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Cost averaging investment strategy in the context of calendar effects

Cost averaging sijoitusstrategia kalenteri anomalioiden yhteydessä

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Tässä kandidaatintutkielmassa tutkittiin cost averaging sijoitustrategian menestystä kahdeksalla eri helsingin pörssin indeksillä vuosien 2009 – 2018 välillä. Tarkastelu jaettiin koko periodin ajalle sekä viiteen lyhyempään segmenttiin. Kyseiseen strategiaan yhdistettiin olettamus viikonpäiväilmiön olemassaolosta ja täten strategian menestystä tarkasteltiin jokaisen viikonpäivän osin. Aiemman kirjallisuuden perusteella viikonpäiväilmiö on toimiala- ja markkinakohtainen ilmiö, joten tarkasteluun valikoitui eri toimialojen indeksejä. Cost averaging sijoitusstrategian menestystä verrattiin myös osta-ja-pidä strategian suoriutumiseen. Maanantai oli yleisesti huonoin päivä ostaa kyseisten indeksien asetteja. Tiistai ja perjantai valikoitui useimpien indeksien parhaimmiksi päiviksi asettien ostoon. Useiden valittujen indeksien hinnoittelu käyttäytyi samoin, johtuen korkeasta korrelaatiosta keskenään ja indeksien sisältävän samoja instrumentteja. Toimialakohtaisia eroja oli kuitenkin havaittavissa. Osta-ja-pidä strategia dominoi pääosin cost averaging strategiaa jokaisella segmentillä paitsi 2011 – 2013 välin segmenttiä, jolloin markkinat kohtasivat laskun. Työn kirjallisuuskatsaus keskittyi tutkimaan syitä, miksi sijoittaja valitsisi cost averaging -, osta-ja-pidä strategian ylitse. Syitä tähän ovat muunmuassa sijoittajan riskin kaihtaminen ja prospektiteorian mukainen häviöiden sekä voittojen eriävä arvostaminen. Ei-rationaaliset investoijat voivat lisäksi hyötyä cost averaging strategian luomista säännöistä vähentääkseen tunneperäistä tuskaansa sijoitusten epäonnistuessa.

ABSTRACT

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This bachelor's thesis researched cost average investment strategy's success on eight different indexes on Helsinki stock exchange during the years of 2009 – 2018. Examination was done on the whole time period and on five smaller time segments. This strategy was combined with the assumption of a day-of-the-week effects existence and thus, the success of the strategy was examined for each day of the week. Earlier literature suggested day-of-the-week effect to be industry and market specific phenomenon. Therefore, indexes from multiple industries were chosen. The success of cost averaging and lump-sum investment were mutually compared. Monday was generally the worst day for asset acquisitions. Tuesday and Friday were the best day for acquisitions. Many of the chosen indexes pricing behaved the same, caused by high correlation and the indexes having partly the same instruments. Industry based differences were still noticeable. Mostly lump-sum investing dominated cost averaging strategy, exception being the 2011 – 2013 segment, where market faced a fall. Literature review focused on searching the reasoning, why the investor would choose cost averaging over lump-sum investing. Earlier literature suggested that risk aversion and prospect theory's explanation for investors subjective valuation toward capital gains and losses can be one of the reasons. Irrational investors can benefit from the strict investment rules that cost averaging strategy creates to ease the emotional pain, that can be caused by the capital losses.

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1. Introduction

Investors seek methods for lowering their investment portfolios risk in various ways. To name a few, these diversification methods can be portfolio size (Elton and Gruber, 1977), international diversification (Todorov, 2017) or even time-based (Bennyhoff, 2009). Diversification aims to combine investments which performance are unlikely to move in the same direction. According to Elton and Gruber diversification is the relationship between the number of different assets and the portfolio's risk. In this bachelor's thesis, we will be taking a closer look on cost averaging (CA), also known as dollar-cost averaging. Brennan, Li and Torous (2005) claim CA is one of the commonly used timing diversification strategies.

Over the decades, mixed results have been published about the rationality and even the profitability of cost averaging. Lump sum (LS) investing has been dominating CA over most of the studies. Still there are researchers who support CA strategy. Grable and Chatterjee (2015) found CA to significantly outperform LS on bear market and Brennan, Li and Torous (2005) stated CA to be superior choice for risk averse investors. CA is still persistently holding its head high among other arguably better strategies. Therefore, one of the topics observed is behavioral aspects and reasoning why investors are attracted to CA. This thesis will not take a stand which strategy is better, but there will be a comparison among these two strategies in a form of pros and cons list. LS investing will also be used as a benchmark when estimating CA's performance. This comparison is based on applications of these two strategies based on real life data from Helsinki stock exchange (HSE).

Calendar anomalies will be introduced in the context of cost averaging strategy for seeing if you can increase your accumulated number of shares by centralizing your acquisitions on a certain weekday. This phenomenon is known as day-of-the-week effect (DOW). Earlier studies show that there have been lower returns on the start of the week compared to the end of the week (Philpot and Peterson, 2011), (Cai, Li and Qi, 2006). This is also called the weekend effect or the Monday effect. Some reports even indicate lower returns on Wednesdays. Later studies prove DOW effect to be country, market and even industry specific phenomenon instead of a global effect

(Högholm, Knif and Pynnönen, 2011). Thus, mixed results of the same kind are expected of HSE.

Main research question is the following:

Are there benefits to allocate your CA-acquisitions into a certain weekday in HSE?

Sub questions are the following:

1. *Were there any differences in number of shares accumulated among weekdays in HSE during the years 2009 – 2018 using CA investment strategy?*
2. *Were there any differences in accumulated number of shares among industries in HSE during the years 2009 – 2018 using CA investment strategy?*
3. *Can you exploit DOW effect in Helsinki stock exchange while using CA investment strategy?*

This gives us an incentive to contemplate day-of-the-week effect and cost averaging strategy together. Cost averaging strategy will be created, and that strategy will be tested on empiric data from HSE. Multiple industries will be observed and the differences in weekdays and industries will be compared via variances and accumulated shares. Shock test analysis will also take part to test the robustness of these results.

The main research question seeks to see if there are any benefits to implement DOW effect into CA-strategy. In this thesis, benefits are measured in number of shares accumulated with the chosen strategies. The sub questions aim to deepen our understanding of are there any differences among industries, weekdays and is the DOW effect lingering in HSE?

Empiric data used on this thesis will be only from Helsinki stock exchange. Since DOW can be somewhat market specific (Högholm et al., 2011), the results are not valid to other markets. Also, this thesis is made in retrospect point of a view, thus regression analysis or other methods are not used to prove statistical significance of calendar effect. Instead, the focus is rear-view examination on what would have happened, if you invested with this strategy during 2009 - 2018.

This thesis will consist of literature review, empiric part and lastly discussion on the results. Literature review includes researched views on CA strategy, its characteristics and limitations. Some of the most common financial behavioral theories will be examined, that factor into investors probability to end up choosing CA over other investment strategies. Efficient markets theory and its different levels are briefly gone through to understand calendar effects better. Most common effects are listed and briefly explained, since there has been proven to be some overlapping of these effects. Focus is going to be on the day-of-the-week effect. Closer presentation of the data used and how it has been processed for examination, will be introduced in chapter three. Empiric part consists of application of CA and LS investment strategy, sensitivity analysis and performance comparison of these two strategies.

2. Literature review

In this chapter, the essential theories and their framework will be introduced. CA strategy is heavily debated over the years and it has many behavioral aspects. Thus, this thesis goes over studies that are showcasing these linkages. Calendar effects and other consistent pricing irregularities, also known as anomalies, should not exist according to the commonly accepted theories like Fama's efficient market hypothesis. Thus, efficient market hypothesis and the possible explanations for DOW effect will be observed. At the end of this chapter past empirical studies about the DOW effect, especially in Finland will be introduced.

2.1 Cost averaging

Cost averaging (CA) is an investment strategy, where the investor allocates his investment capital into equal sums and invests them into assets, at regular intervals. Assets invested in, can be stocks, funds, or any asset in the stock market generally. As an investment strategy, CA aims to ensure that more shares are bought when prices are low and less when the prices are high. (Bierman and Hass, 2004) Richardson and Bagamery (2011) condensed the benefits of this strategy to avoiding investing large sums of capital at the market top. William, Kenneth and Holland (2010) emphasized how CA could result in lower returns if the assets face higher returns in the start of the

accumulation progress and lower returns towards the end. Grable and Chatterjee (2015) described CA as an investment strategy where investor creates an investment strategy to face the market's volatility and to be a rational approach to disciplined investing. Also, they gave this method great value for the investors who have behavioral bias of regret and for the investors who have less tolerance for financial risk.

Richardson and Bagamery (2011) stated in their paper that the majority of studies show that LS investing is far superior in earnings compared to CA. They justified the usage of CA strategy by taking in consideration the investors, who do not have large sums of money to invest and the investors who are investing periodically to a retirement fund. The most commonly recommended strategy for those investors has been CA. Grable and Chatterjee (2015) expressed how CA provides a way to outperform a downward trending market and even if a cyclical rising market occurs, the opportunity cost is not too high. They found results where investor could have made 1.3% more profit during down trending market back in 2010. Also, they had to advise of using LS strategy when facing a up trending market. Predicting such market is not an easy task, so they claimed CA to fit risk averse investor's needs.

For an example, in Table 1 below, we have data from "NoHo Partners Oyj" stock course. Company operates in HSE and the data is taken from Nasdaq Nordic (2019). Time period of this data is from January 2018 to January 2019. Company's daily volatility is 2.47% and annual volatility is around 15.70%. The closing prices of the first trading day of the month are used as a price of the stock. This simplification gives us some understanding why CA might be beneficial to use and how it works. A closer look will be taken how CA can out- or underperform LS investment strategy.

This table's purpose is to give simplified example of how CA and LS performed when invested on a singular stock. Time period chosen for this is January 2018 – January 2019. These results should be interpreted with caution, since sums invested with LS are not converted to present value.

Table 1. Cost averaging versus lump sum investing

Date	Closing price	No. of shares bought with CA	No. of shares bought with LS, if invested the whole 6500€ in this day
1.1.2019	8.64	57.8704	752.3148
1.12.2018	8.24	60.6796	788.8350
1.11.2018	7.88	63.4518	824.8731
1.10.2018	8.84	56.5611	735.2941
1.9.2018	10.65	46.9484	610.3286
1.8.2018	10.60	47.1698	613.2075
1.7.2018	10.60	43.1034	560.3448
1.6.2018	10.60	43.1034	560.3448
1.5.2018	12.10	41.3223	537.1901
1.4.2018	11.00	45.4545	590.9091
1.3.2018	10.60	47.1698	613.2075
1.2.2018	8.18	61.1247	794.6210
1.1.2018	9.20	54.3478	706.5217
Total number of shares accumulated with CA		668,3071	

On this example, the chosen amount of capital is 6500€ and we measure success by the accumulated number of shares. In this case cost averaging strategy buys stocks for 500€ a month. The number of shares bought each month, are displayed in the column “No. of shares bought with CA”. Column “No. of shares bought with LS...” showcases how many stocks investor would have accumulated if they chose to invest the whole 6500€ in that specific day.

The lowest price CA paid was 7.88€ per stock and the highest value at 12.10€. Average buying price for the CA strategy was 9.73€ per stock. CA’s average price per stock managed to outperform LS in seven of the thirteen months included in this examination. To be noted, the difference of CA’s average price and the lowest possible price found on this data is 1.85€. The best outcome for LS investor would have been 824.9 stocks with the price of 7.88€ per stock and the worst outcome 537.2 stocks with the price of 12.10€ per stock.

As we can clearly see, if the stock is volatile it can be beneficial to divert your timing risk by using cost averaging strategy. The number of shares accumulated for CA is 668.3, which is higher than seven of the cases for LS investing strategy. In another hand, the best outcome of LS investment strategy was far superior in comparison with

824.9 stocks to 668.3. As always, one of the biggest issues for investor is timing. CA might not result in as high returns, but it is far from the worst outcome. Thus, it does well as a risk avoidance strategy.

Recent decades of literature and research clearly prove LS to be superior over CA. How is it justified to suggest CA over LS to investors? Cho and Kuvvet (2015) summarized LS versus CA talk with a conclusion. CA's expected return is lower, but so is the risk. Therefore, this strategy is a valid suggestion to risk-averse investors.

2.2 Behavioral aspect of Cost averaging

As mentioned before, there are plenty of reasons why investors choose CA strategy over LS. If the investor acts rationally and wants to maximize their returns from the stock market, then CA should not be the investor's choice. This phenomenon has been studied in the past and Statman (1995) offered a behavioral framework for the persistence of CA investment strategy. He described there to be four behavioral elements, that attracts investors to use this debated strategy. Those elements are prospect theory, aversion of regret, cognitive errors and self-control.

Portfolio theory assumes that all investors are rational, who are trying to maximize their utility. Investors have differing levels of relative risk aversion. Factors that affect risk aversion are income, wealth, age and the level of education. On an interesting note, investors risk aversion can be expected to decrease as the investor's wealth rises. (Riley and Chow, 1992) Risk aversion can be summarized as investors preference of lower-risk option, when there are investments with same expected return. Risk seeking is commonly known as preference for risk. For example, if faced with a decision of choosing guaranteed 5€, or 50% chance of getting 0€ or 10€ the risk seeking investor will choose the risk. Even though, the expected value is the same, risk seeking investor is willing to take more risk, for higher monetary gains. Risk seekers are more interested in capital gains than risk averse investors.

2.2.1 Prospect theory

Prospect theory was first introduced by Kahneman and Tversky in 1979. This theory aimed to give better explanation of how investors really behave in the market, when faced with uncertainty or risk. Before prospect theory, the dominant theory was expected utility. Different from expected utility's theory, investors are assumed to have heuristic characteristics in their decision making. According to Kahneman and Tversky, people behave differently towards potential gains or losses. Investors give more emotional weight towards losses than equal amount of capital gains. The decision-making is portrayed as a two staged process and it is being bound to the investor's situation. The two phases are called editing phase and the evaluation phase. On editing phase, the options are organized according to certain heuristics, so that the decision making would be easier. On evaluation phase, the investor estimates the outcomes by personal preferences. This can be seen on Figure 2. Prospect function, where investors risk-aversion manifests as a concave utility function. On the other hand, choices that lead into capital losses manifest as convex utility function. Thus, the prospect function being asymmetrical and is as a S-shaped utility function.

Statman (1995) claims that a standard investor follows expected utility theory, where the investor evaluates their choices in total wealth. Behavioral investors who follow prospect theory, evaluate their choices by losses and gains. According to Statman standard investors are always risk averse, but people who follow prospect function have higher subjective sense of utility loss. They also evaluate objective loss more than objective gains.

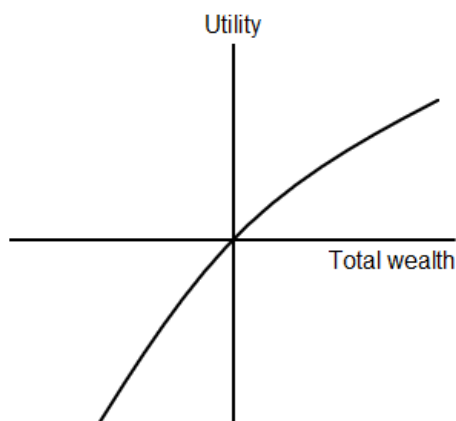


Figure 1. Risk averse investor's standard utility function

In Figure 1 we can see standard utility function, here the investor is risk-averse. This appears as the function being slightly concave. Prospect theory's function is presented in Figure 2. When compared to standard utility function, we see the difference in evaluating losses clearly.

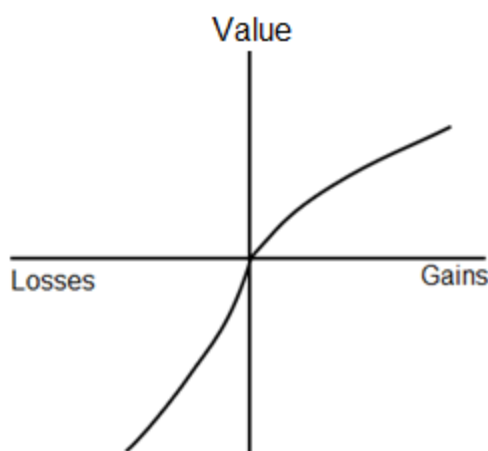


Figure 2. Prospect function

Dichtl and Drobetz (2011) endorse Statmans findings of prospect theory. They claim that LS investing leads to higher returns, when converting cash to stocks, but CA leads into higher prospect values. This is what makes CA strategy more appealing to behavioral investors. Dichtl and Drobetz also indicated in their simulations how CA's popularity should be weighted more in loss aversion and probability weighting, than prospect theories assumptions of investors subjective utility towards losses and gains.

2.2.2 Aversion to regret

Kahneman and Tversky (1979) wrote how investors disappointment in a bad investment result leads into frustration. Statman (1995) endorsed this theory. For an example, when there are two following outcomes: Investment of 100€ that leads into 150€ value at the end of the timeframe, or the same investment can also lead into 70€ outcome. The possible monetary gain is 50€ or possible the loss is 30€. He claims that the monetary gain or loss are not all that will affect the investors choice. Instead we should include feelings like pride and regret. In Statman's framework standard investors do not "suffer" from pride or regret in their investment decisions, but behavioral investors do. The pain and regret of losing cannot be significantly higher than the joy and pride of succeeding, because otherwise the investor would convert their stocks into cash. Thus, it is assumed that behavioral investors follow Kahneman's and Tversky's prospect theory's utility function and standard investors follow normal risk-averse utility function.

Kahneman and Tversky introduced link between regret and responsibility. They found out that choices that are made under small levels of responsibility lead into small levels of regret. Brennan, Li and Torous (2005) also supported this theory. Mengarelli, Moretti, Faralla, Vindras and Sirigu (2014) researched investors level of risk-seeking and loss aversion. They came into a conclusion that people are more likely to avoid regret over guilt. Mengarelli et al. reported how investors are more rational when they are investing on behalf of other people, instead for themselves. The decisions are viewed as less risky and the aversion for regret is lower.

Thus, a behavioral investor can reduce their level of emotional "pain" and reduce their level of feeling responsibility by following an investment rule or strategy as CA. Strict rules for investing can be beneficial for investors whom are identified as behavioral investors, investing for themselves or need strict investing rules to lower their feeling of responsibility.

2.2.3 Lack of self-control and cognitive errors

Statman (1995) notes how following an investment rule as CA gives more benefits, than just the reduction of responsibility. Constantinides (1979) explains how it can be hard to keep buying stocks, even when the market is trending downward. This is where the investor might need courage or relief of responsibility to make those decisions. Buying stock even in a downtrend will lower the investors average cost, even though it can be concerning or even frightening.

Investors who follow CA strategy should know to keep buying on down trending market. Especially if the market rises, more acquisitions on lower prices should lead to higher earnings. Why is it hard to follow the investment rule or strategy? Statman continued to explain investors cognitive errors by tendency to extrapolate recent trends to the future. Example of this is, when there is an equal change of up- or downtrend. If uptrend occurs multiple times in a row, investor is wrongly expecting equal outcome again. Naturally this works the other way around. If the negative outcome occurs multiple times in a row, behavioral investor is in a danger to abandon their chosen strategy.

2.2.4 Behavioral explanations for the day-of-the-week effect

DOW effect has been studied for decades. The cause for it is yet to be discovered. Many hypotheses have been introduced, but none has taken public consensus. Some have suggested that the settlement procedure for transactions is the cause, but when such factor has been taken into count, it has not eliminated DOW effect. Thus, the focus for more recent study has focused on behavioral factors and information effects. Rystrom and Benson (1989)

Dyl and Maberly (1988) focused on information effects to explain lower Monday returns. According to their study unfavorable information is not evenly spread along the week, but on the other hand there is no evidence for favorable information distribution. Dyl and Maberly noted how unfavorable news are usually released during the weekend, which automatically leads to negative response to the stock pricing on Monday. They also pointed out how information flow is the function of calendar time. Where, the

stock exchange is obviously closed for longer times over the weekend than overnight. So, there is more time for bad information flow.

Information flow clearly effects stocks returns. Since cyclical industries profits usually go along with trade cycle, it is only natural to think that macroeconomic oriented information flows have clear effect on their pricing. This was confirmed by Pettengill in 2003. He noted how macroeconomic news had even stronger impact on DOW effect than firm related news.

One common explanation for DOW effect is investors mood patterns. Zilca (2017a) note how research in psychology shows, that lower mood leads to more prudent – and risk averse behavior. Zilca describes “low mood” on Mondays as investor’s week’s “low-point”, where the mood progressively rises towards the weekend. Martikainen and Puttonen (1996) also wrote how investor’s optimism rises towards the end of the week. Abraham and Ikenberry (1994) report how investors feel more pressure to sell stocks on Monday, which lowers the returns. One reason for this is investor’s need to fulfill liquidity needs. Pettengil (1993) found similar results and he also stated how investors prefer to take higher risks towards the end of the week and lower risks right after the weekend. Pettengil also found out how similar investors react differently when exposed to same kind of information flow, thus we can reason that investors who follow these suggested mood patterns partly induce to DOW effect.

Individual investors association with DOW effect has been studied in the past. According to Lakonishok and Maberly (1990) individual investors do the most transactions during Monday. Individual investors seem to increase sell options related to buy options on Monday. This is one possible explanation for Monday’s low returns. Interestingly institutional investors trade the least during Monday. Pettengill (2003) opposes individual investors inducement of DOW. He claims that institutional investors use Monday as strategic planning day and try to exploit DOW effect as much as possible. He even states how institutional investors might even uphold this effect.

One commonly approved hypothesis for DOW effect was introduced by Millers (1988). He proposed that investors self-initiated sell offers overthrow the buy offers during the weekend. As a result, the market falls slightly on Monday. During the week broker

initiated buy offers keep the buy offers just above the sell offers, which leads to higher returns for rest of the week. This scale changes slowly towards end of the week, where the buy offers weigh-in higher.

2.3 Efficient market hypothesis

To understand calendar effects, one must understand the efficient market hypothesis framework. Malkiel (2003) portrayed efficient market hypothesis as markets ability to efficiently adapt to new information and almost instantly to incorporate it to stock pricing. This should eliminate investors chance of achieving greater returns by using methods like technical or fundamental analysis. Mishkin and Eakins (2012, pp. 119-120, 570) defined efficient market hypothesis by financial market's ability to reflect all available information. They represented this by using arbitrageurs, who try to take advantage of market's unexploited opportunities, which moves market almost instantly back to equilibrium by quickly removing all the arbitrage opportunities.

Fama (1970) described three levels of market efficiency, which are weak, semi strong and strong form. On the weak level, information is only in the form of historical data and prices, which are reviewed and discussed by the investors. On semi strong level the asset pricing has included other data and information that has been published and available for all investors. Lastly, strong form which has all the public and private information reflected to the assets pricing.

Malkiel (2003) proceeds to claim that fully efficient markets do not exist, since some investors are far from rational, thus mistakes in the financial markets will be made. This will result to pricing irregularities from which some are even predictable. Such pricing irregularities can surface as calendar effects or anomalies.

2.4 Calendar effects

Calendar effects have been studied broadly over the decades. Some of these calendar effects are disputed and there seem to be differing research results, depending on the

market and the industry. Philpot and Peterson (2011) described calendar effects as a persistent and systematic inefficiencies in market pricing, also known as market anomalies. Calendar effects are problematic for efficient market hypothesis, since according to Fama's (1970) theory, there should not be known consistent pricing inefficiencies.

Anuradha and Rajendran (2014) noted how there is empiric evidence on following calendar effects: January-, turn-of-the-month-, Halloween-, holiday- and the weekend effect. Anuradha and Rajendran also point out how these effects seem distinct. However, many of these effects share trading days, thus they might be interrelated.

Are there other calendar specific anomalies that investors can exploit for extra returns more frequently? Narayan, Narayan, Popp and Ahmed (2015) noted how branch of financial literature shows eminent evidence how market returns are dependent on the weekday, this phenomenon is called DOW effect.

2.5 Day-of-the-week effect

DOW effect refers to phenomenon, where asset returns have systematic disparities among the weekdays. For most markets the day for lower returns is Monday and the day for higher returns is Friday. (Philpot and Peterson, 2011) Therefore, DOW effect is also known as the weekend effect. These return patters can manifest in various assets, like cash and derivatives (Martikainen and Puttonen, 1996), stocks (Cai, Li, and Qi, 2006), currency (Thatcher and Blenman, 2001) and interestingly even in the price of gold (Ma, 1986).

DOW effect is not as unambiguous as one could imagine. Martikainen and Puttonen (1996) reported different lower return days for different countries, where the most common were Monday and Tuesday. They speculated the reasoning for this to be investors more pessimistic view on Mondays and rising optimism towards end of the week. Cross (1973) discovered that in U.S. on S&P-index Monday returns were the most likely to be negative and significantly lower than the other days of the week. Jaffe and Westerfield (1985) support Cross's findings in U.S. and United-Kingdom but find differing results in Australia and Japan, where the day for negative returns was Tuesday.

The Chinese stock market is following the same kind of pattern, where the significantly lower return days seem to be Monday and Tuesday (Cai, Li and Qi, 2006).

Högholm, Knif and Pynnönen (2011) studied DOW effect among EU equity markets. They found out that this effect is not a global effect, but it is country specific and even more, industry specific. Stavárek's and Heryán's (2012) results support this hypothesis, since they did not find consistent DOW effects in the Central European countries during the start of the 2000's.

If markets are working efficiently as Fama (1970) stated and all arbitrages should disappear almost instantly as others will try to take advantage of them as they are discovered. How is it possible that DOW effect still lingers around? This was researched in Dicle's and Levendisses paper in 2014, they claimed, that DOW effect had partly disappeared in developed markets and is currently disappearing in emerging markets. Zilca (2017) reported DOW effect been fading in the past 18 years, but not disappearing. Philpot and Peterson (2011) give new hope for Fama's weak-form hypothesis as they explain the disappearance of DOW effect by investors increasing attention to published patterns and the constantly growing amount of data.

2.5.1 Day-of-the-week effect in Helsinki stock exchange

As mentioned DOW effects patterns and its existence seems to be bound to market and industry. Högholm and Knif (2009) studied DOW effect in HSE pre-euro and post-euro period. They support the hypothesis that post-euro era's weekly volatility patterns manifest stronger at the industry level, rather than market level.

Högholm et al. (2011) reported interesting results from HSE from period January 2000 to December 2006. They indicate higher returns for Wednesdays and Thursdays. Interestingly they also state HSE to have especially low returns on Friday. This opposes the general hypothesis, where returns should be higher on Fridays and lower on Mondays. Interestingly derivative markets showed negative returns in Tuesday in HSE, which is common to small European markets. Also, negative Monday returns were reported in futures and options market. (Martikainen and Puttonen, 1996)

Dicle and Levendis (2014) performed a large study on international data from 2000 to 2007. They used data from 33 countries, including Finland. Results indicate that all of countries included had DOW effects. In their study HSE had lowest returns (open-to-close) on Mondays and highest returns in Friday. Similar results about HSE were found by Boubaker, Essaddam, Nguyen and Saadi (2017), though to be noted they also question the whole existence of DOW effect.

There is relatively little research done about the DOW effect in HSE specifically, but the small amount of existing research seems to endorse the effect's existence. According to Boubaker et al. results seem to vary depending on the time frame observed and the industry. Naturally singular stocks can have more volatility compared to indexes. Thus, these anomalies can stand out or behave very differently comparing to indexes.

These findings are somewhat mixed. Some state HSE has higher returns on Friday and some the opposite. Start of the week seems to have similar results, which are expected lower returns. Lower returns indicate lower asset prices. For an example, if the asset has average negative returns on Monday, the asset is has dropped in price on average on that day. Thus, Monday or Tuesday is expected to be the best days for acquisitions.

3. Data and methodology

To test CA investment strategy with DOW implementations, we are using daily index or stock data from Helsinki stock exchange. All the data is collected from Nasdaq Nordic. These data samples cover the period from January 2, 2009 to December 28, 2018. Assets closing prices are used as measurement. Closing price might not reflect the real buying prices of the asset, since the prices usually fluctuate during the day. Closing prices are commonly used in financial literature (Richardson and Bagamery, 2011; Cai, Li and Qi, 2006), thus same variables are used in this thesis. Since CA strategy follows a strict rule of investing same amount each time, we are not including return from dividends to our examination. Thus, price index is chosen over the growth index. This thesis aims to resolve what amount of stocks the investor can buy on the chosen time periods. The measurement of the success of this strategy is accumulated number

of shares instead of overall returns. Therefore, ignoring dividends is somewhat justified.

In financial literature asset returns are usually used over asset prices. Asset returns give scale-free data which has more descriptive characteristics. Most commonly used form of returns are continuously compounded returns. One of the reasons for this is them being more tractable. Secondly when usage of continuously compounded returns, multi-period returns can be calculated by summing the one-period returns. (Tsay 2005, pp. 2-5) Continuously compounded returns are used in Table 6, but rest of the results use asset prices over returns.

3.1 Used data

Indexes chosen are the following: OMX Helsinki cap PI, OMX Helsinki financials PI, OMX Helsinki industrials PI, OMX Helsinki media PI, OMX Helsinki real estate PI, OMX Helsinki consumer goods and OMX Helsinki consumer services. OMX Helsinki cap PI (HSE cap) is chosen to test the markets overall performance with chosen investment strategy. Seven of the indexes are representing a singular industry to test them as individuals.

HSE cap showcases stock price index of all listed companies. Also, the “cap” indicates that weight of one stock can be only 10%. This gives us better data of how the whole market is doing, when the price fluctuation of bigger companies cannot influence the whole index as much. As in 2019 there are 134 companies included into Helsinki cap PI index, but to be noted, this number has changed over the years when companies have been listed or removed from the marketplace.

Table 2. Number of instruments in certain index

Index	Number of instruments
Helsinki Cap	134
Financial	19
Industrial	41
Media	5

Real Estate	5
Health care	8
Consumer services	14
Consumer goods	16

In the Table 2 we can see the number of instruments (companies included) in the chosen industry indexes. Of the chosen industry indexes, industrial has the most instruments (30.5% compared to HSE cap). Thus, it is expected that it correlates with HSE Cap the closest. Financial, consumer services and consumer goods fall into the mid-section of the chosen indexes. Where financial has 19 (14.2%) instruments, consumer services 14 (10.4%) and consumer goods 16 (11.9%). The remaining three industries are media (3.7%), real estate (3,7%) and health care (5.9%). They have the least number of instruments included in them. Therefore, it can be expected them not to correlate with HSE cap as closely since singular instrument can have significant impacts on the whole index.

Correlations of the indexes are listed on the Table 3 below. As expected, industrial seems to correlate with HSE cap the closest (0.9506). All the indexes correlate with HSE cap somewhat closely except media (-0.2115) and consumer services (0,3189). Interestingly those two correlates strongly with each other (0.8398). This is explained by consumer services including the same instruments as media. Overall it seems that all the indexes have a high correlation coefficient among each other's when excluding consumer services and media.

Table 3. Correlation of the indexes

	Helsinki Cap PI	Financial	Industrial	Media	Real Estate	Health Care	Consumer Services	Consumer Goods
Helsinki Cap PI	1							
Financial	0.9029	1						
Industrial	0.9506	0.931	1					
Media	-0.2115	-0.5535	-0.3592	1				
Real Estate	0.6746	0.7365	0.7145	-0.2188	1			
Health Care	0.8262	0.8495	0.8511	-0.3819	0.5278	1		
Consumer Services	0.3189	-0.0632	0.1554	0.8398	0.1122	0.0763	1	
Consumer Goods	0.8491	0.8891	0.9464	-0.4485	0.7037	0.7715	0.0197	1

When interpreting correlation tables, the values vary from -1 to 1. Negative coefficient means that the indexes are correlating conversely, and positive coefficient indicates that the indexes are moving the same direction. When the correlation coefficient gets a value of 0.8 - 1 we can say that the correlation is extremely high. Values from 0.6 – 0.8 mean high and 0.4 – 0.6 reasonable. (Metsämuuronen, 2011, pp. 371)

3.2 Data characteristics

Statistical indicators of the data used are showcased in the Table 4 below. Data used for the descriptive statistics is on its raw form. Descriptive statistics included are number of observations, mean, standard deviation, minimum value, maximum value, kurtosis, skewness and Shapiro-Wilk test. Vaihekoski (2016) claims that kurtosis, skewness and Shapiro-Wilk are used to describe the distribution of the observations. Kurtosis and skewness tell us how the data used differs from normal distribution.

High kurtosis tells us that the data has more extreme outliers than normal distribution, also it might implicate that the distribution has heavy tails. Negative kurtosis implies there to be fewer extreme values, thus the distribution might have thin tails. Skewness tells us how asymmetric the distribution of the data is. Positive skewness tells that the distribution has a long tail in the left and negative skewness implies that the long tail is on the right side. Kurtosis for the data has high numbers for all the data except consumer goods (0.05), but skewness for that index is (0.82). All the indexes are getting relatively high coefficients for skewness, so it is natural that hypothesis for normal distribution for all indexes is rejected. Shapiro-Wilk test was chosen to further examine if the index data follows normal distribution.

Table 4. Descriptive statistics of the index data

	Observations	Mean	Std. Dev.	Min	Max	Kurtosis	Skewness	Shapiro-Wilk
Helsinki Cap PI	2511	4813.037	1168.963	2279.8	7139.68	0.9601	0.183303	47.180**
Financial	2511	1318.949	390.8677	395.36	1943.88	-1.31	0.245106	122.441**
Industrial	2511	1139.392	330.1023	373.47	1736.7	0.6344	0.183621	31.051**
Media	2511	706.2072	258.1605	309.88	1321.19	0.7307	0.478173	81.696**

Real Estate	2511	912.0404	110.4275	487.45	1177.22	1.3738	1.025787	92.210**
Health Care	2511	1306.77	486.1469	608.47	2826.48	0.3133	0.895501	117.344**
Consumer Services	2511	831.8	181.3649	555.41	1235.83	1.1246	0.428491	123.004**
Consumer Goods	2511	988.5292	228.4661	367.15	1338.39	0.0457	0.815113	105.094**

** indicates statistical significance at the 1% levels.

Graphs of index time series plots can be found in Figure 3 and 4 below. As the correlation coefficient indicated, financials and industrials are following Helsinki cap index closely. Helsinki cap, financials, industrials and consumer goods follow a steady up-trend with a few descents around the start of 2011, 2015 and the end of the inspection period. CA strategy is expected to give worse results in an up-trending market, compared to LS strategy. Therefore, the behavior of the other indexes might give us differing results.

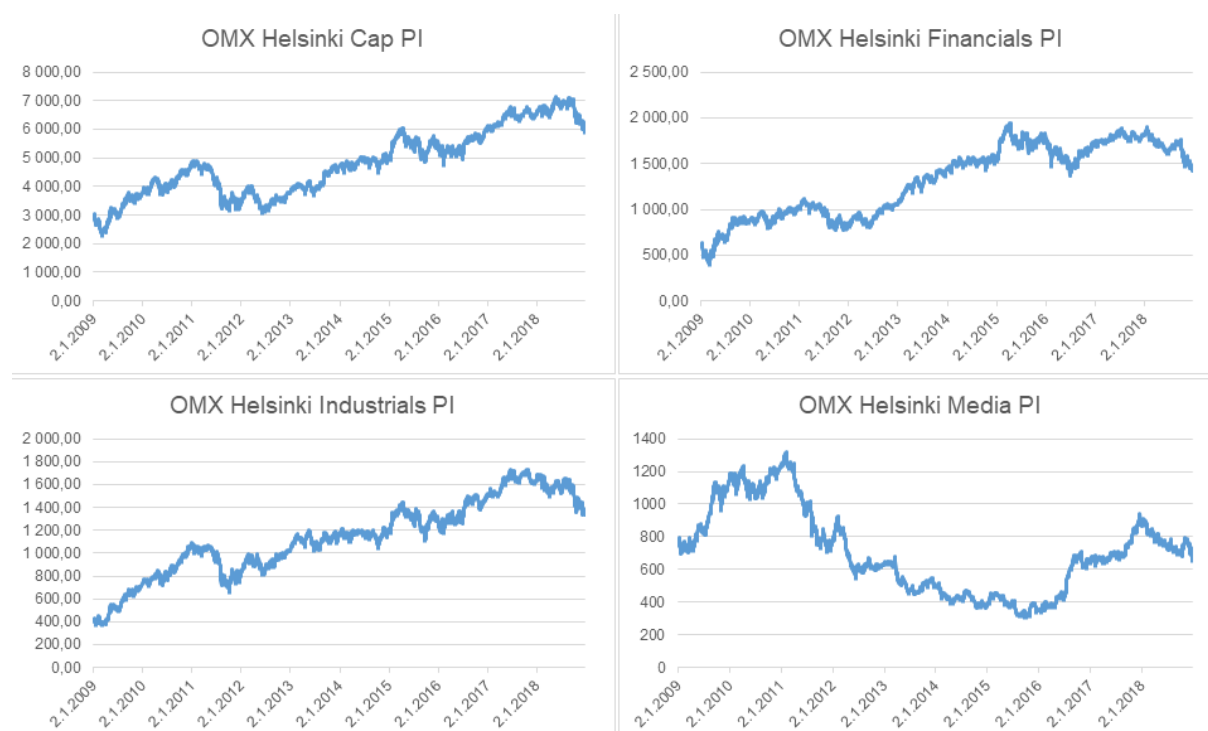


Figure 3. Time series graphs of the indexes of Helsinki cap, financials, industrials and media

Media - and consumer services index had a high correlation and they distinctly follow the same trend. These indexes went up till the start of 2011, which is followed by a

downtrend till the start of 2016. Down trending market is where CA can especially shine against LS. Thus, the results from 2011 to 2016 might give us a good insight how these strategies succeeded during this time. Even health care – and real estate indexes got somewhat high correlation coefficients with other indexes (excluding media and consumer services), on the grounds of graphs presented on Figure 3 Figure 4 they seem somewhat separated from the others.

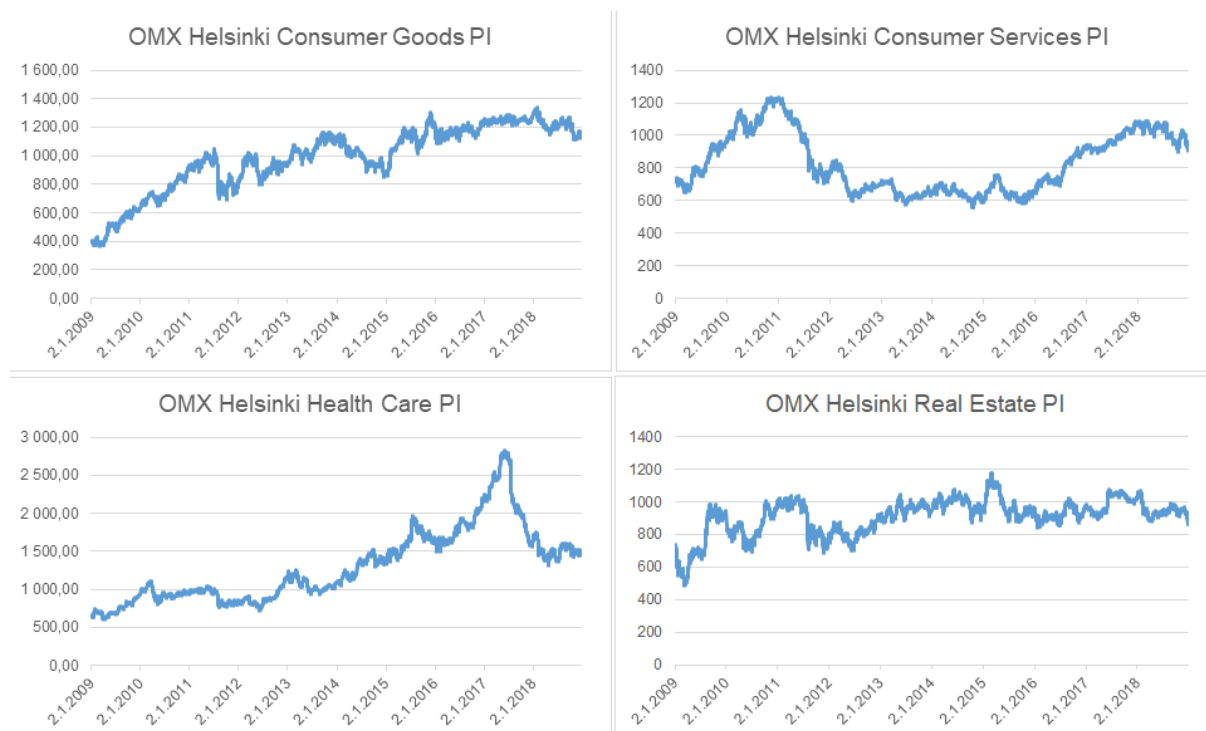


Figure 4. Time series graphs of the indexes of consumer goods, consumer services, health care and real estate

For further examination the index data has been linearly transformed towards lower values. Also, this modified data will be used on the investment strategy simulations. Data has been re-indexed, so the starting value of the time series is 1. Therefore, all of the indexes have been divided by the starting value of the index in question. These indexes cannot be bought as they are from the market, even though there might be similar assets that follow these indexes. Transformation of the price index makes the results more comparable and easier to interpret.

Standard deviation of the weekdays for all the indexes are presented in Table 5 below. As suspected from earlier findings Helsinki cap, financial and industrial follow same kind of behavior. Where the highest standard deviation values were on Wednesdays.

The lowest days for standard deviation are on Mondays in industrial and real estate. On Tuesdays in Helsinki cap and industrial, and on Fridays in financial, media, health care, consumer services and consumer goods. The highest standard deviation values are on Mondays in consumer goods, on Tuesdays in Media, real estate and consumer services and on Wednesdays in Helsinki cap, financial, industrial and health care. Surprisingly none of the highest or lowest values were on Thursday.

Table 5. Standard deviation of weekdays for the indexes on 2009 – 2018 period

Index	Monday	Tuesday	Wednesday	Thursday	Friday
Helsinki Cap PI	0.4002	0.4001	0.4017	0.4015	0.4011
Financial	0.6443	0.6458	0.6473	0.6442	0.6410
Industrial	0.8039	0.8039	0.8065	0.8062	0.8042
Media	0.3354	0.3364	0.3330	0.3311	0.3299
Real Estate	0.1514	0.1528	0.1524	0.1516	0.1493
Health Care	0.7544	0.7594	0.7613	0.7575	0.7528
Consumer Services	0.2520	0.2522	0.2509	0.2502	0.2501
Consumer Goods	0.5805	0.5796	0.5804	0.5790	0.5781

Table 6. Average daily and annualized daily returns for each day of the week on 2009 – 2018 period

Daily returns	Helsinki Cap PI	Financial	Industrial	Media
Monday	-0.0151 %	-0.0188 %	-0.0137 %	-0.0344 %
Tuesday	0.0112 %	-0.0168 %	0.0303 %	-0.0658 %
Wednesday	0.0845 %	0.1089 %	0.1112 %	0.0645 %
Thursday	0.0276 %	0.1160 %	0.0451 %	-0.0815 %
Friday	0.0342 %	-0.0209 %	0.0620 %	0.0942 %
Daily returns	Real Estate	Health Care	Consumer Ser- vices	Consumer Goods
Monday	-0.0345 %	0.0917 %	-0.0594 %	-0.0187 %
Tuesday	-0.0510 %	-0.0558 %	-0.0828 %	0.0100 %
Wednesday	0.0978 %	0.0517 %	0.0936 %	0.0770 %
Thursday	-0.0454 %	-0.0110 %	-0.0251 %	0.0308 %
Friday	0.0676 %	0.0906 %	0.1247 %	0.1138 %
Annual returns	Helsinki Cap PI	Financial	Industrial	Media
Monday	-0.7844 %	-0.9781 %	-0.7108 %	-1.7885 %
Tuesday	0.5798 %	-0.8719 %	1.5731 %	-3.4232 %
Wednesday	4.3950 %	5.6609 %	5.7811 %	3.3551 %
Thursday	1.4369 %	6.0311 %	2.3471 %	-4.2356 %
Friday	1.7764 %	-1.0852 %	3.2218 %	4.8970 %

Annual returns	Real Estate	Health Care	Consumer Ser- vices	Consumer Goods
Monday	-1.7959 %	4.7662 %	-3.0872 %	-0.9719 %
Tuesday	-2.6523 %	-2.8996 %	-4.3051 %	0.5178 %
Wednesday	5.0877 %	2.6876 %	4.8659 %	4.0049 %
Thursday	-2.3590 %	-0.5713 %	-1.3072 %	1.6009 %
Friday	3.5138 %	4.7096 %	6.4858 %	5.9193 %

Table 6 describes the daily and annual returns for each day of the week. This gives us some understanding if there are apparent return patterns in the assets included in the indexes. Results are achieved by using continuously compounded daily returns. These results seem to support the earlier research on Monday effects, by all of the indexes having a negative average returns on Mondays except health care. Also Friday seems to be a positive returns day for all the indexes apart from financials. Tuesday and Thursday seem to have industry specific results, but Wednesday had relatively high positive returns for all the indexes.

Positive average returns indicate that the asset price has risen on average on that weekday, on the 2009 – 2018 segment. Negative returns indicate the opposite. One of goals of CA strategy is to buy assets, when the prices are the lowest and avoid the peaks. Therefore, it is logical that days with negative average returns create a possibly lucrative day for acquisitions since the prices have gone down on average. High returns indicate that the prices have risen on average on that day, thus those days being bad days for acquisitions. This gives us reason to expect that Monday should be a valid day to do asset acquisitions in the CA strategy. Friday and Wednesday should be considered as a poor choice. Tuesday and Thursday might give us surprising results.

3.3 Cost averaging model

CA-investment strategy simulated in this thesis has a few limitations. Firstly, dividends are not included, so the results do not reflect the overall returns. This should be considered, especially when comparing the results with LS investment strategy. Secondly, for computing reasons the weekdays used on the strategy will always be the first weekday of that kind on that month. The Helsinki stock exchange is closed on weekends,

so only days from Monday to Friday are being tested. Thus, the results might be affected by the turn of the month effect. Thirdly, the comparison to LS investment strategy is somewhat biased, since transaction costs are not included in the calculations. This thesis aims to answer if there are benefits to allocate your CA-acquisitions into a certain weekday. Thus, LS strategy works as a mere comparison, to give approximate results of which strategy accumulated more assets. Other factor to keep in mind, this thesis does not include opportunity costs, which appears when investor “holds capital” and misses the profits from alternative options. To partly eliminate this factor, we assume that the CA-investor is a monthly saver. Lastly to be noted, data used in this thesis consist of indexes which cannot be bought as they are. There can be similar assets that follow those indexes, but these are not traded. The usage of indexes aims to make these results be more generalized on the industry studied.

Cost averaging strategy makes strict rules for the investor of what they should follow faithfully. To test DOW effect with CA strategy, each weekday must be tested separately. For example, if Mondays are being tested, this strategy invests 100€ on the first Monday of every month, assuming the stock market is open. For ten-year period the total number of investments is 120, for five years 60 and for three-year period the following number is 36. Following this rule, the total sum invested is bound to time. The ten-year period invests 12 000€, five-year period 6 000€ and the three-year period 3600€.

Helsinki stock exchange is closed on weekends and on holidays. Some of those holidays occur on workdays, thus the stock market can be closed in the middle of the week. This leads to uneven number of trading days on the same weekday. To keep the asset acquisition frequency as even as possible, the rule for the first trading day of the month of that certain weekday is chosen. To test robustness, five different time segments are chosen. Chosen periods are the whole 10-year period 2009 - 2018, two five-year periods 2009 – 2013 and 2014 – 2018 and three 3-year periods 2009 - 2011, 2011 – 2013 and 2016 - 2018.

LS investing strategy will be used as a benchmark, to somewhat measure the success of CA-strategy and to give a general idea on what kind of trends CA can outperform LS. Naturally money loses some of its value during the years, caused by inflation.

Therefore, the amount of money that LS strategy invests must be discounted to present value of the starting date of the segment being tested. To achieve this annual average inflation-% of Finland is used as the discount rate. These rates are displayed in Table 7 below. Data for inflation rates are taken from inflation-eu.

Table 7. Average annual inflation-% in Finland

Year	Annual average inflation-%
2018	1.08 %
2017	0.75 %
2016	0.36 %
2015	-0.21 %
2014	1.04 %
2013	1.48 %
2012	2.81 %
2011	3.42 %
2010	1.19 %
2009	0.01 %

Table 8 showcases the amount of money that is being invested with LS investment strategy on each segment. The amount of money invested with LS is more affected on 2010 – 2013 era, when the inflation-% is higher. For the 10-year segment inflation has eaten ~785€, on five-year segments ~79€ on 2014 – 2018 and ~208€ on 2009 – 2013. On three-year segments the inflation has eaten ~44€ on 2009 – 2011, ~159€ on 2011 – 2013 and ~29€ on 2016 – 2018. LS investment strategy invests the first day of the chosen segment.

Table 8. Present values being invested with LS

Segment	€ invested
2009 - 2018	11215.30
2014 - 2018	5921.44
2009 - 2013	5792.49
2009 - 2011	3556.58
2011 - 2013	3441.19
2016 - 2018	3571.78

4. Research results

In this part each of the indexes are examined separately and the comparison of CA and LS can be found at the end of this chapter. The highest value for each segment is highlighted green and the lowest value as red. Conclusions and possible guidelines are given on the last chapter of this thesis.

4.1 *OMX Helsinki Cap PI*

In Table 9 are the results from Helsinki cap PI index. For the 10-year period Tuesday was the best day to invest and Friday came as the second-best option. Notably, Monday was the worst day to purchase assets on every chosen time-segment. Even though, the results indicate that the number of accumulated shares even out among the weekdays towards the end of the chosen inspection period.

5-year segments show differing results for the best day. On the 2014 – 2018 segment the best day for asset acquisitions was Thursday with 3080,78 shares and the second-best option was Wednesday with 3078.78 shares. On this time period Friday came as the second-worse option. This differs greatly from the other 5-year segment 2009 – 2013. Where Friday was the second-best option and Tuesday being the best day.

In Table 9, differing results on which is the best day for your acquisitions on the three-year segments can be seen. For the 2009 – 2012 period, Tuesday seems to be the dominating day with 2859,60 shares and Friday coming as second-best choice. Wednesday and Thursday seem to have almost no difference among themselves. On the 2011 – 2013 segment Friday and Tuesday were the best days and on 2016 – 2018 segment, the best day was Thursday.

Surprisingly none of the highest or lowest days occurred in the middle of the week. Wednesday's values fall relatively far from the lowest, but still in some cases quite close to the highest value. It seems that for Helsinki Cap index, the days for highest number of shares is a bit random, but Tuesday and Friday seem to perform well on every chosen time-segment. Three reports for the highest number of shares were on Tuesday, two on Thursday and one on Friday.

If compared to the average returns in Table 6, we can see that Monday was the only weekday that had negative average returns for Helsinki cap. Tuesday had relative low positive returns compared to the remaining weekdays. It is expected that the increasing price of the assets rising towards to the end of the week is carried over to Monday, thus moderately low-price increase in Tuesdays creates a tempting day for asset acquisitions.

Table 9. Results from OMX Helsinki Cap price index

Helsinki Cap PI 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	7741.6946	7767.4069	7755.3989	7754.5536	7759.2115
Average number of shares per month	64.5141	64.7284	64.6283	64.6213	64.6601
Average price of one share	1.5500	1.5449	1.5473	1.5475	1.5465
Helsinki Cap PI 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	3072.2668	3077.6753	3078.7820	3080.7737	3074.5425
Average number of shares per month	51.2044	51.2946	51.3130	51.3462	51.2424
Average price of one share	1.9530	1.9495	1.9488	1.9476	1.9515
Helsinki Cap PI 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	4669.4278	4689.7316	4676.6168	4673.7799	4684.6690
Average number of shares per month	77.8238	78.1622	77.9436	77.8963	78.0778
Average price of one share	1.2850	1.2794	1.2830	1.2838	1.2808
Helsinki Cap PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2834.4482	2859.5953	2842.0236	2841.2094	2848.1697
Average number of shares per month	78.7347	79.4332	78.9451	78.9225	79.1158
Average price of one share	1.2701	1.2589	1.2667	1.2671	1.2640
Helsinki Cap PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2686.5889	2696.8214	2693.5068	2688.9950	2697.3120
Average number of shares per month	74.6275	74.9117	74.8196	74.6943	74.9253
Average price of one share	1.3400	1.3349	1.3365	1.3388	1.3347
Helsinki Cap PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	1707.3329	1711.6033	1717.0884	1720.7237	1717.0732
Average number of shares per month	47.4259	47.5445	47.6969	47.7979	47.6965
Average price of one share	2.1086	2.1033	2.0966	2.0921	2.0966

4.2 OMX Helsinki Industrials

Table 10 showcases the results from OMX Helsinki Industrials index. For the 10-year segment Tuesday was the best day with 4869.62 shares. Monday, Thursday and Friday had close results, but Monday still had the lowest number of accumulated shares.

Wednesday fall into the middle, with a decent margin between the lowest and the highest value.

Five-year segment on the 2014-2018 period results were more even compared to the ten-year segment. Monday is still the worst day, but surprisingly Friday came close as the worst day. There was almost no difference in Tuesday's, Wednesday's or Thursday's values. 2009 – 2013 segment had more apparent results. Thursday was the worst day with 3059.55 accumulated shares. with Monday coming close with value of 3060.51. Notably, Tuesday had the highest number of shares with significant margin of 17 shares compared to second highest weekday Wednesday.

Three-year segments give us interesting results. Monday did the worst on all the chosen segments. Tuesday was the dominating choice on 2009 – 2011 and 2011 – 2013 segments, but on the last segment the differences evened out and Thursday shifted to be the best day. For industrials the best day was Tuesday on four of six segments. Monday was the worst day in five out of the six segments and came close to be the worst day for all the chosen segments. Compared to the Helsinki cap index, Friday was not as good a choice. Friday was not the worst or the best day, but it came close as being the worse on many of the chosen segments.

Table 10. Results from OMX Industrials price index

OMX Industrials PI 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	4843.0919	4869.6159	4852.6536	4846.3049	4845.2799
Average number of shares per month	40.3591	40.5801	40.4388	40.3859	40.3773
Average price of one share	2.4778	2.4643	2.4729	2.4761	2.4766
OMX Industrials PI 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	1782.5803	1787.1192	1787.1632	1786.7521	1783.2887
Average number of shares per month	29.7097	29.7853	29.7861	29.7792	29.7215
Average price of one share	3.3659	3.3574	3.3573	3.3580	3.3646
OMX Industrials PI 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	3060.5116	3082.4967	3065.4904	3059.5528	3061.9913
Average number of shares per month	51.0085	51.3749	51.0915	50.9925	51.0332
Average price of one share	1.9605	1.9465	1.9573	1.9611	1.9595
OMX Industrials PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2082.6258	2104.7329	2085.5681	2083.7908	2085.6158
Average number of shares per month	57.8507	58.4648	57.9324	57.8831	57.9338

Average price of one share	1.7286	1.7104	1.7261	1.7276	1.7261
OMX Industrials PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	1513.2110	1525.3834	1521.0025	1514.8181	1517.6319
Average number of shares per month	42.0336	42.3718	42.2501	42.0783	42.1564
Average price of one share	2.3790	2.3601	2.3669	2.3765	2.3721
OMX Industrials PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	979.8129	983.2337	985.2556	985.9329	984.9531
Average number of shares per month	27.2170	27.3120	27.3682	27.3870	27.3598
Average price of one share	3.6742	3.6614	3.6539	3.6514	3.6550

The results can be partly explained by the average returns, which are shown in Table 6. Industrial index followed closely to Helsinki cap, but the main difference in returns is on Fridays. On Fridays the average returns were relatively higher, what makes it an unappealing day for asset acquisitions. Also, Industrials followed Helsinki cap in that sense, that the index is up-trending towards the end of the week. Having no negative average returns for any of the days except Monday and again, Tuesday having the lowest average returns.

4.3 OMX Helsinki financials

Financial index shows us more apparent results, seen on Table 11. On the 10-year segment, again, Monday was the worst day with 6161.22 shares. Wednesday and Thursday had similar results, with difference of 1 share. Tuesday and Friday seemed to be the best days for asset acquisitions. Although Table 6 tells us that financials had negative average returns on Monday, Tuesday and Friday. Three negative average return days in a row (Friday, Monday and Tuesday) may lead into a tempting day for acquisitions on Tuesday. Friday's results are possibly explained by the day having eminently lower returns than Monday or Tuesday. This breaks the hypothesis that investors became more optimistic towards end of the week.

On the later five-year segment 2014 - 2018, the results have evened out. Again, Monday being the worst – and Tuesday the best day. On the earlier five-year segment 2009 - 2013, the results are way more apparent. Monday following the same “bad-day” pattern and Friday being the best by a quite prominent margin.

On the three-year segments Monday was the worst day. Friday and Tuesday had relatively higher number of accumulated shares on every segment. Only exception to this is on 2016-2018's segment by having Thursday as the day for highest number of accumulated shares.

For financial sector it seems that Monday is a poor choice for asset acquisitions. Tuesday and Friday were the best choice. Friday was the best day in three out of the six segments. Even when it was not the best day, it still managed to come close.

Table 11. Results from OMX Helsinki Financials price index

OMX Financials PI 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	6161.2191	6185.8914	6176.6372	6175.7901	6188.4085
Average number of shares per month	51.3435	51.5491	51.4720	51.4649	51.5701
Average price of one share	1.9477	1.9399	1.9428	1.9431	1.9391
OMX Financials PI 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2191.5440	2196.0705	2194.3800	2195.4866	2193.2688
Average number of shares per month	36.5257	36.6012	36.5730	36.5914	36.5545
Average price of one share	2.7378	2.7322	2.7343	2.7329	2.7356
OMX Financials PI 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	3969.6750	3989.8209	3982.2572	3980.3034	3995.1397
Average number of shares per month	66.1613	66.4970	66.3710	66.3384	66.5857
Average price of one share	1.5115	1.5038	1.5067	1.5074	1.5018
OMX Financials PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2623.0346	2643.0147	2629.6170	2628.1356	2640.1068
Average number of shares per month	72.8621	73.4171	73.0449	73.0038	73.3363
Average price of one share	1.3725	1.3621	1.3690	1.3698	1.3636
OMX Financials PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2106.2621	2114.2779	2114.7151	2111.6249	2119.2488
Average number of shares per month	58.5073	58.7299	58.7421	58.6562	58.8680
Average price of one share	1.7092	1.7027	1.7024	1.7048	1.6987
OMX Financials PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	1296.0534	1299.8124	1299.5965	1303.1182	1301.0644
Average number of shares per month	36.0015	36.1059	36.0999	36.1977	36.1407
Average price of one share	2.7777	2.7696	2.7701	2.7626	2.7670

4.4 OMX Helsinki media

As suspected from the correlation coefficient table (found in Table 3), the results are very different from Helsinki cap index. For the ten-year segment the best day was Tuesday with 15135.34 shares and the second-best was Friday with 15132.18 shares. The worst day Wednesday with 15103.34 shares. Aberrantly from the Helsinki cap index, media's worst days did not occur on Mondays.

On five-year segments the best day is Tuesday on 2014 – 2018 segment and Friday on 2009 – 2013 segment. The worst days were Fridays on 2014 – 2018 and Wednesdays in 2009 – 2013. Friday seemed to have relatively cheap asset closing prices somewhere in 2009 – 2013, since it was the worst day in 2009 – 2011 period, but the best in 2011 – 2013 period.

Wednesdays or Friday's results do not seem to be robust enough to do conclusions. However, Tuesday proved to be a decent day for acquisitions for media sector. It beat Monday on every segment and lost to Thursday only in one of the chosen segments. Also, it was the best day in three of the six segments. The worst day was changing among Wednesday and Friday. Interestingly those two days also managed to shift from worst to best and vice versa. Cause the results seem not to be robust on whole 10-year period, the best day cannot be recommended.

Media sectors good results on Tuesdays can be explained by negative average returns on Mondays and Tuesdays. Positive average returns occurred only in Wednesdays and Fridays, thus them being the worst days. Fridays high positive returns carries over to Monday, leading it not to be the best day. To truly understand media sectors week-days pricing pattern, a longer time period is needed to see if the pricing differences in Fridays from 2009 – 2014 occur more frequently. The factor that media index has only five instruments in it, makes it extremely prone to be affected by single instruments extreme pricing changes.

Table 12. Results from OMX Helsinki Media price index

OMX Media PI 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	15124.0644	15135.3391	15103.3454	15122.6166	15132.1809
Average number of shares per month	126.0339	126.1278	125.8612	126.0218	126.1015
Average price of one share	0.7934	0.7928	0.7945	0.7935	0.7930
OMX Media PI 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	9128.9795	9131.6359	9119.0914	9128.5417	9114.0988
Average number of shares per month	152.1497	152.1939	151.9849	152.1424	151.9016
Average price of one share	0.6572	0.6571	0.6580	0.6573	0.6583
OMX Media PI 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	5995.0849	6003.7032	5984.2540	5994.0749	6018.0820
Average number of shares per month	99.9181	100.0617	99.7376	99.9012	100.3014
Average price of one share	1.0008	0.9994	1.0026	1.0010	0.9970
OMX Media PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2845.1382	2861.5695	2850.4631	2844.8745	2841.2691
Average number of shares per month	79.0316	79.4880	79.1795	79.0243	78.9241
Average price of one share	1.2653	1.2581	1.2630	1.2654	1.2670
OMX Media PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	4094.5807	4104.1673	4094.2026	4110.1405	4131.3800
Average number of shares per month	113.7384	114.0046	113.7279	114.1706	114.7606
Average price of one share	0.8792	0.8772	0.8793	0.8759	0.8714
OMX Media PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	4498.4573	4513.4689	4515.4909	4512.0256	4480.8683
Average number of shares per month	124.9571	125.3741	125.4303	125.3340	124.4686
Average price of one share	0.8003	0.7976	0.7973	0.7979	0.8034

4.5 OMX Helsinki real estate

Results from OMX Helsinki real estate PI index found below on Table 13. Indicate similar results with Helsinki cap index. On 10-year segment the best day was Friday with 9753.34 shares and the worst day was Monday with 9704.03 shares. Tuesday was the second-best option, with accumulated number of 9745.48 shares. Monday's poor performance surfaces by a quite significant margin of ~49 shares compared to Friday. Wednesday and Thursday had similar results, with 9734.78 and 9737.68 shares, respectively.

Five-year segments had similar results as the worst day, which was Monday. On the earlier 2009 – 2013 period the best day was Tuesday. On later 2014 – 2018 period this day turned out to be Thursday. Even the best day changed on these two periods, Friday was the second-best option for both five-year segments. Thursday's pricing dropped drastically somewhere in 2014 – 2018 period, since Thursday did somewhat poorly on 2009 – 2013 segment but was dominating on 2014 -2018 and 2016 – 2018 segments. These changes are prone to influences for singular stock movements, since real estate index includes only five instruments just as media sector.

Three-year segments show no surprises on 2009 – 2011 and 2011 – 2013 segments, regarding Tuesday's success. Tuesday was the best choice for these two segments. Notably Friday was the second-best option for all three 3-year segments. Interestingly Monday was the worst choice for 2009 – 2011 and 2016 – 2018 segments, but Thursday was the worst on 2011 – 2013 segment.

Monday performed the worst on five out of six segments and on 2011 – 2013 segment, where it was not the worst it was the second-worst option. Tuesday was the best option on three out of the six segments and once it was the second-best option. None of the highest or lowest results occurred on Wednesdays and it had relatively far values from the worst or the best option. Thursday did rather bad on the beginning of the 10-year segment but ended up being the best option for the 2014 – 2018 and the 2016 – 2018 segments. Notably, it performed poorly on the start of the chosen 10-year time period. Friday was the best choice overall on the 10-year segment and even it was not the best option for any of the shorter emanation periods, it was the second-best option for all of them. Thus, on real estate sector the best day would be Friday or Tuesday and the worst option Monday.

Table 13. Results from OMX Helsinki Real estate price index

OMX Real estate PI 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	9704.0304	9745.4830	9734.7774	9737.6824	9753.3394
Average number of shares per month	80.8669	81.2124	81.1231	81.1474	81.2778
Average price of one share	1.2366	1.2313	1.2327	1.2323	1.2303
OMX Real estate 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	4495.3250	4509.7693	4514.9131	4523.9592	4519.8638

Average number of shares per month	74.9221	75.1628	75.2486	75.3993	75.3311
Average price of one share	1.3347	1.3304	1.3289	1.3263	1.3275
OMX Real estate 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	5208.7054	5235.7136	5219.8642	5213.7232	5233.4757
Average number of shares per month	86.8118	87.2619	86.9977	86.8954	87.2246
Average price of one share	1.1519	1.1460	1.1495	1.1508	1.1465
OMX Real estate PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	3211.1757	3237.4119	3222.5679	3222.4172	3231.6767
Average number of shares per month	89.1993	89.9281	89.5158	89.5116	89.7688
Average price of one share	1.1211	1.1120	1.1171	1.1172	1.1140
OMX Real estate PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2951.3029	2968.5203	2956.0258	2949.5693	2963.6519
Average number of shares per month	81.9806	82.4589	82.1118	81.9325	82.3237
Average price of one share	1.2198	1.2127	1.2179	1.2205	1.2147
OMX Real estate PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2731.3401	2744.7485	2750.5521	2760.3283	2751.7014
Average number of shares per month	75.8706	76.2430	76.4042	76.6758	76.4362
Average price of one share	1.3180	1.3116	1.3088	1.3042	1.3083

4.6 OMX Helsinki health care

OMX Helsinki health care PI index has somewhat differing results from the other indexes. Even though health care index had strong correlation coefficients with Helsinki cap, financials, industrials and consumer goods its average returns differ strongly from the other indexes. From the chosen indexes health care was the only one that had positive average returns on Monday. Interestingly health care index had the biggest returns on Monday, when typically, on rest of the indexes the strongest day was Wednesday or Friday. Correlation coefficients can be found on Table 3 and the average returns on Table 6.

Health care's worst day fluctuated depending on the time period. On later segments (2014 – 2018 and 2016 – 2018) the worst day was Monday, but on earlier segments the worst day occurred on Tuesdays or Thursdays. Aberrant from other indexes Wednesday did well on Health care. Surprisingly it did the best on 2014 – 2018 segment and was the second-best option for the whole 2019 - 2018, 2011 – 2013 and 2016 – 2018 segments. Thursday is a poor day for this index, it was the worst day on three out of the six segments chosen.

Friday ended up being the best day for Health care index. It was the best option on four of the segments, including the whole period and was the second-best option on the remaining two segments. Due the worst day being so time variant and not robust, a reliable warning on the worst day cannot be given.

Table 14. Results from OMX Health care price index

OMX Health care PI 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	6706.6012	6712.7493	6718.6122	6703.1232	6725.5096
Average number of shares per month	55.8883	55.9396	55.9884	55.8594	56.0459
Average price of one share	1.7893	1.7876	1.7861	1.7902	1.7843
OMX Health care 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2368.3709	2373.5354	2383.9182	2376.6484	2379.1843
Average number of shares per month	39.4728	39.5589	39.7320	39.6108	39.6531
Average price of one share	2.5334	2.5279	2.5169	2.5246	2.5219
OMX Health care 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	4338.2303	4339.2139	4334.6940	4326.4749	4346.3254
Average number of shares per month	72.3038	72.3202	72.2449	72.1079	72.4388
Average price of one share	1.3831	1.3827	1.3842	1.3868	1.3805
OMX Health care PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2726.1069	2737.2646	2723.9400	2720.5465	2732.1850
Average number of shares per month	75.7252	76.0351	75.6650	75.5707	75.8940
Average price of one share	1.3206	1.3152	1.3216	1.3233	1.3176
OMX Health care PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2448.0305	2444.4416	2452.9680	2446.4415	2459.8037
Average number of shares per month	68.0008	67.9012	68.1380	67.9567	68.3279
Average price of one share	1.4706	1.4727	1.4676	1.4715	1.4635
OMX Health care PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	1284.8748	1290.9917	1295.7306	1293.7890	1295.8838
Average number of shares per month	35.6910	35.8609	35.9925	35.9386	35.9968
Average price of one share	2.8018	2.7886	2.7784	2.7825	2.7780

4.7 OMX Helsinki consumer services

OMX Helsinki consumer services price index was the only index that showed high correlation with media index, due it contains same instruments. Also, it follows the same

return patterns as media, having the only positive average returns on Wednesdays and Fridays. Consumer services results for accumulated shares follow quite closely to media on the highest return day but has differing results on the worst day.

On the ten-year segment, the best day was Tuesday with 10941.95 shares and the worst day ending up being Wednesday with 10920.71 shares. Notably Monday came close as being the worst on this segment with 10921.35 shares.

Five-year segments had differing results. On 2014 – 2018 segment Monday, Wednesday and Friday had very similar results, with them all being 1-2 shares apart from each other. Even them all being weak, Friday ended up being the worst option with 5542.41 shares. The best option for this period was Thursday with 5555.88 shares. Interestingly on 2009 – 2013 segment the best day was Friday, even it was the worst on the other segment. On this segment Monday was the worst day with 5377.10 shares, Wednesday coming close with 5377.46 shares.

Three-year segment also shows robust results for the worst option, which was Monday on all occasions. On the other hand, the best day is showing us some unstable results by all of them having a different day as the best one. On 2009 – 2011 segment the best day was Tuesday, 2011 – 2013 Friday and on 2016 – 2018 segment Thursday. Notably, Thursday was the second-best option for both three-year segments it was not the best.

Monday was the worst day in four out of six periods and came close as being the worst on the remaining two. Thus, it is recommended not to do any acquisitions on that day while using CA strategy. The best day is somewhat not robust. Tuesday and Thursday were the best or the second-best on option for five out of six segments. Friday was the best the best day for two segments, but also did the worst on one. Also Friday's performance was relatively poor on the remaining segments. Thus, the recommendation for the best day is going to be Tuesday and Thursday.

Table 15. Results from OMX Helsinki consumer services price index

OMX Consumer services 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	10921.3467	10941.9521	10920.7110	10940.0003	10930.1804
Average number of shares per month	91.0112	91.1829	91.0059	91.1667	91.0848
Average price of one share	1.0988	1.0967	1.0988	1.0969	1.0979
OMX Consumer services 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	5544.2498	5554.5330	5543.2558	5555.8774	5542.4100
Average number of shares per month	92.4042	92.5756	92.3876	92.5980	92.3735
Average price of one share	1.0822	1.0802	1.0824	1.0799	1.0826
OMX Consumer services 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	5377.0969	5387.4190	5377.4551	5384.1229	5387.7704
Average number of shares per month	89.6183	89.7903	89.6243	89.7354	89.7962
Average price of one share	1.1158	1.1137	1.1158	1.1144	1.1136
OMX Consumer services PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2803.9791	2821.5821	2809.6003	2809.8109	2805.8009
Average number of shares per month	77.8883	78.3773	78.0445	78.0503	77.9389
Average price of one share	1.2839	1.2759	1.2813	1.2812	1.2831
OMX Consumer services PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	3480.4343	3487.1604	3484.8035	3491.7386	3495.3085
Average number of shares per month	96.6787	96.8656	96.8001	96.9927	97.0919
Average price of one share	1.0344	1.0324	1.0331	1.0310	1.0300
OMX Consumer services PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2863.1203	2875.3110	2867.3732	2883.6211	2870.1026
Average number of shares per month	79.5311	79.8698	79.6493	80.1006	79.7251
Average price of one share	1.2574	1.2520	1.2555	1.2484	1.2543

4.8 OMX Helsinki consumer goods

On OMX Helsinki consumer goods price index, results can be found on Table 16 below. On the 10-year segment Thursday was the worst day with 5190.99 shares, while Tuesday was the best day with 5208.19 shares. Monday, Wednesday and Friday had similar results with number of shares being around 5198 – 5200.

Five-year segments show us differing results on the best day. On the later 2014 – 2018 segment the best day was Wednesday and on the earlier 2009 – 2013 segment the dominant day was Tuesday. Tuesday did also well on the later period, having the second-most accumulated shares. The lowest values do not show a regular pattern for the five-year segments, except them both being at the end of the week. This is partly explained by looking at the average returns in Table 6. This index has positive returns on

all the days except on Mondays, thus it is expected that up-trend towards end of the week may not create a lucrative asset acquisition rule.

Hypothesis of assets prices rising towards end of the week is challenged by one of the three-year segments (2011 – 2013) by having its lowest number of accumulated shares on Monday and its highest value on Friday. This segment seems greatly to differ from the other segments, which follow the hypothesis mentioned above.

Thus, the recommended day for asset acquisitions is Tuesday. This is justified by it doing the best in three out of six of the segments and being the second-best option on two others. Days to avoid are Thursday and Friday, since the price index seems to rise towards end of the week and drop on Monday.

Table 16. Results from OMX Helsinki consumer goods price index

OMX Consumer goods 10-year, 2009 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	5198.8226	5208.1583	5200.9119	5190.9915	5198.7943
Average number of shares per month	43.3235	43.4013	43.3409	43.2583	43.3233
Average price of one share	2.3082	2.3041	2.3073	2.3117	2.3082
OMX Consumer goods 5-year, 2014 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2073.2473	2075.0205	2077.1080	2072.8367	2070.7882
Average number of shares per month	34.5541	34.5837	34.6185	34.5473	34.5131
Average price of one share	2.8940	2.8915	2.8886	2.8946	2.8974
OMX Consumer goods 5-year, 2009 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	3125.5753	3133.1378	3123.8040	3118.1548	3128.0061
Average number of shares per month	52.0929	52.2190	52.0634	51.9692	52.1334
Average price of one share	1.9196	1.9150	1.9207	1.9242	1.9182
OMX Consumer goods PI 3-year, 2009 - 2011	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	2152.9080	2163.4553	2152.2400	2150.6404	2158.5175
Average number of shares per month	59.8030	60.0960	59.7844	59.7400	59.9588
Average price of one share	1.6722	1.6640	1.6727	1.6739	1.6678
OMX Consumer goods PI 3-year, 2011 - 2013	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	1502.8964	1509.7539	1508.6613	1504.4590	1512.5838
Average number of shares per month	41.7471	41.9376	41.9073	41.7905	42.0162
Average price of one share	2.3954	2.3845	2.3862	2.3929	2.3800
OMX Consumer goods PI 3-year, 2016 - 2018	Monday	Tuesday	Wednesday	Thursday	Friday
Number of accumulated shares	1169.2609	1169.2957	1175.9352	1173.5612	1173.2461
Average number of shares per month	32.4795	32.4804	32.6649	32.5989	32.5902
Average price of one share	3.0789	3.0788	3.0614	3.0676	3.0684

4.9 Comparison of cost averaging and lump-sum investing

Comparison results of these two strategies are showcased in Table 17. This aims to give insight of how cost averaging performed on its best scenario compared to lump-sum investing. Figures Figure 3 and Figure 4 illustrates how the chosen indexes have developed on 2009 - 2018. Helsinki cap, industrials and financials followed a steady almost linear up-trend, only “larger” fall can be perceived in 2011. As suspected from the figures, LS was the dominant strategy for the 10-year segment and on both five-year segments. The average price per share is eminently lower on LS strategy. This was somewhat expected, since LS is superior strategy by default when facing a up trending market. CA managed to beat LS on the 2011 – 2013 segment on all three indexes mentioned, this is explained by the drop-in index price in the start of 2011. Aberrant from the other two indexes CA was the superior choice on industrials during the 2016 – 2018 segment.

Table 17. Comparison of the number of accumulated shares with LS and CA strategy for Helsinki cap, industrials and financials.

Helsinki CAP				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	7767.4069	1.0000	1.5449
2014 - 2018	3672.4797	3080.7737	1.6124	1.9476
2009 - 2013	5792.4786	4689.7316	1.0000	1.2794
2009 - 2011	3556.5782	2859.5953	1.0000	1.2589
2011 - 2013	2071.8186	2697.3120	1.6609	1.3347
2016 - 2018	1918.2219	1720.7237	1.8620	2.0921
Industrials				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	6188.4085	1.0000	1.9391
2014 - 2018	2497.5396	2196.0705	2.3709	2.7322
2009 - 2013	5792.4786	3995.1397	1.0000	1.5018
2009 - 2011	3556.5782	2643.0147	1.0000	1.3621
2011 - 2013	2010.8869	2119.2488	1.7112	1.6987
2016 - 2018	1226.1934	1303.1182	2.9129	2.7626
Financials				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	4869.6159	1.0000	2.4643
2014 - 2018	2083.9625	1787.1632	2.8414	3.3573
2009 - 2013	5792.4786	3082.4967	1.0000	1.9465

2009 - 2011	3556.5782	2104.7329	1.0000	1.7104
2011 - 2013	1298.9726	1525.3834	2.6491	2.3601
2016 - 2018	1154.9027	985.9329	3.0927	3.6514

Media and customer services were the two indexes that differed from the rest. These two correlated highly due medias instruments being included in customer services as well. Still these two indexes behaved differently. On media, CA was the superior strategy on the 2009 – 2018, 2009 – 2013 and 2011 – 2013 segments. CA had significantly lower average price on 2011 – 2013 segment (0,8714 versus 1,6030), when the pricing drop hit hard. On customer services CA managed to beat LS only on the 2011 – 2013 segment.

Table 18. Comparison of the number of accumulated shares with LS and CA strategy for media and customer services

Media				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	15135.3391	1.0000	0.7928
2014 - 2018	9329.9514	9131.6359	0.6347	0.6571
2009 - 2013	5792.4786	6018.0820	1.0000	0.9970
2009 - 2011	3556.5782	2861.5695	1.0000	1.2581
2011 - 2013	2146.6875	4131.3800	1.6030	0.8714
2016 - 2018	7802.0284	4515.4909	0.4578	0.7973
Customer services				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	10941.9521	1.0000	1.0967
2014 - 2018	6640.6017	5555.8774	0.8917	1.0799
2009 - 2013	5792.4786	5387.7704	1.0000	1.1136
2009 - 2011	3556.5782	2821.5821	1.0000	1.2759
2011 - 2013	2018.8822	3495.3085	1.7045	1.0300
2016 - 2018	3983.6382	2883.6211	0.8966	1.2484

Lastly, in Table 19 we have the comparison results from real estate, health care and customer goods. Results are in the favor of LS investment strategy. For the real estate index, CA was able to beat LS only in 2011 – 2013 and 2016 – 2018 segments. Health care index had a high peak in 2017. LS investing managed to buy before the peak and CA bought steadily before, during and after the peak. Therefore, CA lost to LS on 2014 – 2018 by a quite heavy margin and the average buying price difference closing to

0.90€. CA still managed to beat LS on the 2011 – 2013 segment. Surprisingly, customer goods had aberrant results compared to the other indexes. CA strategy lost in segments chosen but came notably close to LS in three segments (2014 – 2018, 2011 – 2013 and 2016 – 2018).

Table 19. Comparison of LS and CA for Real estate, health care and customer goods

Real estate				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	9753.3394	1.0000	1.2303
2014 - 2018	4574.5625	4523.9592	1.2944	1.3263
2009 - 2013	5792.4786	5235.7136	1.0000	1.1460
2009 - 2011	3556.5782	3237.4119	1.0000	1.1120
2011 - 2013	2485.4545	2968.5203	1.3845	1.2127
2016 - 2018	2727.0869	2760.3283	1.3097	1.3042
Health care				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	6725.5096	1.0000	1.7843
2014 - 2018	3503.8652	2383.9182	1.6900	2.5169
2009 - 2013	5792.4786	4346.3254	1.0000	1.3805
2009 - 2011	3556.5782	2737.2646	1.0000	1.3152
2011 - 2013	2260.3191	2459.8037	1.5224	1.4635
2016 - 2018	1400.0919	1295.8838	2.5511	2.7780
Customer goods				
Segment	No. of shares (LS)	No. of shares (CA)	Avg. price (LS)	Avg. price (CA)
2009 - 2018	11215.3037	5208.1583	1.0000	2.3041
2014 - 2018	2110.9040	2077.1080	2.8052	2.8886
2009 - 2013	5792.4786	3133.1378	1.0000	1.9150
2009 - 2011	3556.5782	2163.4553	1.0000	1.6640
2011 - 2013	1456.0168	1512.5838	2.3634	2.3800
2016 - 2018	1176.0565	1175.9352	3.0371	3.0614

5. Conclusion

This bachelor's thesis aimed to answer the question if there are any benefits to allocate your asset acquisitions on a certain weekday, if there are any differences in the weekdays or among the industries and it also questioned the existence of slowly fading DOW-effects in Helsinki stock exchange. Thesis familiarized to cost averaging and

sought reasonings to choose this highly debated investment strategy from earlier literature. This led to seeking answers from well-known behavioral theories such as Kahneman's and Tversky's prospect theory. A deeper review to literature about the behavioral reasons and possible explanations of DOW-effect was also made. Other calendar effects were briefly introduced and Fama's hypothesis of efficient markets was introduced to further understand the absurdity of the existence of these anomalies.

The research results are in line with the earlier literature. Mondays were low return days for each of the indexes except for health care. Tuesday was also a day for negative or relatively low returns. Friday was a high return day for indexes, except for financials. For all the indexes the highest returns happened at the end of the week. Even though many indexes had negative returns on Thursday. This phenomenon follows the weekend effect. Just as the earlier literature stated, DOW effects seem to have eminent differences among industries. Helsinki cap was chosen to reflect the behavior of the whole market and indexes like media behaved very differently compared to it. Time was another factor that was claimed to shake these effects. This was true on most of the cases, where the best days to invest with CA fluctuated specially around the 2011 stock crash.

The time period chosen to investigate this effect was only 10-years, what is relatively short time period. Still on most of the indexes the results were somewhat robust. Even though the recommended weekdays for asset acquisitions did not always perform the best, they usually did relatively well. CA strategy aims to guarantee lower average price for the assets bought. Choosing indexes to test CA strategy might give biased results of the real power of CA. Indexes are not usually so sensitive and volatile as singular stocks. Therefore, these results do not necessarily illustrate practical benefits of this strategy.

Based on the results, some guidelines can be given on which weekdays to avoid and which should be favorable towards the CA investor. These results can be found on Table 20 below. This gives answers the questions of the existence of DOW-effect and if there are benefits to do asset acquisitions of a certain weekday. LS strategy was used as a benchmark and as an alternative investment strategy. Thus, working as an opportunity cost for CA strategy. As majority of the earlier literature claimed, LS was

the superior choice on most of the indexes. Though, CA did well on a crashing market and managed to beat LS on a few segments. Thus, choosing CA strategy over LS can be justified for investors who follow prospect utility function. The emotional pain that can be caused by regret and capital losses, could have been avoided or reduced on markets filled with uncertainty by choosing strategy that aims to reduce risk.

Table 20. Recommendations based on results

Index name	Days to buy	Days to avoid
Helsinki Cap	Tuesday, Friday	Monday
Industrials	Tuesday	Monday
Financials	Tuesday, Friday	Monday
Media	Tuesday	-
Real estate	Friday, Tuesday	Monday
Health care	Friday	Monday, Thursday
Consumer services	Tuesday, Thursday	Monday
Consumer goods	Tuesday	Thursday, Friday

To further understand how DOW effect manifests in HSE, it could be wise to include more industries, longer time period and even research singular stocks behavior. Also, a regression analysis could be made on the average returns on each weekday. This would give statistical evidence and give expected returns for each weekday. CA strategy could be investigated by doing simulations on different markets and during different trends. It could be interesting to see how CA performs on recession and in the face of trade war. This is topical question now, since there are noticeable signs of trade war with China and US. It could also be interesting to interview investors who choose CA strategy and see if the reasonings for this strategy follow hypothesis like prospect theory.

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