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The Asset Growth of Firms and Stock Price Momentum

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Abstract

OBJECTIVES OF THE STUDY

The purpose of this thesis is to see whether large asset growth expansions or contractions are related to momentum effect. In momentum strategy, past winner stocks are bought and past loser stocks are sold in order to profit from momentum anomaly.

DATA AND METHODOLOGY

Data is retrieved from the Thomson- Reuter Datastream/WorldScope database. The sample covers all firms that have existed during July 1985 and June 2015 from particular stock markets of Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom as well as Canada and Japan.

Two-tailed t-tests are conducted in Stata to measure the return differences of different stock portfolios formed from this data. In the first test, stock portfolios are sorted into three groups (low, middle, high) based on prior asset growth for countries in order to see if the returns are lower in high asset growth groups. In the second test, stock portfolios are sorted into three groups (low, middle, high) based on past 11-month returns for countries in order to see whether the past winners (high group) outperform the past losers (low group). In the third test, stocks are grouped into asset growth groups (low, middle, high) in order to see is there momentum effect present in the low and high asset growth groups. Finally, OLS regressions are conducted for each country with the aggregate momentum profits as the dependent variable and lagged aggregate asset growth rate as the explanatory variable.

FINDINGS OF THE STUDY

The results show that there is an asset growth effect present in most of the countries of the sample but the momentum effect was not significantly present. The key finding is that, there are significant momentum profits in the highest asset growth rate group and often in the low asset growth rate groups as well. This is in line with Nyberg and Pöyry (2014), who find that the momentum effect is strong when there are large asset expansions and contractions. Large balance sheet asset growth rate changes do seem to be related to the momentum effect.

Keywords asset growth, momentum strategy, market anomaly

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Abstract of master's thesis

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Työn nimi Yritysten varojenkasvu ja osakkeiden hinnan dynamiikka

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Tiivistelmä

TUTKIMUKSEN TAVOITTEET

Tämän gradun tarkoitus on tutkia, onko firmojen suurilla varojen kasvuilla tai supistumisilla yhteyttä momentum –anomaliaan. Momentum -strategiassa haetaan momentum –anomaliaan perustuvaa voittoa ostamalla viimeaikaisten voittajafirmojen osakkeita ja myymällä viimeaikaisten häviäjien osakkeita.

DATA JA METODOLOGIA

Data tulee Thomson- Reuter Datastream/WorldScope –tietokannasta. Otanta kattaa kaikki firmat, jotka ovat heinäkuun 1985 ja kesäkuun 2015 välisenä aikana olleet listattuna pörsseihin Itävallassa, Belgiassa, Suomessa, Ranskassa, Saksassa, Italiassa, Hollannissa, Norjassa, Espanjassa, Ruotsissa, Sveitsissä, Isossa-Britaniassa, Kanadassa ja Japanissa.

Kaksisuuntaisia t-testejä tehdään Statassa, jotta saadaan selville tuottoerot eri osakeportfolioiden välillä, jotka on muodostettu otannasta. Ensimmäisessä testissä osakeportfoliot jaetaan kolmeen ryhmään (matala, keskiväli, korkea) osakefirmojen aiemman taseen varojenkasvun perusteella, jotta nähdään ovatko tuotot alhaisempia korkean varojenkasvun kokeneissa firmoissa. Toisessa testissä osakkeet jaotellaan kolmeen ryhmään (matala, keskiväli, korkea) osakkeiden aiemman 11-kuukauden tuottojen perusteella, jotta nähdään tuottavatko aiemmat voittajaosakkeet (korkea ryhmä) paremmin kuin aiemmat häviäjäosakkeet (matala ryhmä). Kolmannessa testissä osakkeet ryhmitellään taseen varojen perusteella kolmeen ryhmään (matala, keskiväli, korkea), jotta nähdään onko momentumia matalassa ja korkeassa varojenkasvu -ryhmässä. Lopuksi, OLS –regressiot tehdään maittain, missä maittaista momentum –tuotoista muodostettua, markkina-arvolla painotettu keskiarvoa selitetään markkina-arvolla painotetulla maittaisella taseen varojenkasvun lagatullla keskiarvolla.

TUTKIMUKSEN TULOKSET

Tulosten mukaan korkea varojen kasvu liittyy matalaan tuottoon suurimmassa osassa otanta-maita, mutta statistisesti merkitesevää momentumia ei löytynyt. Avainlöydös on se, että merkitseviä momentum –tuottoja löytyi korkean varojenkasvun ryhmästä ja usein myös matalan kasvun ryhmästä. Tulokset ovat samanlaisia tutkimuksen Nyberg ja Pöyry (2014) kanssa, jossa todettiin vahvaa momentumia niiden firmojen osakkeissa, joiden taseen varat ovat joko kasvaneet tai kutistuneet merkittävästi.

Avainsanat varojenkasvu, momentum -strategia, markkinapoikkeavuudet

The Asset Growth of Firms and Stock Price Momentum

Table of contents

List of tables

1. Introduction

1.1 Setting of the study and key research area

The continuation of short-term returns or the momentum effect seems to be one of the more stubborn anomalies that do not disappear from the stock markets even though it has been discovered a while ago. Market anomalies are return distortions in the stock markets that challenge the efficient-market hypothesis. In its strongest form, the theory of efficient markets holds that the past behavior of stock prices does not contain any useful information about the future stock prices. Momentum trading strategy is one which buys stocks with the highest past returns and sells stocks with the lowest past returns over the past 2-12 month period. This simple trading strategy of buying recent winners and selling recent losers seems to produce large risk-adjusted profits. Jegadeesh and Titman (1993) discover this effect, which has been titled the momentum effect. Usually market anomalies tend to disappear over time once they have been discovered as investors exploit these strategies. However, since the momentum effect has such a high persistency, it has attracted academic debate about whether it is truly a sign of market inefficiency or a result of a rational pricing depending on what drives the momentum effect.

The financial literature has variety of explanations for the momentum effect. The most commonly cited reasons for the momentum effect and its persistence include behavioral biases like investor herding, investor over and under-reaction and confirmation bias. Another interpretation is that stocks underreact to new information, which means that good and bad news take long time to fully incorporate to the price. The initial stock price reaction, according to this point of view, is then too mild and only partial.

Nyberg and Pöyry (2014) find that short-term stock return momentum profits are large for firms that have experienced either large asset expansions or contractions, even when controlling for previously documented firm-level drivers of momentum. This implies that momentum effect relates to the investment behavior of firms. Furthermore, Nyberg and Pöyry (2014) discover that momentum seems to be driven by *rapid* rather than slow changes in the assets of the firms. This is not a compatible finding to that of Berk et al. (1999), who model that momentum profits arise due to slow changes in firms' asset bases resulting in staleness in expected returns that lead to momentum. The results of Nyberg and Pöyry (2014) are more

compatible with those of Hackbarth and Johnson (2012) who argue firms with more investment flexibility have a distinctive feature that their risk falls, on average, as profitability declines and as operating leverage increases. The opposite happens with firms with less investment flexibility. Their model implies U-shaped autocorrelations conditional on lagged operating variables. The link between expected growth and the asset growth seems strong. Fama and French (2006) find that lagged growth shows strong power to forecast asset growth up to 3 years ahead. This means that realized asset growth might be useful as a proxy for expected growth.

In case, the momentum effect is related to the firm-level investment, a change in the total balance sheets assets of a firm can be used as a simple proxy of the firm-level investments. Inspired by the promising results of Nyberg and Pöyry (2014), who show that asset growth rate seems to explain momentum profits in the U.S. context, this thesis expands their study to examine whether the asset growth rate can also explain the momentum effect internationally. Specifically, Nyberg and Pöyry (2014) argue that extreme firm-level asset expansions and contractions, as measured by the asset growth rate variable, seem to be the connected to the momentum profits. In other words, this thesis examines whether large balance sheet asset expansions or contractions could be behind the momentum profits using the asset growth rate proxy. This thesis also draws attention to the possible aggregate asset growth correlations between countries, in which there are clear times of higher and lower asset growth internationally. It will test whether or not an international aggregate asset growth rate can predict momentum profits in individual countries.

1.2 Research questions

In this thesis, the stock markets in 14 countries are analyzed in order to see if there is momentum profits and whether they can be explained by firm-level investment activity. If there are momentum profits, it is further examined whether the cross-sectional return premiums are connected to one another in 14 countries.

There are four research questions that will be examined in order to see whether asset growth rates can explain momentum profits. The principal research questions can be summarized as follows.

1. Is the asset growth effect present in the stock markets of the selected countries? Does the asset growth effect differ across the countries? The asset growth effect means that the average monthly holding period returns are smaller for those firms that have experienced more asset growth.
2. Is momentum effect present in the stock markets of the selected countries? The momentum effect means that stocks that outperform their peers produce higher returns in the future (from two to 12 months of time).
3. Do larger changes in assets result in larger momentum profits?
4. Can international aggregate asset growth rate explain momentum in individual countries?

1.3 Contribution to the existing literature

Jegadeesh and Titman (1993) have shown that buying recent winners and selling losers produces abnormal returns. However, the persistence of momentum profits after the anomaly has been widely publicized suggests that there might be more to the momentum effect than simple market inefficiency or bias. Market anomalies are hard to profit from in the long-term even if they occur systematically due to trading costs, taxes and the level of risk. Overall, the momentum effect seems to be rather re-occurring in international markets but lacks a satisfying explanation.

The contribution of my thesis to the financial literature and research is straightforward. It expands the study of Nyberg and Pöyry (2014) by studying the possible relationship between large asset expansions and contractions in relation to momentum profits outside the context of United States. To my knowledge, existing research has not studied asset growth rate as an explaining factor of momentum in the international context. I study stocks of 12 European countries as well as Japan and Canada in order to see if the results of Nyberg and Pöyry (2014) apply outside of the U.S. data. Nyberg and Pöyry (2014) find that large changes in balance sheet asset growth rates are one of the most robust factors in explaining momentum profits. In order to study the relationship between asset growth rates and the momentum profits, both asset growth effect and momentum effect are also looked into separately in this thesis.

So, one contribution of this thesis is to examine the momentum profits in the international context with new data. Previous research finds momentum effect internationally, but the momentum effect seems to vary across different time spans and countries (Rouwenhorst, 1998).

The sample covers stocks in 14 countries over a 30-year time period of, which should provide a healthy view on the existence of the momentum effect internationally. As momentum effect is known vary in time, it is interesting to see how strong the effect will be when the year 2009 is included in the data. The year 2009[1] has been notoriously bad for the momentum strategies, which means that the strength of the momentum effect might change in a newer data set if it is discovered at all. Another contribution is to test whether the asset growth rates of firms are connected to momentum profits similarly as in the findings of Nyberg and Pöyry (2014) who use the United States data. Also, investors who might seek to benefit from the momentum anomaly might find this information useful. After all, there are plenty of professional funds that rely on the momentum anomaly. Furthermore, if investors trade based on the momentum effect, this might contribute to the creation of stock bubbles. Since stock bubbles can even lead to a financial crisis, understanding the momentum effect further is academically intriguing even from a more macroeconomic perspective as well.

The asset growth rate effect is also examined in this thesis using international data. Basically, the aforementioned effect states that stocks that have had higher asset growth rates seem to face lower future returns. Watanabe et al. (2013) find a positive return spread between the low and high asset growth groups in 27 countries out of 40. Since the effect is not present in all countries, the results are somewhat mixed. This thesis uses a newer dataset that covers 14 countries in order to shed light to the asset growth rate effect.

To sum up, the main contribution of this thesis is to examine whether there is a connection between the asset growth effect and momentum effect in the international stock markets. Investors are interested in the more internationally diversified portfolios as this decreases the overall portfolio risk, which is why it is important to understand the momentum effect in a more global setting. Linking the momentum premium and investment can potentially lead to models that are able to explain economic drivers behind risk premiums and provide more comprehensive explanation of stock returns. However, such theoretical considerations are out of the scope of this thesis.

1.4 Research scope and limitations

[1] Quantpedia.com

This thesis focuses on common stocks listed on exchanges located in 14 countries during the period from July 1985 to June 2015. I define firm level investment activity in terms of annual changes in the total balance sheet assets. No other measures of investment are considered. Since accounting data measures past values instead of present values, measuring investment in terms of balance sheet assets has its downfalls. For example, there have been changes in the treatment of software assets as expenses instead of investments in the IFRS. In summary, the total assets represented in the balance sheet of a particular firm are subject to accounting requirements, which means that the total assets do not represent the actual assets of the firm. I do not attempt to clean the balance sheet asset values, except for excluding those observations that seem large enough to be coding errors. However, the asset growth rate is a simple measure of total investment activity in a firm that can provide preliminary indication whether or not investment is related to the momentum effect.

In this thesis, the drivers behind the many possible drivers of momentum profits are not being investigated. Instead, the interest is in finding out whether there is a connection between large asset growth rate changes and momentum profits. The other factors that might impact the momentum profits are left outside the scope of this thesis. These include, for example, market sentiment, return volatility and credit rating. Nyberg and Pöyry (2014) test these commonly cited other drivers of momentum profits and conclude that these factors do not explain momentum profits away from their data. Instead, large asset growth rate changes seem to be connected to the momentum effect. Therefore, for the purpose of this thesis, the focus will be only on the large asset growth rate contractions and expansions as well as on country-wise asset growth correlations as the possible dynamics connected to the momentum profits in the international stock markets.

Usually momentum profits are studied in intermediate horizon periods ranging from two month to a year. However, in this thesis the time horizon is only one month. Nyberg and Pöyry (2014) use this shorter horizon of one month as well. However, they couple it with robustness tests on two longer holding periods (three and six months) to ensure that their results are robust on longer time horizons as well. Since they find that their results are not significantly altered by the choice of different time span, it is deemed that it is enough to use only the one-month investment horizon to measure the various portfolio returns (momentum portfolio returns and asset growth rate portfolio returns) in this thesis as well.

One limitation of this thesis is that there are not that many firms available in all of the countries included in the sample. This means that in order to examine the difference between

the top (winner) and bottom (loser) stock portfolio returns, the stocks are not divided into as many groups as is usually the convention in similar studies. In this thesis, stocks need to be sorted into groups based on their prior asset growth rates as well as their prior 11-month returns. Usually the convention has been to use ten groups when dividing stocks into such categories, but due to the small amount of stocks in most of the countries in this sample, I do not divide the stocks into so many groups. For example, Nyberg and Pöyry (2014) use ten groups when they investigate stock portfolios. Having fewer groups can mean that the results will not be as significant due to less stricter categories that are used to classify stocks into portfolios. In this thesis, I report the results for three groups (low, middle and high). Furthermore, the pattern how the asset growth effect and the moment effect evolve when moving from the top to the bottom stock portfolio will not be that visible from the results.

Not only is the amount of portfolio categories a matter of choice, but the way to divide stocks into the groups is also a crucial decision. In my thesis, the low group consists of stocks with the annual asset growth rate (or the past 11-month return) between 0 and the 25th quartile and the high group consists of the 75th quartile and above. I also test the 20^{th} and 80^{th} percentile groups, respectively. For example, Griffin et al. (2003) use the 20% bottom and 20% top stocks to study the momentum profits to their international dataset.

Another possible limitation in this thesis is the choice to divide stocks into categories based on percentiles. Perhaps, it might be more informative to divide stocks into groups based on their level of asset growth instead. For example, all stocks that have asset growth of 0% could form one group. Stocks with negative asset growth could form another. This might provide more useful results that are easier to analyze in terms of negative asset growths, zero asset growth and high asset growth rates. Furthermore, this would inherently take into account the periods of higher and lower asset growth.

1.5 Overview of the key results

The key results of this thesis show that there is, indeed, an asset growth effect present in most of the countries of the sample. Although the effect is only statistically significant in a few countries, in 11 countries out of a total of 14 countries show positive spreads between the low asset growth rate and high asset growth rate portfolios. So, the higher the asset growth, the lower the returns.

Another key result is that the momentum effect was not significantly present, except in Finland. This was tested by comparing the spread of buying the 11-month winners and selling the 11-month losers portfolios. The results are not consistent with what Nyberg and Pöyry (2014) find from the United States. Regardless of the lack of significance, the spreads are positive for all of the countries except for Norway. Overall, a strong momentum effect is not documented internationally during the time period of July 1985 to June 2015 but we do not reject the momentum effect either. The existence of momentum effect is generally documented in international research. However, the momentum effect is known to be smaller in certain time periods. This could be why strong momentum profits are not documented in this thesis as the year 2009 is included, which was a very bad year for momentum profits according to Quantpedia.com.

The final key result of this thesis is that, especially when using the equal-weighted returns, there are significant momentum profits in the highest asset growth group. Interestingly, even though momentum effect was not significantly present in a particular country, it is found in almost all high asset growth rate groups as well as often in the low asset growth rate groups as well. This is in line with Nyberg and Pöyry (2014), who find that the momentum effect is strong when there are large asset expansions and contractions. However, the results differ greatly between the countries, which should be taken into account before making any generalizations about the results. Nonetheless, the balance sheet asset growth rate changes do seem to be related to the momentum effect and it requires further research to establish the underlying reasons behind this connection.

1.6 Structure of the paper

The rest of the thesis is organized as follows. Next, the Section 2, *Literature review*, describes the theoretical background of the relationship between asset changes and the return momentum as well as the related empirical studies that provide insight into the phenomena. The research questions of this thesis arise as a result of this theoretical and empirical review. Section 3, *Data and methods*, presents the data and the methods to be used in this thesis. The Section 4, *Results*, explains the empirical results and key findings in context of previous research. Finally, conclusion and suggestions for future research about the topic are provided in the Section 5, *Summary and conclusions*.

2. Literature review

In this section, I will present relevant previous studies and review the relevant literature in order to provide further background information to the topic of this thesis. First, the momentum effect will be explained and the most common efficient-market and inefficient-market hypothesis explanations provided to the momentum effect will be reviewed in the context of academic studies. After looking into different possible explanations for the existence of momentum effect, an extreme asset growth rate is introduced as one plausible factor related to the momentum effect. Then, the rest of this section will review what exactly the asset growth effect is and how common it is in the international financial markets. Finally, I will go through the study by Nyberg and Pöyry (2014) to an abundant detail because it is the one research that is the most closely connected to this thesis. The study by Nyberg and Pöyry (2014) is the one that this thesis extends into an international context, which is why it is crucial to understand the methods and findings of that particular study in order to compare the findings of this thesis and their study.

2.1 Momentum effect

The momentum effect has sparked academic interest because it seems to be one of those stubborn anomalies that do not fade over the passage of time. So far, financial theory is unable to fully explain the underlying mechanics behind the momentum effect, which is why plenty of research has looked into momentum effect in detail. However, there are many theories and possible explanations to what might lay behind the momentum effect.

Analogous to the law of gravity in physics, in financial markets one might expect that what goes up will soon fall down. However, what is interesting in the stock markets is that this does not seem to be the case. Jegadeesh and Titman (1993) were the first to document this abnormal stock behavior, which is termed as the momentum effect. Simply put, a trading strategy that buys stocks with the highest returns (past winners) and sells stocks with the lowest returns (past losers) over the past 2-12 month period produces large risk-adjusted profits compared to some other trading strategies (this has been demonstrated by many studies including Fama and French, 1996). Jegadeesh and Titman (2001) further show that momentum profits have continued in the United States during the 1990s, even after their initial discovery of the effect.

What is more, the momentum profits seem to also exist outside the United States. For example, Rouwenhorst (1998) finds significant momentum profits in 12 other countries.

The momentum effect is considered to be a market anomaly. Market anomalies are a group of stock return discrepancies in the stock market. Most of the market anomalies disappear once they have been discovered or some market anomalies are claimed to be nothing but a result of excessive data mining. Since, the momentum effect is documented in variety of studies done with different countries and time periods, it does not support the idea that momentum is simply a result of data mining.

What makes market anomalies academically interesting is that they challenge the fundamental theory of efficient markets, which states that the security prices should reflect all available information available during a particular time. Therefore, the past stock price movements should not provide clues about the future stock prices. In addition to the momentum effect, some other famous market anomalies include small-firm effect (smaller firms outperform bigger ones), the January effect (stocks that underperformed in the fourth quarter of the prior year tend to outperform the markets in January) and that stocks with below-average price-to-book ratios outperform the market. Market anomalies can have a variety of explanations, such as unfair competition, lack of market transparency, regulation, or behavioral biases. The small-firm and value effect are frequently explained with a higher level of risk associated with these stocks. In other words, the higher returns on these stocks are a reward from increased risk in these stocks. Since momentum effect is so widely documented and some other market anomalies are explained to relate to a level of increased risk with particular type of stocks, the momentum effect might not be market inefficiency after all but have rationality underlying it.

Multiple models have been developed in order to provide a better understanding for the stock price momentum effect. However, there are many underlying variables that are suggested to play a role in the momentum effect. With many possible variables and their interaction dynamics, it is clear why there exists such a wide range of alternative models and as well why the underlying variables and their relation to momentum effect should be carefully examined by research. The large expansion (contraction) of the balance sheet assets of firms is one of those possible underlying factors. This is the factor that is investigated in this thesis. Before going through the asset growth rate explanation, some other common explanations of momentum are reviewed first.

In summary, the momentum effect has been explained in various ways. Whenever random anomalies arise from stock market data, it is always important to ensure that the effect is real and not a result of data mining. However, since momentum has persistent in the U.S. and found in other countries as well, it seems that there is more to momentum than simple data mining. Momentum effect has, therefore, been further explained by elaborate theories that range from inefficient markets to efficient markets explained by such factors as risk, which will be reviewed next.

2.1.1 Momentum effect explained by inefficient market theories

The explanations provided for the momentum effect can be divided into two groups. The first group considers momentum effect as a sign of inefficient markets. The other group argues that momentum effect is the result of rational stock pricing. First, the inefficient market explanations are reviewed in this subsection.

When the momentum effect was first discovered in the United States, Jegadeesh and Titman (1993) assumed that the momentum effect had a firm specific cause. They assumed that investors react only gradually to a new firm-specific piece of information. In other words, when good or bad news about individual stocks reach the investors, the investor behavior does not fully adjust the prices of the stocks immediately. The implication of this theory is that the prices will correct themselves over time. However, before the markets correct themselves, momentum profits can exist in the short-term or intermediate horizon (about two to 12 months).

The time horizons are fundamental when exploring the momentum effects. The momentum effect was originally discovered in the context of studying how past returns can predict future stock returns. What is titled momentum effect in this thesis is one that is specific to a short to intermediate time interval (past two- to 12-month returns). There are, in fact, reversals in momentum in very short-term and long-term time horizons. DeBondt and Thaler (1985, 1987) show that long-term price reversals take place in which the long-term past losers outperform long-term past winners. The time interval for these long-term reversals varies between the next three to five years. Jegadeesh (1990) and Lehmann (1990) report similar price reversals at monthly and weekly intervals. Therefore, momentum is very time horizon specific phenomenon. Furthermore, as originally predicted by Jegadeesh and Titman (1993) stock prices seem to correct themselves over time. So, the momentum trading strategy seems to work over

the short term, but it is actually the value effect trading strategy that seems to work over the long term.

Trading volumes are closely connected to momentum as well. Lee and Swaminathan (2000) examine momentum and trading volumes[2]. They find that stocks with high (low) past trading volume have lower (higher) future returns and have more negative (positive) earnings surprises. Past trading volume seems to be a good predictor of both the magnitude and persistence of future price momentum. They also find that the momentum effect reverses in the subsequent five years. The reversal is also faster for those stocks that have experienced extreme momentum. If trading turnover is seen as a proxy for the degree of investor interest in a particular stock, it is understandable why information diffuses faster into the prices of those stocks that have more active investor coverage. The study by Lee and Swaminathan (2000), therefore, supports the idea that momentum effect might be a result of market inefficiency coming from the investor side.

Generally the behavioral finance models understand the momentum effect as a result of some sort of cognitive and psychological biases of the investor(s) (studies such as Barberiset al., 1998, Daniel et al., 1998, as well as Hong and Stein, 1999). These models take the view that investors do not correctly respond to new information and revise their trading strategies. These behavioral finance models have been criticized for not being specific enough about the time horizon, in which the reversals should occur. Furthermore, the behavioral explanation suffers slightly in its credibility by the fact that behavioral momentum profits should be exploitable to a degree as long as there are some rational investors in the market place. Any trading strategy that consistently produces high abnormal returns in relation to risk seems to eventually vanish from the stock markets, which is why it seems unlikely that such an anomaly would exist for a long time without being exploited by investors.

Plenty of studies support these behavioral finance theories. For example, Hong et al. (2000) show by controlling the size of firms, that momentum profits are larger with stocks that do not have much analyst coverage. Hong et al. (2000) also note that small firms with low analyst coverage experience the highest momentum. Their findings support the original idea by Jegadeesh and Titman (1993) that firm-specific information is recognized by the investors

[2] The liquidity point of view itself is interesting and it is related to the trading volumes. It is suggested that firms with relatively low trading volume are more illiquid and compensated for that with higher expected return (Amihud and Mendelson, 1986). However, when it comes to studying momentum effect, it does not matter whether illiquid stocks are compensated with higher returns throughout their lives, since the momentum looks at how the prices reverse.

slowly over time and might be the cause of momentum effect. Grinblatt and Moskowitz (2004) observe that higher momentum profits are related to smaller firms with few institutional owners, firms with high volume and growth firms. This study has similar results than the previous studies described in this subsection. Even so, it also draws attention to the differences between growth and value firms

However, there might be more to momentum effect than simply the cognitive biases of the invetors. For example, Chan et al. (1996) point out that we should treat return momentum and earnings momentum separately from one another. Their study finds that the momentum effect seems to, a degree, come from gradual diffusion of earnings news. Yet, they discover that price momentum seems to be separate from the earnings momentum. This suggests that momentum might have many different origins.

Moskowitz and Grinblatt (1999) argue that the profitability of a momentum strategy is basically a result of momentum effect in industry components of stock returns. Theoretically, their idea is that momentum trading strategies must at least be constrained by factor risk exposure or else it would eventually vanish from the stock markets. If industry momentum drives much of individual stock momentum, momentum strategies are not very well diversified since stocks within an industry are often highly correlated.

Hou (2001), on the other hand, is in the opinion that information gradually spreads within industries, which can cause industry momentum. Moskowitz and Grinblatt (1999)[3] do, in fact, find large industry momentum in the NYSE, AMEX and Nasdaq stocks during the time period July 1963 to July 1995. However, Chordia and Shivakumar (2002) show that industry momentum is insufficient to fully explain momentum profits. Similarly, Grundy and Martin (1998) are unable to explain the momentum profits with time-varying factor exposures, cross-sectional differences in expected returns, or industry effects. Their result is in line with that of Grundy and Martin (2001), who show that individual stock- and industry-based momentum returns seem to be detached from one another.

2.1.2 Momentum effect explained by efficient market theories

[3] Two-digit Standard Industrial Classification (SIC) codes are used to form 20 value-weighted industry portfolios.

On the other hand, the momentum effect has also been explained rationally by theories that support the efficient market hypothesis and see momentum as a result of logical stock pricing. Risk and excessive co-movement of stock returns compared with dividends are some possible rational factors behind momentum effect that have received vast academic research.

Since risk is tied to the expected returns of stocks, many efficient market theories look how risk might explain the momentum effect. Conrad and Kaul (1998) and Berk et al. (1999) argue that stocks with high (low) past returns are those with high (low) unconditional expected returns, suggesting that the momentum profits are a result of cross-sectional variability in expected returns. These unconditional expected returns do not fluctuate heavily over time, which implies that momentum profits should persist, in practice, indefinitely or unless the level of risk changes. The problem with this idea, termed the risk explanation of momentum, is that momentum does seem to reverse in longer time horizons (Jegadeesh and Titman, 2001). Jegadeesh and Titman (2001) have criticized the findings of Conrad and Kaul (1998). In their opinion, the results in Conrad and Kaul (1998) are driven by estimation errors in expected return variance. Furthermore, Jegadeesh and Titman (2001) show that U.S. momentum profits quickly disappear.

However, some studies find controversial results about this long-term reversal of momentum. For example, Chordia and Shivakumar (2002) find that both U.S. pre-ranking and post-evaluation momentum profits are positive, consistent with a risk explanation. These results differ from the results of studies such as DeBondt and Thaler (1985, 1987).

There is plenty of contradicting research and criticism about the risk explanation of momentum. For example, Fama and French (1996) as well as Grundy and Martin (2001) show that the expected returns measured from the Fama-French model do not seem to explain momentum profits. Conrad and Kaul (1998) estimate that cross-sectional dispersion in expected returns can partially explain momentum, but not fully. Jegadeesh and Titman (1993) establish that momentum is not driven by market risk. On the other hand, Chordia and Shivakumar (2002) project momentum profits onto lagged macroeconomic variables and conclude that U.S. momentum profits are completely explained.

Some of the models have received less criticism. For example, Berk et al. (1999) have a risk-based model, in which firm investment life cycles and growth rates are considered. In their model, interest rates and systematic risk of the current projects of a firm determine its value. Slow turnover in the firm's project portfolio leads to persistence in both the firm's asset base

and its systematic risk, which make expected returns positively correlated with lagged expected returns. Momentum profits arise as a result of persistent systematic risk in the portfolio of projects of a firm, but these momentum returns decrease as those assets depreciate. The simulations of the model produce similar momentum profits that exist in the United States, but the horizons for the profits are much longer than what is perceived empirically. Their momentum profits become negative at the fifth year.

Another model by Johnson (2002) explains momentum profits as a result of a positive relation between expected returns and firm growth rate shocks. If a firm has had higher actual past realized return, a firm is more likely to have a high growth rate. Any firm that has had an extreme realized return is experiencing a highly persistent shock to the dividend growth rate, which in turn changes future expected returns in the same direction. Because high growth rates go hand in hand with high growth rate risk, stocks with high past realized stock prices must earn higher future expected returns as a form of compensation. The model produces momentum profits that can decline rapidly and remain positive, which matches the pattern perceived in the actual stock markets.

Basically, it is unclear what type of risk the momentum profits could compensate for. Griffin et al. (2003) compare international momentum profits in high and low business cycle states as classified by GDP growth and aggregate stock market movements and find that momentum profits are generally positive in all macroeconomic states. If momentum was related to economic distress risk, negative momentum profits should occur during times of low GDP growth. Griffin et al. (2003) conclude, that international momentum profits cannot be explained by their choices of standard macroeconomic state variables. This finding does not support the idea that momentum could be a business cycle risk. However, this contradicts with the findings of Chordia and Shivakumar (2002) who show with NYSE and AMEX stocks that momentum profits can be explained by a set of lagged macroeconomic variables.[4] In their set-up, momentum profits fade if stock returns are adjusted for their predictability based on these macroeconomic variables.

Chordia and Shivakumar (2002) find that during recessions, the momentum strategy returns are negative, though statistically insignificant (−0.72). Their results show that momentum profits only occur during the expansionary periods (0.53). The difference between the findings

[4] These macroeconomic variables include dividend yield, default spread, yield on three-month T-bills and term structure spread

of these two studies, however, might be the result of that fact that Chordia and Shivakumar (2002) do not skip a month between the formation and investment periods, which are a common convention. Additionally, Chordia and Shivakumar (2002) use different classification criteria of economic states to two states, expansionary and recessionary, than Griffin et al. (2003). Overall, there is no consensus about what causes momentum profits. However, momentum effect could be a factor of many different explanations, which would mean that more than one explanation might be partially correct.

2.1.3 Momentum during different time periods and in different regions

This subsection will investigate the occurrence of momentum in certain time periods and regions in order to understand how frequent and strong the momentum effect is. Most of the studies about momentum effect come from United States. Therefore, the momentum effect and its perseverance in the U.S. market are reviewed first. Then, it is looked at how frequent it is in other countries.

In the United States, during the period from July 1926 to December 1951, the momentum profits are actually slightly negative (−0.61%) in NYSE, AMEX stocks (Chordia and Shivakumar, 2002). However, from January 1951 to December 1994, the momentum profits are positive and significant (Chordia and Shivakumar, 2002). This shows that there is variance in the existence of momentum profits, even in the United States.

Rouwenhorst (1998) has studied the momentum effect internationally. Rouwenhorst (1998) finds that between 1980 and 1995, a portfolio of past medium-term winners outperforms a portfolio of medium-term losers after correcting for risk by 1% monthly. In all of the twelve countries included in his sample, the return continuation is present and last on average for about one year. Return continuation is negatively related to firm size, but is not limited to small firms. The international momentum returns are correlated with those of the United States, which suggests that exposure to a common factor, may drive the profitability of momentum strategies (Rouwenhorst, 1998).

Overall, momentum profits are high in many European markets, small but positive in most emerging markets and, at least occur in five Asian markets (Rouwenhorst, 1998, 1999 and Chui et al., 2000). The momentum profits are smallest in Asia, but outside Asia the winner minus loser portfolio profits are highly significant (Griffin et al., 2003). Therefore, on average, on

international level, there seems to be a universal momentum effect. More specifically, Griffin et al. (2003) finds that 2 African countries, 5 of 6 American countries, 10 of the 14 Asian countries and 14 of the 17 European countries display positive mean momentum profits. The average monthly momentum profit is 1.63, 0.78, 0.32 and 0.77 in Africa, Americas (excluding the United States), Asia and Europe, respectively. The average momentum profit for all non-U.S. developed markets is 0.73% per month or 8.74% per year compared to a statistically insignificant 0.27% per month or 3.24% per year for emerging markets.

Griffin et al. (2003) examine whether macroeconomic risk can explain momentum profits internationally. The theory is that if momentum profits arise due to systematic risk and international stock markets are integrated, momentum strategies should be highly correlated across countries and continents. They find large momentum profits but the correlations among 40 countries, whether within regions or across continents, are weak. This indicates that if momentum is driven by macroeconomic risk, the risk is largely country specific.

Griffin et al. (2003), similar to most academic studies, find that momentum profits reverse and become negative over longer horizons also in international stock markets (the reversal occurs between the time span from one to five years). The findings about the rapid reversals of international momentum profits are somewhat incompatible with the risk-based explanations of momentum. However, this does not completely reject risk as a possible explanatory factor of the momentum effect. Their sample begins in 1975 (if country data is available) and the sample ends in December 2000 (earlier for some countries).

Griffin et al. (2003) also distinguish where the momentum profits come: are the momentum profits driven by the winners or losers. In most countries, both winners and losers outperform the local market index. However, since smaller stocks are more frequent in the winner and loser portfolios, the smaller stocks might cloud the results. In Europe, however, the loser portfolios are the ones that underperform the market. It is interesting that the momentum seems to be differently driven in Europe compared to rest of the markets, if the effect is universal and would have a uniform explanation.

2.2 Asset growth effect

Stocks with higher asset growth rates seem to have lower future returns both in the United States and internationally. Cooper et al. (2008) measure the total combined investment activity

in a firm by a change in the balance sheet total assets (asset growth). The measure is simple and summarizes the total investment situation in a satisfactory manner. Using this measure, Cooper et al. (2008) find that a value-weighted portfolio of stocks in the top asset-growth decile underperforms the portfolio of stocks in the bottom decile by 13% annually. The result holds for the U.S. stock market from 1968 to 2003. On the global level, Watanabe et al. (2013) pool stocks of 40 international markets together and show that equal-weighted decile portfolios have a significantly negative return spread between the top and bottom decile portfolios (-5.4% annually). The average asset growth decile portfolios within each country, on the other hand, have an annual 4.8% return spread between the top and bottom decile. Across countries, the asset growth effect varies (the return spread between the top and bottom asset growth decile portfolios is negative in 27 countries out of 40).

While the asset growth effect is internationally documented, the rationality of the negative effect of investment on stock returns is open to interpretation. Some argue that it is a sign of market inefficiency while others offer different rational reasons that might explain why investments decrease stock prices.

When a firm expands, it can be empire building or acquiring new companies (Titman et al., 2004). Both of which cases, there is often a premium paid on acquiring a new company. The empire building can explain why the returns go down for firms that invest heavily. The capital structure market timing that affects the rhythm of external financing is another plausible explanation (Baker and Wurgler, 2002). When a firm cuts down its assets, it can focus more or it might be acquired in the future. As investors speculate whether such company will soon be acquired, there might be an increase in the price of these contracted firms.

The earnings management (Teoh et al., 1998) and excessive extrapolation on past growth by investors (Lakonishok et al., 1994) might also result in decreased returns for firms that grow in assets. Another explanation is comes from studies of Cochrane (1991, 1996) and Liu et al. (2009). They focus on the characteristics of the firms that make these large investments. They point out that these stocks tend to have lower discount rates, which naturally means that these firms have lower expected returns as well. Berk et al. (1999) and Carlson et al. (2004) argue that firms reduce their risk after they exercise growth or real options, which can be seen as lower returns as well. In practice, it is nearly impossible to answer to the question whether there is mispricing or not in the market, if the returns of the stocks fall in response to increased investments.

Mixed results have been obtained from studies that have investigated the asset growth effect on stock returns. Corporate governance affects the asset growth effect in the U.S. market (e.g., Titman et al., 2004; Lipson et al., 2010; Lam and Wei, 2010). Whereas in the U.S., there seems to be support in favor of the mispricing hypothesis, it does not carry over to explaining the cross-country differences in the asset growth effect. Watanabe et al. (2013) find the asset growth effect is stronger in countries with higher capital market to GDP ratio and lower bank loan to GDP ratio, which indicates that asset growth is a stronger predictor of returns in those countries with more efficient stock markets. This finding does not favor mispricing hypothesis, because mispricing to should be more common in less efficient markets. In an interesting set-up, they come to this conclusion by examining 40 countries from the time period 1982 to 2006 in order to see to what extend can country characteristics relate to the magnitude of asset growth effects. For example, if the asset growth effect is a result of mispricing, it should be stronger and more evident in those countries where stocks are less efficiently priced and arbitrate is more difficult to carry out. Furthermore, in countries where asset growth is on average more sensitive to discount rate, the power of asset growth to predict future stock return is higher.

Cooper et al. (2008) make a distinction between how the firms grow and the expected returns. They show that firms that grow rapidly by raising external financing and investing have lower stock returns, whereas firms contracting via divesture, share repurchase and debt retirement have higher stock returns. Overall, it seems that the asset growth effect can also have different explanations depending on the country and firm-level characteristics instead of a simple universal one.

2.3 Asset growth and momentum in Nyberg and Pöyry (2014)

Nyberg and Pöyry (2014) have comprehensively studied the topic of interest in this thesis, which is why their findings are discussed in detail in this sub-section. Nyberg and Pöyry (2014) make some key findings concerning the momentum effect. One of these is that large changes in asset base of a firm seem to enhance short-term stock momentum. Furthermore, momentum seems to be driven by rapid, rather than slow, changes in the assets of firms.

Many academic studies make indirect predictions about how the asset expansions of firms can predict the amount of momentum profits. So in this sense, it is not a new idea that momentum might be related to the firm assets and investment behavior. For example, Chen et al. (2010) propose a three-factor model, where there is a factor connected to investment.

Another model of momentum suggested by Johnson (2002) implies that stock returns are more sensitive to changes in expected growth when expected growth is high. According to the findings of Nyberg and Pöyry (2014), the asset growth seems to impact the momentum beyond what can be explained by the expected growth rates only using this model.

Nyberg and Pöyry (2014) use data from the United States, or more specifically New York Stock Exchange, American Stock Exchange and NASDAQ firms with data on the CRSP stock exchange database and Compustat annual industrial files (1964 - 2006). In their set-up, stocks are divided into ten groups based on their past asset growth rates. Stocks within the asset groups are then divided into five portfolios based on their 11-month past returns. The momentum strategy to be investigated is one that buys (sells) the 11-month winners (losers). This strategy is replicated for all of the asset growth groups.

The findings are that momentum payoffs seem large for firms that have either expanded or contracted their assets notably. Similarly, the momentum payoff seem low for firms that have not have large changes in their assets to either direction. In fact, firms with asset growth rate rate near zero have equal-weighted momentum payoff of 0.26% per month (insignificant statistically). The momentum payoff is defined as the difference between buying the portfolios of the 11-month winners and selling the 11-month losers.

After the zero asset growth rate group, the momentum profits are monotonically increasing (nearly). In the highest asset growth rate group, the momentum profit is 1.52% monthly and highly significant. In the lowest asset growth group, the monthly average momentum profit is 1.03% and still statistically significant.

There are various findings from several studies about what can affect momentum profits. Hong, et al. (2000) find that momentum payoff is higher for smaller stocks. Daniel and Titman (1999) as well as Sagi and Seasholes (2007) find that momentum is the most significant for stocks with low book-to-market equity ratios. Lee and Swaminathan (2000) find that momentum is significant in high turnover stocks. Zhang (2006) finds that momentum is higher for stocks with large information uncertainty (proxies with variables like return volatility). Avramov et al. (2009) find that momentum is greater in low credit quality firms. Nyberg and Pöyry (2014) control for the previously identified drivers of momentum profits: market value of equity, book-to-market, share turnover, return volatility (which represents things like information uncertainty) and credit rating. The find that their results are robust and balance sheet asset growth rate strongly relates to the momentum effect.

Nyberg and Pöyry (2014) also examine the properties of quarterly aggregate asset growth. Chordia and Shivakumar (2002) as well as Cooper et al. (2004) find that momentum effect diminishes during recessions and after periods of negative market returns. Interestingly, average firm expansion is also lower during these periods. However, if asset expansion does drive momentum effect, then even during these times of low returns, firms with high level of asset expansion should still experience large momentum profits. Cooper et al. (2008) show that firms with high lagged asset growth rates display anomalously low returns relative to standard adjustments for risk. Nyberg and Pöyry (2014), therefore, assign their sample to four groups based the magnitude of the aggregate asset growth rates in the previous quarter and study the quarterly momentum returns during these market states. They, indeed, find that during periods of high aggregate asset growth, the momentum profits reach their highest state and vice versa.

In their study, stocks are divided into 4 groups based on the aggregate asset growth rates increase. The 11/1/1 strategy is used to mitigate short-term horizon negative return autocorrelation as well as bid-ask bounces. Nyberg and Pöyry (2014) test for robustness of these (with L=3 and L=6). Longer holding period, however, does not change the results nor excluding firms with low credit ratings. Overall, the momentum effect is strong in their sample. Equal-weighted return spread is 0.90% monthly (statistically significant). With value-weighted returns, the momentum effect is slightly reduced.

Since the existing literature and empirical findings are not harmonious about the interaction of firm-level asset growth and momentum. Linking the momentum premium and investment can provide a unified framework that helps to explain economic drivers behind risk premiums and provide more comprehensive explanation of stock returns. The method used in this thesis is similar to one by Nyberg and Pöyry (2014) but this thesis expands their study by examining whether the cross-sectional return premiums are connected to one another in 12 European countries as well as in Japan and Canada. The time horizon is also different between the two.

2.4 Research questions

This sub-section will go through the research questions of this thesis. From the literature review, it became apparent that although plenty of research has examined the momentum anomaly, the reason underlying the anomaly is still unclear. Nyberg and Pöyry (2014) point out that the asset growth rate of firms seems to drive the momentum effect in the U.S. data. Since

asset growth effect is present in many countries (although to a differing degree), it is of interest to examine can the asset growth rate of firms explain momentum also in the international stock markets.

There is some preliminary indication that the reasons behind the asset growth rate effect differ according to the country. Therefore, it might not be so clear-cut whether or not the asset growth rate can explain the momentum outside the U.S. stock markets. The relationship between momentum effect and asset growth rate remains a less well-understood topic. More empirical findings about the topic are needed. Due to these considerations, I will study the effect of firm asset growth rates on the momentum effect in the international stock markets. In other words, I will study how well balance sheet asset growth rates can explain momentum profits in 14 different countries. According to my knowledge, such comprehensive view on the relationship between asset growth rate and momentum profits has not provided before in academic research in terms of international stock markets.

This thesis investigates four research questions related to momentum anomaly. Inspired by the findings of Nyberg and Pöyry (2014), there are four research questions, which are examined in this thesis, related to the asset growth effect and momentum anomaly. The research questions are as follows.

1. Is the asset growth effect present in the stock markets of the selected countries? Does the asset growth effect differ across the countries? The asset growth effect means that the average monthly holding period returns are smaller for those firms that have experienced more asset growth.
2. Is momentum effect present in the stock markets of the selected countries? The momentum effect means that stocks that outperform their peers produce higher returns in the future (from two to 12 months of time).
3. Do larger changes in assets result in larger momentum profits?
4. Can international aggregate asset growth rate explain momentum in individual countries?

In this thesis, the expectation is that rapid asset growth and contraction is related to the momentum profits, at least to some extent. Furthermore, the aggregate asset growth correlation is expected to drive momentum correlations between countries. I also try to predict the

momentum profits with lagged asset growths using OLS regressions. The next section goes through the methodology used to answer these research questions.

3. Data and methods

Now that the research questions have been formulated, this data and methods section will describe what observations are included and what tests are carried out in this thesis. First, it will be described how the data was chosen. Furthermore, the revisions made to the data are explained. In order to determine the effect of asset growth on momentum, the methods used will be clarified. Finally, the descriptive statistics of the sample will be summarized.

3.1 Data formation

Data about international stock returns, market values and total balance sheet assets is retrieved from the Thomson- Reuter Datastream/WorldScope (hereafter "Datastream") database. The final data set includes time series variables of monthly stock return, quarterly total balance sheet assets and monthly market values for stocks in U.S. dollars. The time span for the data is from July 1985 to June 2015. The purpose is to have a comprehensive time span but because the amount of data about European stocks before 1985 is limited, this is chosen as a starting point for the data that makes the sample cover a total of 30 years of accounting data for firms. The sample begins from July and ends in June because the asset growth rate is frequently calculated this way in similar studies (Nyberg and Pöyry, 2014 and Watanabe et al., 2013).

The sample has some limitations in the availability of observations during the earlier time periods. For example, in the case of Finland, the observations for balance sheet data generally start from the time period 1998 at the earliest. Within the entire sample period from July of 1985 to June 2015, the actual sample starting dates can vary between countries depending on the availability of observations. It is important to note that the amount of observations can also vary greatly during the sample time period. Overall, more stocks are available in the later years of the sample.

I begin by retrieving all active and inactive firms in the stock exchanges of chosen countries available in Datastream. The sample is then adjusted by dropping out those firms that do not have the required data available or do not have unique firm identifiers. The countries covered in the sample are Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom (12 European countries) as well as Canada and Japan. The 12 European countries were chosen based on the expected availability

of the data. The United States is not included because earlier research has covered this region. The data covers mostly the European market but Japan and Canada are included for more heterogeneity due to their large availability of data. The countries with larger sample sizes were naturally preferred because they lead to more reliable results. Table 1 presents the descriptive statistics of the sample of 18,162 firms with observations ranging from July 1985 to June 2015 from 14 different countries.

Table 1 - Summary statistics of the sample

Country	Start date	End date	Amount of firms	Amount of firms, % of total sample	Average monthly total market value (mUSD)	Avg total monthly market value, % of total market
Austria	7/1985	6/2015	171	0.94	77 286	0.48
Belgium	7/1985	6/2015	262	1.44	409 535	2.56
Canada	7/1985	6/2015	2 078	11.44	885 943	5.86
Finland	7/1985	6/2015	211	1.16	135 829	0.84
France	7/1985	6/2015	1 668	9.18	1 374 691	9.02
Germany	7/1985	6/2015	1 651	9.09	1 115 973	8.22
Italy	7/1985	6/2015	524	2.89	568 102	3.91
Japan	7/1985	6/2015	5 097	28.06	3 526 222	36.93
Netherlands	7/1985	6/2015	297	1.64	529 670	3.93
Norway	7/1985	6/2015	482	2.65	141 304	0.83
Spain	7/1985	6/2015	287	1.58	453 174	2.87
Sweden	7/1985	6/2015	780	4.29	270 412	1.72
Switzerland	7/1985	6/2015	390	2.15	654 485	4.24
The UK	7/1985	6/2015	4 264	23.48	2 404 784	18.59

Table 1 describes the descriptive statistics of the sample of 18,162 firms with observations ranging from July 1985 to June 2015 for 14 different countries with various stock exchanges. Stocks are sorted into countries based on the stock exchange to which they have been listed.

Japan has the highest amount of firms in the sample (5 097 firms) followed by the United Kingdom (4 264 firms) and Canada (2 078 firms), whereas Austria has the least amount of firms in the sample (171 firms). Japan represents 28% of all the observations in the sample as well as it has the largest market share (37%).

The stocks are assigned their nationality based on what stock exchange the stock has been listed. This means that they are not classified based on the headquarters of the company (domicile). This might make the country-wise correlations more homogeneous because the business borders are blurred. For example, some Finnish companies headquartered in Finland with mostly Finnish business might choose to list to Swedish exchange due to various reasons, such as cheaper costs associated with the Swedish listing. However, simple being headquartered in Finland does not mean that the company does business in the Finnish market. Since the country-wise correlations are of interest in this thesis, this dilemma is kept in mind. Since earlier research has used US listed-exchanges to study the US firms, this classification is similar to that principle.

To avoid survivorship bias, both active and defunct research files of stocks are included. The survivorship bias has been dealt in a varied ways in previous researches. Some researches require that a firm should be listed for at least 2 years before they are included in the sample. However, in this thesis, all available observations are included in order to have a larger sample size. The sample sizes of particular European countries are much smaller than what similar data from the United States would be, which is why there is more cautiousness when it comes to dropping observations compared to previous research methods.

The sample covers all firms that have existed during the time spam instead of the active ones. Some firms might have ceased to exist or merged during the time period. Datastream attempts to adjust its total returns for any split. However, when examining the sample, there are large stock returns that appear to be coding errors. The coding errors can significantly impact the results by exaggerating the average stock returns with extremely high returns.

One way that previous research has dealt with this is to drop observations if the returns exceed $\pm 25\%$. However, it is always possible that such observations are, in fact, actual values and not errors. Regardless, these values are outliers that can influence the results to a great degree. One option, used by Watanabe et al. (2013), is to winsorize asset growth rate at the top and bottom 1%. Nyberg and Pöyry (2014), on the other hand, do not winsorize. In this thesis, the observations are not trimmed but two types of tests for robustness of the results are

conducted. Firstly, the tests are run with the assumption that the Datastream data does not include coding errors. Secondly, the tests are run with those observations excluded that appear as possible coding errors based on our rules. One of these rules is that those returns and asset growth rates that exceed 1000% are excluded as possible coding errors. When it comes to market values, no such coding error search is conducted.

The final sample is further modified by excluding so-called 'doubles' in order to have each firm only represented once. Some companies are represented twice in the Datastream data, because, for example, they have shares with differing voting rights. Only ordinary common equity is included.

The results of the thesis are calculated in two ways: equal-weighted returns and value-weighted returns. The value weight is a firm's market capitalization at the beginning of the holding period scaled by the average market capitalization of the country. Since the same currency is used through the countries, this makes them comparable. Since market value is only used to calculate the weights for each monthly return, there should be no strength of currency effect over time that might be reflected on the results.

Because the stocks at the bottom of the market values have some special characteristics, these are often excluded in most studies. Watanabe et al. (2013), for example, exclude the bottom 10 percentile of stock whereas Nyberg and Pöyry (2014) exclude those stocks with market value at the end of each June below the 20th percentile of market cap of NYSE stocks. In this thesis, I chose not to exclude the microcaps, because the observations for the European countries were quite limited and the sample might have suffered from excluding 20% of the sample. For robustness, the stocks in the bottom 10% of the market value are excluded to control for any biases from small and illiquid stocks. The equal-weighted returns might be affected by prior losers in the lowest asset growth group that covers most of those stocks with low market capitalization. Fortunately, Nyberg and Pöyry (2014) showed with US data, that the microcaps were not driving their findings. Nyberg and Pöyry (2014) find that the effect of asset growth on momentum holds also within a group of microcaps, small stocks (defined with a market value between 20^{th} and 50^{th} NYSE stock exchange percentile) and large stocks in their sample of NYSE stocks.

The total returns obtained from Datastream need to be converted into monthly returns. There is a problem that Datastream total returns are indexes and when the firm ceases to exist, the index keeps its last value. Hence, when converting the values into monthly returns, it is

impossible to tell what the last time a firm has existed was. However, the existence of other data at the same time provides some indication to this. In this thesis, I solve the problem by assuming that when a firm has more than three unchanged last observations, the firm has ceased to exist. Dealing with this requires some manual adjustments to the data.

There are many other factors that might have an effect on the results. For example, previous research has pointed out that market value of equity, book-to-market, share turnover, return volatility and credit rating can affect momentum profits. Bandarchuk and Hilscher (2013) further argue that many momentum strategies enhance profits because those strategies trade with those stocks that have more extreme returns. Nyberg and Pöyry (2014) test these potential momentum drivers and control for the level of past returns and find that these factors do not explain their results. Therefore, such data and considerations are left out of the scope of this thesis.

The methods that test the effect of asset growth rates on momentum are similar to the ones used in Nyberg and Pöyry (2014). First, the variable asset growth needs to be defined. The rest of this section is dedicated to the explanation of the method.

3.2 The definition of the asset growth variable

The asset growth variable is crucial in this thesis. It summarizes the investment and financing behavior of a particular firm. We use a common method to calculate the asset growth rates from the data of quarterly total assets. Similar to Cooper et al. (2008) as well as Nyberg and Pöyry (2014), an annual asset growth rate variable is defined as the annual percentage change in the total balance sheet assets of a firm. This is denoted as follows.

$$AG_{i,t} = \frac{AT_{i,t} - AT_{i,t-1}}{AT_{i,t-1}}$$

$AG_{i,t}$ denotes the asset growth and $AT_{i,t}$ the total balance sheet assets of firm i at time t. In Datastream, the variable total assets is the field 02999. A common timing convention is to match the accounting variables for fiscal year ending in calendar year t with the portfolios that are formed at the end of June in year t + 1. Therefore, the asset growth for a firm i at time t is matched with returns from July of year t + 1 to June of year t + 2. This common convention ensures that investors have received all the information about the new accounting variables of the firm before the portfolios are formed.

3.3 The definition of the momentum profits

The momentum strategy is one that categorizes past year winners and losers to top and bottom portfolios and takes a long position in the winner portfolio and a short position in the loser portfolio. The amount of categories that is most frequently used in the academic research is ten. However, in this thesis, three portfolios are formed due to the fact that there might not be enough observations available in each country if ten categories were to be used.

The momentum strategies consist of a ranking period, over which winners and losers are determined and an investment period, over which winners are held and losers sold short. Similar to Fama and French (2008) as well as Nyberg and Pöyry (2014), the momentum portfolios in this thesis are sorted according to a J/K/L strategy, where J=11, K=1 and L=1. In other words this notation means that stocks are sorted based on the return sizes during a formation period of 11 months (J=11). One month is skipped between the portfolio formation and holding periods. This is common practice to avoid microstructure effects, the effects of short-horizon negative return autocorrelation (Jegadeesh, 1990) and bid-ask bounces.

The most commonly used horizon to study the momentum effect ranges from six to twelve months. However, in this thesis the horizon is 1 month similar to what Nyberg and Pöyry (2014) have used in their study. In addition, Nyberg and Pöyry (2014) also use longer holding periods (three and six months) to check for the robustness of their results, which is why it was not deemed necessary for this thesis. After the holding periods, the resulting momentum portfolios will be sorted again.

If the holding period equal-weighted and value-weighted return spread between past loser and past winner portfolios, denoted as $High - low$, are significant and positive, a momentum anomaly is present.

3.4. The asset growth effect

How the asset growth rates of firms affect their stock returns in the international markets is examined with a similar method used by Nyberg and Pöyry (2014) as well as in Watanabe et al. (2013). In particular, univariate sorts are formed from the data. At the end of June in the year

t, stocks are grouped into three deciles based on their asset growth rates. This is done separately for each country in the sample. Then, an equal-weighted portfolio is constructed for each of these deciles (low, middle and high) and held for a year (from July in the year t to June in the year t+1). The difference in the return spread of the deciles low and high is calculated. It is the difference in the 1-year holding-period return (July of year t to June of year t+1) between the two portfolios.

Whereas Nyberg and Pöyry (2014) as well as Watanabe et al. (2013) sort their data into ten portfolios based on the asset growth rates during the prior year for one country, we use only three portfolios (low, middle and high). The low group is the stocks with the total asset growth below or equal to the 25th quartile, whereas the high group is the stocks with the total asset growth below higher or equal to 75th quartile. The middle groups consist of the observations in between the groups high and low. The portfolios are held for a period of one year, after which the portfolio rebalancing takes place.

The descriptive statistics of asset growth deciles will reveal whether the average monthly holding period returns decrease from low to high asset growth groups. If the holding period equal-weighted and value-weighted return spread between a high asset growth rate portfolio and a low asset growth rate, denoted as $Low - high$, are significant and positive, a asset growth rate effect is present. Cooper et al. (2008) as well as Nyberg and Pöyry (2014) both find such pattern. However, Nyberg and Pöyry (2014) report a pattern that is not monotonic. However, if Nyberg and Pöyry (2014) do not screen for a size, they document similar monotonic negative pattern between asset growth rates and portfolio returns as in the other study. Chan et al. (2008) also find asset growth effect only in the stocks with the highest asset growth rates if they exclude small stocks.

3.5 Cross-sectional interaction between asset growth and momentum

The sample stocks from the period July 1985 to June 2015 are sorted into portfolio categories separately for each country to study cross-sectional interaction between asset growth and momentum. At the end of June, three portfolios are formed based on the asset growth rates during the prior year for one country. In each asset growth decile, stocks are further sorted into three categories based on their past 11-month returns. The first month after the first holding period is excluded from the analysis. These three portfolios are then held for a year, after which

the portfolio rebalancing takes place. The momentum profits between the past winners and past losers is calculated in each of these asset group rate portfolios separately. The idea is to see whether momentum exists in these asset growth groups.

Different from the setup used in this thesis, Nyberg and Pöyry (2014) exclude stocks below the 20th percentile and tested for robustness using holding periods of 3 and 6 months. Additionally, they also use Fama and French (1993) three factor momentum returns for robustness. Furthermore, they also used 10x5 portfolio sorts whereas 3x3 portfolio sort is used in this thesis.

In this thesis, OLS regressions are also run, in which I aim to explain the country aggregate momentum profits with lagged aggregate asset growth rate as the explanatory variable. Additionally, OLS regression is also run with lagged aggregate asset growth rate in a particular country as the possible predictor of aggregate momentum profits in that country.

4. Results

This section goes through the results of the thesis. Methods are briefly explained throughout the section, when necessary. For more detailed explanations of the methods, refer back to the previous section, Section 3.

4.1 Descriptive statistics of asset growth deciles

To get a basic overview of the balance sheet asset growth rates in the sample data, the descriptive statistics of asset growth deciles are presented in Table 2. Table 2 shows the time-series averages of the following statistics: the minimum, the 25th percentile, the average, the median, the 75th percentile, the maximum as well as the standard deviation of stock asset growth rates in each of the countries included in the sample. These time-series averages for each of the statistical measure that are reported in the Table are calculated as an average from the quarterly time-series measures (minimum, median etc.) for asset growth rates in each of the sample country. The raw data is assumed to contain some coding errors, which are excluded from the descriptive statistics. In order to see what the sample looks like if it was assumed that there are no coding errors in the asset growth rate data, refer to Appendix A.

Table 2 - Summary statistics about asset growth (coding errors excluded)

Country	25th percentile	Average	Median	75th percentile	Standard deviation	Min	Max
Austria	-0.018	0.136	0.052	0.165	0.434	-0.598	2.652
Belgium	-0.023	0.159	0.062	0.178	0.536	-0.618	4.222
Canada	-0.036	0.255	0.073	0.277	0.765	-0.846	7.607
Finland	-0.027	0.135	0.050	0.163	0.440	-0.480	3.365
France	-0.020	0.161	0.061	0.182	0.525	-0.806	6.249
Germany	-0.043	0.172	0.045	0.179	0.628	-0.828	7.097
Italy	-0.017	0.144	0.059	0.165	0.489	-0.685	4.833
Japan	-0.020	0.065	0.031	0.094	0.259	-0.725	5.718
Netherlands	-0.034	0.136	0.052	0.167	0.491	-0.680	4.118
Norway	-0.022	0.256	0.092	0.278	0.711	-0.660	5.290
Spain	-0.017	0.138	0.065	0.169	0.435	-0.526	3.469
Sweden	-0.031	0.222	0.080	0.256	0.646	-0.703	5.530
Switzerland	-0.025	0.106	0.041	0.125	0.412	-0.664	3.721
The UK	-0.041	0.231	0.072	0.249	0.757	-0.918	8.349

Table 2 shows the average quarterly minimum, 25th percentile, average, median, 75th percentile, maximum and standard deviation of stock asset growth rates in each of the 14 countries included in the sample, when coding errors are assumed and excluded. Because coding errors are assumed in the asset growth rates, those observations where the quarterly asset growth exceeds 1000% is excluded from the sample. The values in the Table 2 are denoted in decimals (1.00 = 100%). The time period is from July 1985 to June 2015.

From the asset growth summary statistics, it is apparent that Norway has the highest average and median asset growth rate, whereas Japan has the lowest asset growth rate. The standard deviation in the asset growth rates is highest for the United Kingdom and the most modest for Japan. So, Japan has the lowest variation in the asset growth rates, whereas the United Kingdom has the largest maximum growth rate as well as the largest minimum growth rate. Austria has the lowest maximum growth rate and Finland has the lowest minimum growth rate. The 25th quartile average quarterly growth rate is negative for all the countries in the sample but the average and median growth rates are positive for all of the countries.

The average asset growth for all of the aggregate asset growth series in this sample is 0.165 quarterly. The results are consistent with the ones of Watanabe et al. (2013) in that similar countries have almost similar time-series average measures although not exactly identical since the time period is different between their study and the one used in this thesis.

4.2 The asset growth effect

How the asset growth rates of firms affect the stock returns of firms in the international markets is examined next using univariate portfolio sorts. At the end of June in the year t, stocks are grouped into three deciles based on their prior asset growth rates. This is done separately for each country in the sample. Then, an equal-weighted or value-weighted portfolio is constructed for each of these deciles (low, middle and high) and held for a year (from July in the year t to June in the year t+1). After the portfolios are held for a period of one year, the portfolio rebalancing takes place, which means that stocks are sorted again to three groups based on the asset growth in the past year. The difference in the return spread of the deciles low and high is reported in the "Low-high" column of Table 3.

Nyberg and Pöyry (2014) as well as Watanabe et al. (2013) sort their data into ten portfolios based on the asset growth rates, but in this thesis only three portfolios are formed (low, middle and high). The low group is the stocks with the total asset growth below or equal to the 25th quartile, whereas the high group is the stocks with the total asset growth below higher or equal to 75th quartile. The middle groups consist of all the observations in between the groups high and low. The differences in the profits between the lowest and highest asset growth groups are of interest and compared to the results of similar studies that might use more strictly defined boundaries between the highest and lowest asset growth groups. Cooper et al. (2008) as well as Nyberg and Pöyry (2014) both find that the average monthly holding period returns decrease from low to high asset growth groups.

The equal and value-weighted monthly stock returns of these stock portfolio sorts based on prior asset growth rates are shown in Table 3 and 4.

Table 3 - Stock portfolio sorts based on prior asset growth rate for countries, market-weighted monthly returns

	Low	**Middle**	**High**	Low-High	**t**
Austria: HPRet (VW)	0.017	0.013	0.014	0.003	1.0900
Belgium: HPRet (VW)	0.015	0.050	0.016	-0.001	-0.1383
Canada: HPRet (VW)	0.022	0.015	0.015	0.007*	2.3410
Finland: HPRet (VW)	0.018	0.013	0.020	-0.001	-0.1502
France: HPRet (VW)	0.018	0.014	0.011	0.007**	2.9727
Germany: HPRet (VW)	0.014	0.013	0.011	0.003	0.9973
Italy: HPRet (VW)	0.014	0.011	0.009	0.004	1.5522
Japan: HPRet (VW)	0.011	0.008	0.009	0.002	0.9539
Netherlands: HPRet (VW)	0.013	0.012	0.015	-0.003	-0.9155
Norway: HPRet (VW)	0.024	0.017	0.021	0.003	0.9825
Spain: HPRet (VW)	0.016	0.013	0.015	0.001	0.4614
Sweden: HPRet (VW)	0.022	0.017	0.016	0.006	1.8051
Switzerland: HPRet (VW)	0.013	0.012	0.011	0.001	0.5440
The UK: HPRet (VW)	0.018	0.013	0.014	0.004	1.685

The results of three portfolios (low, middle and high asset growth rate) sorted on the yearly percentage change in the balance sheet total assets of the stocks. The low group is the stocks with the total asset growth below or equal to the 25th quartile, whereas the high group is the stocks with the total asset growth below higher or equal to 75th quartile. The middle groups consist of the observations in between the groups high and low. Asset growth rates greater than 1000% and stock returns greater than 1000% are excluded from this sample. The sample period is from July 1985 to June 2015. The reported values are the average monthly holding period returns. VW denotes value-weighted returns, which gives weights to the stocks proportional to the outstanding market value. The significance of the mean raw return difference between the low and high asset growth portfolios is estimated with student's t-test. The two-tailed p-values evaluate the null hypothesis that a trading strategy that buys high asset growth stocks and sells low asset growth stocks produces a mean return that is different from zero. The significance is denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Canada and France show significant results.

Table 4 - Stock portfolio sorts based on prior asset growth for countries, equal-weighted monthly returns

	Low	**Middle**	**High**	Low-High	**t**
Austria: HPRet (EW)	0.010	0.010	0.008	0.003	0.8703
Belgium: HPRet (EW)	0.009	0.042	0.009	0.000	0.0026
Canada: HPRet (EW)	0.018	0.013	0.010	0.008***	3.9375
Finland: HPRet (EW)	0.013	0.011	0.011	0.004	1.1615
France: HPRet (EW)	0.015	0.011	0.009	0.007***	3.4519
Germany: HPRet (EW)	0.009	0.009	0.004	0.005*	2.1039
Italy: HPRet (EW)	0.007	0.006	0.004	0.003	1.3498
Japan: HPRet (EW)	0.008	0.005	0.004	0.004*	2.5106
Netherlands: HPRet (EW)	0.014	0.009	0.008	0.005*	2.0048
Norway: HPRet (EW)	0.014	0.014	0.009	0.006*	2.0386
Spain: HPRet (EW)	0.010	0.009	0.010	-0.000	-0.1317
Sweden: HPRet (EW)	0.016	0.013	0.008	0.007**	2.7716
Switzerland: HPRet (EW)	0.008	0.007	0.005	0.003	1-8582
The UK: HPRet (EW)	0.010	0.010	0.003	0.007***	5.6295

The results of three portfolios (low, middle and high asset growth rate) sorted on the yearly percentage change in the balance sheet total assets of the stocks. The low group is the stocks with the total asset growth below or equal to the 25th quartile, whereas the high group is the stocks with the total asset growth below higher or equal to 75th quartile. The middle groups consist of the observations in between the groups high and low. Asset growth rates greater than 1000% and stock returns greater than 1000% are excluded from this sample. The sample period is from July 1985 to June 2015. The reported values are the average monthly holding period returns. EW denotes equal-weighted returns that does not take into account the market capitalization.

The significance of the mean raw return difference between the low and high asset growth portfolios is estimated with student's t-test. The two-tailed p-values evaluate the null hypothesis that a trading strategy that buys high asset growth stocks and sells low asset growth stocks produces a mean return that is different from zero. The significance is denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Canada, France, Germany, Japan, the Netherlands, Norway, Sweden and the United Kingdom show significant results.

According to the results, only Canada and France have asset growth rate effect returns that are significant when considering the market-weighted portfolio returns. The asset growth rate effect refers to the difference in the portfolio returns of the lowest and highest asset growth rate group. However, Germany, Japan, the Netherlands, Norway, Sweden and the United Kingdom also demonstrate significant asset growth rate effect if the equal-weighted portfolio returns are considered.

The results are harmonious with the findings of previous research. Watanabe et al. (2013) find that the average asset growth decile portfolios within each country included in their sample have an annual 4.8% return spread between the top and bottom decile. The spreads in this thesis are denoted as monthly spreads. The average spread is 0.26% monthly for the market-weighted time series (0.44% for the equal-weighted time series). However, when converted to an annual spread for comparison purposes, the average spread within each country is 3.1% in the market-weighted return case (5.4% in the equal-weighted return case). Considering that Watanabe et al. (2013) use 10 groups (where the dispersion between the highest and lowest asset groups is greater than in this thesis), the results of this thesis seem very consistent with their findings. In summary, they find an annual 4.8% return spread between the top and bottom decile and the spread in this thesis is 3.1% in the market-weighted return case and 5.4% in the equal-weighted return case. The numbers are very comparable.

Even though only two countries out of fourteen demonstrate significant asset growth effect when considering the market-weighted portfolio spreads, most countries have positive spread between the low and high asset growth groups. Belgium, Finland and the Netherlands are the only countries with negative spread between the low and high asset growth groups. Therefore, 11 countries out of 14 (79%) that are included in this thesis have a positive spread. In comparison, Watanabe et al. (2013) find that 27 countries out of 40 (68%) included in their sample have a positive spread. The reason why the percentage of countries in Watanabe et al. (2013) that have asset growth effect is less than in our sample might be because their sample includes plenty of South American countries. Watanabe et al. (2013) find that most South American countries tend to not have a pronounced asset growth effect. They conclude that the asset growth effect is strong in developed markets and weak in emerging markets, with the exception that the effect is significant in Africa and in Asian emerging markets, while insignificant in Asian developed markets. Simply put, the asset growth effect is mainly present in the developed markets. Our sample covers mainly developed markets, which might explain why as much as 79% of the countries included in this thesis show a positive spread between the low and high asset growth rate groups.

Overall, the results of this thesis indicate that internationally stock returns decrease when asset growth rate is large for a firm, although the spread between the low and high asset growth rate groups is not significantly different from zero in most countries, at least in the market-weighted returns case (Table 3). Country-wise differences do exist in the results as Watanabe et al. (2013) also note. In the case of equal-weighted returns, for all countries in the sample

(except Spain), the returns from high-low portfolio strategy were greater than zero. In the equal-weighted returns case, most of the countries in the sample showed returns for the high-low portfolio that were significantly different from zero.

4.3 The momentum effect

The momentum effect is examined next using similar univariate sorts as in the previous asset growth effect case. Basically, three portfolios are formed based on the prior 11-month returns of the stocks. However, there is one-month lag between the formation and holding periods, which means that the previous month is not included in the calculation of the past 11-month return of the stock. This is a common convention in similar studies (for example, Nyberg and Pöyry, 2014). The portfolio strategy can be denoted more shortly as 11-1-1, which means that past 11-months are used, one month prior to portfolio formation is skipped and that there is one-month holding period before the portfolio is rebalanced. If the holding period equal-weighted and value-weighted return spread between the past loser and past winner portfolios, denoted as $High - low$, is significant and positive, a momentum anomaly is present in the sample.

Nyberg and Pöyry (2014) find a significant momentum effect between the prior winner and loser portfolios for a sample of U.S. stocks. After they control for the Fama-French three factors, the momentum anomaly is even more pronounced. In this thesis, it is expected to find momentum effect in all of the countries. The results of the univariate sorts are shown in Tables 5 and Table 6, which show the stock portfolio sorts based on the past 11-month returns for each country. The possible coding errors are excluded from the data.

Table 5 - Stock portfolio sort based on past 11-month returns for countries, excluding possible coding errors, value-weighted monthly returns

	Low	**Middle**	**High**	High-low	**t**
Austria: HPRet (VW)	0.012	0.011	0.015	0.002	0.5775
Belgium: HPRet (VW)	0.014	0.012	0.018	0.004	0.8808
Canada: HPRet (VW)	0.022	0.014	0.026	0.004	0.7543
Finland: HPRet (VW)	0.010	0.011	0.023	0.013*	2.3789
France: HPRet (VW)	0.015	0.014	0.017	0.002	0.6504
Germany: HPRet (VW)	0.012	0.009	0.017	0.005	1.2050
Italy: HPRet (VW)	0.011	0.011	0.015	0.004	1.0881
Japan: HPRet (VW)	0.012	0.010	0.014	0.002	0.3991
Netherlands: HPRet (VW)	0.011	0.012	0.016	0.005	1.2157
Norway: HPRet (VW)	0.024	0.017	0.022	-0.002	-0.4093
Spain: HPRet (VW)	0.011	0.011	0.015	0.004	0.8958
Sweden: HPRet (VW)	0.024	0.014	0.026	0.002	0.244
Switzerland: HPRet (VW)	0.009	0.011	0.015	0.006	1.5399
The UK: HPRet (VW)	0.015	0.014	0.018	0.003	0.6710

The results of three stock portfolios sorted based on their past 11-month returns. There is a one-month lag between the formation and holding periods (hence 11 months). The holding period is one month, which means that new portfolios are formed monthly. The time period is from July 1985 to June 2015.

The low group is the stocks with past 11-returns below or equal to the 25th quartile, whereas the high group is the stocks with past 11-returns higher or equal to 75th quartile. The middle group consists of the observations in between the groups high and low. The significance is denoted as follows: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. These results are for the value-weighted returns (VW).

Table 6 - Stock portfolio sort based on past 11-month returns for countries, equal-weighted monthly returns

	Low	**Middle**	**High**	High-low	**t**
Austria: HPRet (EW)	0.008	0.008	0.013	0.004	1.1911
Belgium: HPRet (EW)	0.011	0.008	0.018	0.007	1.6015
Canada: HPRet (EW)	0.025	0.016	0.025	0.001	0.1682
Finland: HPRet (EW)	0.007	0.011	0.016	0.009*	2.5696
France: HPRet (EW)	0.014	0.011	0.018	0.004	1.6225
Germany: HPRet (EW)	0.009	0.006	0.013	0.004	1.4166
Italy: HPRet (EW)	0.004	0.006	0.013	0.009**	2.7844
Japan: HPRet (EW)	0.007	0.007	0.007	0.000	0.0264
Netherlands: HPRet (EW)	0.001	0.009	0.018	0.018***	5.0147
Norway: HPRet (EW)	0.010	0.010	0.017	0.007*	2.1508
Spain: HPRet (EW)	0.004	0.008	0.013	0.009*	2.5589
Sweden: HPRet (EW)	0.013	0.012	0.019	0.006	1.5653
Switzerland: HPRet (EW)	0.002	0.007	0.014	0.012***	4.7044
The UK: HPRet (EW)	0.006	0.009	0.017	0.012***	4.5461

The results of three stock portfolios sorted based on their past 11-month returns. There is a one-month lag between the formation and holding periods (hence 11 months). The holding period is one month, which means that new portfolios are formed monthly. The time period is from July 1985 to June 2015.

The low group is the stocks with past 11-returns below or equal to the 25th quartile, whereas the high group is the stocks with past 11-returns higher or equal to 75th quartile. The middle group consists of the observations in between the groups high and low. The significance is denoted as follows: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. These results are for the equal-weighted returns (EW).

The results of the univariate sorts are not as expected. In the case of value-weighted returns, there is no significant momentum effect present (except in Finland). However, the results are different for equal-weighted portfolios, where significant momentum effect is present in 7 countries out of 14 (the countries are Finland, Italy, the Netherlands, Norway, Spain, the Switzerland and the United Kingdom).

It can be concluded that there seems to be slightly positive momentum returns, but nothing too significant at least on the value-weighted returns side. Nyberg and Pöyry (2014) also have results that are more significant when they use equal-weighted returns instead of value-weighted returns. Since most countries do not demonstrate significant momentum effect, it might be because in this thesis, the high and low past return groups are broader than what Nyberg and Pöyry (2014) use. They use 10 groups of equal size and compare the spread between the lowest and highest group, whereas in this thesis the 25% bottom group and 25% top group is used. However, the results for the 20% bottom and 20% top groups do not change the results significantly (available in Appendix D). In that case, only Finland remains significant in the case of value-weighted returns and negative spread only occurs in Norway. So, the results of the 20% bottom and top group are similar to the ones with the 25% bottom and top group.

Not only is the choice of countries different, but the time period between this thesis and Nyberg and Pöyry (2014) also differs and might affect the results. The momentum portfolio had a terrible year in 2009 with more than 80% drawdown.[5] The sample time period of this thesis includes this year. This might be one reason why the momentum profits are not that large in this thesis. Most studies on momentum use time periods that take place before the financial crisis. For example, Nyberg and Pöyry (2014) use a time period from July 1968 to June 2006. In addition, not only were the momentum profits affected in 2009, but the investments as well. The investments grew before the year 2009 internationally. After that, investments were cut back. Since the link between momentum and investments (in the form of asset growth) is the topic of this thesis, it is good to keep in mind that some big changes in the economic environment have occurred during the sample period of this thesis. For future research, it might be interesting to duplicate the tests in this thesis but to exclude the year 2009 and see if it changes the results.

The findings on momentum with international data mostly show significant momentum effects with some discretion depending on the region being studied. Rouwenhorst (1998) study the time period from 1980 to 1995 and find an average of 1% monthly momentum profits internationally. Furthermore, the international momentum returns seem to correlate with those of the United States. The momentum profits are smallest in Asia, but outside Asia the winner minus loser portfolio profits are highly significant (Griffin et al., 2003). Griffin et al. (2003) finds that 14 of the 17 European countries display positive mean momentum profits. The

[5] The data is from Kenneth French library - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/F-F_Momentum_Factor.zip

average monthly momentum profit is 0.32% in Asia and 0.77% in Europe. The average momentum profit for all non-U.S. developed markets is 0.73% per month compared to a statistically insignificant 0.27% per month for emerging markets. Comparing these results to the results of this thesis, there are some similarities. In this thesis, the average monthly momentum profit for all the countries is 0.39% per month in the value-weighted case and 0.73% in the equal-weighted case. So, in the equal-weighted returns case, the monthly momentum profits are similar to what Griffin et al. (2003) find in their sample for non-U.S. developed markets, even though the countries and the time period are different between the two.

Since most of the countries included in this thesis do not display significant momentum profits, it is interesting to see what the findings are for the tests about how the asset growth rate can explain momentum profits. However, the momentum effect might be present within the low and high asset growth rate groups even if it is not strongly present in the overall sample. The next sub-sections will go through these tests.

4.4 Cross-sectional interaction between asset growth and momentum

In order to study the cross-sectional interaction between the asset growth groups and momentum, at the end of each June, stocks are sorted into three portfolios based on their asset growth rate during the prior year. In each of the three asset growth decile (low, middle, high), stocks are further sorted into three categories based on their past 11-month returns. The first month after the first holding period is excluded from the analysis when calculating the prior 11-month return. These 11-month returns represent the momentum strategy and the 11-month returns for each stock are calculated monthly, which means that within the asset growth rate groups, the stocks are sorted into three groups on a monthly basis. The asset growth rate portfolios themselves are rebalanced on a yearly basis. The results are presented in the Table 7, which is quite large due to the amount of countries included in the sample.

Table 7 - Momentum within asset growth groups for each country, equal-weighted and value-weighted returns

Austria

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.003	0.008	0.016	0.013*	1.9990
Middle (EW)	0.005	0.010	0.014	0.009*	2.2727
High (EW)	-0.051	0.007	0.009	0.059***	20.5685
Low (VW)	0.015	0.008	0.021	0.007	0.8645
Middle (VW)	0.014	0.013	0.013	-0.001	-0.2411
High (VW)	-0.049	0.012	0.011	0.060***	6.5340

Belgium

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.008	0.008	0.015	0.007	1.0903
Middle (EW)	-0.001	0.008	0.014	0.015***	3.9509
High (EW)	-0.003	0.008	0.014	0.016***	4.1361
Low (VW)	0.010	0.007	0.007	-0.004	-0.3541
Middle (VW)	0.005	0.010	0.016	0.013*	2.3596
High (VW)	-0.001	0.008	0.016	0.016*	2.4349

Canada

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.012	0.012	0.023	0.011*	2.2068
Middle (EW)	0.011	0.011	0.021	0.010*	1.9692
High (EW)	-0.001	0.008	0.020	0.021***	4.2244
Low (VW)	0.026	0.016	0.025	-0.001	-0.1600
Middle (VW)	0.020	0.013	0.020	-0.000	-0.0049
High (VW)	0.007	0.014	0.023	0.016**	2.7739

Finland

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.016	0.006	0.016	-0.000	-0.0412
Middle (EW)	0.008	0.011	0.015	0.007	1.5557
High (EW)	0.004	0.008	0.012	0.010	1.6345
Low (VW)	0.017	0.011	0.018	-0.001	-0.0854
Middle (VW)	0.011	0.016	0.015	0.005	0.7259
High (VW)	0.014	0.012	0.017	0.005	0.7011

France

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.012	0.013	0.016	0.003	0.7135
Middle (EW)	0.006	0.010	0.016	0.009***	3.6049
High (EW)	0.000	0.005	0.016	0.016***	4.2666
Low (VW)	0.015	0.015	0.019	0.005	0.9253
Middle (VW)	0.013	0.014	0.015	0.002	0.5424
High (VW)	0.012	0.009	0.013	0.001	0.2250

Germany

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	-0.376	0.010	0.014	0.390***	31.8979
Middle (EW)	0.001	0.008	0.018	0.016***	3.8627
High (EW)	-0.005	0.019	0.014	0.018***	4.3880
Low (VW)	-0.337	0.010	0.020	0.356***	27.5990
Middle (VW)	0.009	0.011	0.017	0.007	1.7616
High (VW)	0.008	0.014	0.021	0.013*	2.0660

Italy

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.005	0.005	0.011	0.006	1.3567
Middle (EW)	0.002	0.006	0.011	0.009**	2.7100
High (EW)	-0.094	-0.003	0.116	0.209***	49.2057
Low (VW)	0.013	0.013	0.014	0.001	0.1006
Middle (VW)	0.010	0.010	0.014	0.004	1.0838
High (VW)	-0.084	-0.001	0.101	0.185***	46.5906

Japan

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.017	0.009	0.005	-0.012	-1.5409
Middle (EW)	0.012	0.006	0.004	-0.008	-1.6832
High (EW)	0.005	0.005	0.008	0.003	0.5203
Low (VW)	0.013	0.011	0.013	-0.000	-0.0285
Middle (VW)	0.010	0.007	0.007	-0.003	-0.8267
High (VW)	0.010	0.007	0.013	0.004	0.7974

the Netherlands

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.002	0.010	0.039	0.037***	3.3571
Middle (EW)	0.003	0.010	0.014	0.010**	3.2957
High (EW)	-0.005	0.009	0.014	0.019***	3.3385
Low (VW)	0.009	0.015	0.020	0.011	1.5670
Middle (VW)	0.006	0.012	0.014	0.008	1.8652
High (VW)	0.006	0.015	0.017	0.010	1.7855

Norway

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.010	0.014	0.022	0.012	1.6879
Middle (EW)	0.013	0.013	0.017	0.004	0.7818
High (EW)	0.001	0.003	0.022	0.020***	3.3385
Low (VW)	0.023	0.021	0.025	-0.002	-0.2116
Middle (VW)	0.022	0.015	0.019	-0.004	-0.7851
High (VW)	0.012	0.013	0.024	0.012	1.6837

Spain

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.016	0.009	0.016	-0.001	-0.0714
Middle (EW)	0.006	0.009	0.014	0.008*	2.2216
High (EW)	-0.162	0.011	0.016	0.222***	15.4138
Low (VW)	0.027	0.013	0.019	-0.007	-0.7812
Middle (VW)	0.012	0.012	0.016	0.004	0.7696
High (VW)	-0.206	0.007	0.016	0.178***	12.2621

Sweden

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.019	0.014	0.022	0.003	0.4453
Middle (EW)	0.009	0.010	0.021	0.011*	2.4028
High (EW)	0.000	0.006	0.014	0.014*	2.4351
Low (VW)	0.026	0.020	0.021	-0.005	-0.6074
Middle (VW)	0.019	0.012	0.022	0.004	0.6498
High (VW)	0.012	0.012	0.019	0.007	1.0025

Switzerland

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.003	0.009	0.018	0.015***	3.3087
Middle (EW)	0.005	0.009	0.013	0.008**	2.8854
High (EW)	0.000	0.005	0.014	0.014***	3.5365
Low (VW)	0.007	0.011	0.014	0.007	1.4063
Middle (VW)	0.007	0.011	0.015	0.008	1.9119
High (VW)	0.006	0.011	0.017	0.010	1.9612

The United Kingdom

Asset growth	Low	Middle	High	High-low	t-value
Low (EW)	0.005	0.008	0.018	0.013**	3.0481
Middle (EW)	0.004	0.010	0.016	0.012***	4.2054
High (EW)	-0.007	0.002	0.016	0.023***	5.9101
Low (VW)	0.020	0.013	0.019	-0.001	-0.2468
Middle (VW)	0.013	0.012	0.016	0.004	0.9302
High (VW)	0.012	0.011	0.019	0.007	1.3675

Summary for all countries

Asset growth	Significant High-low
Low (EW)	6 (43%)
Middle (EW)	11 (79%)
High (EW)	12 (86%)
Low (VW)	1 (7%)
Middle (VW)	1 (7%)
High (VW)	6 (43%)

Table 7 presents the average equal-weighted and value-weighted returns for 3x3 portfolios sorted independently based on the asset growth rates during the prior year and past 11-month returns. The momentum portfolio strategy, which is denoted by $High - low$ and its t-value are reported in the last columns (in other words, the strategy to buy past winners and sell past losers).

The bottom group consists of observations below or equal to the bottom 25% and the top group consists of observations below or equal to top 25%. The middle group contains observations that are in-between the low and

high groups. These bottom, middle and high groups are rebalanced monthly for the momentum strategies and annually for the asset growth groups. In the momentum strategy, the holding period is one month. The results are shown for each country separately.

The summary for all countries shows the amount of countries that had significant result for a particular portfolio. The percentages in parenthesis show the percentage of countries, which had a significant result out of a total of 14 countries. The significance is denoted as follows: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The time period is from July 1985 to June 2015

Interestingly, significant momentum profits arise in many countries when dividing portfolios according to the asset groups. When considering the value-weighted returns, Austria, Belgium, Canada, Germany, the Netherlands, Norway, Spain and the Switzerland all show statistically significant momentum profits within the high asset growth group. A few other things can be noticed from the results. When country has momentum profits within one asset growth group, there is likely to be momentum profits in the other asset growth groups as well.

The high asset growth group is the one where there seems to be most significant momentum profits. This is interesting because Griffin et al. (2003) find that momentum seems to be driven by the past loser portfolios in Europe. However, this would need to be further studied whether or not, the momentum in those high asset growth groups is mainly due to the past losers or both past winners and losers.

Similar to Nyberg and Pöyry (2014), the results are stronger in the equal-weighted returns than in value-weighted returns. The low and middle asset growth rate group demonstrates significant momentum profits in seven percent of the countries in the sample whereas the high asset growth rate group shows significant momentum profits over 43% of sample countries. The results seem to support what Nyberg and Pöyry (2014) suggest: the momentum effect seems to be connected to large changes in asset growth rates.

4.5 Aggregate asset growth and momentum and country correlations

The correlations between the sample countries are studied in this sub-section and the results are presented in a correlation matrix in Table 8.

Table 8 - Correlations between aggregate asset growths for some countries (average)

	AU	BE	CA	FI	FR	DE	IT	JP	NL	NO	ES	SE	CH	UK
AU	1	0.55	0.38	0.44	0.61	0.52	0.57	0.39	0.49	0.63	0.69	0.60	0.52	0.52
BE		1	0.27	0.76	0.88	0.85	0.69	0.26	0.81	0.73	0.82	0.75	0.76	0.63
CA			1	0.41	0.40	0.38	0.17	0.22	0.49	0.51	0.47	0.52	0.12	0.72
FI				1	0.84	0.75	0.81	0.33	0.62	0.63	0.76	0.76	0.68	0.75
FR					1	0.87	0.79	0.36	0.79	0.74	0.86	0.85	0.72	0.74
DE						1	0.65	0.14	0.82	0.65	0.74	0.82	0.61	0.62
IT							1	0.30	0.44	0.43	0.71	0.65	0.72	0.57
JP								1	0.04	0.46	0.41	0.29	0.50	0.52
NL									1	0.68	0.74	0.74	0.43	0.62
NO										1	0.71	0.76	0.60	0.69
ES											1	0.71	0.67	0.67
SE												1	0.62	0.78
CH													1	0.54
UK														1

Table 8 shows the correlations between aggregate asset growths of Austria, Belgium, Canada, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom. The aggregate asset growths for each country have been calculated as the average asset growth per quarter. The asset growth rates that exceed 1000% have been excluded from the sample as possible coding errors. The time period is from July 1985 to June 2015.

From Table 8, it is evident that the asset growths of each of the 14 countries in the sample are positively correlated with one another. Not a single correlation coefficient is negative in the correlation matrix. The magnitude of the positive correlations naturally varies between countries, however. Overall, Japan and Canada are not as strongly correlated with the European countries compared to how correlated European countries are with each other. The positive correlations suggest that the asset growths between countries move in similar directions with each other. This means that during the times of high asset growth in one country, the other countries are also likely to experience high asset growth and vice versa.

In order to see whether country-wise momentum profits can be predicted by the aggregate asset growth in all countries, OLS regression analysis is run next. Table 9 shows the results of the OLS regressions, in which for each country, their average monthly momentum profits are predicted with the average "global" lagged aggregate asset growth rate variable. The "global" aggregate asset growth rate is calculated as the equal-weighted average of the average asset growth rates in each sample country. In other words, the average growth rate for country A is calculated at the time t and repeated for the remaining 13 countries in the sample. The lagged aggregate asset growth factor is equal-weighted between the countries, which means that it is

not proportional to the market weights of each country. The lagged aggregate asset growth rate is chosen to be equal-weighted instead of market-weighted, because Japan, the United Kingdom and Canada represent such a large proportion of the total market share of the sample. However, the results for market-weighted aggregate asset growth rate are also available in the Appendix E.

Table 9 reports the results of simple OLS regressions $R_{t+1} = \propto + AG_t + \varepsilon_t$, which are run with equal-weighted international lagged asset growth rates as the explanatory variable for the momentum profits in individual countries. *R* denotes the country-wise momentum profits at the time t + 1 and *AG* is the lagged aggregate asset growth rate composed of all the sample countries at the time t. Equal-weighted momentum returns are used for each country instead of value-weighted ones.

Table 9 – OLS coefficients of countries with the country aggregate momentum profits as the dependent variable and lagged aggregate asset growth rate as the explanatory variable

Country	AG coefficient	t-value	Positive/negative
Austria	-0.013	-0.34	-
Belgium	0.032	0.79	+
Canada	-0.041	-1.22	-
Finland	0.001	0.04	+
France	0.042	1.50	+
Germany	0.087	2.74**	+
Italy	0.007	0.21	+
Japan	0.008	0.27	+
Netherlands	0.003	0.08	+
Norway	0.012	0.34	+
Spain	0.006	0.18	+
Sweden	0.051	1.21	+
Switzerland	0.009	0.35	+
The UK	0.025	0.94	+

Table 9 shows the results of simple OLS regressions with equal-weighted lagged international asset growth rates as the explanatory variable for the momentum profits in individual countries. The country-wise average monthly momentum profit is calculated from the equal-weighted returns of the high and low groups based on their past 11-month portfolios returns (with one-month holding period and one-month lag between the past returns and

holding period). The aggregate asset growth rate is the equal-weighted average of all the average annual asset growth rates for all the countries. The significance is denoted as follows: p < 0.05, ** p < 0.01, *** p < 0.001. The time period is from July 1985 to June 2015. Only Austria and Canada take on a negative coefficient.

As can be seen from Table 9, only Austria and Canada have a negative aggregate *AG* coefficient, whereas the 12 other countries have a positive aggregate *AG* coefficient. The results, however, are only significant for Germany. The results can be interpreted as follows. For most countries, the momentum profits are positively related to the aggregate "international" asset growth factor, which means that lagged asset growth seems to predict momentum profits in most cases although not significantly. So, not only do the asset growths between countries move in similar direction, but also the momentum profit tends to be positive during the times when the lagged aggregate asset growth rate is higher.

In order to see whether country-wise average momentum profits can be predicted by the aggregate asset growth in that particular country, further OLS regressions are necessary. Table 10 shows the results of the OLS regressions, in which for each country, the average monthly momentum profit is explained with the average asset growth rate for that country. The asset growth rate in particular country is the equal-weighted average of all of the annual asset growth rates. However, the results for market-weighted aggregate asset growth rate are also available in the Appendix F. So, Table 10 reports the results of simple OLS regressions $R_{t+1} = \propto + \mathrm{AG}_t + \varepsilon_t$, which are run with equal-weighted lagged country-wise asset growth rates as the explanatory variable for the momentum profits in individual countries. In the equation, *R* denotes the momentum profits at the time t + 1 and *AG* denotes the lagged aggregate asset growth rate in a particular country at the time t. Equal-weighted momentum returns are used for each country instead of value-weighted ones.

Table 10 – OLS coefficients of countries with the country aggregate momentum profits as the dependent variable and lagged aggregate asset growth rate in a particular country as the explanatory variable

Country	AG coefficient	t-value	Positive/negative
Austria	0.027	0.81	+
Belgium	0.001	0.004	+
Canada	0.035	1.40	+
Finland	-0.08	-0.25	-
France	0.041	1.61	+
Germany	0.060	3.13**	+
Italy	0.028	0.80	+
Japan	-0.011	-0.26	-
Netherlands	-0.014	-0.45	-
Norway	-0.007	-0.40	-
Spain	0.010	0.28	+
Sweden	0.048	1.90	+
Switzerland	0.004	0.13	+
The UK	0.029	1.41	+

Table 10 shows the results of simple OLS regressions with equal-weighted lagged country-wise asset growth rates as the explanatory variable for the momentum profits in that country. The country-wise average monthly momentum profit is calculated from the equal-weighted returns of the high and low groups based on their past 11-month portfolios returns (with one-month holding period and one-month lag between the past returns and holding period). The aggregate asset growth rate is the equal-weighted average of all the average annual asset growth rates in that particular country. So, the momentum profits at the time t + 1 are explained with the asset growth rates at the time t. The significance is denoted as follows: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The time period is from July 1985 to June 2015. Finland, Japan, the Netherlands and Norway have a negative coefficient.

As can be seen from Table 10, only Finland, Japan, the Netherlands and Norway have a negative *AG* coefficient, whereas the 10 other countries in the sample have a positive *AG* coefficient. The results, however, are only significant for Germany. The results can be interpreted as follows. For most countries, the momentum profits are positively related to the average lagged asset growth factor in that country. This means that in most cases lagged asset growth rate factor can predict the momentum profits although not significantly. So, the momentum profit in a particular country tends to be positive during the times when the lagged aggregate asset growth rate is higher.

5. Summary and conclusions

This section concludes the thesis. The research summary is provided in this section. Some limitations of this thesis are also covered and suggestions for further research are provided. A review of theoretical and practical implications is provided in the end.

5.1 Research summary

In this thesis, I examine whether the momentum effect is related to large changes in the balance sheet assets of firms. A momentum strategy is one that buys stocks with the highest returns over the past two to twelve months and sells those stocks with the lowest return over the same period of time can creates profits that seems abnormally high in relation to its risk. Studies make indirect predictions about the impact of changes in the firms' asset bases on expected return momentum. The comparison of existing return momentum models is out of the scope of this thesis.

I use methodology similar to the one used by Nyberg and Pöyry (2014) but applied to a more global dataset. My data covers stocks from particular stock markets of Austria, Belgium, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom as well as Canada and Japan during July 1985 and June 2015.

The results of this thesis show that there is an asset growth effect present in most of the countries of the sample. This is in line with previous research such as Watanabe et al. (2013). The findings give support to the idea that the asset growth effect seems to not be a universal one and its size and significance varies greatly across countries. As with previous studies (Watanabe et al., 2013), the asset growth effect seems to be modest in Japan but more pronounced in developed European countries. It is out of the scope of this thesis to speculate whether the asset growth effect is a result of market inefficiency or explainable by financial theories. However, the effect seems to remain even in the newer data instead of disappearing over passage of time once it has been discovered. For future research, it is interesting to continue to test whether the asset growth effect disappear internationally and further investigate the theories behind this phenomenon.

Another finding in this thesis is that the momentum effect was not significantly present contrary to Nyberg and Pöyry (2014). The momentum effect is tested by comparing the spread of buying the 11-month winners and selling the 11-month losers (divided into three groups: low, middle and high). The results are not consistent with what Nyberg and Pöyry (2014) probably due to difference in time period and choice of countries. However, the significance might also be affected by the fact that the sample countries in this thesis contain fewer observations than the United States data, which was used in Nyberg and Pöyry (2014). The spreads between the high and low 11-month return groups are still positive for all of the countries except Norway. However, the momentum effect is not significant for any of the countries except for Finland. Therefore, the findings do not support that a strong momentum effect is present in the other 13 countries during July 1985 and June 2015. However, when momentum is investigated within asset growth rate groups, interesting findings emerge.

The key finding in this thesis is that there are significant momentum profits in the highest asset growth rate group and frequently in the low asset growth rate groups as well. This is in line with Nyberg and Pöyry (2014), who find that the large changes in firm total assets enhance short-term return momentum even when controlling for other firm-level drivers of momentum. Nyberg and Pöyry (2014) conclude that momentum is driven by rapid, rather than slow, changes in the assets of firms. The findings of this thesis support this strongly.

5.2 Limitations of the thesis

This sub-section covers some of the limitations of this thesis. The main focus on this sub-section is to discuss those limitations that come from the methodological choices of this thesis and how they could affect the results. The sub-section will also discuss relevant future research modifications to the chosen research when necessary. However, more suggestions for future research are provided in the next sub-section.

One limitation of this thesis is that there are not that many firms available in each country. This means that in order to examine the top (winner) and bottom (loser) stock returns, the stocks are not divided into as many groups as is usually the convention in similar studies. For example, Nyberg and Pöyry (2014) use ten groups of stocks, which is usually the convention to study the momentum effect as well as the asset growth effect. Due to the lack of available firms in most countries, a slightly modified research setup is used in this thesis. Having fewer groups can

mean that the results will not be significant due to less stricter categories of stocks. Furthermore, the pattern how the asset growth effect and moment effect evolve when moving from low to high portfolios will not be that visible from the results of this thesis with only three categories. The return pattern of stock groups would be more evident with more categories of stocks. The choice about how to divide the groups of stocks into a certain number of categories could also be done differently

In this thesis, I report the results for three groups (low, middle and high) of stocks. However, not only is the amount of groups of stocks open to question, but the way to divide stocks into the groups can also differ. In this thesis, the low group consists of stocks with the annual asset growth between 0 and the 25th quartile and the high group consists of the 75th quartile and above. I also tested the 20^{th} and 80^{th} percentile groups, respectively. For example, Griffin et al. (2003) use the 20% bottom and 20% top stocks to study the momentum profits to their international dataset. The choice about how to assign the stocks into groups has similar effects on the results of this thesis as the choice of the amount of groups used.

Another limitation in this thesis is the choice to divide stocks into categories by absolute percentages. Perhaps, it might be more informative to divide stocks into groups based on their level of asset growth instead. For example, all stocks that have asset growth of 0% could form one group. Stocks with negative asset growth could form another. This might provide more useful results that are easier to analyze in terms of negative asset growths, zero asset growth and high asset growth rates. Furthermore, this would take into account the fact that there are periods of higher and lower asset growth.

A further limitation is that a short investment horizon is used in this thesis (1 month). Usually momentum is studied over intermediate holding periods (6 to 12 months). However, Nyberg and Pöyry (2014) used longer horizons as well as the short-term horizon and found no extremely significant differences in their results. In addition, for future research, it might be interesting to duplicate the tests in this thesis but to pay attention to different momentum time periods and their effect on the momentum. For example, what happens to the results if the year 2009 is excluded? Since the momentum strategy has had some extremely bad years, this could be why the results on the momentum effect might not be significant for the whole time period used in this thesis. However, the momentum effect might still be highly significant in certain time periods.

5.3 Suggestions for further research

There are many suggestions for future research both in terms of how to enhance the methodology used in this thesis and what interesting directions to take theories behind the momentum effect. However, the focus in this sub-section will be on how to enhance the methods in this thesis and what modifications and additional tests could be run to see how robust the results of this thesis are. Some modifications to the methods used in this thesis are mentioned in the previous sub-section in relation to the limitations in this thesis.

One possible change to the methodology used in this thesis could be to incorporate the Fama- French three-factor model to study the asset growth rate and momentum effect. Nyberg and Pöyry (2014) use the Fama-French model and similar setup in the context of the international countries to check for the robustness of these results could be carried out. In the case of Nyberg and Pöyry (2014), they find that their results are more pronounced when the Fama-French three-factor model was used. Therefore, it is predicted that the results of the methods used in this thesis might also become more significant if such model was incorporated in the analysis. Also Nyberg and Pöyry (2014) use the Newey-West (1987) t-statistic, whereas simple student's t-test is used in this thesis. Using the Newey-West (1987) t-statistic might also help with the possible autocorrelations of the stock returns

Similar to Griffin et al. (2003), future research could distinguish whether it matters if the momentum profits are mainly driven by the past winners or past losers when using asset growth rates to explain the results. Furthermore, studies could look at momentum effect beyond stock markets and in commodity prices and currencies as well as what this means in terms of the asset growth effect. If momentum is present in commodity prices and currencies, what other factors than asset growth might play a role in this effect.

5.4 Practical implications

Past research supports the idea that the momentum effect and firm-level investment are connected. For example, Hackbarth and Johnson (2012) show that firms with more investment flexibility have risk that falls, on average, as profitability declines, whereas the opposite is true

for firms with less investment flexibility. Their model implies that return autocorrelations should be U-shaped conditional on lagged operating variables. Firms near expansion or contraction option have enhanced momentum returns. Fama and French (2006) show that lagged growth predicts asset growth up to three years ahead. Chen et al. (2010) three-factor model includes a factor for investment. Nyberg and Pöyry (2014) show that the model does decrease the overall magnitude of the momentum profits. However, it does not explain the differences in profits across the asset growth groups. Nyberg and Pöyry (2014) show that interaction between asset growth and momentum is not driven by within-groups differences in the expected growth rates. For example, Johnson (2002) has a model where firm's log price to dividend ratio is convex with respect to expected growth rates. This model implies that stock returns are more sensitive to changes in expected growth when expected growth is high. Overall, what can be concluded from these past studies is that the relationship between the momentum effect and firm-level investment is not fully understood yet.

The idea about balance sheet asset growth rate as one of the most robust predictors of the momentum effect should definitely be studied further. The findings in this thesis indicate that large changes in the asset bases of firms seem to be connected to the momentum effect. The current models that explain how investment and returns are connected should definitely be developed further to account for the possible effect of company asset growth rate on momentum. Since there are times when momentum effect reverses, it is important to analyze the factors behind momentum into more detail and analyze why the value effect trading strategy seems to work better than momentum in longer investment horizons. Understanding the nature of momentum profits better can help even with the understanding of stock market bubbles because it can make investors more aware of how to not just invest in the heat of a momentum strategy without understanding why and when to invest in it.

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Appendices

Appendix A. Asset growth summary statistics

The asset growth summary statistics of the sample that have not been cleaned from possible coding errors is listed in Appendix A. The sample period is from July 1985 to June 2015.

Appendix A shows the time-series average minimum, 25th percentile, average, median, 75th percentile, maximum and standard deviation of stock asset growths in each of the countries when no coding errors are assumed. These time-series averages are calculated from the annual measures (minimum, median etc.) of asset growth in each country. It can be seen that the times-series average measure of the average is affected by these maximum asset growths that seem to be extreme (asset growth over 1000% is frequent in the data).

Norway has the highest average and median asset growth, whereas Japan has the lowest.

Asset growth summary statistics

Country	25th percentile	Average	Median	75th percentile	Standard deviation	Min	Max
Austria	-0.018	0.561	0.052	0.165	3.610	-0.598	30.867
Belgium	-0.022	0.573	0.063	0.181	4.963	-0.618	55.165
Canada	-0.035	2.953	0.076	0.292	56.243	-0.846	1490.969
Finland	-0.027	0.142	0.050	0.163	0.493	-0.480	4.058
France	-0.020	1.521	0.062	0.185	34.179	-0.806	938.830
Germany	-0.042	2.145	0.046	0.189	36.381	-0.828	964.628
Italy	-0.017	3.041	0.060	0.168	36.106	-0.685	519.722
Japan	-0.020	0.085	0.031	0.095	1.018	-0.725	51.540
Netherlands	-0.034	0.188	0.053	0.168	0.946	-0.680	9.685
Norway	-0.022	3.445	0.093	0.285	45.076	-0.660	637.882
Spain	-0.017	0.196	0.066	0.170	0.988	-0.526	10.685
Sweden	-0.031	0.578	0.080	0.261	6.240	-0.703	118.873
Switzerland	-0.025	0.138	0.041	0.125	0.775	-0.664	9.119
The UK	-0.040	1.322	0.074	0.261	26.541	-0.918	1005.218

Appendix B. Exchanges

The firms in the sample for each country come from the exchanges listed in Appendix B.

Austria:

- Vienna Stock Exchange WBO

Belgium

- Antwerp (Historical) ANT
- Brussels Terme XBT
- Euronext.liffe Brussels BRU
- EASDAQ EAS

Canada

- Alberta
- Canadian National
- Montreal Exchange
- Toronto

Finland

- Helsinki HEL

France

- Bordeaux BOR
- Euronext.liffe Paris PAR
- Lille LIL
- Lyon LYO
- Marseilles MAR
- Nancy NAY
- Nantes NAN

Germany

- Berlin BER
- Bremen BRE
- Dusseldorf DUS
- Frankfurt FRA
- Hamburg HAM

- Hanover HAN
- Munich MUN
- Stuttgart STU
- XETRA XET

Italy

- Milan MIL

Japan

- Fukuoka
- Japan OTC
- Nagoya
- Osaka
- Sapporo
- Tokyo

The Netherlands

- Amsterdam Unlisted XAO
- Euronext.liffe Amsterdam AMS

Norway

- Norwegian Over the Counter NOT
- Oslo Stock Exchange OSL

Spain

- Barcelona BAR
- Bilbao BIL
- Madrid MAD
- Madrid SIBE MC
- Valencia VAL

Sweden

- AktieTorget AK
- Stockholm OME

The Switzerland

- Basel BSL
- Berne BRN
- Geneva GVA

- SIX Swiss ZRH

The United Kingdom

- ICAP Securities and Derivatives Exchange PLU
- London LON
- London OTC B5
- SEAQ International XSQ

Appendix C. Clarifications on the Datastream economical concepts

The sample comes from Datastream. The sample consists of monthly stock returns for firms, which are defined as the change in price of a stock added with dividend on yearly basis. On Datastream, the return index or total return (RI) shows a theoretical growth in value of a share holding over a specified period, assuming that dividends are re-invested to purchase additional units of an equity or unit trust at the closing price applicable on the ex-dividend date. The return index is cumulative because it adds any changes on to the previous day's value.

Appendix D. Stock portfolios sorted based on their past 11-month returns.

The results of three stock portfolios sorted based on their past 11-month returns are shown in the Appendix D. There is a one-month lag between the formation and holding periods (hence 11 months). The holding period is one month, which means that new portfolios are formed monthly.

The low group is the stocks with past 11-returns below or equal to the 20th quartile, whereas the high group is the stocks with past 11-returns higher or equal to 80th quartile. The middle group consists of the observations in between the groups high and low. The table presents the value-weighted portfolio returns. The extremely high returns are excluded as coding errors.

The significance is denoted as follows: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	Low	**Middle**	**High**	High-low	**t**
Austria: HPRet (VW)	0.013	0.011	0.017	0.004	0.9040
Belgium: HPRet (VW)	0.017	0.012	0.018	0.001	0.2813
Canada: HPRet (VW)	0.022	0.014	0.030	0.008	1.3778
Finland: HPRet (VW)	0.010	0.011	0.023	0.013*	2.1244
France: HPRet (VW)	0.015	0.014	0.019	0.004	0.9409
Germany: HPRet (VW)	0.013	0.010	0.018	0.005	1.0272
Italy: HPRet (VW)	0.011	0.010	0.017	0.005	1.1691
Japan: HPRet (VW)	0.012	0.010	0.014	0.002	0.4643
Netherlands: HPRet (VW)	0.011	0.012	0.016	0.006	1.1524
Norway: HPRet (VW)	0.027	0.017	0.024	-0.003	-0.5524
Spain: HPRet (VW)	0.012	0.012	0.017	0.005	0.8906
Sweden: HPRet (VW)	0.022	0.015	0.027	0.005	0.7386
Switzerland: HPRet (VW)	0.009	0.011	0.014	0.005	1.3161
The UK: HPRet (VW)	0.016	0.014	0.021	0.005	0.9876

Appendix E. OLS coefficients of countries with the country aggregate momentum profits as the dependent variable and aggregate lagged asset growth rate as the explanatory variable.

The results of simple OLS regressions with value-weighted international lagged asset growth rates as the explanatory variable for the momentum profits in individual countries are shown in the Appendix E. The country-wise average monthly momentum profit is calculated from the value-weighted returns of the high and low groups based on their past 11-month portfolios returns (with one-month holding period and one-month lag between the past returns and holding period). The aggregate asset growth rate is the value-weighted average of all the average annual asset growth rates for all the countries. The time period is from July 1985 to June 2015. So, the country-wise aggregate momentum profit is calculated as the market-value-weighted profit. The aggregate asset growth rate is the market-weighted average of that of all of the countries. The significance is denoted as follows: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Country	**Coefficient**	**t-value**	Positive/negative
Austria	-0.023	-0.49	-
Belgium	0.028	0.59	+
Canada	-0.050	-0.91	-
Finland	-0.058	-0.95	-
France	0.058	1.38	+
Germany	-0.014	-0.27	-
Italy	-0.013	-0.28	-
Japan	-0.011	-0.26	-
Netherlands	-0.039	-0.77	-
Norway	0.039	0.76	+
Spain	0.024	0.45	+
Sweden	0.025	0.37	+
Switzerland	0.036	0.84	+
The UK	0.021	0.41	+

The aggregate asset growth factor is market-weighted, which means that it is largely made up of Japanese asset growth rates. However, interestingly Japan does not have a positive correlation with the aggregate asset growth factor. Japan, the United Kingdom and Canada represent the largest total market share of the sample.

Appendix F. OLS coefficients of countries with the market-weighted aggregate momentum profits for a country as the dependent variable and lagged aggregate asset growth rate in a particular country as the explanatory variable.

The results of simple OLS regressions with market-weighted country-wise lagged asset growth rates as the explanatory variable for the momentum profits in that country are shown in the Appendix F. The country-wise average monthly momentum profit is calculated from the market-weighted returns of the high and low groups based on their past 11-month portfolios returns (with one-month holding period and one-month lag between the past returns and holding period). The aggregate asset growth rate is the market-weighted average of all the average annual asset growth rates in that particular country. So, the momentum profits at the time t + 1 are explained with the asset growth rates at the time t. The significance is denoted as follows: $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The time period is from July 1985 to June 2015.

Country	**Coefficient**	**t-value**	Positive/negative
Austria	0.253	0.60	+
Belgium	-0.981	-1.39	-
Canada	-0.364	-0.77	-
Finland	-0.539	-0.85	-
France	0. 444	0.41	+
Germany	0.819	1.62	+
Italy	-0.499	-0.54	-
Japan	0.460	0.46	+
Netherlands	-0.379	-0.52	-
Norway	-0.181	-0.55	-
Spain	0.085	0.11	+
Sweden	0.105	0.23	+
Switzerland	0.038	0.06	+
The UK	0.832	0.98	+

Finland, Japan, the Netherlands and Norway have a negative coefficient in the case of equal-weighted returns and equal-weighted aggregate asset growth rates. However, with the market-weighted returns and market-weighted aggregate asset growth rates, Belgium, Canada, Finland, Italy, the Netherlands and Norway have negative coefficients. So, only the coefficient for Japan becomes positive in the market-weighted case compared to the equal-weighted case.