.61	-0.60	1.04	0.46	0.33	1.04	**2.55****	0.96	1.12	-0.89	1.33	-0.62
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.21	-0.18	-0.10	0.21	-0.02	0.16	0.19	-0.19	-0.08	-0.23	0.06	0.01
t-statistic	0.96	-0.92	-0.58	0.97	-0.18	0.71	0.83	-0.98	-0.44	-1.19	0.24	0.23
C. Difference between TD+3 and TD+2 periods												
Difference	0.39	-0.10	-0.19	0.19	-0.04	0.08	-0.04	-0.27	-0.17	-0.12	-0.05	0.03
t-statistic	1.60	-0.58	-1.00	0.69	-0.32	0.20	-0.34	-1.33	-0.89	-0.71	-0.36	0.49
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.15	-0.26	0.21	-0.06	-0.05	0.03	0.24	-0.02	0.09	-0.18	0.11	-0.03
t-statistic	-0.68	-1.28	1.37	-0.15	-0.07	0.36	1.53	0.06	0.69	-0.80	0.78	-0.61
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.37	0.09	-0.32	0.27	0.02	0.13	-0.05	-0.17	-0.17	-0.06	-0.04	0.05
t-statistic	1.16	0.14	-1.31	0.82	-0.09	0.29	-0.36	-0.78	-0.77	-0.37	-0.32	0.57

Appendix P. Average daily returns and differences between different settlement cycle periods for the Swedish OMXS 30 index

This table presents average daily returns of OMXS 30 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 3, 2002 - October 3, 2014)												
Average return	-0.15	0.02	0.05	**0.28**	0.21	0.05	**0.34**	0.04	0.03	**-0.21**	-0.09	0.00
t-statistic	-1.20	0.18	0.38	**2.21****	1.62	0.38	**2.70*****	0.27	0.25	**-1.65***	-0.70	0.05
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.19	0.04	-0.10	0.15	0.05	0.03	-0.07	-0.21	-0.09	-0.08	0.12	0.06
t-statistic	0.70	-0.13	-0.84	0.47	-0.04	-0.15	-0.68	-1.39	-0.80	-0.76	0.32	1.06
C. Difference between TD+3 and TD+2 periods												
Difference	0.34	0.01	-0.15	-0.13	-0.15	-0.02	-0.41	-0.24	-0.13	0.12	0.21	0.06
t-statistic	1.07	-0.18	-0.77	-0.71	-0.80	-0.29	-1.74	-1.11	-0.69	0.24	0.56	0.73
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.04	0.19	0.14	0.10	0.15	0.15	0.22	-0.27	0.03	-0.03	-0.11	0.05
t-statistic	-0.56	0.86	0.52	0.32	0.62	0.57	1.04	-1.92	-0.16	-0.48	-0.96	1.01
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.24	-0.16	-0.24	0.05	-0.10	-0.11	-0.29	0.06	-0.12	-0.05	0.23	0.01
t-statistic	0.88	-0.65	-0.95	0.14	-0.43	-0.48	-1.17	0.20	-0.50	-0.25	0.86	0.13

Appendix Q. Average daily returns and differences between different settlement cycle periods for the Swiss SMI index

This table presents average daily returns of SMI index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (May 3, 1993 - October 3, 2014)												
Average return	-0.06	0.08	0.07	0.10	0.09	0.10	**0.29**	0.08	0.00	0.11	-0.02	-0.01
t-statistic	-0.64	1.19	1.13	1.47	1.34	1.52	**3.94*****	1.22	0.20	1.61	-0.16	-0.53
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.11	-0.13	0.11	0.27	0.06	-0.06	0.01	0.01	0.08	-0.07	0.01	0.01
t-statistic	0.58	-0.79	0.61	1.54	0.30	-0.40	0.05	0.05	0.41	-0.43	0.00	0.11
C. Difference between TD+3 and TD+2 periods												
Difference	0.17	-0.21	0.04	0.17	-0.03	-0.17	-0.28	-0.07	0.07	-0.18	0.03	0.02
t-statistic	0.71	-1.08	0.08	0.72	-0.25	-0.89	-1.40	-0.41	0.26	-0.95	0.06	0.29
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.10	0.01	0.13	0.00	0.06	-0.09	**0.32**	-0.14	-0.06	0.18	-0.07	0.06
t-statistic	-1.27	-0.35	0.59	-0.48	0.06	-1.13	**2.07****	-1.59	-0.96	0.97	-0.99	1.51
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.21	-0.14	-0.02	0.27	-0.01	0.02	-0.30	0.16	0.14	-0.25	0.07	-0.05
t-statistic	1.24	-0.44	0.14	1.56	0.21	0.35	-1.20	0.99	0.91	-0.94	0.60	-0.82

Appendix R. Average daily returns and differences between different settlement cycle periods for the British FTSE 100 index

This table presents average daily returns of FTSE 100 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 2, 1986 - October 3, 2014)												
Average return	-0.02	0.04	0.08	**0.15**	0.07	0.08	**0.24**	0.08	**0.10**	0.00	0.05	-0.01
t-statistic	-0.10	0.89	1.40	**2.49****	1.37	1.48	**3.98*****	1.50	**1.71***	0.22	1.00	-0.62
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.11	-0.18	0.02	0.26	0.01	0.02	-0.02	0.02	0.07	-0.06	0.19	0.03
t-statistic	0.50	-1.32	-0.08	1.45	-0.15	-0.08	-0.35	-0.04	0.23	-0.58	1.02	0.64
C. Difference between TD+3 and TD+2 periods												
Difference	0.13	-0.22	-0.06	0.11	-0.07	-0.06	-0.26	-0.06	-0.03	-0.06	0.14	0.04
t-statistic	0.43	-1.35	-0.52	0.36	-0.56	-0.54	-1.55	-0.51	-0.36	-0.54	0.50	0.72
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.09	0.10	0.03	0.00	0.11	-0.17	**0.51**	-0.11	0.07	0.11	-0.05	0.02
t-statistic	-0.87	0.60	0.07	-0.18	0.68	-1.40	**3.68*****	-1.00	0.37	0.65	-0.56	0.53
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.20	-0.28	-0.01	0.26	-0.11	0.18	**-0.54**	0.13	0.00	-0.17	0.24	0.01
t-statistic	0.93	-1.38	-0.11	1.21	-0.55	0.84	**-2.6****	0.60	-0.06	-0.86	1.12	0.14

Appendix S. Average daily returns and differences between different settlement cycle periods for the Australian S&P/ASX 200 index

This table presents average daily returns of S&P/ASX 200 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (June 1, 1992 - March 4, 2016)												
Average return	-0.04	0.08	**0.13**	**0.13**	0.03	**0.14**	0.09	**0.16**	-0.04	-0.05	-0.03	0.01
t-statistic	-0.90	1.19	**1.96***	**1.97****	0.29	**2.18****	1.22	**2.54****	-0.83	-1.01	-0.72	0.67
B. TD+2 period (March 7, 2016 - December 29, 2017)												
Average return	0.18	0.05	-0.07	-0.16	0.20	-0.06	0.18	0.01	**-0.39**	-0.09	0.39	**0.09**
t-statistic	0.64	-0.21	-1.00	-1.61	0.76	-0.93	0.59	-0.51	**-3.01*****	-1.10	1.96	**1.87***
C. Difference between TD+3 and TD+2 periods												
Difference	0.23	-0.03	-0.20	**-0.29**	0.17	-0.20	0.09	-0.16	**-0.35**	-0.04	0.42	0.07
t-statistic	0.69	-0.47	-1.24	**-1.66***	0.45	-1.25	0.09	-1.04	**-1.89***	-0.50	1.57	1.13
Periods around changes												
D. TD+3 period five years before change (March 4, 2011 - March 4, 2016)												
Average return	0.02	0.13	**0.27**	**0.26**	-0.10	0.11	-0.01	0.01	-0.19	-0.03	-0.07	0.01
t-statistic	0.12	1.00	**2.04****	**1.94***	-0.80	0.83	-0.13	0.01	-1.50	-0.27	-0.56	0.16
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.16	-0.08	**-0.34**	**-0.42**	0.30	-0.17	0.19	0.00	-0.20	-0.06	0.45	0.08
t-statistic	0.36	-0.69	**-1.79***	**-2.14****	0.94	-1.08	0.47	-0.34	-1.19	-0.58	1.61	1.15

Appendix T. Average daily returns and differences between different settlement cycle periods for the New Zealand S&P/NZX 50 index

This table presents average daily returns of S&P/NZX 50 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 3, 2001 - March 4, 2016)												
Average return	-0.06	0.04	0.05	**0.17**	**0.11**	**0.24**	0.05	**0.13**	0.00	-0.03	-0.02	0.00
t-statistic	-1.14	0.65	0.91	**3.05*** **	**1.97** **	**4.34*** **	0.90	**2.39** **	0.03	-0.55	-0.47	0.18
B. TD+2 period (March 7, 2016 - December 29, 2017)												
Average return	0.02	0.09	0.00	0.08	**0.27**	**0.28**	0.04	0.09	-0.15	0.03	0.15	0.03
t-statistic	-0.10	0.45	-0.29	0.44	**1.98** **	**2.06** **	0.07	0.43	-1.51	0.00	0.99	0.90
C. Difference between TD+3 and TD+2 periods												
Difference	0.07	0.04	-0.05	-0.08	0.14	0.03	-0.01	-0.04	-0.14	0.05	0.15	0.03
t-statistic	0.31	0.11	-0.52	-0.71	0.79	0.05	-0.24	-0.47	-1.12	0.18	0.88	0.60
Periods around changes												
D. TD+3 period five years before change (March 4, 2011 - March 4, 2016)												
Average return	-0.06	0.04	0.05	**0.17**	**0.11**	**0.24**	0.05	**0.13**	0.00	-0.03	-0.02	0.00
t-statistic	-1.14	0.65	0.91	**3.05*** **	**1.97** **	**4.34*** **	0.90	**2.39** **	0.03	-0.55	-0.47	0.18
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.06	-0.01	-0.01	-0.12	0.14	0.00	-0.03	0.12	-0.18	-0.01	0.11	0.01
t-statistic	0.36	-0.14	-0.11	-0.93	0.91	-0.10	-0.25	0.78	-1.33	-0.14	0.68	0.22

Appendix U. Average daily returns and differences between different settlement cycle periods for the Spanish IBEX 35 index

This table presents average daily returns of IBEX 35 index during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 16, 1992 - September 28, 2016)												
Average return	0.03	-0.07	0.07	**0.18**	0.01	0.12	**0.22**	0.08	0.04	-0.03	0.02	0.00
t-statistic	0.33	-0.84	0.71	**1.97****	0.13	1.29	**2.49****	0.88	0.44	-0.41	0.15	0.14
B. TD+2 period (September 29, 2016 - December 29, 2017)												
Average return	0.12	0.38	0.08	-0.06	0.05	0.07	0.09	-0.09	-0.03	0.34	0.01	0.03
t-statistic	0.41	1.56	0.23	-0.39	0.10	0.18	0.27	-0.50	-0.27	1.40	-0.09	0.41
C. Difference between TD+3 and TD+2 periods												
Difference	0.09	0.45	0.01	-0.24	0.04	-0.05	-0.14	-0.17	-0.08	0.38	-0.01	0.02
t-statistic	0.16	1.08	-0.03	-0.66	0.03	-0.20	-0.40	-0.48	-0.25	0.89	-0.09	0.20
Periods around changes												
D. TD+3 period five years before change (September 29, 2011 - September 28, 2016)												
Average return	0.10	-0.21	0.04	0.23	0.02	0.02	-0.07	-0.24	0.10	0.16	-0.01	0.03
t-statistic	0.35	-1.21	0.05	0.97	-0.05	-0.07	-0.49	-1.36	0.34	0.63	-0.22	0.54
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.02	0.59	0.04	-0.28	0.03	0.05	0.15	0.15	-0.13	0.18	0.02	0.00
t-statistic	0.05	1.42	0.10	-0.70	0.08	0.13	0.38	0.38	-0.31	0.45	0.05	-0.04

Appendix V. Pooled average daily returns and differences between different settlement cycle periods for the US value-weighted and Canadian S&P/TSX Composite indices

This table presents pooled average daily returns of US value-weighted and S&P/TSX Composite indices during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-7	T-6	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	T+6	T+7	Other days
Complete periods																
A. TD+5 period (January 2, 1986 - June 1, 1995)																
Average return	-0.01	-0.08	0.06	-0.01	**0.11**	0.08	**0.12**	**0.29**	0.09	**0.19**	**0.12**	-0.01	-0.08	0.06	0.08	-0.01
t-statistic	-0.03	-0.93	0.92	0.08	**1.66***	1.24	**1.79***	**3.97*****	1.38	**2.6*****	**1.76***	-0.02	-0.93	0.99	1.25	-0.41
B. TD+3 period (June 2, 1995 - September 1, 2017)																
Average return	-0.01	**-0.07**	0.01	-0.01	0.08	0.09	0.07	0.11	**0.19**	0.09	0.04	-0.01	-0.02	-0.02	**-0.08**	**0.06**
t-statistic	-1.07	**-1.99****	-0.81	-1.05	0.25	0.31	0.03	0.62	**1.86***	0.38	-0.41	-1.09	-1.25	-1.17	**-2.13****	**2.51****
C. TD+2 period (September 5, 2017 - December 29, 2017)																
Average return	0.27	-0.02	0.13	-0.03	-0.06	**0.46**	0.04	0.21	0.13	**-0.21**	-0.04	0.15	0.05	0.25	0.18	0.07
t-statistic	1.27	-0.56	0.36	-0.67	-0.83	**2.49****	-0.19	0.89	0.30	**-1.8***	-0.68	0.46	-0.16	1.13	0.66	1.21
D. Difference between TD+5 and TD+3 periods																
Difference	0.00	0.01	-0.05	0.00	-0.03	0.00	-0.06	**-0.18**	0.10	-0.09	-0.09	0.00	0.06	-0.08	**-0.17**	0.08
t-statistic	-0.61	-0.58	-1.07	-0.67	-0.91	-0.61	-1.13	**-2.17****	0.21	-1.44	-1.37	-0.63	-0.15	-1.33	**-2.06****	1.75
E. Difference between TD+3 and TD+2 periods																
Difference	0.28	0.06	0.12	-0.02	-0.14	0.38	-0.02	0.10	-0.07	-0.30	-0.07	0.16	0.07	0.27	0.26	0.01
t-statistic	0.48	0.09	0.20	-0.06	-0.26	0.64	-0.06	0.17	-0.12	-0.54	-0.14	0.26	0.11	0.45	0.44	0.03
Periods around changes																
F. TD+5 period five years before change (June 1, 1990 - June 1, 1995)																
Average return	**-0.10**	**-0.13**	0.03	0.12	**0.16**	0.06	0.13	**0.24**	0.07	0.11	0.06	**-0.13**	**-0.16**	0.07	0.13	0.03
t-statistic	**-1.77***	**-2.16****	-0.04	1.08	**1.65***	0.27	1.31	**2.73*****	0.49	1.04	0.31	**-2.23****-2.52****		0.40	1.30	1.24
G. TD+3 period five years after change (June 2, 1995 - June 2, 2000)																
Average return	0.16	**-0.13**	0.12	-0.06	0.04	-0.05	0.06	-0.02	**0.38**	0.19	0.15	0.27	0.24	-0.11	**-0.13**	0.10
t-statistic	0.42	**-1.73***	0.15	-1.22	-0.43	-1.12	-0.34	-0.94	**2.15****	0.68	0.40	1.29	1.05	-1.61	**-1.74***	2.08
H. TD+3 period five years before change (September 1, 2012 - September 1, 2017)																
Average return	0.08	0.01	0.05	**-0.11**	-0.03	0.14	0.06	0.00	0.11	0.00	0.01	0.02	0.01	-0.01	0.06	**0.08**
t-statistic	0.03	-0.69	-0.30	**-1.99****	-1.16	0.67	-0.19	-0.79	0.29	-0.80	-0.76	-0.67	-0.72	-0.95	-0.25	**2.25****
I. Difference between TD+5 period five years before change and TD+3 period five years after change																
Difference	0.26	0.00	0.09	-0.18	-0.12	-0.10	-0.08	**-0.26**	0.31	0.08	0.10	**0.40**	**0.40**	-0.18	**-0.26**	0.07
t-statistic	1.25	-0.42	0.15	-1.59	-1.20	-1.11	-0.94	**-2.17****	1.58	0.07	0.19	**2.23****	**2.17****	-1.60	**-2.16****	1.18
J. Difference between TD+3 period five years before change and TD+2 period																
Difference	0.19	-0.03	0.08	0.08	-0.03	0.32	-0.02	0.21	0.02	-0.22	-0.04	0.13	0.04	0.26	0.12	-0.01
t-statistic	0.52	-0.06	0.23	0.23	-0.05	0.87	-0.03	0.57	0.06	-0.55	-0.09	0.36	0.11	0.71	0.34	-0.06

Appendix W. Pooled average daily returns and differences between different settlement cycle periods for the European group indices

This table presents pooled average daily returns of European group indices during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 3, 2000 - October 3, 2014)												
Average return	-0.09	0.04	0.04	**0.17**	0.07	**0.15**	**0.21**	0.11	0.02	-0.04	-0.04	-0.03
t-statistic	-0.61	0.81	0.83	**2.19****	1.15	**2.04****	**2.67*****	1.53	0.59	-0.07	-0.06	-1.30
B. TD+2 period (October 6, 2014 - December 29, 2017)												
Average return	0.13	**-0.21**	-0.07	0.27	-0.05	0.04	0.13	-0.06	-0.07	-0.14	0.04	0.06
t-statistic	0.43	**-1.68***	-0.81	1.25	-0.67	-0.17	0.40	-0.72	-0.84	-1.25	-0.14	1.34
C. Difference between TD+3 and TD+2 periods												
Difference	0.23	**-0.25**	-0.11	0.10	-0.12	-0.12	-0.08	-0.16	-0.09	-0.10	0.08	0.10
t-statistic	0.60	**-1.66***	-0.99	0.01	-1.02	-1.02	-0.84	-1.22	-0.91	-0.94	-0.08	1.61
Periods around changes												
D. TD+3 period five years before change (October 2, 2009 - October 3, 2014)												
Average return	-0.13	-0.08	0.14	0.05	0.05	0.02	**0.31**	-0.09	0.08	0.03	-0.03	0.02
t-statistic	-1.05	-0.69	0.84	0.18	0.20	0.01	**1.95***	-0.81	0.37	0.04	-0.34	0.54
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.26	-0.13	-0.21	0.22	-0.10	0.01	-0.18	0.04	-0.15	-0.17	0.07	0.04
t-statistic	1.00	-0.79	-1.14	0.80	-0.62	-0.13	-0.97	-0.01	-0.86	-0.94	0.12	0.64

Appendix X. Pooled average daily returns and differences between different settlement cycle periods for the European group indices

This table presents pooled average daily returns of S&P/ASX 200 and S&P/NZX 50 indices during different cycle periods, differences between different settlement cycle periods, and the corresponding t-values. Returns are in percentages and differences in percentage points. The day T is the last trading day of the month. In average returns, the t-statistic tests the hypothesis that the daily average return in a trading day is different from the other days. In differences, the t-statistic tests the hypothesis that the daily average returns are different from each other. *, ** and *** denote statistical difference at 10%, 5% and 1% levels, respectively. Statistically significant returns and differences are also bolded.

Trading day	T-5	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	T+5	Other days
Complete periods												
A. TD+3 period (January 3, 2001 - March 4, 2016)												
Average return	-0.02	0.09	**0.11**	**0.12**	0.08	**0.19**	0.07	**0.12**	-0.03	-0.03	-0.02	0.00
t-statistic	-0.27	1.59	**1.80***	**2.00****	1.31	**3.22*****	1.15	**2.06****	-0.45	-0.55	-0.41	0.03
B. TD+2 period (March 7, 2016 - December 29, 2017)												
Average return	0.13	0.06	-0.04	-0.04	0.24	0.11	0.11	0.08	**-0.28**	-0.01	**0.28**	0.05
t-statistic	0.66	0.08	-0.76	-0.77	1.54	0.48	0.44	0.20	**-2.74****	-0.56	**1.91***	1.50
C. Difference between TD+3 and TD+2 periods												
Difference	0.15	-0.03	-0.14	-0.16	0.16	-0.08	0.04	-0.04	**-0.25**	0.02	0.30	0.05
t-statistic	0.54	-0.48	-1.12	-1.20	0.61	-0.76	-0.08	-0.55	**-1.72***	-0.20	1.44	1.01
Periods around changes												
D. TD+3 period five years before change (March 4, 2011 - March 4, 2016)												
Average return	0.06	0.13	0.10	**0.23**	0.02	**0.20**	0.04	0.00	-0.10	0.03	-0.02	0.01
t-statistic	0.47	1.32	0.99	**2.43****	0.03	**2.06****	0.25	-0.18	-1.28	0.13	-0.34	0.54
E. Difference between TD+3 period five years before change and TD+2 period												
Difference	0.08	-0.07	-0.14	**-0.27**	0.22	-0.09	0.07	0.08	-0.18	-0.04	0.30	0.04
t-statistic	0.22	-0.66	-1.09	**-1.88***	1.10	-0.77	0.19	0.24	-1.30	-0.48	1.57	0.79