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Evidence of the Size Effect on Nasdaq Nordic

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Abstract

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This Bachelor's thesis examines the presence of such a renowned market anomaly as the size effect on Nasdaq Nordic equity markets. The main objective of the study was to find evidence as to whether small capitalization companies outperform big capitalization companies on Nasdaq Nordic.

The study is made up of a theory section and an empirical section. The theory section discusses the past studies on the size effect and other market anomalies. The empirical part focuses on finding evidence of the presence of the size effect on Nasdaq Nordic. The study was based on descriptive statistical methods. The indices values for small and big capitalization firms on Nasdaq Nordic were collected for up to a thirteen-year period ending in December 2019. The annual and monthly returns were calculated using the return data. The findings were analysed by using charts and comparing risk and return ratios with the help of Microsoft Excel.

The results of the study indicate that the size effect was present on Nasdaq Helsinki and Nasdaq Stockholm over the observed period. On Nasdaq Copenhagen, the size effect was not documented. The analysis also confirms that the size effect is strongest in January and that the big capitalization firms outperform the small capitalization firms in the down market. The latter results are supported by the studies presented in the theory section of this thesis.

The analysis showed that the size effect is present on at least few of Nasdaq Nordic equity markets and therefore could be explored by investors. Moreover, investors can additionally benefit by taking into account the presence of the January effect and the state of the economy. However, past returns do not guarantee similar returns in the future, and the size premium could disappear in the future.

Keywords
Size effect, January effect, market anomaly, Nasdaq Nordic, OMX Small Cap, OMX Large Cap

Table of contents

1 Introduction

The idea that the companies with small capitalization or small cap earn higher returns compared to those of big capitalization companies, known as the size effect, is well acknowledged in the financial world. Although the validity of the concept is still challenged by academics, the investment strategies based on the concept are popular among both institutional and private investors and the analysts add small cap premium when calculating the expected returns of small capitalization companies.

This thesis studies the presence of the size effect on Nasdaq Nordic equity markets for the period from 2007 to 2019. The thesis consists of an introduction, theoretical framework, research design, findings and the discussion, each of the topics is covered in a chapter with the corresponding title.

This chapter introduces the background of the topic and its topicality, research question and thesis demarcation. The international aspect and anticipated benefits of the thesis are discussed. The key concepts will be defined at the end of the chapter for the reader's convenience.

1.1 Background

This thesis's topic was inspired by a post of a finance professor at the Stern School of Business at New York University Aswath Damodaran in his blog "Musings on markets" from April 11, 2015. In that blog post, professor Damodaran argues that the size effect, though visible when analysing historical data from the U.S. equity market, could not be proved on any other market and does not apply for the U.S. equity market anymore (Damodaran 2015).

The size effect – or the observation that small capitalization firms have historically provided a better return than the market portfolio and big capitalization firms – is considered as one of the most prominent market anomalies and a sign of market inefficiency. The size effect was noticed when comparing the returns of different asset classes. Overall, based on historical returns, small capitalization companies or small stocks outperformed other asset classes on the U.S. stock market over 1926-2017 as shown in the table 1 below.

Table 1. Average annual returns for different U.S investments, 1926-2017 (Berk & DeMarzo 2020, 364)

Investment	Average Annual Return
Small stocks	18.70 %
S&P 500	12.00 %
Corporate bonds	6.20 %
Treasury bills	3.40 %

Further analysis was conducted to understand the returns on stocks of companies based on different market capitalizations. The analysis included the division of companies into groups or deciles based on market capitalization to compare the returns of different groups over time. As can be seen on the chart (figure 1), small cap companies earn bigger annual returns than big cap companies, and the best result are shown by companies in the decile with smallest market capitalization.

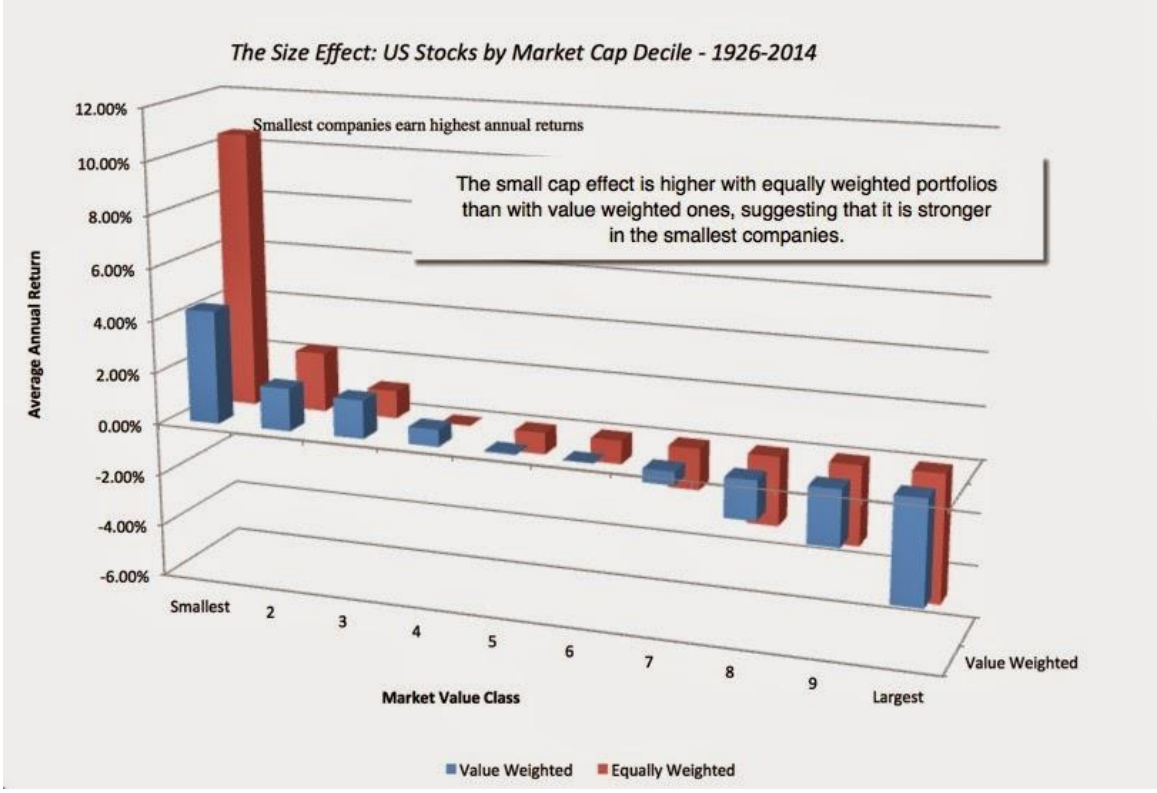

Figure 1. Average annual returns of companies by market capitalization decile on the U.S. stock market, 1926-2014 (Damodaran 2015)

These results have inspired investors to explore the size effect in their trading strategies. Shortly after the discovery of the size effect in the 1980s, numerous small-cap stock funds

and indices were launched. Some researchers (Schwert 2003) suggest that that event led to the disappearance of the size premium.

Whether the size effect exists now is a matter of debate among academics. Some studies claim that the size effect disappeared after the 1980s, but there is no consensus on this issue. Some of the works from the entire body of studies on the size effect are reviewed in the literature section of this thesis.

Despite the absence of strong evidence of the size effect, it is widely used as a basis for trading strategies by fund managers. As of 2019, more than 10 Finnish small capital mutual funds and 2 micro-cap funds are available to investors. These funds are launched by financial institutions such as OP, Säästöpankki, Nordea, Danske and so on.

The lack of consensus on the existence of the size effect and its wide application in practice makes it an interesting topic for applied analysis on the Nordic stock markets. Based on this analysis, it will be possible to draw conclusions as to whether investors ' expectations regarding the premium for small cap investments are justified.

1.2 Research question

This thesis aims at studying the presence of one of the market anomalies - the size effect - on Nasdaq Nordic stock markets. Therefore, the research question is defined as:

RQ: Does the size effect is present on Nasdaq Nordic?

In order to answer the stated research questions, the following investigative questions (IQs) are addressed in the thesis:

1. Do the small capitalization companies historically outperform those of big capitalization on Nasdaq Nordic?
2. How the size premiums are affected by investment horizon and economic conditions?
3. Does the size effect is strongest in January?

The overlay matrix presented below (table 2) contains theoretical framework, research methods, and chapter numbers containing the results of the analysis for each of the investigative questions.

Table 2. Overlay matrix

Investigative Questions (IQs)	Theoretical Framework	Method	Results
IQ 1. Do the small capitalization companies historically outperform those of big capitalization on Nasdaq Nordic?	Market capitalization, market indices, market anomalies, investing strategies	Quantitative research	Ch. 4.1
IQ 2. How the size premiums are affected by investment horizon and economic conditions?	Investment horizon, economic crisis	Quantitative research	Ch. 4.2
IQ 3. Does the size effect is strongest in January?	EMH, cumulative return, compound annual growth rate (CAGR), standard deviation of returns	Quantitative research	Ch. 4.3

1.3 Demarcation and scope

This thesis tests the size effect on Nasdaq Nordic stock exchanges. The markets analysed include the Copenhagen, Stockholm and Helsinki Stock Exchanges operated by Nasdaq. Nasdaq Iceland was not included in the analysis due to the limited amount of data available. The Norway Stock Exchange, although part of the Nordic equity markets, is not operated by Nasdaq and therefore was not included into the analysis.

Nasdaq indices for small and big (large) capitalization firms on Nasdaq Helsinki, Nasdaq Stockholm and Nasdaq Copenhagen were used for analysis. The study covers the period from 2007 to 2019, since the end of 2006 is the first year when information on the indices was published. The shorter period 2014-2019 was used to analyse the Copenhagen indices. The data is discussed in more detail in Chapter 3.2.

The thesis does not look into possible reasons for the existence or absence of the phenomenon. Transaction costs and other possible costs associated with executing a trading strategy that would affect the size of the premium are also outside the scope of this thesis. However, these aspects provide an opportunity for further research and, along with other suggestions, are discussed in Chapter 5.4 of this thesis.

1.4 International aspect

The size effect is an established concept in the corporate finance theory. After the initial discovery of the size effect by testing the data from the U.S. equity market, the anomaly became widely known, and the presence of the phenomenon was verified in other national equity markets. In this thesis, Nasdaq Nordic stock markets are explored for the signs of the size effect.

Thus, the international aspect of this thesis is addressed by analysing a well-known phenomenon in finance in national equity markets located in the Nordic geographical area.

1.5 Anticipated benefits

Stakeholders of this thesis include the general public interested in trading strategies and the author of this paper. While for investors the results of the work may be of the greatest interest, the author would benefit from both the results themselves and the process of writing the thesis.

A trading strategy based on the size effect, sometimes referred to as large against small stocks, is popular among fund managers and individual investors. Numerous mutual funds in Finland invest in shares of small listed companies to provide excess returns for investors. Individual investors can employ the size effect theory by forming a portfolio of individual stocks, using market capitalization as a criterion for portfolio formation, investing in small cap mutual funds, or investing in the small cap market index. Investors exploring the size effect in their trading strategy expect higher returns than those of the market portfolio. The results of this thesis could be used to justify or refute these expectations and to modify the trading strategy.

Despite the potential practical value of the results obtained, the author of this paper is to benefit from the process of preparing and writing this thesis. Given the author's genuine interest in corporate finance and financial markets, the chosen topic of the thesis provides an opportunity to deepen understanding and acquire new knowledge and skills. Working on the thesis also provides an opportunity to get acquainted with the most relevant academic works in the field of finance and to study the scientific methods used to analyze ideas and concepts. All the calculations for the thesis were made in Microsoft Office Excel, one the most usable and accessible programs used for financial analysis.

1.6 Key concepts

The size effect refers to the observation that smaller firms have higher returns than large firms on average over long horizons (Crain 2011, 3). It is important to note that the size refers to market capitalization and not other non-price size measures, such as, for example, sales, book value of assets or equity, number of employees, which may also indicate the size of the company, but do not produce any premium (Alquist, Israel & Moskowits 2018,14-18). The size effect is often used as a synonym for size premium, size anomaly, small firm effect, returns to size, and so on.

Market capitalization is the total market value of equity; equals the market price per share times the number of shares (Berk & DeMarzo 2020, 1130).

There is no single methodology that is used to classify firms into **big** and **small capitalization**. Researches use both relative and absolute scales in their works. Nasdaq in its index methodology (2018), divides companies listed on Nasdaq Nordic stock exchanges into three segments. Large capitalization companies are companies with a market value of more than one billion euros, mid cap companies are those with a market value of between 150 million and 1 billion euros, and companies with a market value of fewer than 150 million euros form the small cap segment.

A market index is the market value of a broad-based portfolio of securities (Berk and DeMarzo 2020). Most common types of market indices are value-weighted, equally weighted and price-valued indices. For example, the OMXH25 is a capitalization-weighted stock price index consisting of the 25 most actively traded stocks on the Helsinki Stock Exchange.

A size premium is the higher expected return earned by stocks with low market capitalization or “the return achieved by buying (being long in an absolute sense or overweight relative to a benchmark) small stocks and selling (shorting or underweighting) large ones” (Alquist & al. 2018, 2). The latter is used as one of the factors in Fama-French three- and five-factor asset pricing models.

A market anomaly is a change in the price of a security that cannot be explained by the information available on the market. Market anomalies should be consistent over time and should not be the result of data mining.

The Efficient Markets Hypothesis (EMH) is the theory that asset prices reflect all available information and therefore are fairly priced. A market where prices reflect all available information is called an efficient market. (Fama 1970, 383)

SMB (Small Minus Big) is one of the factors in the Fama-French asset pricing model. The factor represents the size effect in the model and is calculated as the average return on three small portfolios minus the average return on three big portfolios.

2 Theoretical framework

This chapter provides the theoretical framework for the thesis. A review of previously conducted studies on the size effect helps to better understand this phenomenon by looking at its various aspects and issues that are still topical for the researchers nowadays. Furthermore, the analysis of academic works on the size effect helps to correctly define the goals and plan the empirical part of this thesis. In figure 2 the conceptual framework for the thesis is presented.

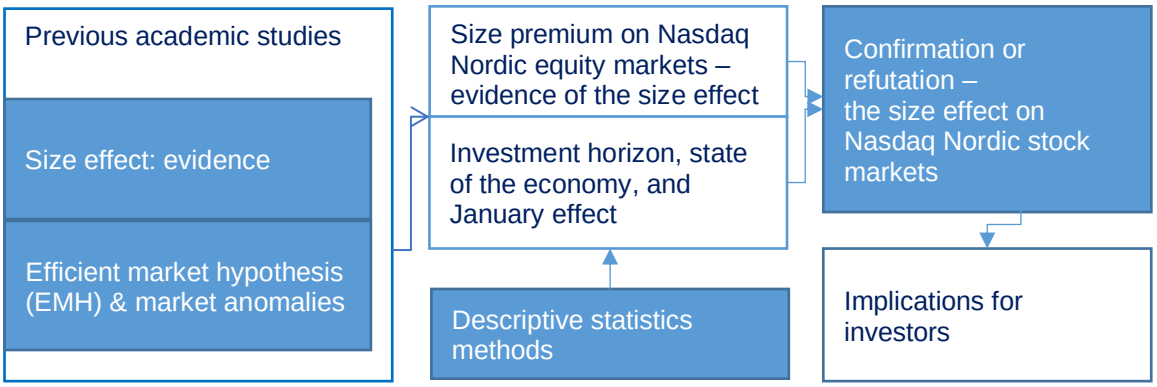

Figure 2. Conceptual framework

The size effect was first observed by Rolf Banz in 1981, who examined the relationship between returns and the total market value of the firms' common stocks on the New York Stock Exchange and found that smaller firms on average had better returns than larger ones. This discovery was important to the financial world for several reasons. First, it challenged the validity of the efficient market hypothesis. Second, it led to the development of new asset pricing models that would better explain stock returns than CAPM. Third, the discovery of the size effect has changed the investment landscape by contributing to the appearances of numerous small cap indices and funds (Schwert 2002). Forth, investors and analysts begun to use the additional small cap premium for small firms, which increases their cost of capital compared to big firms (Damodaran 2015).

This chapter provides an overview of research papers on the size effect and other known market anomalies.

2.1 Size effect

First, the size effect, which is the fundamental idea of this thesis, is considered. Although the size effect is commonly accepted in practice, academics have challenged the anomaly

ever since it was initially documented by Banz (1981), Keim (1983), and Roll (1983). The size effect is one the most renown anomalies, it received much more citations in academic literature than other factors with the a much stronger historical record and theory behind, with the exception for value (Alquist & al. 2018, 47-48).

After the discovery in 1981, many academics announced that the size effect had since disappeared or weakened. The works that claimed that the size premium does not exist anymore are discussed in later chapters. Also, the size effect was initially documented on the US equity markets, but since then it was also tested on other international equity markets and was not be observed there or provided only a weak record. However, few recently released works suggest that the size effect still exists and shows even more robust results if the quality of small stocks is controlled (Alquist & al. 2018; Asness, Frazzini, Israel, Moskowitz & Pedersen 2018a).

2.1.1 CAPM and its development

The discovery of the size effect by Banz (1981) was one of the first and the most prominent contradictions to the Capital Asset Pricing Model (CAPM), which was developed independently by Sharpe (1964), Treynor (1961), Lintner (1965), and Mossin (1966). The CAPM model is used to calculate the expected returns (*r*) for risky assets. The model explains the differences in returns by systematic (market) risk and a single risk factor – beta or β, the security sensitivity to market risk. The equation for the CAPM model is presented below. Banz by testing historical data discovered that the firm size adds to the explanation of the stock returns provided by market betas (Fama & French 1992, 427).

$$r_i = r_f + \beta_i(r_m - r_f)$$

Where:

r_i – expected return on a security
r_f – risk-free rate
r_m – expected return of the market
β_i – beta of a security
$(r_m - r_f)$ – risk premium

By testing CAPM on historical data, the researchers identified factors other than the market risk that help explain the asset's returns, which are known as CAPM anomalies. Fama & French (1993) developed a capital asset pricing model that explain stock returns by adding two more factors to the market risk factor – the size of the firm and the book-to-market ratio. (Crain 2011, 6.) One of the most popular multifactor models at present is the

Fama-French-Carhart (FFC) factor specification, which explains the expected return by adding the fourth factor to the previously mentioned three factors – prior one-year momentum (Berk & DeMarzo 2020, 507-508).

2.1.2 Evidence of the size effect after 1980s

Some researchers report that the size effect has disappeared since the 1980s, shortly after the original papers were published, or that the size effect is not very significant, since it produces only small abnormal return and a Sharpe ratio (Asness & al. 2018a).

In the work “The disappearing size effect”, researchers analysed the relation between returns and firm size over three time periods – before the 1980s, after 1980s, and over a period that included both previous intervals. They observed that from 1963 to 1981, the difference between the returns of small and big companies, or 1st and 10th decile of all the companies on NYSE, Amex and Nasdaq stock exchanges ranked by market capitalization, was 13% on an annualized basis, and from 1982 till 1997 the difference was minus 2%. Over the longer period of 1963-1997, the corresponding difference was 6%. (Horowitz, Loughran & Savin 2000.) These data, also presented in figure 3, allows to conclude that the size effect was significant before it was detected, but shortly after it disappeared. The figure is prepared by the author based on the data from Horowitz & al. research (2000, 87).

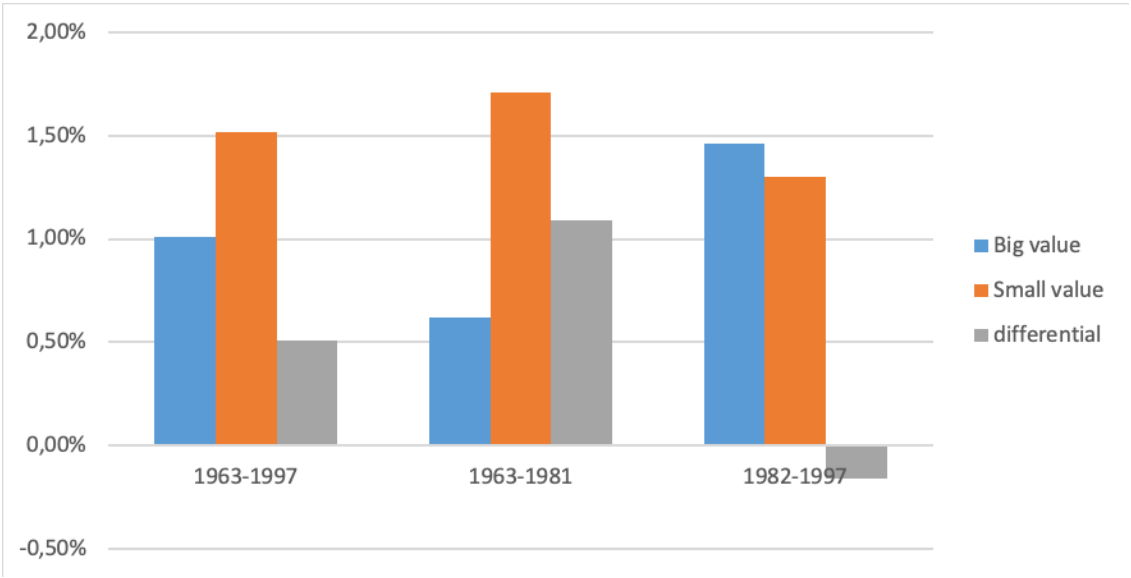

Figure 3. Average monthly returns of small and big firms and their differential on the U.S. stock markets, 1963-1997

Alquist & al. (2018) calculated the Sharpe ratio of the small minus big factor (SMB) for the original data sample when the size effect was discovered (1936 to 1975) and subsequent

decades until 2017. They discovered that after the 1980s, the size premium dropped rapidly and was negative for a decade after the size effect was introduced and was slightly positive for the next two decades. This allowed the authors to conclude that the size effect had disappeared and there is no significant size premium associated with small cap strategies anymore. (Alquist & al. 2018, 10-11.)

Hur, Pettengill, and Singh (2014) analysed data from 1931 to 2006 and observed a strong size effect consistent with previous studies that also used a long time period. However, while small firms outperformed big firms in up markets, portfolios consisting of big companies' stocks showed better returns than small stock portfolios in down markets. Moreover, the relationship between size and return was significant only in down markets. (Hur, Pettengill & Singh 2014.)

While numerous researchers demonstrate that the size effect has disappeared or weakened since the 1980s, some authors suggest that it did not exist in first place or was not statistically significant. The analysis for the initial data period (1926-1975) with fixed data errors showed that the size effect was not particularly strong and was captured by market risk, analysis for 1926-2017 proved the size premium to be significant, but it appeared to be insignificant after adjusting for beta (Alquist & al. 2018). Levy & Levy (2011) demonstrate that size effect is observed when monthly returns are used to calculate beta, but disappears if observations over a longer period, such as year, are used.

2.1.3 Size effect on international equity markets

The analysis of the size effect on international equity markets provides a weak record. However, it is worth noting that the time intervals used by researchers to analyse international stock markets are much smaller than the interval used when analysing the size effect on the U.S. stock market. The analyzed period for international markets often begins after the 1980s, when the size effect, according to many scientific works, began to weaken on the U.S. stock market. The choice of time period is presumably due to the lack of statistics on international stock markets, while data for the U.S. stock market has been available since 1926. Therefore, data from international markets confirm studies conducted on the basis of data from the U.S. equity markets that the size effect has weakened or disappeared.

Fama and French (2012) analysed four regions – North America, Europe, Japan, and Asia Pacific – for the period from 1991 till 2010. They found that there is no size premium in

any of the regions during the sample period and the average SMB returns are close to zero. (Fama & French 2012.)

The analysis of emerging markets from 1985 to 2000 showed that the returns for small firms are greater than those of large firms, therefore the size effect is present. But the result is not robust if extreme observations are removed. (Barry, Goldreyer, Lockwood & Rodriguez 2002.)

Finally, researchers on Australia stock market documented the size effect over the 1990-2008 sample, but found that the trading strategy based on return-to-size does not provide significant profits after accounting for liquidity and transactions costs (Bettman, Ng & Sault 2010).

2.1.4 January effect and the size effect in microcap firms

While the size effect is being questioned by academics, two other anomalies associated with the size premium – the January effect and the concentration of the size effect in microcap firms - are mostly confirmed by observations.

The researchers claim that the size effect, when observed, is concentrated in the smallest or microcap firms. Horowitz & al. (2000) as discussed earlier, observed the size effect between 1963 and 1997, but when they removed firms with a market capitalization under 5 million dollars from the sample, the result became statistically insignificant. Thus, the conclusion that the size effect exists only in the smallest listed firms could be inferred. Fama & French (2008) received similar results, reporting that the size effect is the strongest among microcap firms using the 1963-2005 sample.

The January effect is the observation that stock returns are on average higher in January compared to other months, and that this effect is more pronounced in smaller firms (Crain 2011, 15-16).

Keim (1983) reported a 15% difference in January returns between small and big firms for the period 1963-1979. Figure 4 shows the monthly market-weighted return difference between the smallest and largest size quintile of all NYSE, Amex, and Nasdaq firms for the period 1927–2010, as reported by Van Dijk (2011, 3271). According to the chart, the difference in returns is more than 5% (not annualized) in January and tends to zero in other months.

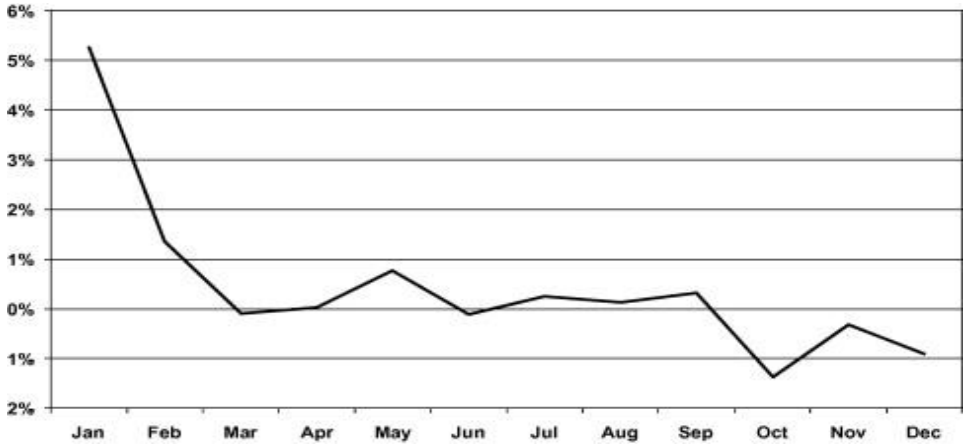

Figure 4. Seasonal patterns in the size effect in US equity returns 1927–2010 (Van Dijk 2011, 3271)

Another observation that can be made is that the January effect has diminished over time, as has the size effect. Moller and Zilca (2008) reported that "the size of the January effect in the most recent 1985–2004 period is somewhat weaker than the period that precedes it." Alquist & al. (2018) reported that the monthly return of the SMB portfolio in January was 2.1% in 1926-2017 and only 1% for a shorter sample of 1976-2017 and concluded that the size effect comes exclusively from January returns. Besides, the January effect can be observed regardless of the state of the market, in contrast to the size effect, which is significant only in down markets (Hur, Pettengill & Singh, 2014).

The January effect is particularly strong for stocks with low prices. Data shows that stocks that had fallen in December and had had low prices showed particularly high market differential returns in January (Branch & Chang 1990). However, Horowitz & al. (2000, 92-93) showed that when adding just $0.125 to stock prices on December 31, the average January returns for the smallest size decile falls from more than 8% to 0.37% in period 1982-1997. The authors attribute this to a large percentage of firms with stock prices below $2 in the smallest decile.

2.1.5 Size effect and controlling for other factors

Currently, as evidenced by the numerous studies cited above, most researchers dispute the existence of the size effect. However, several recently publised studies suggest that when controlling for quality factors of the stocks the evidence of the size effect is strong. Furthermore, the researchers claim that some of the challenges associated with the size effect, such as the disappearance of the size premium after the 1980s, a weak international record, abnormal January returns, and an uneven distribution of the size

effect with concentration in the smallest firms, have been resolved. (Asness & al. 2018a, 479-509; Alquist & al. 2018, 43-47.)

Asness, Frazzini and Pedersen (2018b) describe the quality as the characteristics of stocks for which investors are willing to pay a higher price. These stock's quality characteristics include profitability, growth, safety, and so on. In the same paper, they suggested a quality factor called "quality-minus-junk (QMJ)" that is long in quality stocks and short in junk (opposite to quality) stocks. Fama and French (2015) added two more factors to their factor model that could also be classified as "quality": "RWM, the difference between the returns on diversified portfolios of stocks with robust and weak profitability, and CMA, the difference between the returns on diversified portfolios of the stocks of low and high investment firms".

Alquist & al. (2018, 45) demonstrated that "the size effect seems to have been made substantially stronger by including the two new Fama and French factors RMW and CMA". First Asness & al. (2018a), and then Alquist & al. (2018, 45-47) showed that the size premium substantially increased after controlling for quality while using the same QMJ factor.

Controlling for quality factors helps to observe the size effect and resolves many of its flaws, but it is no the "pure size effect", which still has a weak historical record (Alquist & al. 2018, 46).

2.2 Market anomalies

The size effect is one of the most prominent market anomalies. The existence of anomalies questions the validity of the efficient market hypothesis, or the notion that the price of a security fully reflects all available relevant information. A trading strategy associated with size premium promises to beat the market in the long run, which is impossible according to EMH. However, the size effect is only one of a number of market anomalies that could bring an abnormal return to investors.

Later in this chapter, the EMH and its levels along with other market anomalies are discussed.

2.2.1 Efficient-market hypothesis

An efficient market means that the prices of securities accurately reflect all related information and adjust instantly to all new information in the market. As the information

becomes available to all investors, good company's news will encourage investors to buy its stock and, as a consequence, raise the prices, and the bad news will push the prices down. The pressure from buyers and sellers will maintain the fair price of a financial asset.

The EMH has a strong influence on trading strategies. The fair price implies that it is not possible to find stocks with undervalued or overvalued prices and benefit from this by buying undervalued and selling overvalued financial assets. Therefore, it is not possible to earn superior risk-adjusted returns or do so consistently and/ or in the long term. This statement questions the ability of active management funds to outperform the market and explains the growing popularity of passive funds and ETFs. However, if the EMH is valid and assets are fairly priced, the investor buying stocks can expect fair compensation for the purchase of risky asset, which consists, according to CAPM, of a risk-free rate and a payment for risk associated with purchase of the stocks.

EMH has three forms – weak, semi-strong and strong – depending on what kind of information is available to investors. Each of the following levels of EMH incorporates all the previous ones, with a strong form including both weak and semi-strong. A weak form of
EMH assumes that stock prices reflect all the information that is already available in the market and studying the past trend or using methods of technical analysis will not yield superior returns. The semi-strong form of EMH assumes that the price quickly adapts to all new information that becomes available, implying that both technical and fundamental analysis are ineffectual. The strong form holds that the price already reflects both public and private information, including insider's information. (Corporate Finance Institute.)

2.2.2 Other market anomalies

In addition to the previously discussed the size anomaly, January effect and micro cap in this chapter other market anomalies are given. Usually, market anomalies are detected when conducting empirical tests. For example, the size anomaly was first observed while testing CAPM on historical data by Banz (1981). Market anomalies, when explored by investors, can lead to superior return in the market. However, investors who rely on trading strategies based on market anomalies should follow new research on anomalies, as anomalies can weaken or disappear over time, as has happened with the size premium. Some researched claim that the profitability of portfolio's strategies based on most prominent anomalies has approximately halved in recent years (Chordia, Subrahmanyam & Tong 2014). This thesis does not imply listing all known anomalies.

By definition, the market anomaly implies that the observed pattern is not explained by the existing models or paradigms. However, the new model could be developed to incorporate the anomaly. For example, new factors are added to asset pricing models to capture the risk associated with an anomaly and better explain stock's returns. Fama and French included some market anomalies in their firse three-factor (1993) and then five-factor (2014) asset pricing models. These models are designed to better predict stock returns by capturing sources of risk other than the market risk in CAPM.

One of the most prominent asset price anomalies (other than the size effect) found in academic literature according to Alquist & al. (2018, 8-9 & 47-48) are

- Value, or the notion that value stocks – those that trade at a lower price, given its fundamentals - outperform growth stocks.
- Momentum, or the tendency of growing stocks to continue growth for some time in the future.
- Low beta or low-volatility anomaly, which is the observation that stocks with lower beta (low volatility stocks) outperform stocks with higher beta (high volatility stocks).
- Reversals, the evidence that stock with relatively poor returns for some time (mounth, year) tend to reverse the course in the next period and vice versa.
- Liquidity, less liquid stocks earn liquidity premium oven more liquid stocks.
- Quality, or the notion that "high quality" stocks or stocks with high profitability, growth measures, and so forth, outperform "low quality" or junk stocks.

3 Research design

In this chapter the research design of the thesis is presented. The chapter starts with stating the objective and target of the research and presenting the scheme of the research design for this thesis. The methodology of the thesis is then discussed in detail, including data analysis methods and data used for analysis.

3.1 Research objective and target

The objective of this thesis is to determine whether the size effect is present on Nasdaq Nordic equity markets over 2007-2019 period. The target of the research is to analyse various aspects of the size effect in order to understand how it can be better explored.

The research was designed to provide a solid argument for answering the research question of this thesis: Does the size effect exist on Nasdaq Nordic stock markets? In order to answer this question and investigative questions that support RQ, the best way is to analyse the historical returns of small and big companies over the period of time. Therefore, quantitative analysis of the secondary data with the use of descriptive statistic methods was chosen as a research approach for this thesis.

The research was planned to be conducted in two stages. The appropriate data collection methods and data analysis methods were chosen in order to be able to answer the research question of the thesis. Details of the research design are presented in the figure 5.

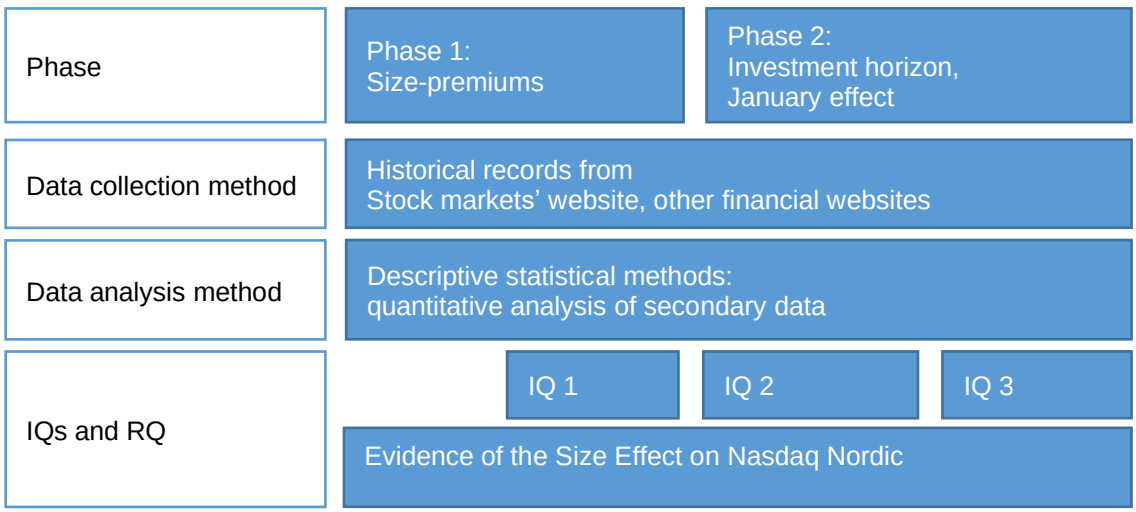

Figure 5. Research design

3.2 Data

In this section, the data used for the thesis is discussed in detail. The data source for this thesis, the type of data, and the geographic and time frames of this data are covered. The financial data for the thesis is the historical returns of the indices of big and small capitalization firms listed on Nasdaq Nordic equity markets, and the analysed time sample is from 2007 till 2019.

For the purpose of analysis, both monthly and annual returns we used in calculations. In cases where annual returns were not available, monthly data was used to calculate it. The annual returns were used to calculate the size premiums, and the monthly returns were used to estimate the January effect. Data on historical returns were retrieved from two sources – Nasdaq Nordic and Finance! Yahoo websites.

When choosing the period for analysis, the main factor was the availability of data on indices' values. For the indices of the Helsinki and Stockholm Stock Exchanges, data is available starting from the end of 2006, and the period of 13 years, from 2007 to 2019 was analysed. Data for the Copenhagen Large Cap index becomes available starting from 2013, so the period of 6 years from 2014 to 2019 was investigated. Additionally, in order to analyse returns over different investment periods, the above periods were divided into sub-periods.

This thesis analyses data from Nasdaq Nordic equity markets. These equity markets are operated by Nasdaq Nordic, a subsidiary of Nasdaq, Inc., which gives the official names of these exchanges as Nasdaq Helsinki, Nasdaq Stockholm, Nasdaq Copenhagen and Nasdaq Iceland. The Iceland Stock Market, although part of the Nordic equity markets, was excluded from the analysis due to the lack of comparable data for the Large Cap Index. In addition to Finland, Sweden, Denmark and Iceland, Norway comprises the Nordic geographic region. However, the Norwegian stock market is not operated by Nasdaq, and therefore was not included in the analysis.

To observe the size effect, the returns of the portfolios of large and small capitalization firms must be compared with each other over a long period. In this thesis, the official indices of small and large capitalization firms are used as a proxy for such portfolios.

According to the methodology of Nasdaq OMX Indexes (2018), all the listed companies are divided into three segments depending on a firm's market capitalizations. Companies with a capitalization of more than 1 billion euros make up a large capitalization segment,

mid capitalization companies are those with market capitalization from 150 million to 1 billion euros, and small companies have a capitalization of fewer than 150 million euros.

The indices are formed using the same breakpoints for market capitalization, for example, a large cap index is formed by companies with a market value of shares over a billion euros. Large and big capitalization are the same concepts, although Nasdaq used the word “large” in names of the indices of firms with big capitalization. Also, Nasdaq, Inc. uses capitalization in euros for forming the indices, thought markets operate in local currencies. The methodology used for Nasdaq indices is the same across the Nordic markets. The full names of the indices used in the analysis are:

OMX_Helsinki_Large_Cap_GI,
OMX_Helsinki_Small_Cap_GI,
OMX_Stockholm_Large_Cap_GI,
OMX_Stockholm_Small_Cap_GI,
OMX_Copenhagen_Large_Cap_GI
OMX_Copenhagen_Small_Cap_GI.

The indices consist of a different number of companies. Large Cap companies’ index on the Helsinki Stock Exchange includes 35 big companies or 25% of the 141 companies listed on the exchange. OMX_Stockholm_Large_Cap_GI consists of 131 companies out of 378, or 35% of all listings. The Large Cap Index on the Copenhagen Stock Exchange includes 41 companies or 31% of the total number of 132 listings.

Small Cap indices consist of 36% of all listed companies on Nasdaq Helsinki, 28% on Nasdaq Stockholm and 47% of all listings on Nasdaq Copenhagen.

All indices are value-weighted, meaning the weight of each company in the index depends on its market capitalization. All dividends are assumed to be reinvested in the index, which is indicated by the GI suffix at the end of the full name of the indices.

3.3 Research methods

The thesis utilizes methods of descriptive statistics throughout the analysis. Descriptive statistics provide a variety of methods for analysing and comparing the data obtained. In the first stage of the analysis, the returns of indices of big and small capitalization firms for each of the three selected markets are analysed. The cumulative returns are presented on the charts for visual comparison, and the risk and return parameters of the indices are presented in a table form. Next, the cumulative returns of indices for various investment

periods are presented in form of charts and tables. Finally, the average monthly returns are analysed to observe the seasonal pattern.

To compare the performance of different indices, the cumulative returns based on annual data are plotted on charts for each of the stock markets. Specifically, the development of a €100 hypothetical investment into both small and big firms' indices over the entire data period is observed. The cumulative return in this case is equal to total return, which is calculated using the following formula:

$$r = \frac{p_T - p_1}{p_1}$$

Where:

r – total return of an asset

p_T – price of an asset at time *T*

p_1 – initial price of an asset

For each equity markets, apart from the chart with cumulative returns, the risk and return indicators are presented in table format. The return characteristics are represented by the cumulative and compounded annual growth rate (CAGR). CAGR is the compounded average annual growth rate or a year-over-year growth rate that, when applied to the initial value and compounded, will lead to the final value at the end of the period (Berk & DeMarzo 2020, 1122). The usage of the compound growth rate is justified by the nature of the indices used for calculations, which implies that all dividends are reinvested.

$$CAGR = (\frac{p_j}{p_t})^{(1/T)} - 1$$

Where:

CAGR – compounded annual growth rate

p_j - ending value of an asset at time *j*

p_t - initial value of an asset at time *t*

T – total number of periods (years)

The risk of investments in indices is measured by the standard deviation. The standard deviation measures the volatility or variability of returns.

$$\sigma = \sqrt{Var(r)} = \sqrt{\frac{\sum_{i=1}^{N}(r_i - \overline{r})^2}{N}}$$

Where:

σ – standard deviation of the returns

$Var(r)$ – variance of the return *r*

r_i – return of an asset at time *i*

$\overline{r}$ – average return of an asset

N – the number of data points

The Sharpe ratio measures the ratio of reward (return) to volatility (standard deviation) provided by a portfolio or an investment (Berk & DeMarzo 2020, 415). The Sharpe ratio allows to compare investments with each other. Generally, a greater value of the Sharpe ratio indicates better risk-adjustment return. The Sharpe ratio can be used to analyse both past and expected performance of assets or portfilios. A portfolio's or an asset's excess return is calculated over the risk-free rate according to the formula below. Government bonds are usually used as a risk-free rate. They are not completely risk-free, but are used in this capacity in calculations, since their guarantor is the state, which is usually considered a reliable borrower. Risk-free rate used in calculations of the Sharpe ratio in this thesis is the average Euribor rate for 12 months over the data sample**.**

$$Sharpe\ ratio = \frac{portfolio\ excess\ return}{portfolio\ volatility} = \frac{r - r_f}{\sigma}$$

Where:

r – asset return

r_f – risk-free rate

σ – standard deviation of the returns

Finally, to find ϕ seasonal pattern in stock returns or, more specifically, to prove or refute the presence of the January effect on the Helsinki Stock Exchange, the average monthly returns are calculated. Average monthly return is the sum of the returns divided by the number of periods for which these returns are available. In particular, all January returns on the OMX Helsinki Small Cap Index are added together and then divided by the number of years for which the observations are available, and the same process applies to other months. The results are presented on the chart. According to the theory presented in the theoretical framework chapter of this thesis, the January effect is especially prominent in firms with small capitalization, so the OMX Helsinki Small Cap Index is analyzed to answer one of the investigative questions.

$$\overline{A} = \frac{1}{T}(R_1 + R_2 + \cdots + R_T) = \frac{1}{T}\sum_{t=1}^{T} R_t$$

Where:

$\overline{A}$ – average monthly return of an asset

R_t – realized monthly return of an asset at time t

T – number of periods

4 Findings

In this chapter, the results of the performed analysis are presented. These findings would allow to answer the investigative questions of this thesis and eventually answer the research question. The chapter is divided into three subchapters. First, the Finnish, Swedish, and Danish equity markets were looked into one by one for the evidence of the size effect. Then, the influence of investment periods on the profitability of small cap trading strategy was analysed. And last, the January effect was studied.

4.1 Size premiums on Nasdaq Nordic

4.1.1 Nasdaq Helsinki

First, the small cap premium was analysed on Nasdaq Helsinki. The chart below shows the growth in value of 100 euros invested in the OMX Helsinki Small Cap and OMX Helsinki Large Cap indices at the end of 2006. Returns were calculated on a year-end basis, and the type of the indices chosen for comparison assumes that all dividends are reinvested, and transaction costs are not included in calculations. Charts for the Stockholm and the Copenhagen Stock Exchanges in subsequent chapters were prepared using similar assumptions.

It is clear from the chart that the small cap index has significantly outperformed the large cap index over the entire sample period. Moreover, only for few years at the beginning of the observation period, which also coincided with the period of the global financial crisis, large cap firms surpassed small cap firms in terms of profitability.

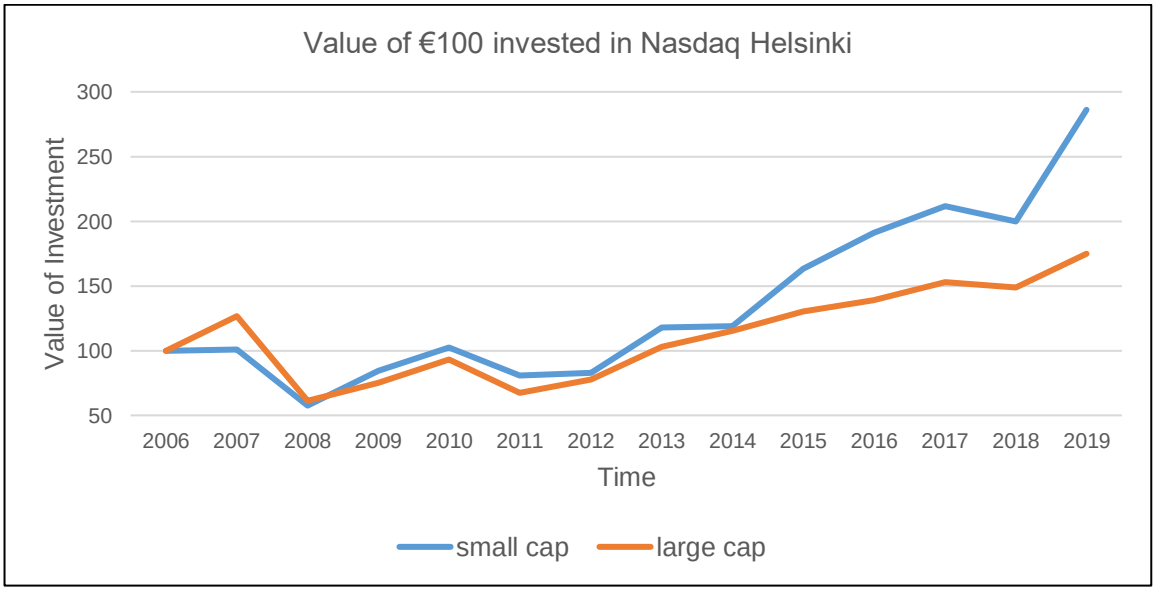

Figure 6. Value of €100 invested at the end of 2006 in the OMX Helsinki Small Cap and OMX Helsinki Large Cap Indices, 2007-2019

The following table (table 3) presents different risk and return characteristics for both indices over the same period as in the chart above. As noted earlier, the OMX Helsinki Small Cap Index provided 111 percentage points (pp) higher return than the OMX Helsinki Large Cap Index over the holding period of 13 years. Despite the significant difference in returns, the investment in the Small Cap Index was only slightly riskier than the investment in the Large Cap Index with 4 pp difference in the standard deviations of returns of the two indices. The Sharpe ratios reflect this discrepancy with the difference of approximately 13 pp in favour of the Small Cap Index.

Table 3. Risk and return ratios for small and big cap indices on Nasdaq Helsinki, 2007-2019

	OMX Helsinki Small Cap	OMX Helsinki Large Cap
Total return	186.1 %	74.9 %
Average annual return	11.8 %	7.5 %
CAGR	8.4 %	4.4 %
St.deviation	25.7 %	22.4 %
risk-free rate	1.4 %	1.4 %
Sharpe ratio	0.41	0.28

4.1.2 Nasdaq Stockholm

The growth of 100 euros invested on Nasdaq Stockholm in the OMX Stockholm Small and Large Cap indices is plotted on the chart below (figure 7). Two periods can be clearly distinguished on the chart. During the first period, which lasted from 2007 to 2014, both indices moved together with the Large Cap Index showing slightly better results. However, in 2015 the Small Cap Index surpassed the Large Cap Index and continued to grow at an accelerated rate, increasing the gap in profitability.

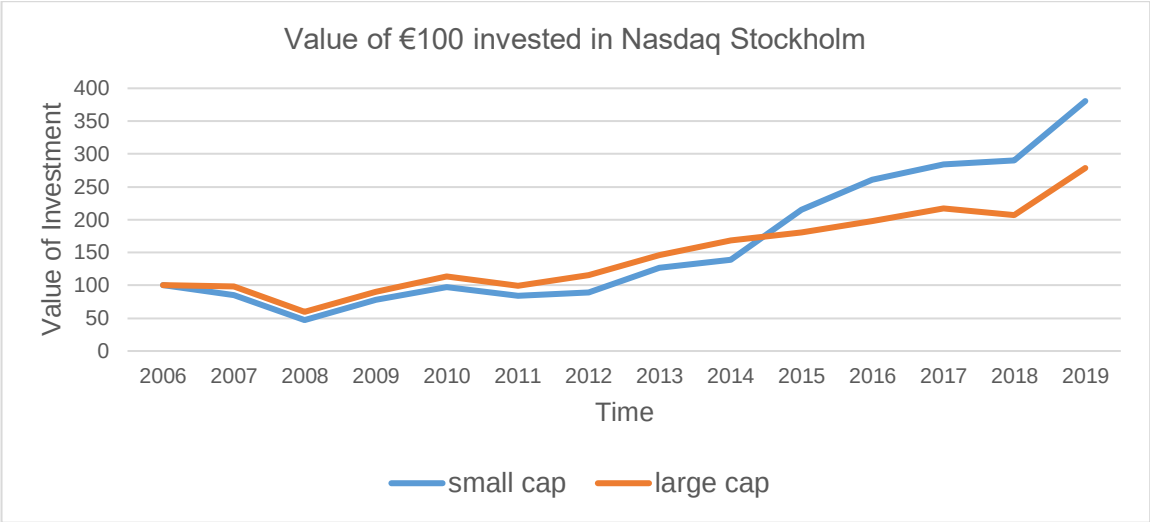

Figure 7. Value of €100 invested at the end of 2006 in the OMX Stockholm Small Cap and OMX Stockholm Large Cap Indices, 2007-2019

The risk and return characteristics of investments in the Small and Large Cap Indices in Sweden are summarized in table 4 below. The OMX Stockholm Small Cap delivered higher cumulative return than the OMX Stockholm Large Cap index with the investment in the first index increased by 280.6% compared to only 178.6% increase in the latter. In accordance with the theory, the more profitable investment turned out to be riskier, which is reflected in the standard deviation being approximately 7 pp higher for OMX Stockholm Small Cap. However, the investors in the Small Cap Index were better compensated for risk, as indicated by the Sharpe ratio.

Table 4. Risk and return ratios for small and big cap indices on Nasdaq Stockholm, 2007-2019

	OMX Stockholm Small Cap	OMX Stockholm Large Cap
Total return	280.6 %	178.6 %
Average annual return	14.9 %	10.6 %
CAGR	10.8 %	8.2 %
St.deviation	28.9 %	21.8 %
risk-free rate	1.3 %	1.3 %
Sharpe ratio	0.47	0.43

4.1.3 Nasdaq Copenhagen

The growth of the investments in the OMX Copenhagen Small and OMX Copenhagen Large Cap Indices is plotted on the chart below (figure 8). The investment horizon was only 6 years since the data on the Large Cap index is available starting from 2013. Three periods can be distinguished based on the analysis of the movements of the indices.

During the first three years of the observed period, the Large Cap Index outperformed the Small Cap index, for 2016-2017 the indices were moving close to each other with similar returns, and in 2019 the Large Cap Index showed better results again. Over the entire period 2014-2019, the large cap firms showed slightly better results than small cap firms. The investment of 100 euros made at the end of 2013 in the OMX Copenhagen Small Cap Index would increase to €203 by the end of 2019, compared to 214 euros received on 100 euros investment in the OMX Copenhagen Large Cap Index. The difference in the total returns on indices is approximately 10 pp in favour of the Large Cap Index.

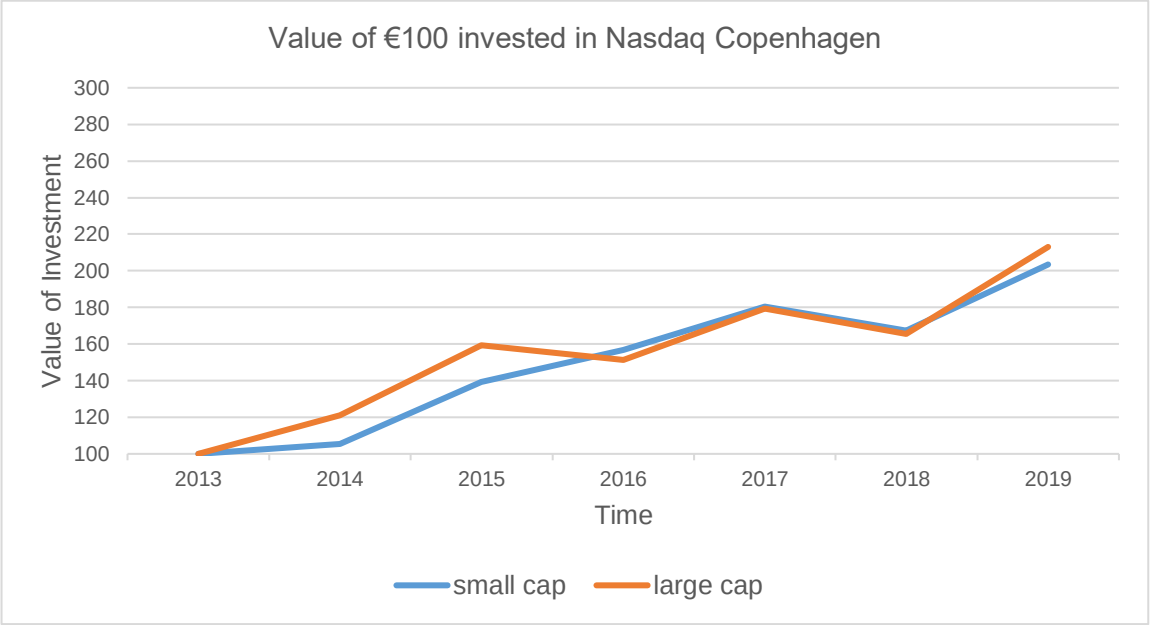

Figure 8. Value of €100 invested at the end of 2013 in the OMX Copenhagen Small Cap and OMX Copenhagen Large Cap indices, 2014-2019

The difference in average annual returns between the Small and Large Indices is only 1,3 pp and it is the lowest value among all equity markets reviewed in this work. Investment in the Copenhagen Stock Exchange size-based indices had the best risk-return characteristics among the markets reviewed with Sharpe ratio close to 1, and such a high value could be explained by low standard deviation or risk of the investments. All the risk and return characteristics are shown in table 5.

Table 5. Risk and return ratios for small and big cap indices on Nasdaq Copenhagen, 2014-2019

	OMX Copenhagen Small Cap	OMX Copenhagen Large Cap
Total return	103.5 %	113.1 %
Average annual return	13.3 %	14.5 %
CAGR	12.6 %	13.4 %
St.deviation	12.3 %	15.4 %
risk-free rate	1.2 %	1.2 %
Sharpe ratio	0.98	0.86

4.2 Impact of the investment period on a premium

The size effect assumes that small stocks are more profitable than big stocks over long horizons. To prove the size effect, the researchers used an entire sample of available data on the U.S. stock markets' returns dating back to 1926, and data records starting from the 1980s were analysed to prove that the size effect disappeared. When the sample included both periods, from 1926 to the 1980s and from the 1980s till 2010s, the observed size effect was weak. In this thesis, the maximum period analysed was 13 years, and while the data indicated that there was the size effect in two of the three markets under consideration, the behavior of the indices within the period under review is worth considering.

Despite the overall performance of the over the observed period, the moment of investment, the investment horizon and economic conditions of the economy have a significant impact on the premium. For example, this effect can be estimated by the movement of indices on the Helsinki Stock Exchange. The graphs shown below (figure 9 and figure 10) illustrate the growth of 100 euros invested in the same indices discussed earlier, the OMX Helsinki Small Cap and the OMX Helsinki Large Cap, but investments made at the end of 2006 grew for 8 years, and investments made at the end of 2014 grew for 5 years until the end of 2019. Over the 2007-2014 period, investors in small and big stock would earn 19% and 15% respectively. However, over the shorter period of 2015-2019, investment in small stocks would grow by 140%, while investment in large stocks would grow by only 52%.

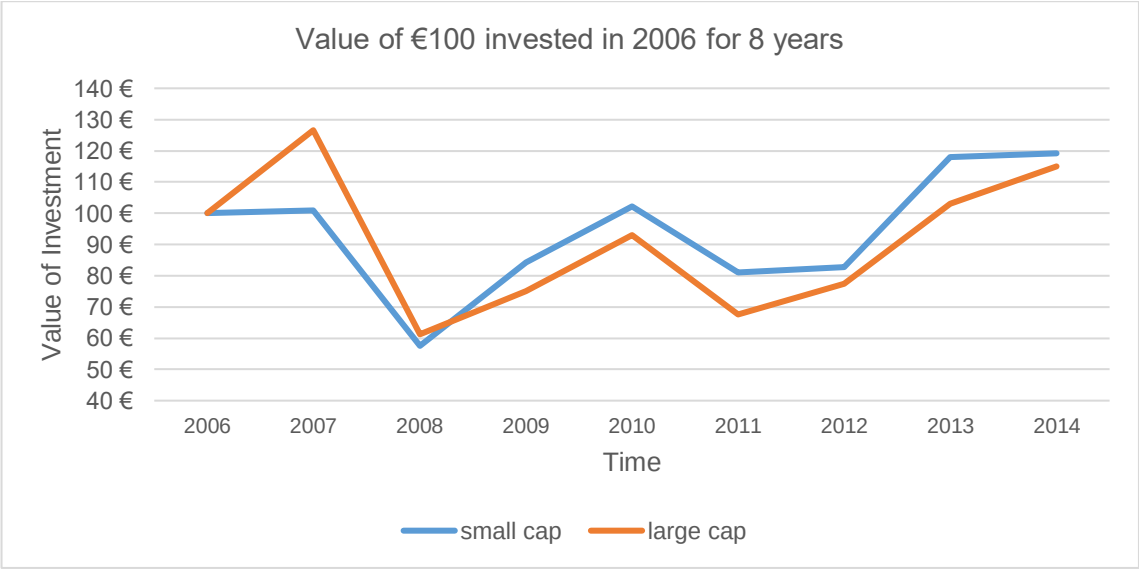

Figure 9. Value of €100 invested in the OMX Helsinki Small Cap and OMX Helsinki Large Cap Indices at the end of 2006, investment period 2007-2014

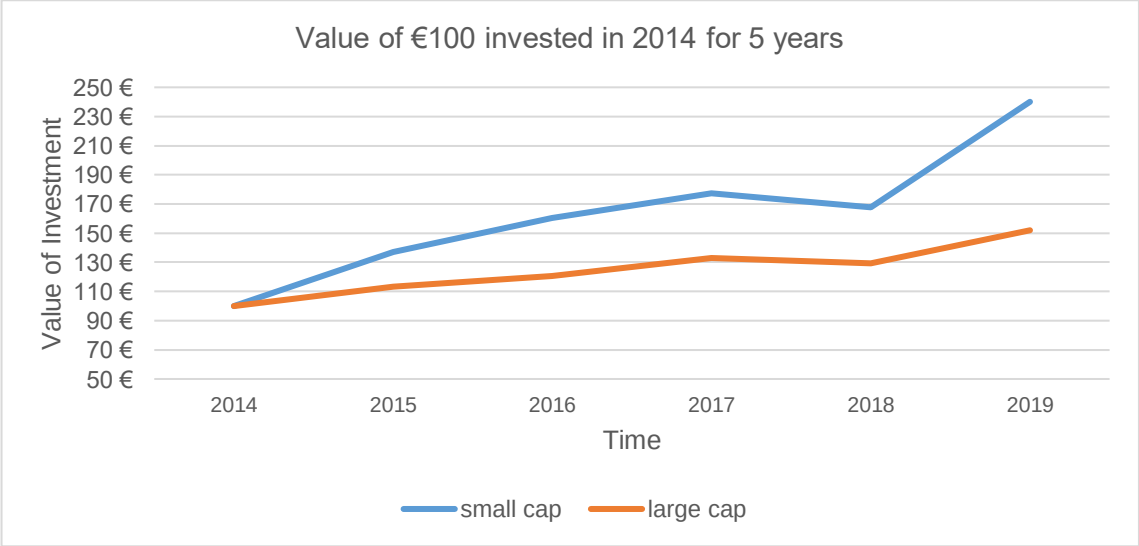

Figure 10. Value of €100 invested in the OMX Helsinki Small Cap and OMX Helsinki Large Cap indices at the end of 2014, investment period 2015-2019

Table 6 below summarizes the return values for different investment periods. As can be observed, for each of the periods the Small Cap Index produced superior returns to the Large Cap Index, but the difference in returns significantly depends on the investment intervals. The highest total returns were achieved over the entire observed period of 13 years for both indices.

Table 6. Return ratios for the Small and Large Cap Indices on Nasdaq Helsinki for different investment periods over 2007-2019

	2007-2014		2015-2019		2007-2019	
	small	large	small	large	small	large
total return	19.2 %	15.1 %	140.1 %	52.0 %	186.1 %	74.9 %
CAGR	2.2 %	1.8 %	19.1 %	8.7 %	8.4 %	4.4 %

On Nasdaq Stockholm, the cumulative return of the Large Cap Index for 2007-2014 was 30 pp higher than the return of the Small Cap Index for the same period. In the subsequent period, for 2015-2019, investors in the Small Cap Index would be better off than investors in the Large Cap index. Among all the periods considered, investors in the Stockholm Small Cap Index that invested money for the longest period of thirteen years would get the most profit. The returns for different investment horizons in indices on the Stockholm Stock Exchange are presented in the table 7 below.

Table 7. Return ratios for Small and Large Cap indices on Nasdaq Stockholm for different investment periods over 2007-2019

	2007-2014		2015-2019		2007-2019	
	small	large	small	large	small	large
total return	39.2 %	68.7 %	77.3 %	54.2 %	281 %	179 %
CAGR	4.2 %	6.8 %	12.1 %	9.0 %	11 %	8 %

The poor performance of small cap funds on the Helsinki and Stockholm Stock Exchanges in 2008-2009 coincided with the global financial crisis of 2008-2009. During this period, both small and large cap indices dropped, but the indices of large firms declined by a smaller percentage. On Nasdaq Stockholm, the OMX Stockholm Large Cap Index outperformed the OMX Stockholm Small Cap index during the financial crisis of 2008-2009 and for several years after. This observation is consistent with the results of the academic work of Hur & al. (2014), who argued that during a “down economy” companies with big capitalization outperform those with small capitalization and found that this observation is statistically significant.

4.3 January effect

The purpose of the final stage of the analysis was to observe whether the size effect is dominated by the January effect. The analysis of January returns is acceptable regardless of whether the size effect is present of not in a particular equity market. As was illustrated in the theoretical framework of this thesis, though the size effect weakened or even

disappeared after the 1980s, the presence of the January effect is not questioned by academics.

To prove or disprove the stronger January returns, the OMX Helsinki Small Cap Index for 2006-2019 sample was further examined. The figure 11 below plots the average monthly returns of the small cap index for each month from January till December.

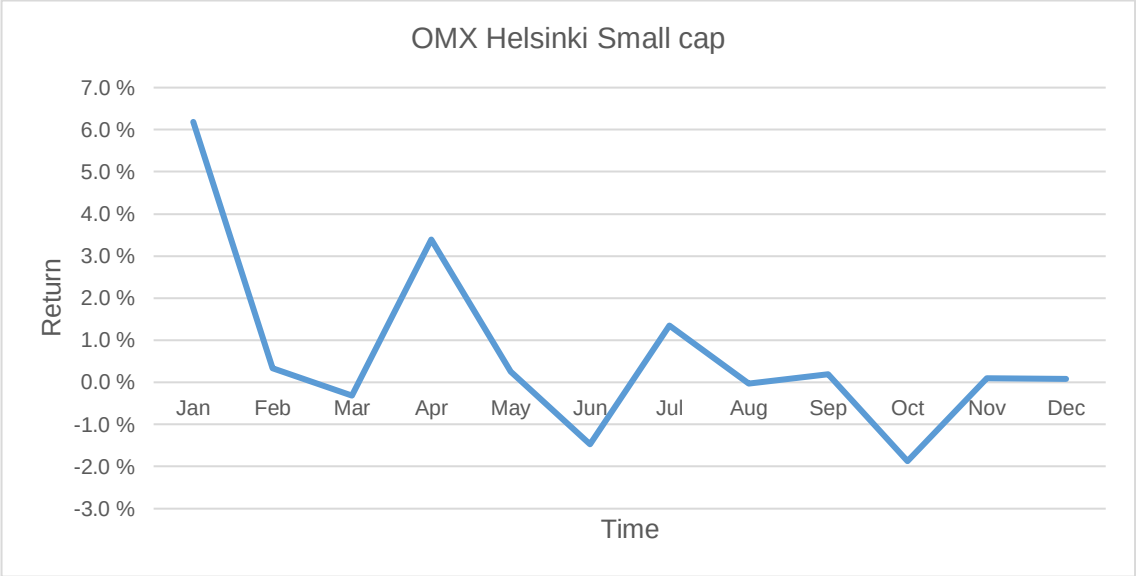

Figure 11. Average monthly returns of the OMX Helsinki Small Cap Index, 2007-2019

As the figure clearly shows, the January's returns stood out from the returns of the other months. The average returns in January were 6.2% compared to the average returns of 0.18% for the months from February to December. However, the returns in months other than January were not flat with, for example, average April return being only 3% smaller than average January return.

5 Discussion

In this chapter, the conclusion is presented along with the answers to the investigative questions. The validity and limitations of the research are discussed, as well as the suggestions for further research and the author's reflection on learning.

5.1 Conclusion

The conclusion is supposed to answer the research question of this thesis: Does the size effect exist on Nasdaq Nordic stock markets? The analysis showed that the size effect was present on the stock exchanges in Helsinki and Stockholm. On both markets the large cap indices outperformed the small capitalization indices over the 2007-2019 sample period. However, for certain consecutive years, large cap firms showed better results than those of small capitalization on both markets. From this it can be concluded that the investment horizon and the moment of entering the market significantly affect the premium that an investor receives from their investments. The analysis also confirmed the hypothesis that the big cap firms perform better than small cap firms in down markets. The claim that the size effect is particularly strong in January was supported by data for the OMX Helsinki Small Cap Index. However, the size effect did not originate exclusively in January, since the returns in some other months were significantly different from zero.

The size effect was not documented on the Copenhagen Stock Exchange for the sample period. However, the structure of the OMX Copenhagen Large Cap Index raises the validity concerns about this result, which are discussed in chapters below.

The evidence of the size effect on the Helsinki and Stockholm Stock Exchanges could be explored by investors who are looking for abnormal returns on their investments. The January effect and the stock's behaviour in down markets could also be taken into consideration. The liquidity issues, usually associated with investing in small stocks, and transaction costs could have a significant impact on the premium and should be taken into consideration before making an investment decision. In addition, it should be noted that past returns are not a guarantee of future results.

5.2 Main findings

In this chapter, the main findings of the thesis are presented in the form of answers to investigative questions. Reference to the theoretical framework is made in the answers to the questions.

1. **Do the small capitalization companies historically outperform those of big capitalization on Nasdaq Nordic?**

The answer to this question depends on the market. As the analysis showed, on the Helsinki and Stockholm Stock Exchanges, the small cap indices significantly outperformed the big cap indices for the entire observation period. On Nasdaq Copenhagen, the OMH Copenhagen Large Cap outperformed OMX Copenhagen Small Cap over the 2014-2019 period, but the difference in average yearly returns was only 1.3 pp. Such diversity is not significant and could indicate that there was no difference in the returns of small and big capitalization companies over the observed period of 6 years.

As shown in the theoretical basis of this thesis, there is no consensus among scientists where the size effect has only weakened or disappeared since the 1980s. Most researchers believe that the size effect has only weak record on the international markets. The presented analysis showed that the size effect was present in the stock markets of Finland and Sweden for the observed period. How strong this effect is and how it has changed in comparison with earlier periods cannot be found out due to the lack of indices' data.

2. **How the size premiums are affected by investment horizon and economic conditions?**

The analysis showed that the investment horizon does impact the size premium that an investor receives. Though the historical record was relatively short, its analysis led to conclusion that the investment period, as well as the moment of entering the market, strongly affect the profitability of investments. Although the small stock indices outperformed those of big capitalization on Nasdaq Helsinki and Nasdaq Stockholm for the entire observed period, the analysis revealed periods when both indices showed relatively low profitability or the big cap firms produced superior returns to those of small cap firms. This observation does not contradict the theory that thought companies with small market capitalization outperform those with a big market capitalization over long periods, in some periods of history the big capitalization companies had better results than small capitalization firms for several years in a row.

Further analysis of the periods showed that during the global financial crisis of 2008-2009, Large Cap indices showed better results than Small Cap indices. This observation supports the findings of Hur & al. (2014) who claim that a portfolio consisting of stocks of large companies performs better in down markets. There were no data on the

Copenhagen indices for this period. The intuitive explanation for this phenomenon is that during a period of unstable economy investors prefer to keep their funds in more stable and less risky companies, so they prefer large companies to small ones.

3. Does the size effect is strongest in January?

The analysis based on data from the Helsinki Stock Exchange allowed concluding that the returns of small capitalization firms are highest in January. On average, the January OMX Helsinki Small Cap index's returns were 6 percentage points higher than the returns in other months. This result is similar to the results obtained from the analysis of the January effect on international equity markets.

However, in comparison with, for example, Van Dijk's observations (2011, 3271), the returns of the Small Cap Index in months other than January on Nasdaq Helsinki did not fluctuate around zero. Thus, it can be concluded that the size effect is strongest in January, but it is not dominated by January's returns. It can be inferred that the observed January effect on Nasdaq Helsinki was weaker than the January effect on other international markets, and this finding requires further study.

5.3 Validity and limitations

The research was designed, and the methods were chosen in such a way as to provide solid arguments to answer the research question of this thesis. The validity is especially important in quantitative research, and this is the main method this thesis uses. The data for the research was collected from official sources. The theoretical framework of this thesis was mainly based on the academic research papers published in scientific journals. The descriptive statistical methods were closely followed in the empirical part of the thesis.

The main validity concern of this thesis that could make its results not comparable with the results obtained in other papers on the size effect was the usage of indices in the research. The indices were considered as proxies for portfolios of small and big firms in this thesis. However, the main method that is used in the analysis of the size effect assumes the division of stocks into portfolios, often as many as ten, based on market capitalization and comparing the returns of such portfolios with each other. The use of indices implies some limitations, for example, it does not allow to compare the return of the smallest decile of companies by market capitalization with the returns of the biggest decile, which would allow to make more accurate conclusions. Also, depending on the capitalization of firms in each particular market, the indices represent a different proportion

of companies, and the results of two indices could be not comparable. For example, on the Helsinki Stock Exchange, the OMX Helsinki Large and OMX Helsinki Small Cap Indices represent 25% and 36% of all listed companies respectively, which are comparable shares of companies. But on the Copenhagen Stock Exchange, the respective proportions of large and small companies in indices are 31% and 47%, and so the OMX Copenhagen Small Cap index represents almost half of the total amount of listed companies and could not be used as a proxy for small cap stocks. This fact raises questions about the validity of results obtained from Nasdaq Copenhagen.

The other limitation of this thesis was the short historical record of observations. Originally the size effect was noticed by analysing a data sample that goes back to 1926, and the definition of the size effect states that small firms outperform those with large capitalization over long periods. However, since data on indices used in this thesis became available starting from 2016, the longest period used for analysis is 13 years, which is a relatively short historic record.

Also, the considered time period included only one financial crisis of 2008-2009, and the data of this period served as the basis for the conclusion about the profitability of indices on down markets. in order to make a more reasonable conclusion about the difference in returns of companies with small and large capitalization during the crisis, the period under review should include at least several crises.

5.4 Suggestions for further research

The opportunity for further research concerns topics not covered or slightly covered in this thesis, some ideas for research can be obtained from the theory review in this thesis. For example, based on logic we can conclude that companies with small capitalization are less liquid compared to companies with large capitalization, and this may be the reason for the existence of the size premium. However, this suggestion along with other possible explanations should be further researched.

Another suggestion for further research concerns the profitability of a trading strategy based on exploring the size premium. Even if the size premium exists, it may be difficult to receive it due to transaction costs. Linked to a trading strategy, the research could be conducted on the profitability of Finnish small cap mutual funds that invest in small companies.

Also, the recent papers on the validity of the size effect while controlling for the quality characteristics of the stocks, like the work of Asness & al. “Size matters, if you control

your junk" (2018a), provide an opportunity for further analysis. This theory can be checked for validity by testing the financial data on Nordic equity markets.

It is worth noting that a more valid research of the size effect could be conducted by comparing the size-based portfolio's returns. This analysis will also allow evaluating the linearity of the size-based premiums. However, until the number of registered companies increases significantly, or their market capitalization is more evenly distributed, the possibility of conducting such an analysis on Nordic equity market remains questionable.

5.5 Reflection on learning

I found the process of writing the thesis to be both challenging and highly satisfying. While researching the topic, I deepened my knowledge about the core finance theory and concepts but also learned about the most recent research topics. Because I could not apply the most typical research methods used in analysing the size effect, I had to figure out what methods could be used to test the phenomenon in the framework of this thesis and how to prove the concept with data from the real world.

The main discovery for me was the close connection between practice and current academic research. The conclusions of the latest research papers can be immediately used in trading practices and be useful for all kind of investors. Therefore, it is highly important to follow the latest research papers in order to have the most up-to-date reliable and practical knowledge.

The main obstacle I have encountered is the lack of deeper knowledge of statistics and the methods it uses. The data for the research must be analysed in a consistent and reliable manner using appropriate statistical methods in order for the research to be reliable and comparable to other studies. Also, the volume of data in finance requires a more efficient method of data processing and analysis, so a deeper knowledge of Excel and possibly programming languages would help to conduct a more thorough analysis.

References

Alquist, R., Israel, R. & Moskowitz, T. 2018. Fact, Fiction, and the Size Effect. Journal of Portfolio Management, 45, 1, pp. 34-61.

Asness, C., Frazzini, A., Israel, R., Moskowitz, T.J. & Pedersen, L.H. 2018a. Size matters, if you control your junk. Journal of Financial Economics, 129, 3, pp. 479-509.

Asness, C.S., Frazzini, A. & Pedersen, L. H. 2018b. Quality minus junk. URL: https://link.springer.com/article/10.1007/s11142-018-9470-2. Accessed: 6 April 2020.

Banz, R. W. 1981. The relationship between return and market value of common stocks. Journal of Financial Economics, 9, 1, pp.3-18.

Barry, C., Goldreyer, E., Lockwood, L. & Rodriguez, M. 2002.
Robustness of size and value effects in emerging equity markets, 1985–2000. Emerging Markets Review, 3, 1, pp. 1-30

Berk, J. & DeMarzo, P. 2020. Corporate finance. 5th ed. Pearson, p.1130.

Bettman, J.L., Ng, W.S.K. & Sault, S.J. 2010. The economic significance of trading based on the size effect in Australia. Australian Journal of Management, 36, 1, pp. 59-73

Branch, B. & Chang, K. 1990. Low price stocks and the January effect. Quarterly Journal of Business and Economics, 29, 3, pp. 90-118.

Bryan, A. 2014. Does the Small-Cap Premium Exist? URL: https://www.morningstar.com/articles/631329/does-the-small-cap-premium-exist. Accessed: 3 April 2020.

Chordia, T., Subrahmanyam, A. & Tong, Q. 2014. Have capital market anomalies attenuated in the recent era of high liquidity and trading activity? Journal of Accounting and Economics, 58,1, pp. 41-58.

Corporate Finance Institute. What is the Efficient Markets Hypothesis? URL: https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/efficient-markets-hypothesis/. Accessed: 8 April 2020.

Crain, M. 2011. A literature review of the size effect. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1710076. Accessed: 7 February 2020.

Damodaran, A. 2015. The small cap premium: Where is the beef? URL: https://aswathdamodaran.blogspot.com/2015/04/the-small-cap-premium-fact-fiction-and.html. Accessed: 7 February 2020.

Daniel, W.W. & Terrell, J.C. 1997. Business Statistics, Basic Concepts and Methodology. Houghton Mifflin. Boston.

Euribor 12 months**.** URL: https://www.euribor-rates.eu/en/current-euribor-rates/4/euribor-rate-12-months/. Accessed: 17 April 2020.

Fama, E.F. 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. The Journal of Finance, 25, 2, pp. 383-417

Fama, E.F. & French, K.R. 1992. The Cross-Section of Expected Stock Returns. The Journal of Finance, 42, 2, pp.427

Fama, E.F. & French, K.R. 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33, 1, pp.3-56.

Fama, E.F. & French, K.R. 2012. Size, value, and momentum in international stock returns. Journal of Financial Economics, 105, 3, pp. 457-472.

Fama, E.F. & French, K.R. 2008. Disserting anomalies. Journal of Finance, 63, 4, pp. 1653-1678

Fama, E.F. & French, K.R. 2015. A five-factor asset pricing model. Journal of Financial Economics, 116, 1, pp. 1-22.

Horowitz, J.L., Loughran, T. & Savin, N.E. 2000. The disappearing size effect. Research in Economics, 54, pp. 83-100.

Hur, J., Pettengill, G. & Singh, V. 2014. Market states and the risk-based explanation of the size premium. Journal of Empirical Finance, 28, pp. 139-150.

Keim, D.B. 1983. Size-related anomalies and stock return seasonality: Further empirical evidence. Journal of Financial Economics, 12, pp. 13-32.
Levy, H & Levy, V. 2011. The small firm effect: A financial mirage? Journal of Portfolio Management, 37, 2, pp. 129-138.

Lintner, J. 1965. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. Review of Economics and Statistics, 47, pp. 13-37.

Moller, N. & Zilca, S. 2008. The evolution of the January effect. Journal of Banking & Finance, 32, 3, pp. 447-457.

Mossin, J. 1966. Equilibrium in a Capital Asset Market. Econometrics, 34, pp. 768-783.

Nasdaq. 2018. Rules for the Construction and Maintenance of the NASDAQ OMX All-Share, Benchmark and Sector Indexes. URL: https://indexes.nasdaqomx.com/docs/Methodology_NORDIC.pdf. Accessed: 9 May 2019.

Reinganum, M. R. 1981. Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings' Yields and Market Values. Journal of Financial Economics, 9, 19-46.

Roll, R. 1983. Vas ist das? The turn of the year effect and the return premia of small firms. Journal of Portfolio Management, 9, 2, pp. 18-28.

Sharpe, W.F. 1964. Capital asset prices: a theory of market equilibrium under conditions of risk. Journal of Finance, 19, pp. 425-442.

Schwert, G.W. 2002. Anomalies and Market Efficiency. NBER Working Paper Series, Cambridge.

Treynor, J. 1961. Market Value, Time, and Risk. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2600356. Accessed: 1 March 2020.

Van Dijk, M.A. 2011. Is size dead? A review of the size effect in equity returns. Journal of Banking & Finance, 35, 12, pp. 3263-3274.