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Exploring the Asset Growth Effect

An Empirical Investigation of the Finnish Market 2003–2022

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Author:
Teo Totro

Supervisor:
Ph.D. Abu Chowdhury

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A stock market anomaly refers to an unusual or unexpected behavior observed in the stock market that deviates from what traditional financial theories or efficient market hypothesis would predict. These anomalies are typically seen as opportunities for investors to potentially earn abnormal returns by exploiting the market's inefficiencies. Anomalies exist in several types and occur in different ways since they can occur just once or continuously.

This thesis focuses on a fundamental anomaly called the asset growth effect. The asset growth effect refers to the relationship between firms' asset growth rates and subsequent stock returns. Previous evidence suggests that firms experience lower stock returns in the future after experiencing higher total assets growth rates. Like with all anomalies, there is debate in finance literature whether the negative impact of growth in total assets on stock returns is evidence of rational asset pricing or investors' irrationality. People from the behavioral finance camp justify the effect with various arguments related to mispricing. The traditional systematic risk-based explanation for the higher returns is that firms with lower asset growth are associated with relatively higher risk and therefore higher expected returns.

I conducted several regression analyses to find out if the asset growth effect exists in the Finnish stock market. My sample consists of all listed and delisted Finnish nonfinancial companies from 2003 to 2022. The existence of the anomaly is examined both at an individual stock level and portfolio level. In addition to growth in total assets, I consider other growth variables and subcomponents of the balance sheet and examine if they have a connection with future stock returns.

My results suggest that the asset growth effect does not exist in Finland without controlling. The size of the company has an impact on results, but the results are still insignificant. When using a lagged asset growth rate as a proxy for growth, the asset growth effect exists and is significant. Transaction costs impact on asset growth effect and the effect exists with significant results when portfolios are first sorted based on illiquidity and then based on asset growth rates. Asset growth effect exists among liquid stocks. The results suggest that when asset growth is based on growth in other than fixed assets, the growth has a negative relation with future stock returns. Debt seems to have a negative and cash positive relation with subsequent stock returns.

Key words: the asset growth effect, abnormal returns, behavioral finance, total assets, anomaly, efficient market hypothesis

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Osakemarkkina anomalioilla viitataan osakemarkkinoilla havaittuun epätavalliseen tai odottamattomaan malliin tai käyttäytymiseen, joka poikkeaa siitä, mitä perinteiset rahoitusteoriat tai tehokkaiden markkinoiden hypoteesi ennustaisivat. Anomaliat nähdään tyypillisesti sijoittajien mahdollisuuksina ansaita epänormaaleja tuottoja hyödyntämällä markkinoiden tehottomuutta. Anomalioita on useita tyyppejä ja ne esiintyvät eri tavoin. Osa anomalioista voi esiintyä vain tiettyinä ajankohtina ja osa puolestaan esiintyy jatkuvasti

Tässä tutkielmassa keskitytään fundamentaaliseen anomaliaan, jota kutsutaan omaisuuserien kasvun anomaliaksi. Omaisuuserien kasvun anomalialla tarkoitetaan yritysten omaisuuserien kasvuvauhdin ja sitä seuraavien osaketuottojen välistä suhdetta. Aiemmat todisteet viittaavat siihen, että enemmän kasvaneiden yhtiöiden tulevaisuuden osaketuotot ovat pienempiä kuin vähemmän kasvaneilla yrityksillä. Kuten kaikkien anomalioiden kohdalla, rahoituskirjallisuudessa käydään keskustelua siitä, onko varojen kasvun negatiivinen vaikutus osaketuottoihin osoitus järkevästä omaisuuserien hinnoittelusta vai sijoittajien irrationaalisuudesta. Käyttäytymistieteellisen leirin edustajat perustelevat vaikutusta erilaisilla virheelliseen hinnoitteluun (mispricing) liittyvillä argumenteilla. Perinteinen systemaattiseen riskiin perustuva selitys korkeammille tuotoille puolestaan on se, että vähemmän kasvaviin yrityksiin liittyy suhteellisesti korkeampi riski, mikä puolestaan selittää korkeamman odotetun tuoton.

Suoritin useita erilaisia regressioanalyysejä selvittääkseni omaisuuserien kasvun anomalian esiintymistä Suomen osakemarkkinoilla. Otokseni koostuu kaikista listatuista ja pörssistä poistuneista suomalaisista rahoitusalan ulkopuolisista yrityksistä vuosina 2003–2022. Anomalian olemassaoloa tarkastellaan sekä osake- että portfoliotasolla. Omaisuuserien kokonaiskasvun lisäksi tarkastelen muita kasvumuuttujia ja taseryhmiä ja niiden yhteyttä tulevaisuuden osaketuottoihin.

Tuloksieni mukaan omaisuuserien kasvun anomaliaa ei esiinny Suomen osakemarkkinoilla, ellei tuloksia ole kontrolloitu muilla muuttujilla. Yrityksen koko vaikuttaa tuloksiin, mutta tulokset eivät ole tilastollisesti merkittäviä missään kokoluokassa. Kun varojen kasvun mittarina käytetään kaksi vuotta aikaisempaa taseen kasvuvauhtia, omaisuuserien kasvulla on vaikutusta osaketuottoihin ja vaikutus on tilastollisesti merkittävä. Transaktiokustannukset vaikuttavat omaisuuserien kasvun anomalian esiintymiseen, ja vaikutus on merkittävä. Kun osakkeet lajitellaan portfolioihin ensin epälikviditeetin ja sitten omaisuuserien kasvuvauhdin perusteella, niin anomaliaa esiintyy likvideimmissä osakkeissa. Tulokset myös osoittavat, että kun varojen kasvu perustuu muiden kuin käyttöomaisuushyödykkeiden kasvuun, kasvulla on negatiivinen vaikutus tuleviin osaketuottoihin. Velan kasvulla näyttää olevan negatiivinen ja käteisen kasvulla positiivinen vaikutus myöhempiin osaketuottoihin.

Avainsanat: Omaisuuserien kasvun anomalia, epänormaalit tuotot, käyttäytymistieteellinen rahoitus, omaisuuserät, anomalia, tehokkaiden markkinoiden hypoteesi

TABLE OF CONTENTS

1 Introduction 10

1.1 Background 10

1.2 Motivation 11

1.3 The scope and restrictions 13

1.4 Structure 14

2 Theoretical background 16

2.1 Pricing models 16

2.1.1 Modern Portfolio Theory 16

2.1.2 Capital Asset Pricing Model 18

2.1.3 Arbitrage Pricing Theory 20

2.2 Market efficiency 21

2.3 Behavioural finance 25

2.4 Anomalies 27

3 Literature review 29

3.1 Empirical evidence 29

3.1.1 Asset growth effect in US markets 29

3.1.2 Asset growth effect in non-US Markets 30

3.1.3 Balance sheet and growth anomalies 32

3.2 Explanations for the Asset Growth Effect 34

3.2.1 Risk-Based explanations 34

3.2.2 Mispricing explanations 35

3.2.3 Other explanations 37

4 Data and empirical methods 39

4.1 Data 39

4.1.1 Asset growth effect data 39

4.1.2 Other growth variable data 43

4.1.3 Balance sheet subcomponent data 44

4.2 Empirical methods 45

4.2.1 Portfolio tests 45

4.2.2 Fama-French three-factor model 47

4.2.3 Fama-MacBeth regressions 48

4.2.4 Double-sorted portfolio tests 50

4.2.5 Subcomponent tests 51

4.3 Descriptive financial and return statistics 51

5 Empirical results 55

5.1 Portfolio results 55

5.2 Fama-MacBeth regressions results 65

5.3 Double-sorted portfolio results 70

5.4 Subcomponent tests results 78

6 Summary 81

References 84

Appendices 89

Appendix 1: Definitions of asset growth and other growth measures 89

Appendix 2: Definitions of balance sheet subcomponents 89

LIST OF FIGURES

Figure 1. Capital market line and the efficient frontier (Sharpe 1964, modeling) 17

Figure 2. Stock price movements for new information available (Knupfer & Puttonen 2008, modeling) 22

Figure 3. Time series statistics for annual asset growth rates 43

Figure 4. Portfolio performance compared to the market index. 59

LIST OF TABLES

Table 1. Number of firms per year 40

Table 2. Firm characteristics of quintile portfolios 54

Table 3. Asset growth quintile portfolio raw returns 57

Table 4. Fama-French three-factor risk-adjusted portfolio returns 61

Table 5. CAPEX and L2ASSETG quintile raw portfolio returns 64

Table 6. Fama-MacBeth regressions of annual stock returns on Asset growth and other measures I 67

Table 7. Fama-MacBeth regressions of annual stock returns on Asset growth and other measures II 69

Table 8. Double-sorted portfolio returns - IVOL 72

Table 9. Double-sorted portfolio returns - AMIHUD 73

Table 10. Double-sorted portfolio returns – BHRET06 76

Table 11. Double-sorted portfolio returns – CAPEX 77

Table 12. Fama-MacBeth regressions of annual stock returns on subcomponent growth rates 80

1 Introduction

1.1 Background

Abnormal returns earned by certain investment strategies have been one of the most studied phenomena in financial literature during the last decades. Empirical evidence of continuous abnormal returns contradicts the traditional financial theory that assumes markets to be efficient. The Efficient Market Hypothesis (EMH) suggests that stock markets are efficient if share prices fully reflect in all information available at any given time, with correct magnitude and without delay. (Samuelsson 1965, Fama 1970). Market efficiency also means that stock returns follow a random walk: stock returns from yesterday do not affect returns of today since prices change only after new information enters the market. However, several studies have documented empirical evidence of firm characteristics that are associated with economically significant abnormal returns. The findings have sparked a debate on efficient market existence.

The relationship between characteristics of the companies and stock returns has been studied extensively around the world over the past decades. Book-to-market (The value-effect), size (The size-effect), and past returns (The momentum effect) are characteristics, that have aroused the greatest interest in prior literature. It is well examined that greater book-to-market and past returns increase stock returns whereas firm size is negatively correlated with stock returns. (Gray & Johnson 2011). Anomalies exist in several types and occur in different ways since they can occur just once or continuously. One classification for anomalies is that an anomaly can be technical or fundamental. In addition, there is calendar anomalies that occur in certain times. (Latif et al. 2011).

One objective in anomaly studies is to find ways to achieve abnormal returns if such exist. Investors can utilize research results in their investment decisions if results suggest that some company-specific characteristics are linked to higher returns. Such results are not consistent with the EMH. (Malkiel 2003). It is not possible to earn extraordinary risk-adjusted returns according to EMH, since all available information impact on stock prices and the new information is available to everyone at the same time. Thus, EMH proponents argue that abnormal results are compensation for bearing higher risk (rational asset pricing). The other camp of financial research suggest that anomalies are due to mispricing (irrationality). (Cooper et al. 2008, Fama 1970). This thesis focuses on a fundamental anomaly called the Asset Growth Effect.

The asset growth effect refers to the relationship between asset growth and stock returns. Cooper et al. (2008) studied this relationship first in US market and recognized that it is possible to predict stock returns by observing previous movements in the amount of a firm's total assets. They observed stock returns in the US market during 1986-2003 and found a significant negative relation between growth in total assets and future stock returns. The lowest asset growth decile firms achieved 18% annual returns while the highest asset growth decile firms had 5% annual returns. The annual 13 % spread is significant and standard asset pricing models cannot explain it. Total assets include, for example, cash, current assets, properties, plants, equipment, and other assets. Before Cooper et al. (2008), research had focused on the effects of growth in financing activities and investment activities. They overlooked the broader implications concerning the potential impact on total asset growth resulting from comprehensive firm investments and divestments (Cooper et al. 2008). Since Cooper et al. (2008), the anomaly has been researched in various markets. Maybe the most challenging question in prior studies has been determining the underlying causes.

Like with all anomalies, there is debate in finance literature whether the lower returns after investment is evidence of rational asset pricing or investors' irrationality. People from the behavioral finance camp justify the effect with various arguments related to mispricing. They explain the asset growth effect with, for example, over-investment and empire-building tendency, the market timing of issuing or retiring external financing, earnings management before financing activities or acquisitions, and excessive extrapolation of investors from past growth when valuing companies. The rational asset pricing camp underlines the connection between investment levels and expected return, although explanations have different variations. They have explained the effect with results that large investing companies are more often companies with low discount rates, higher investments lead to lower expected returns and firms reduce their risk after growing through capital investments. (Watanabe et al. 2013).

1.2 Motivation

I will study the asset growth effect in the Finnish stock market (OMX Helsinki) and try to find out if any factors explain the effect. Studying this topic is important for many reasons. Even though there has been prior research on asset growth effect in various markets, it is not widely studied in Finland. There are various studies of the effect in the Nordic market (Sweden, Denmark, Norway, Finland) and some international studies that also cover Finland. Results in the Nordic market suggest the presence of the Asset growth effect in the Nordic. The Nordic market is quite homogenous, but still, there might be some country-specific variances in results.

The prior results in Finland are not in line with other Nordic countries. Titman et al. (2013) and Watanabe et al. (2013) documented the nonexistence of the Asset growth effect in Finland, meaning that there is no statistically significant association between growth in total assets and subsequent returns. Interestingly, Watanabe et al. (2013) and Titman et al. (2013) documented the stronger asset growth effect in more developed markets, which is not in line with the results in Finland since Finland is a developed country. The size of the company and the characteristics of the financial market have also been found to have an impact on the magnitude of the asset growth effect.

Albeit the asset growth effect has been studied in Finland, there are various reasons to further study this anomaly in Finland. Firstly, prior studies sample periods vary between 1980 and 2010 and my time-period under observation is from 2003 through 2022. Schwert (2003) finds that many of the well-known stock return anomalies do not hold up when changing time periods. The value effect and size effect disappeared after the articles that pointed out them were published. Anomalies seem to reverse or disappear in some cases after they are documented in the finance literature. For that reason, it is possible that prior results were simply statistical deviations or abnormal returns are arbitraged away. Lipson et al. (2011) documented that the necessary condition for the asset growth effect is a high level of holding costs. They also pointed out the importance of transaction costs. These costs probably vary between time periods.

Secondly, the prior studies have examined the anomaly in Finland only on the portfolio level. In this thesis, the aim is to conduct more detailed regression analysis at the portfolio level as well as at the individual stock level. Thirdly, I will regress certain growth-related variables on subsequent stock returns that have not been tested in Finland yet. Thus, I aim to find out new firm characteristics that affect future stock returns.

Investment can be considered important both for an individual company and for the economy as a whole. For example, by investing in research and development, we can keep up with technological progress, increase the processing rate of products and services, or create entirely new products. Research and development investments have replaced fixed investments in Finland in recent years. When reading news or following conversations, one can recognize that new investments are often very welcomed, especially if the investment comes from abroad. Investments often bring money and new jobs to the economy. Investment is important as it is reforming the economy and creating a basis for growth. In Finland, the total amount of investment was 30 billion euros in 2021. (Elinkeinoelämän keskusliitto 2022).

I think it is paradoxical that investments are considered to be a good thing, but previous studies suggest that they are not favorable to shareholders. Elinkeinoelämän Keskusliitto (2022) reports that investment enables growth and development. From a company perspective, growth means that a firm's business expands. Whereas development will increase productivity, which in turn will increase the financial results. If productivity increases and business expands, it is strange that stock returns are worse than returns without investment. This effect may be due to either poor investment (rational asset pricing view) or market inefficiency (behavioral finance view).

Thus, the last analysis of this thesis focuses on the subcomponents of the balance sheet. By decomposing the asset growth, it is possible to observe if any major balance sheet components have a relationship with subsequent stock returns. The decomposed test is not examined in Finland previously. I separate the balance sheet into two parts: the asset investment and asset financing part. The asset investment side of the balance sheet includes for example investments in tangible and intangible assets which in turn include research and development investments and fixed assets investments.

1.3 The scope and restrictions

This thesis aims to examine the relationship between a firm's asset growth rate and subsequent stock returns. This relation is studied in the Finnish stock market (OMX Helsinki) from 2003 through 2022. My sample includes all listed and delisted nonfinancial primary stocks listed in OMX Helsinki during my sample period with few restrictions. My first research question is:

1. Does the asset growth effect exist in the Finnish stock market?

a. If the asset growth effect exists, does the intensity vary between small, medium, and large companies?

b. Do holding costs, transaction costs or past returns have an impact on the existence of asset growth effect?

The asset growth effect is studied at both portfolio and individual stock level. In portfolio tests, firms are further sorted into three size groupings to examine research question 1a. I also examine the risk-adjusted predictive volume of asset growth effect in portfolio-level returns. I control risk-adjusted returns by Fama and French (1993) three-factor model. I follow Cooper et al. (2008) and Lipson et al. (2011) and further examine the asset growth effect from the Fama-MacBeth framework (Fama & MacBeth 1973). In this method, regressions are conducted individually for each stock. The second research question is:

2. Are there any growth variables that affect future stock returns?

I conduct various portfolio-level and individual stock-level tests to examine other investment variables that may affect future stock returns. Methods for these tests remind ones used with asset growth effect in question 1.

To document reliable results, I do some manual adjustments to data and have some restrictions for firms to be included in my sample. The first manual adjustment for data is to exclude stocks that have two or more stock series. I accept only one stock series per firm since the accounting variables are similar for all series. The other manual adjustment is to delete all financial companies. Financial firms usually have more debt and different balance sheet structures. These differences compared to nonfinancial firms could have an impact on the results of this thesis. (Cooper et al. 2008). All stocks must have total assets data from the prior year and total return data for a year under observation on portfolio tests. In Fama-MacBeth regressions, I require that stock must be listed no later than 5 months before regressions. This requirement allows to have data for all independent variables.

1.4 Structure

The structure of the rest of this thesis will now follow. Chapter 2 introduces the traditional stock pricing models, including Modern Portfolio Theory, Capital Asset Pricing Model, and Arbitrage pricing theory. The chapter represents the efficient market theory as well and introduces the behavioral finance approach. The final part of the chapter explores anomalies. Chapter 3 focuses on previous literature on asset growth effect and other related anomalies. I broadly explore possible explanations for the asset growth effect and compare different results.

The empirical part begins in Chapter 4, where data and empirical methodology of my regressions are presented. I also provide descriptive financial characteristics of my sample. The results of regression analysis are reported in Chapter 5 and compared to previous literature. Finally, I summarize the results and make conclusions in Chapter 6.

2 Theoretical background

The second chapter of this thesis covers the key theories in finance. I discuss the key theories and models related to security pricing and market efficiency. Finally, I try to describe how the psychology and behavior of market participants might affect the functionality of these key theories in the real market. Since the asset growth effect makes abnormal returns possible for investors, it is necessary to first understand the theoretical approach to pricing and stock returns. These key pricing models have an assumption of an efficient market and market rationality. Thus, it is important to be aware of what an efficient market means and what conditions it requires.

Since many empirical studies have recognized that markets are not efficient and theories cannot explain all events or price movements, I also represent an alternative perspective to approach financial markets called behavioral finance. This “camp” allows abnormal returns and thus the existence of asset growth effect and other anomalies that will be finally discussed.

2.1 Pricing models

2.1.1 Modern Portfolio Theory

The article published by Markowitz (1952) is considered as a delineated publication in the history of finance and is considered as a defining article of modern portfolio theory (MPT) since its suggestions anticipated plenty of subsequent developments in the field of finance. The key idea of Markowitz (1952) MPT is to minimize the risk of the portfolio by decentralizing capital investing to divergent securities. Investors should not be interested in the risk or return of individual assets, but risk and return of the portfolio.

Markowitz (1952) formula for portfolio problem is a choice of the mean and variance of a portfolio of securities. He proved the fundamental theorem of mean-variance portfolio theory, which states that by holding the variance constant, expected return can be maximised. On the other hand, by holding the expected return constant, variance can be minimised. As a result of these two principles, an efficient frontier is formulated enabling investors to choose their portfolios based on investors own risk-return preferences. The theory's essential message was that securities should not be chosen solely depending on their unique attributes. Instead of focusing on unique attributes, co-movements of each security with other securities must be considered. Moreover, considering these co-movements allows investor to construct a portfolio with same expected return than by constructing a portfolio without considering the co-movements between securities, but the risk level is lower. (Elton & Gruber, 1997)

Markowitz (1952) article covered investments in a variety of investment classes, including, for example, stocks, commodities, and real estate. Sharpe (1964) expanded security classes by accepting lending and borrowing of riskless assets at a pure interest rate. He introduced Capital Market Line (CML) that reflects rational investing according to MPT. The capital market line is represented below together with the efficient frontier. A rational investor chooses a point on the CML, which comprises only efficient portfolios. If investor seek to increase the expected return, they must be willing to take on more risk. The CML consists of a risk-free interest rate and a market portfolio. The rational investor makes their investment decision by considering their risk preferences along this capital market line.

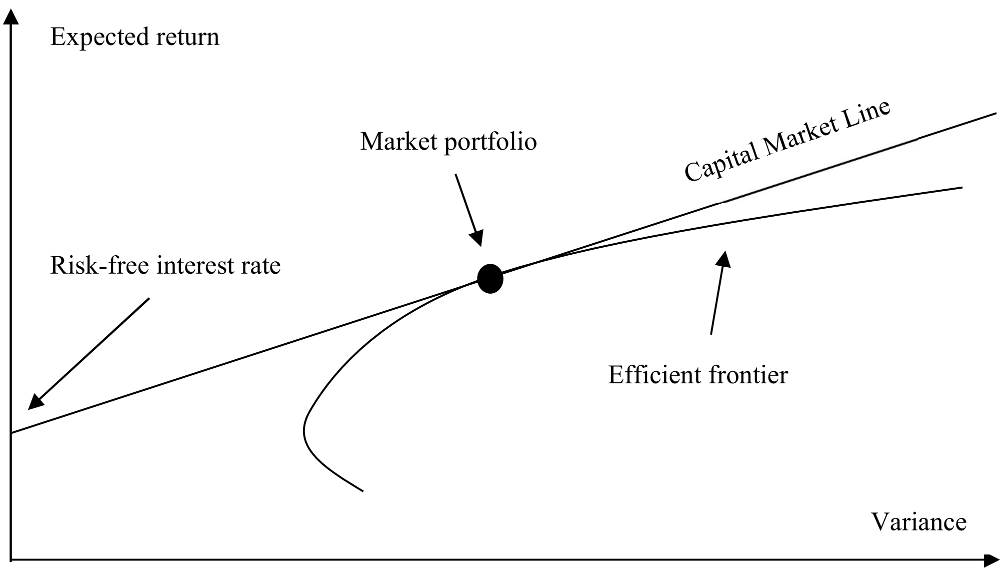

Figure 1. Capital market line and the efficient frontier (Sharpe 1964, modeling)

In Figure 1, CML is starting from a risk-free rate and an efficient frontier consists of securities with risk. Rational investor chooses their point on CML based on an individual's risk preferences by weighting their investments between the market portfolio and risk-free rate. If an investor is seeking more risk and expected return, one can borrow debt at risk-free rate and invest borrowed money into the market portfolio. Rational investors therefore are always on some point of CML (Sharpe, 1964)

2.1.2 Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) was first introduced by Sharpe (1964) and Lintner (1965) and it is developed on the Markowitz (1952) modern portfolio theory and mean-variance model. CAPM is utilised to quantify the correct required rate of return of a security, from a theoretical perspective. CAPM equation, as proposed by Sharpe (1964) and Lintner (1965), incorporates the fundamental assumptions that it is possible to borrow and lend at risk-free rate. The equation for CAPM is defined as:

$$E(R_i) = R_f + \beta_i \times (E(R_m) - R_f)$$

Where, $E(R_i)$ is the expected return on asset i, and β is the market beta of asset i. R_f is the risk-free rate of return, and R_m is the market return. The equation states that the expected return on asset *i* is the risk-free rate of return (R_f) together with a risk premium. This risk premium is a multiplication of the market risk premium $E(R_m) - R_f$ and the market beta of asset i. In simpler terms, the expected return on asset i is determined by adding the risk-free interest rate (R_f) to a risk premium. Risk premium is a combination of the asset's market beta (β_{im}) and the premium per unit of beta risk $E(R_m) - R_f$. (Elbannan 2015).

The model uses the market beta (β) of asset i, which quantifies asset i return's response to changes in the market return. Beta is calculated by dividing the covariance of the asset's return with the market return by the variance of the market return. The equation is as follows:

$$\beta_i = \frac{COV(R_i R_M)}{\sigma^2(R_M)}$$

Where $COV(R_i R_m)$ presents covariance between the market returns and security returns and $\sigma^2(R_M)$ is a variance of market return. The Beta of the market portfolio is always 1, meaning that if the beta of an individual asset is over (under) 1, its movements are more unstable (stable) compared to the market portfolio. (Elbannan 2015)

CAPM is widely used in cost of capital estimations for firms and when evaluating the portfolio performance. The model holds a central position in investment courses at universities. Its allure lies in its ability to offer efficient and intuitively pleasant predictions regarding risk measurement and the relationship between expected return and risk. However, the empirical performance of the CAPM has been poor. The shortcomings of the model in empirical analyses may be attributed to theoretical deficiencies resulting from numerous simplifying assumptions. Alternatively, the challenges in examining adequate tests of the model could also contribute to its empirical problems. (Fama & French 2004). Elbannan (2015) has listed the following assumptions for CAPM, that are initially listed by Sharp (1964), Lintner (1965), and Markowitz (1952):

i. All investors choose a point along the efficient frontier, where all available investments maximize their utility. Investors are risk aversion, prioritize utility maximization, and primarily consider two factors: the expected return (mean) and the associated risk (variance). The specific position along the efficient frontier that investors select, as well as the portfolio they ultimately opt for, is determined by their individual utility function and the trade-off they are willing to make between risk and return.

ii. All funds can be borrowed or lent by risk-free rate.

iii. All investors share similar expectations, implying that they collectively estimate identical probability distributions for future rates of return.

iv. All investors have the same one period investments holding period.

v. Investors have the flexibility to purchase or divest portions of their holdings in any security or portfolio they possess.

vi. Transaction costs or taxes on purchasing or selling assets do not exist.

vii. There is no inflation or fluctuations in interest rates.

viii. Capital markets are in a state of equilibrium, where all investments are accurately priced, and investors cannot influence these prices.

CAPM has got judging in various studies for its certain assumptions. Firstly, the model assumes unrestricted risk-free borrowing and lending. Secondly, one-period investment focus and one-period risk and return consideration. Additionally, concerns have been raised regarding how efficiently market Betas can adequately describe expected returns and the usage of a market portfolio proxy that encompasses all securities with risk.

In addition, Fama and French (1997) conducted a study that revealed the imprecision in estimating the cost of equity capital for specific industries when employing the CAPM framework, leading to standard errors exceeding 3 percent per year. These inaccuracies arouse from uncertainties regarding the true expected risk premiums and the imprecise estimation of industry betas. Their research underscores that the estimation of the cost of equity may present even greater imprecision when applied to specific firms and projects. (Elbannan, 2015).

2.1.3 Arbitrage Pricing Theory

The arbitrage pricing theory (APT) by Ross (1976) is formulated to offer an alternative testable pricing model to the well-known CAPM. There are two prominent distinctions between the Arbitrage Pricing Theory (APT) and the Capital Asset Pricing Model (CAPM). First and foremost, the APT permits the consideration of multiple generating factors, unlike the original Sharpe (1964) model, which only accounts for one. Secondly, the APT asserts that any market equilibrium must adhere to the absence of arbitrage opportunities. As a result, every equilibrium is characterized by a linear relationship between an expected return of the security and its loadings on the common factors, which dictate the amplitude of its return response. The APT has three fundamental key assumptions. (Reinganum 1981):

i. Capital markets are perfectly competitive, allowing for unrestricted buying and selling of securities. All relevant information is available to all investors, and it is free.

ii. Investors always prefer more wealth to less wealth with certainty. This assumption implies that investors are rational and risk-averse, seeking to maximize their returns while minimizing risks.

iii. The asset returns' stochastic process can be expressed in the form of a k-factor model:

$$R_i = E_i + b_{i1}\delta_1 + \cdots + b_{ik}\delta_k + \epsilon_i$$

$$\text{for} \qquad i = 1, \ldots, N$$

where R_i is the return on asset i, E_i represents expected return for asset i and b_{ik} is a reaction of asset i's returns to changes in the common factor δ_k. δ_k is a common factor, with a mean of zero, affecting the returns of all assets. ϵ_i is defined as an idiosyncratic effect on asset i's return. It is assumed that this idiosyncratic effect can be fully diversified away in portfolios with numerous assets. In that case the mean is zero. (Reinganum 1981).

The APT economic argument is a simple one. In market equilibrium, the return on a portfolio with zero investment and zero systematic risk is zero, provided that the idiosyncratic effects become negligible in a sufficiently large portfolio. By combining this economic rationale with principles from linear algebra, we can define the expected return on any asset i as:

$$E_i = \lambda_0 + \lambda_1 b_{i1} + \cdots + \lambda_k b_{ik}$$

The term λ_0 can be seen as the expected return of an asset with zero systematic risk (i.e., $b_{01} = b_{02} = b_{0k} = 0$). The weights $\lambda_1, \ldots, \lambda_k$ can be seen as factor risk premia, while the b_i's coefficients represent the pricing relationships between these risk premiums and asset i. In essence, the expected returns of the assets are collectively determined by the reaction coefficients of each asset and the shared risk premiums. (Reinganum 1981).

2.2 Market efficiency

The basic assumption in financial theory in general, is that financial markets are efficient. In practice, this means that all public and relevant information is reflected in share prices immediately, because there are a huge number of investors, and all public information is available to everyone immediately. Abnormal returns are therefore hard to find. Market efficiency also means that stock returns follow a random walk. Stock returns from yesterday do not affect returns of today when the market is efficient. This is because the share price only changes when new information enters the market. The figure below describes the three scenarios of stock price movements when new information is available. In an informatively efficient market, security price reacts to new information correctly and without delay. When markets are not efficient, investors do not immediately handle new information, but the security price increases (decreases) to the correct level over time. (Knupfer & Puttonen 2018). Three scenarios of stock price movements are described in Figure 2 below. Dashed lines represent inefficient markets, where investors overreact or react too slowly to the newly available information. The solid line represents therefore efficient market reaction.

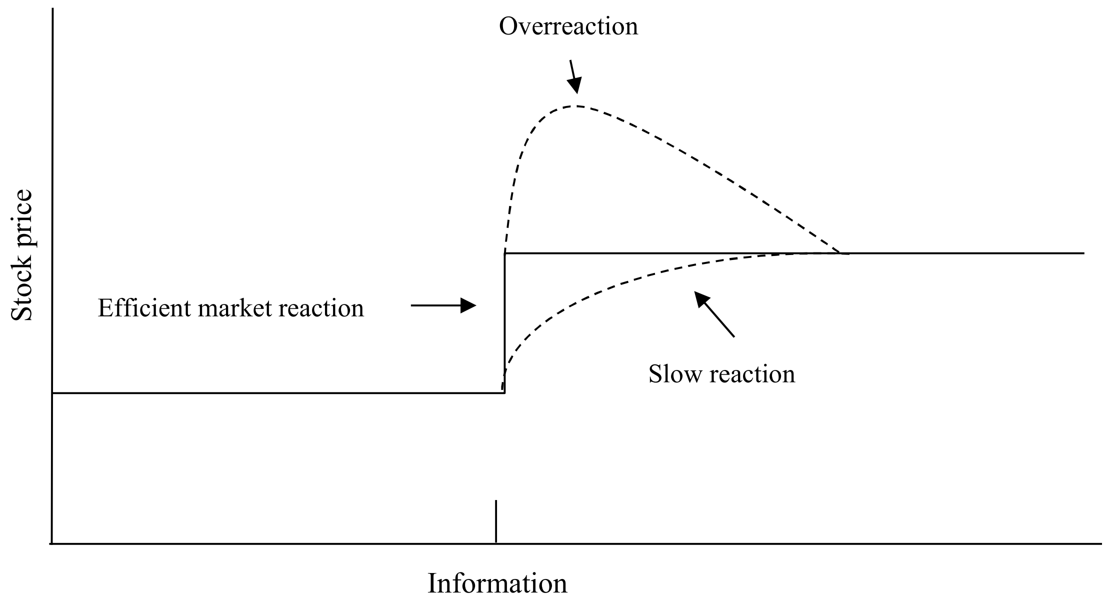

Figure 2. Stock price movements for new information available (Knupfer & Puttonen 2008, modeling)

The idea of efficiency in financial markets is from Efficient Market Hypothesis (EMH), first published by Samuelsson (1965) and afterward improved by Fama (1970) to the form it is known these days. The hypothesis is one of the most famous theories in the field of finance literature and it is cited widely in different studies and papers. EMH suggests that stock markets are efficient when share prices entirely reflect in all information available at any given time and correct level without delay. To achieve market efficiency, Fama (1970) lists three conditions that should be met. Efficient markets are achieved when:

i. There are no transaction costs in trading securities.

ii. All available information is costlessly available to all market participants.

iii. All agree on the implications of current information for the current price and distributions of future prices of each security.

However, Fama (1970) admits, that the frictionless market, the information availability to everyone at the same time, and the consensus on the effects of information on security price do not describe the market that we meet in practice. Thus, these conditions are not necessary, but they are sufficient. If market participants consider all available information, even in the presence of substantial transaction costs that may influence transaction activity, it does not necessarily imply that once transactions occur, prices will fail to fully incorporate the available information. Market efficiency can still be maintained if a 'sufficient number' of market participants receive the information. Furthermore, differences in opinions regarding the impact of information on prices do not inherently indicate market inefficiency. Market efficiency is upheld as long as there is no consistent pattern of certain investors consistently making more accurate valuations of available data than what is already reflected in stock prices. (Fama 1970).

In practice, there are transaction costs and taxes in the market, and obtaining new information is not free. It is not free, since at least information gathering takes time that could be used for something else. The financial theory is aware of these flaws and thus accepts that markets can be efficient without being perfect. Market efficiency neither requires that the stock prices should always equal to the actual value of the investment. Market efficiency means that deviations of the market price from the actual value are random: the market value may be above or below the correct value, but these deviations must be random and therefore unpredictable. Deviations being random means that the probability of stock being over or undervalued is even probable at any given time. Abnormal stock prices cannot be correlated with any independent variable. Anyone should not be able to find constantly over or undervalued shares with certain investing strategies. This inability means that the asset growth effect or any other investing anomaly should not exist. (Knupfer & Puttonen 2018).

The market efficiency is divided into three forms in EMH: weak form, semi-strong form, and strong form. When markets are weakly efficient, stock prices reflect all historical stock price information. In semi-strong efficient markets stock prices fully reflect all historical stock price information and also all information that is publicly available. In highly efficient markets, share prices include information about past price performance, all other public information, and all inside information. The inside information is difficult to describe in this situation. One explanation could be that when a firm’s management makes decisions, those reflect immediately on the stock prices. Not after publishing those decisions. There is a connection between efficiency form and the possibility to earn abnormal returns. When share prices reflect perfectly on a particular subset of information, it is not possible to overperform against market return by utilizing that particular subset of information. Investors cannot beat market returns by using historical stock price information when the market is in a weak efficient form. When the market is semi-strong efficient, there is no possibility to beat market return by using publicly available information. For example, investors cannot use fundamental information about the firm and overperform against the market. If the market efficiency is in strong form, there is practically no chance to beat market return since stock prices include already even inside information. (Fama 1970).

There has been some criticism of EMH and its assumptions for market conditions. The following three factors face the most of misunderstanding when arguing about EMH functionality in practice: deviation of stock prices, overperforming against the market, and marketplace rationality. (Clarke et al 2001, 11). Firstly, as discussed above, stock prices are not always at the same level as their actual value. Market efficiency does not necessitate that the stock prices must always be same as the actual value of an investment. Market efficiency means that deviations of the stock price from the actual value are random: the market value may be above or below the correct value, but these deviations must be random and therefore unpredictable. (Knupfer & Puttonen 2018, Clarke et al. 2001, 11)

Secondly, there is no statement in EMH that no one can beat the market. New information is arriving constantly making stock prices fluctuate. An investor can earn if the new information causes the price of the security she owns to increase. (Clarke et al. 2001, 8). Out of a great amount of investors, someone regularly beats the market even in the long run. In an efficient market, the reason is not a good investment strategy, but luck. A market will be inefficient if it turns out that all those who beat the market follow a similar investment style. In efficient markets, the expected return on an investment corresponds to the long-term risk level of the investment. Naturally, actual returns and expected returns may differ in the short term. (Knupfer & Puttonen, 2018).

Lastly, the market as a whole is rational. EMH does not state that every participant must be rational. If one investor sells stocks in underprice to her friend, it is not evidence of the market inefficiency. In an efficient market, the joint actions of all investors determine the correct prices for shares. Rational participants contribute to the market's rationality by capitalizing on decisions made by irrational investors. (Knupfer & Puttonen, 2018).

2.3 Behavioural finance

The key assumption behind neoclassical finance is that market participants and decision-makers are rational. They can recognize and utilize all the relevant information available. Market participants are utility maximizers. This neoclassical view is behind all pricing models and efficient market hypothesis discussed earlier in Chapter 2. (Niskanen & Niskanen 2013)

The field of behavioral finance was developed in the 1990s. The academic discussion moved away from econometric models and analyzes of prices, stock returns, and dividends toward developing wider models that consider also human psychology. The researchers had found too many anomalies that models could not explain. (Shiller 2003). In recent decades, behavioral finance theory has emerged alongside this neoclassical financial theory. Some believe that behavioral financing has come to challenge previous views, while others believe that it complements the neoclassical approach and enables more explanations of financial market phenomena that reflect human behavior. (Niskanen & Niskanen 2013).

Behavioral finance is built upon two key pillars: cognitive psychology and the limits to arbitrage. Cognitive psychology explores the intricacies of human thought processes and decision-making. A rich body of psychological literature reveals that individuals exhibit systematic errors in their thinking, including tendencies towards overconfidence and a disproportionate reliance on recent experiences. Furthermore, individual preferences can introduce distortions into financial decision-making. Behavioral finance recognizes the importance of understanding human behavior rather than dismissing it with an arrogant disregard. (Ritter 2003).

The second pillar, limits to arbitrage, centers on discerning the conditions under which arbitrage forces are efficacious and when they are not. Arbitrage, the practice of capitalizing on price discrepancies to secure risk-free profits, is a cornerstone of classical finance theory, predicated on efficient markets and rational participants. Nevertheless, behavioral finance acknowledges that psychological biases and market imperfections can hinder the full exploitation of arbitrage opportunities. These limitations may arise due to various factors, such as cognitive biases influencing investor decisions, transaction costs eroding potential profits, short-selling constraints, or the existence of noise traders. In this thesis, the focus is more on this pillar of behavioral finance. (Ritter, 2003)

Misvaluations of assets are frequent, nevertheless it is not easy to earn abnormal profits from them. There are two forms of misvaluations: ones that are nonrepeating and long-term and ones that are repeating or arbitrageable. If misvaluation is nonrepeating and long-term it is hard to earn abnormal returns, since identifying the peaks or troughs in real-time is challenging. In turn, when misvaluations are repeating, certain trading strategies can reliably make abnormal earnings. (Ritter, 2003).

Shleiffer and Vishny (1997) argue that arbitrage has a critical role when analyzing security markets since its effect is to change prices to be on a fundamental value level and thereby maintaining market efficiency. They also emphasize that the textbook example of arbitrage does not define exchange in the real market very well. Their main point is that arbitrageur faces additional risks of losses in many cases, calling that risk arbitrage. In risk arbitrage, the arbitrageur does not achieve a guaranteed profit with probability 1 but faces uncertainties and potential losses. Traders need capital to both make the trade and manage potential losses. This holds for most real-world arbitrage transactions in bond and stock markets, making them examples of risk arbitrage in the practice. Such arbitrage holds risk and requires capital, unlike described in the textbook model.

One approach to behavioral finance are phenomena that efficient market theory cannot explain. For example, price-to-price feedback theory and Smart Money vs. Ordinary Investors theory. The feedback model presents the situation when speculative prices increase, and some investors succeed. Investors get attention and further price increase expectations heighten. Investors' demand increase and thus generates another round of increasing prices. After several similar cycles a speculative "bubble" is born, where high future expectations keep very high stock prices up. High prices are not sustainable and at some point bubble eventually bursts and prices go down. (De Long et al. 1990).

Smart Money vs. Ordinary Investors theory relates to the assumption of market efficiency. It suggests that irrational optimists buy stocks when smart money sells, and vice versa, effectively neutralizing the influence of irrational traders on market prices. However, it's documented that the success of smart money does not completely counteract the impact of ordinary investors. In fact, De Long et al. (1990) examined in their study, which included both feedback traders and smart money, that smart money amplifies the effect of price-to-price feedback, rather than decreasing it. Smart money buys stocks before feedback traders in a “bubble” because smart money is anticipating in increased prices that will be caused by feedback traders. A rational utility-maximizer would not do that.

This thesis focuses on the asset growth effect which is one kind of anomaly. Anomalies are one of the most famous forms and examples of behavioral finance. We will focus on other anomalies in Section 2.4, and on the asset growth effect in Chapter 3 in more detail.

2.4 Anomalies

In the 1970s, there was starting to be some disquiet over neoclassical pricing models and efficient market hypothesis. There was a growing tendency to move away from traditional viewpoints and embrace a more eclectic approach to understanding financial markets and the economy. First reports of anomalies were published, highlighting inconsistencies with the efficient market theory. Findings were not still presented as significant evidence against the market efficiency. (Shiller 2003). Fama (1970) identified certain anomalies, such as serial dependencies in stock returns, nevertheless highlighting how small those anomalies were.

Stock anomalies refer to a situation where the price of a particular stock or group of stocks deviates significantly from what would be expected based on the prevailing market conditions or neoclassical pricing models. Anomalies exist in several types and occur in different ways since they can occur just once or continuously. One classification for anomalies is that anomaly can be technical or fundamental. In addition, there is calendar anomalies that occur in certain point of the year or week. (Latif et al. 2011).

Banz (1981) examined that small companies on the New York Stock Exchange experienced higher average returns than what was expected based on CAPM. This anomaly is called as “small-firm effect” and after the first finding, many articles have extended and clarified the small-firm effect. Basu (1977) documented that stocks with high E/P (earnings-to-price) ratios have earned positive abnormal returns relative to the CAPM. Afterward, many other papers examined the same effect for firms with high D/P (dividend yield) or for firms with high B/M (book-to-market) ratios. This anomaly is called as “Value effect”.

De Bondt and Thaler (1985) discovered an anomaly known as the "contrarian effect", where stocks with lower prior returns in the prior three to five years (past losers) overperform against firms with higher past returns (past winners). In contrast, Jegadeesh and Titman (1993) identified a "continuation effect" or "momentum effect", wherein portfolios formed based on the total returns in the year prior, reveal that recent past winners outperform recent past losers.

Keim (1983) found that by investing in small firms it is possible to get abnormal returns during the first two weeks in January. The explanation given for this anomaly is related to income tax purposes. Small firms have higher volatility so more of them experience capital losses before year ending because investors want to realize the capital losses for tax purposes. Stock prices decrease in December as a result of these realizations and leads to a rebound in January when investors repurchase those shares. This anomaly is called as "January effect" or "The turn-of-the-year effect". The other calendar anomaly is called "The weekend effect". French (1980) documented that the mean return of the S&P500 is negative from Friday to Monday.

Even though much research has proved that anomalies exist, they seem to be difficult to exploit. The problem with exploiting anomalies lies in the fact that it is difficult to know anything definite about their behavior in the future. It is possible that the anomaly will not work in the future. In an efficient market, this would be expected to happen because investors quickly notice pricing quirks. (Knupfer & Puttonen, 2018).

When anomalies are represented in the literature, they often disappear or reverse. For that reason, it has been discussed if prior abnormal profit opportunities have since been arbitraged away or if they just were simply statistical deviations that caught market participants' and academics' interest. Schwert (2003) found that many of the well-known stock return anomalies do not hold up when changing time periods. The value effect and size effect, in fact, disappeared after the articles that pointed out them were published.

3 Literature review

After examining the theoretical background of pricing models and getting aware of neoclassical and behavioral finance, it is natural to move on to empirical evidence. Financial theories and models give their textbook views to security pricing, but it is not always in line with movements in real security markets. In this chapter, the focus is on the Asset growth effect and explanations for its existence or non-existence. I investigate empirical results in US markets and non-US markets separately since many studies cover only US stocks. Results might differ between markets due to differences in market characteristics and sample sizes. Other balance sheet and growth-related anomalies are as well discussed.

3.1 Empirical evidence

3.1.1 Asset growth effect in US markets

Cooper et al. (2008) studied the relation between asset growth and future stock return as a first and recognized that it is possible to predict stock returns by observing previous movements in the amount of a firm's total assets. They observed stock returns in the US market during 1986-2003 and found a significant negative relation between growth in total assets and stocks' future returns. Firms in the lowest asset growth quintile achieved annual returns of 18%, while those in the highest asset growth quintile had annual returns of 5%. The annual 13 % spread is significant and standard asset pricing models cannot explain it.

They also examined the long-run effectivity of sorting based on asset growth ratio by reporting the average monthly returns for each portfolio 5 years before and 5 years after portfolio sorting. The effect seems to continue in years 2 through 5 after the formation of portfolios. Li et al (2012) documented similar results with an international sample. They studied the asset growth effect in MSCI World Universe, that consist of all developed markets. Their results suggest that the two-year total asset growth rate can lead to abnormal stock returns for as long as four years following the formation of portfolios.

Cooper et al. (2008) had a test for subcomponents of total assets. They documented that the total assets growth is the greatest growth measure, compared to subcomponents of total assets. Cao (2016) reported that all kind of growth in total assets is not similar and are not associated with future negative returns which is not in line with Cooper et al. (2008). Cao (2016) examined that growth in net operating assets together with total assets results in positive returns in the future. He highlighted that the growth in net operating assets is the main factor..

Lipson et al. (2011) examined the asset growth effect widely in US market between 1968 and 2003. They had both Fama-MacBeth regressions and portfolio-level tests. As a result, the reported -0,012 coefficient estimate (t-stat = -9,09) on Fama-MacBeth regression when the model included total returns as a dependent variable and book-to-market-ratio, market value, and asset growth rate as independent variables. The mean monthly spread in the portfolio test was 1,31% and statistically significant. The spread return is calculated as low growth stock portfolio returns minus high growth stock portfolio returns. When portfolios were double sorted with asset growth and market value, the effect was stronger among small firms.

Lam and Wei (2011) had similar results when examining the effect in US markets from 1971 to 2009. Their evidence of the asset growth effect weakened when larger firms had more weight in their portfolios. Cai et al. (2019) resulted a negative relation as well between asset growth ratio and future stock returns. Their evidence suggests the existence of this anomaly being attributed to investors' overreaction to growth opportunities. They further documented that firms with longer sequences of asset growth face a stronger magnitude of the asset growth effect.

Mortal & Schill (2015) made an interesting finding when studying post-acquisition returns together with asset growth rates. They documented that low post-deal returns for acquisitions of shares are explained more precisely by the asset growth effect. They propose that a distinguishing nature related to underperforming acquisitions is their propensity to increase their assets.

3.1.2 Asset growth effect in non-US Markets

Watanabe et al. (2013) studied the asset growth effect in 43 different countries between 1982 and 2010. During this time, they observed a positive spread in 30 and 25 countries when equal-weighted (EW) and value-weighted (VW) portfolios were constructed. Spread refers to low growth firms’ total returns minus high growth stocks’ total returns. The equal-weighted annual spread returns vary from -10,92% to 10,53%. Annual spread returns in VW portfolios varied from -14,12% in the Czech Republic to 15,38% spread in France. In Finland, the annual EW spread return was 3,36% (t-statistic = 0,48) while the annual VW spread return was 5,00% (t-statistic = 0,64). These results in Finland were not statistically significant. They reported that the anomaly is greater when capital markets are more developed and efficient, leading to more efficiently priced stocks. On the other hand, asset growth effect is not related to country-specific characteristics, such as investor protection, accounting quality, and limits to arbitrage according to their findings.

Yao et al. (2011) documented also that country-specific characteristics do not affect the power of asset growth effect in Asian security markets. However, they examined weaker relations in countries with persistent and homogenous asset growth rates. The relation was also weaker when firms grow by bank financing. They studied the effect in 9 markets in Asia and found a negative correlation between growth in total assets and subsequent stock returns.

Gonenc and Ursu (2018) examined that in certain circumstances, country-specific characteristics influence the magnitude of the asset growth effect. Their sample consists of stocks in 26 emerging stock markets from 2005 through 2013. They documented stronger asset growth effect during the financial crisis year compared to other years. But after investigating differences across countries, they examined that this stronger asset growth effect during crisis years is present specifically in developing countries characterized by low levels of shareholder and creditor protection.

Titman et al. (2013) studied the effect internationally and documented variations as well in the results of the asset growth effect. Their sample consists of data from 40 countries from 1980 through 2010, including data from Finland. Unlike Cooper et al. (2008), they had portfolio tests where stocks were allocated into 5 portfolios, not into 10. The average monthly spread in Finland was 0,12% (t-stat = 0,41) in EW portfolios, meaning that the relationship between asset growth rate and total return is negative but statistically insignificant. The corresponding spread for all developed countries was 0,35% (t-stat = 6,04) and statistically significant. They documented that significant asset growth effect is present in developed countries, but the effect does not exist in developing countries. 22 of 26 developed countries resulted in a positive spread but only 10 of them had statistically significant results.

Artikis et al. (2022) reported a significantly negative relationship between asset growth and future total returns in Finland at individual stock levels. The relationship was negative for large and for small firms, but significant only for small firms. On portfolio tests, the spread was not statistically significant anymore. They investigated the effect in 16 European countries during the period from 1988 to 2016. When all countries combined, the spread was negative and statistically significant.

Bettman et al. (2011) studied the anomaly in the Australian equity market. Their sample consists of all Australian stocks from 1998 to 2008. Their results were contradictory since they indicated that the asset growth effect exists with equal-weighted returns. However, the effect disappears when stock returns are value weighted. They argue that the presence of the anomaly in EW returns was because small firms had an overstated influence on results. Gray and Johnson (2011) examined opposite results in the Australian equity market over the time period from 1983 to 2007. They documented that the effect is present among the largest firms in Australia. The monthly average spread between the EW portfolio of low-growth large stocks and high-growth large stocks was 1%, equating to 13% per annum. The asset growth effect remained at an individual stock level after other variable controlling.

Papanastasopoulus (2017) documented a negative relationship between growth in total assets and future stock returns in European market. The effect seems to extend across loss and profit firms, but the magnitude of the effect seems to be notably greater among loss firms and is significantly reduced for profit firms.

3.1.3 Balance sheet and growth anomalies

Prior to Cooper et al. (2008), studies had primarily concentrated on the consequences of growth in investment or financing activities, overlooking the wider perspective of potential total asset growth effects resulting from comprehensive firm investment and disinvestment. There have been several studies that focus on subcomponents of total assets, such as accruals, total debt, tangible assets, or larger parts of the balance sheet. The other growth-related area under the interest of financial research has been an association between capital expenditures and future stock returns.

Accruals anomaly is a well-documented anomaly in academic literature. This anomaly refers to the negative relationship between accounting accruals and future stock returns.

Sloan (1996) was the first to study this relationship and documented that returns are dependent on the relative magnitude of accrual components of earnings. Their sample period was from 1962 to 1992, and the sample consisted of US stocks. Lew and Nissim (2006), Collins and Hribar (2000), and Xie (2001) have documented the existence of accrual anomaly in US market. Hirshleifer et al. (2012) results from US market suggest that accrual anomaly is due to mispricing since investors misvalue the accrual characteristic.

Pincus et al. (2007) studied the accruals anomaly internationally in 20 countries and their results suggest that the anomaly exists only in four countries: Canada, Australia, the US, and the UK. This is not in line with the portfolio tests of LaFond (2005) who documented significant abnormal returns for spread portfolios in 15 countries out of 17. He suggests that the underlying reason for accrual anomaly varies between markets and is not a result of a common underlying factor(s).

Zhang (2007) studied the accruals anomaly and other business growth-based anomalies. Growth variables under examination were external financing, capital expenditure, employee growth, and cash sale growth. In her portfolio tests with each variable, future stock returns decrease monotonically from quintile 1 (low growth) to quintile 10 (high growth). These results of capital expenditures and future stock returns are in line with the prior results by Titman et al. (2004), who examined this relationship in the US with portfolio tests from 1973 to 1996. They found that firms that increase their capital expenditures seem to experience lower stock returns over the next five-year period. Their evidence proves that market participants underestimate the importance of unfavorable information about the intentions of managers. The negative spread was stronger when firms had high cash flows and/or lower debt ratios. These firms might have a higher propensity for overinvesting.

Anderson and Garcia-Feijoo (2006) also had capital expenditures growth rate (CAPEX) as a variable for investing. They documented a significant relation between growth in CAPEX and future stock returns. They observed a connection between the investment effect and the capitalization effect and the book-to-market effect, suggesting that low-book-to-market firms have experienced an increase in their investments and market values in previous years.

Artikis et al. (2022) decomposed the growth in total assets into two components: real investment growth and accounting distortions. Real investment is the component for growth and accounting distortions are the component for efficiency, related to the efficient use of existing capital. They analyzed 16 countries in Europe and found that both components are associated with the asset growth effect in 8 countries. When analyzing a sample where all countries were integrated, they examined positive and significant abnormal returns for both components.

When companies are investing, they must finance investments with either external or internal funds. External financing refers to issuing equity or debt. Loughran and Ritter (1995) studied equity issuances and future stock returns in US market from 1970 to 1990. They documented that firms issuing stocks significantly underperform compared to firms that do not issue new equity. This underperforming was measured for five years after the offering date by calculating average annual returns. Spiess and Affleck-Graves (1999) got similar results when straight and convertible debt offerings were the source for external funds in US market from 1975 to 1989. They documented that firms making debt offerings underperform in the long run after issuing and the effect is greater for small and younger firms.

3.2 Explanations for the Asset Growth Effect

3.2.1 Risk-Based explanations

Risk-based explanations are typically closer to neoclassical finance approaches. The traditional systematic risk-based explanation for the higher returns is that firms with lower asset growth are associated with relatively higher risk and therefore higher expected returns.

One explanation for the asset growth effect is related to real options theory, which suggests that the effect is due to the risk level. By investing in projects with positive net present value, a firm exercises growth options and thus reduces the risk associated with its equity. Real options theory assumes rationality to explain the asset growth effect. (Artikis et al. 2022). Berk et al. (1999) modelled firms expected returns as a function that consider firm growth options and assets in place. In their model, the significance of growth options relative to assets in place diminishes after investment. At the same time, overall risk decreases, and therefore the association between expected returns and investment is negative. This explanation is also suggested by later research (Anderson & Garcia-Feijoo 2006, Lyandres et al. 2008).

Many rational models, that are based on the q-theory of investment, have tried to explain the negative relation between asset growth and subsequent stock returns. The q-theory of investment provides insight into optimal investment behavior, suggesting that firms alter their investment decisions in response to movements in the cost of capital. When the cost of capital decreases, new projects' net present value is higher. As a result, value-maximizing managers are incentivized to increase corporate investment. This leads to a negative relationship between investment and return. (Artikis et al. 2022). At this point, it is important to understand that cost of capital is the same as the expected return in an efficient market.

It is possible to forecast future sock returns if investment levels are depended on future discount rates (Lipson et al. 2011). Titman et al. (2013) results suggest an explanation based on q-theory. Their international evidence shows that the asset growth effect is influenced by the managerial abilities or willingness to make investments that align with expected future stock returns.

Q-theory predicts that when investment frictions are greater, the asset growth effect should be greater. Li and Chang (2010) used financing constraints as a variable for investment frictions and found only limited results supporting the idea that the asset growth effect is greater for financially constrained firms. Consequently, q-theory with investment frictions falls short in explaining the anomaly. Their research suggests that proxies related to limits-to-arbitrage take precedence over q-theory with investment frictions in explaining the volume of the asset growth effect. I will discuss more about limits-to-arbitrage next.

3.2.2 Mispricing explanations

Mispricing explanations for asset growth effect are often related to the irrationality of investors and therefore to behavioral finance. Market participants misinterpret the information behind the growth in total assets which leads to investors' irrationality.

The first mispricing explanation is related to firms' market timing behavior when making financial decisions. Usually, managers have a better understanding of their firms' value and therefore raise equity financing when their own shares are overvalued and buy back stock if their shares are underpriced. Market timing results in a negative link between financing (asset growth) and subsequent stock returns if investors do not consider market timing behavior. (Watanabe et al. 2013). The market timing is connected with a time-varying rate of return. In many studies, the asset growth effect is linked with the situation that growth in total assets is associated with investment expenditures.

Titman et al. (2004) also explored time-varying rates of return. Firms may increase their investments when their expected returns are unusually low, indicating a situation where the cost of capital is unusually low. The low future returns are not the effect in that case. They rather are the cause of abnormal capital expenditures. This observation is also related to the second mispricing explanation which is based on overinvestment. Managers have agency problems when deciding of new investment for firm. Empire-building tendency leads to investments in projects, that have negative net present values which in turn decrease firm value. (Watanabe et al. 2013). Investors may not fully realize the agency problem associated with overinvestment. Thus, they tend to overestimate the value of a company with high investment levels because they overvalue the expected cash flows from upcoming projects. The low returns after growth in assets are a result of a market correction of the previous overpricing. (Titman et al. 2004).

The third explanation is based on the extrapolation bias of investors, which means that investors excessively extrapolate from past growth in the valuation of firms. It results in the overvaluation of high past growth firms and their future low returns. (Watanabe et al. 2013). Cooper et al. (2008) proposed that there is a connection between overinvestment and extrapolation bias. They focused on overconfidence after high market returns. High-growth managers become overconfident after high market returns, and as a result they increase investment levels. Higher investment levels cause greater overreaction of investors to high growth rates. Thus, mispricing is greater between low-growth firms and high-growth firms after high market returns. Gray and Johnson (2011) documented that investors over-extrapolate past growth gains and therefore asset growth effect is attributable to mispricing.

The fourth possible explanation for the asset growth effect being attributed to mispricing is corporate earnings management. Before firms are issuing external financing or they are preparing for acquisitions, they might have incentives to manipulate their financial numbers to look better to have favorable market valuation or to get better financial terms.

This explanation suggests that the asset growth effect is not resulting from real growth. The negative correlation between asset growth and subsequent stock returns is rather a result created by earnings management. (Watanabe et al. 2013).

All four above-described explanations have an assumption that investors mis react to information that is publicly available when valuing stocks. The lower stock returns observed in high asset growth stocks can be seen as a market correction in response to investors' initial misreaction. Market timing explanation, overinvestment explanation, and corporate earnings management explanation depend on the existence of asymmetric information and agency problems of managers. (Watanabe et al. 2013).

The mispricing explanations require some limit to arbitrage, or the mispricing would never occur since the standard conclusion in finance literature is that arbitrage trade pressure eliminates mispricing. Anomalies arise due to the existence of limits to arbitrage, as they cannot be rapidly arbitraged away. (Lipson et al. 2011). Arbitrage costs can be divided into transaction costs and holding costs. Lipson et al. (2011) had idiosyncratic volatility as a proxy for holding costs and documented that idiosyncratic volatility is a necessary condition for the asset growth effect. They found out that the anomaly is much greater for firms with high idiosyncratic volatilities in portfolio tests. In individual stock-level tests, they documented that when the variable of idiosyncratic volatility multiplied by asset growth rate is included in the regression model, this variable is the only significant variable.

Li and Sullivan (2011) got similar results when focused on the risk of arbitraging the asset growth effect. They documented that the mispricing in the anomaly is driven the most by investors' demands for higher compensation for bearing greater arbitrage risk. In their study, the asset growth effect exists predominantly within stocks that have high idiosyncratic volatility. Idiosyncratic volatility increases uncertainty which in turn increases costs and inhibits the profitable arbitrage of the asset growth effect.

3.2.3 Other explanations

International studies have proposed some regional or country-specific characteristics that have an impact on asset growth effect magnitude or even on existence. Yao et al. (2011) documented that the efficiency of the regional financial system in terms of financial resource allocation and investment opportunity valuation has an impact on asset growth effect existence and magnitude of the effect. They examined the effect in the Asian market and found out that asset growth was more homogeneous and there was not that much overinvestment behavior when compared to US markets. The most relevant explanation factor for the asset growth effect was the nature of financial system. The asset growth effect is weaker when the banking system has a dominant role in financing. This could be attributed to either the monitoring role banks assume or the tendency of firms to underinvest in financial systems where banks have dominant role.

These findings of financial markets align with Titman et al. (2013), who documented that the asset growth effect is correlated with many financial market measures, including market development, market index, the market-cap-to-GDP ratio, the access-to-equity, the stock-value-traded-to-GDP ratio, and the stock-value-traded-to-market-cap ratio. Companies in more developed countries with well-established capital markets tend to face the asset growth effect with higher magnitude compared to firms in areas with less developed financial markets. However, they did not find a significant relationship between the asset growth effect and corporate governance or trading costs.

Watanabe et al (2013) examined the asset growth effect internationally. Their evidence suggests that market efficiency-related market characteristics have the greatest explanatory power when it comes to the extent level of the asset growth effect. Informationally more efficient market experiences stronger asset growth effect. However, investor protection, limits to arbitrage, and accounting quality country characteristics did not explain the variation of the anomaly across countries. These findings of the explanatory power of market accessibility characteristics or market efficiency characteristics are not consistent with a mispricing explanation. One might anticipate that in more developed countries with efficient financial markets and robust governance, the degree of asset growth mispricing would be lower. (Li & Sullivan 2011).

4 Data and empirical methods

In this section, I will first describe my data source. I will describe how the data is chosen and what kind of revisions are made and reasons for revisions. Then empirical methodology for portfolio-level tests, portfolio construction process, and construction process of factors are explained. After that, I move on to individual stock-level tests and explain the methodology and variables used in regressions. Finally, I will present statistics to clarify the data and characteristics of the companies and portfolios under investigation.

4.1 Data

4.1.1 Asset growth effect data

Monthly stock returns, accounting items, and market values are obtained from the Refinitiv Eikon Datastream database. The obtained data includes time series data of monthly stock returns, monthly market values for companies, annual total assets, annual tangible assets, annual capital expenditures, annual common equity shareholders, annual common shares outstanding, daily stock prices, annual cash, annual current assets, annual intangible assets, annual minority interest, annual retained earnings, and annual total debt. All data is retrieved and presented in Euros. This data is retrieved for all nonfinancial companies listed on OMX Helsinki stock index between 2003 and 2022. There are both active and delisted companies in this data since I follow Cooper et al. (2008) and include both defunct and active companies to not give too much weight to survivorship bias or historical performance.

The first step in data retrieving is to collect monthly stock returns, monthly market values for companies, and annual total assets for all listed and delisted stocks in OMX Helsinki stock exchange. This data must be collected separately for delisted and active companies in Refinitiv Eikon Datastream. For active companies, I collect data by using a constituents list that includes all listed stocks in OMX Helsinki (Datastream item LHEXINDX). To get data for delisted companies, I have to use another constituent list that covers all delisted companies in Finland (Datastream item DEADFI).

The first manual adjustment for data is to exclude stocks that have two or more stock series on the list. I accept only one stock series per firm since the accounting variables are similar for all series. The other manual adjustment is to delete all financial companies.

Financial firms usually have more debt and different balance sheet structures. These differences compared to nonfinancial firms could have an impact on the results of this thesis.

Delisted companies are those that have been removed from a stock exchange or other trading platform, which means their shares are no longer publicly traded. Delisting can occur for a variety of reasons, such as bankruptcy, financial distress, regulatory non-compliance, mergers or acquisitions, or a company's decision to go private. (Investopedia). The constituent list I use include all delisted companies since 1984 so companies that are delisted before July 2003 must be removed manually. I also remove manually other than the main stock series of the firms.

The total number of firms under observation is 202 firms with 124 active and 78 defunct. The yearly number of observed firms vary over time. Table 1 presents the number of firms per year, the total market value of all stocks, and the average market value at the beginning of July each year from 2003 through 2021.

Table 1. Number of firms per year

This table reports the number of firms per portfolio holding period. Portfolios are reconstructed at the beginning of July of year *t* from 2003 to 2021. The total market value on the Start date (m€) is calculated each year on the portfolio formation date. The average market value on the Start date (m€) is the Total market value on the Start date (m€) divided by number of firms.

Start date	End date	Amount of firms	Total market value on Start date (m€)	Average market value on Start date (m€)
7/2003	6/2004	127	132 183	1 041
7/2004	6/2005	124	135 233	1 091
7/2005	6/2006	126	164 870	1 308
7/2006	6/2007	126	189 538	1 504
7/2007	6/2008	123	274 705	2 233
7/2008	6/2009	121	187 912	1 553
7/2009	6/2010	120	123 684	1 031
7/2010	6/2011	115	141 105	1 227
7/2011	6/2012	116	147 884	1 275
7/2012	6/2013	114	125 748	1 103
7/2013	6/2014	118	127 368	1 079
7/2014	6/2015	118	163 517	1 386
7/2015	6/2016	122	174 683	1 432
7/2016	6/2017	127	182 263	1 435
7/2017	6/2018	126	216 475	1 718
7/2018	6/2019	126	230 767	1 831
7/2019	6/2020	127	224 131	1 765
7/2020	6/2021	122	214 248	1 756
7/2021	6/2022	124	291 051	2 347
Averages		**122**	**181 440**	**1 480**

Table 1 reports the number of firms, total market values of all firms, and average market value of firms under investigation per portfolio holding period. The number of firms varies from 114 in 2012 to 127 firms in the years 2003, 2016, and 2019. The time series average number of firms is 122. Total market value on start dates in million euros varies from 123 684 in the year 2009 to 291 051 in 2021. The time series average total market value at the start date in million euros is 181 440. The average market value per firm in million euros varies from 1 031 in the year 2009 to 2 347 in 2021. The time series' average market value per firm is 1 480 million euros.

The sample includes both active and delisted companies to avoid survivorship bias. In previous studies, this bias is dealt with in different ways. In some studies, only firms that have been listed for at least 2 years before are included in the sample. As seen in Table 1, the number of firms varies from 114 to 127 in my data sample. To get a big enough yearly sample and as many observations as possible, every firm that is listed on the formation date at the beginning of July on year t is included in this thesis. However, stocks are excluded if total assets data is not available from years t-2 and t-1.

When observing market values, Datastream does not clear market values for delisted companies after they are defunct. Thus, in this thesis market values of delisted companies are manually adjusted to zero when the market value has been the same for three months in a row. Market values are observed on the company level with the Datastream item MVC. MVC is the company's consolidated market value, and it is displayed in millions of euros. This item is company-level market value instead of the market value of individual security. Thus, it is better suited for this thesis, as there is only one share series observed for each company. MVC is equivalent to MV for companies with a single listed equity security. However, in the case of companies with multiple listed or unlisted equity securities, MVC encompasses the market values of all these securities combined.

In stock returns, I consider both dividends and the changes in stock values. Stock return data is calculated from the monthly Total Return Index (Datastream item RI), and it is calculated separately for each firm. This variable is called total returns and the formula for it is defined as:

$$RI_t = RI_{t-1} \times \frac{P_t + D_t}{P_{t-1}},$$

where RI_t is the Total Return Index at time *t*, P_t is the stock price at time *t* and *D* refers to the dividend paid. In Datastream data, the Total Return Index remains at the same level as the last closing price after the firm is delisted. In this thesis, all data after delisting is manually removed.

Following Cooper et al. (2008) in asset growth rates, changes in the amount of total assets year-on-year are considered as follows:

$$ASSETG_{t-1} = \frac{TA_{t-1} - TA_{t-2}}{TA_{t-2}}$$

where ASSETG denotes the asset growth rate and TA are Total Assets in year *t*–1 and *t*–2. For asset growth rates, changes in Total Assets (Datastream item WC02999) are obtained. A restriction for this variable is that the total assets con not be zero in either years *t*-1 and *t*-2.

The main objective in my first research question is the relationship between these above defined two formulas. If Total Assets (2) grow on year *t*-1, how Total Returns (1) react on year *t*. Portfolios are reconstructed in the July of each year *t* from 2003 to 2021 based on asset growth rates from the end of year *t*-2 to the end of the year *t*-1. Thus, returns from January of year *t* to July of year t are not considered. The rationale behind this convention is that investors should be provided with comprehensive accounting information about a firm before making investment decisions.

Figure 3 represents time series statistics for annual asset growth rates from 2002 through 2020. The average asset growth rate was highest in 2006, being 31%. The lowest average was documented in 2009 when the average growth rate was -3%. The top median growth rate of 11% was measured as well in 2006. The lowest median growth rate was in 2013.

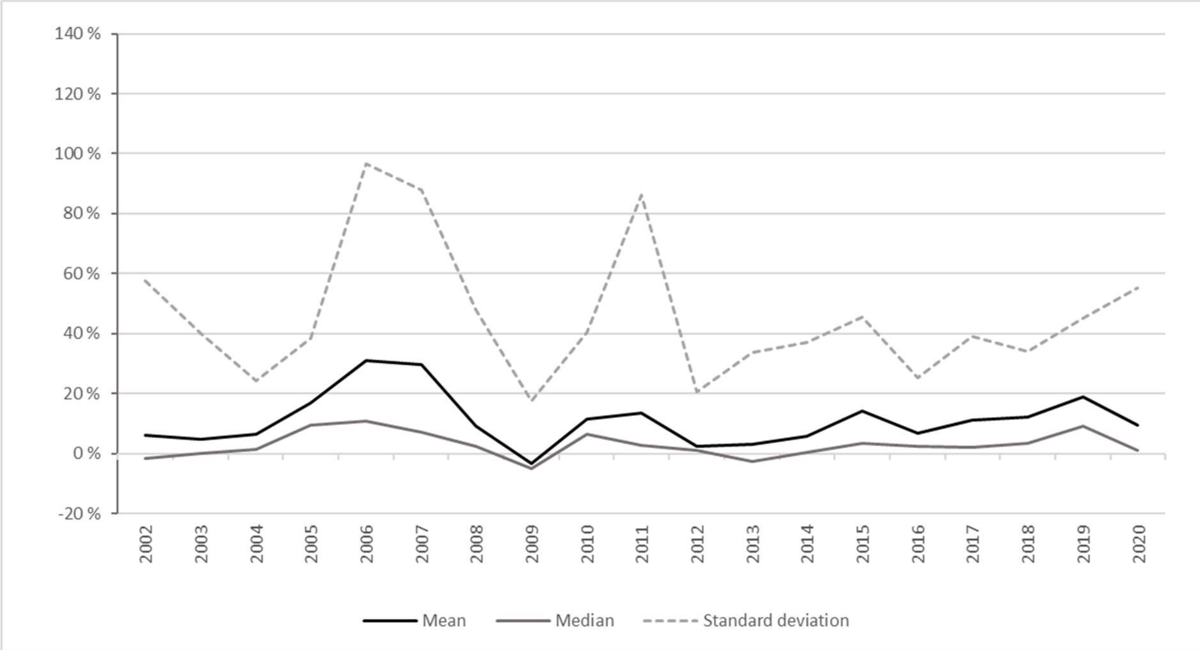

Figure 3. Time series statistics for annual asset growth rates

4.1.2 Other growth variable data

After observing the asset growth effect at the portfolio level, I will focus on other company growth measures and try to find an answer to my second research question. I will examine if any other growth characteristics result in lower stock returns in the future alone or together with growth in total assets.

The focus of these regressions is on capital expenditures, net property, plant and equipment, past stock returns, idiosyncratic volatility, transaction costs, and lagged asset growth rates. When observing the connection between capital expenditures and stock returns, I follow Xing (2008) and use the growth rate in capital expenditures. This measure is called CAPEX and LCAPEX refers to a lagged change in capital expenditures. The PS measure is from Polk and Sapienza (2006), and it is the ratio of capital expenditures to net property, plant, and equipment.

Relationships between lagged asset growth rate and future stock returns are observed with three measures: L2ASSETG, L3ASSETG, and L4ASSETG. I will follow Cooper et. al. (2008) and examine if the asset growth effect is not limited to change in total assets just one-year prior to portfolio construction. Thus, L2ASSETG refers to a change in total assets from the year ending *t*-3 to the year ending in *t*-2, L3ASSETG to the change in total assets from the year ending in *t*-4 to *t*-3, and L4ASSETG change in the year ending *t*-5 to year ending in *t*-4.

Momentum factors in this thesis are BHRET06 and BHRET36. Those factors are calculated from firms' buy-and-hold total returns prior to portfolio restructuring. BHRET06 refers to the time-period from the beginning of January in year *t* to the end of June in year *t*. BHRET36 refers to the time-period from the beginning of July *t*-3 to the end of June in year *t*.

Li and Sullivan (2011) and Lipson et al. (2011) studied the Asset growth effect associated with arbitrage risk. They found that the asset growth effect is affected by high barriers to arbitrage meaning that investors who want to profit from asset growth anomaly, must be willing to accept increased uncertainty in returns. Investors demand higher returns for bearing higher arbitrage risk. Lipson et al. (2011) separated arbitrage costs into transaction costs and holding costs. In this study, the proxy for holding costs is firms' idiosyncratic volatility (IVOL). IVOL is defined as the standard deviation of the residuals from a regression of daily stock returns on an equal-weighted market index (OMX Helsinki) from July 1 in year *t*-1 to the end of June in year *t*. In all tests, idiosyncratic volatility is multiplied by the square root of 255 trading days per year.

The transaction costs measure used in this thesis is called AMIHUD. It is the price impact variable proposed in Amihud (2002). It is calculated as the ratio of the absolute daily stock return value to the daily euro trading volume. In all tests, AMIHUD is used as a natural logarithm of the initial value. Formulas for all above mentioned variables are defined in more detail in Appendix.

4.1.3 Balance sheet subcomponent data

I separate the balance sheet into two parts: the asset investment and asset financing part. This decomposition is similar to accounting principles. The asset investment consists of the left-hand side of the balance sheet and asset financing consists of the right-hand side of the balance sheet. I mainly follow Cooper et al. (2008) in decomposition. The only exception is in intangible assets, which are separated from Property, plant, and equipment.

The investment subcomponents used are cash (CASH), current assets (CA), which is calculated as total current assets less cash, net property plant and equipment (PPE), intangible assets (IA) and other assets (OA) that is calculated as Total assets minus all other variables. The financing part is separated into stock (STOCK), total debt (DEBT), retained earnings (RE), and other operating liabilities (OPL). OPL is again calculated as total assets less all other variables. For each growth subcomponent, the growth ratio is calculated as a change in balance sheet value from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. All data is from Refinitiv Eikon Datastream.

4.2 Empirical methods

4.2.1 Portfolio tests

Following the portfolio sorting methods by Cooper et al. (2008) and Watanabe et al. (2013), stocks are allocated into portfolios at the end of June of each year t. Portfolio sorting is based on annual asset growth rates from the fiscal year ending in calendar year $t-2$ to the fiscal year ending in year $t-1$. The equation for asset growth rate is described in Section 4.1.1. Portfolios are constructed at the end of June to make sure that investors are provided with comprehensive accounting information about a firm before making investment decisions.

In this thesis, stocks are sorted into quintile portfolios. Cooper et al. (2008) allocate stocks into deciles, which means they have 10 portfolios. In their study, the asset growth effect was studied in the US stock market. The size of the US stock market is far greater than the Finnish stock market studied in this thesis. Watanabe et al. (2013) studied the asset growth effect with various numbers of portfolios depending on the size of the market under investigation. They study asset growth effect in 43 countries and have three different procedures to sort stocks. In markets where the number of stocks is between 30 and 50, stocks are sorted into tercile portfolios (three portfolios). If the number of stocks in each market is from 50 to 100, they sort stocks into quintiles. Decile portfolios are used in the market when the number of stocks each year is over 100.

To have a sufficient amount of stocks in each portfolio, quintile portfolios are used in this thesis. Firms in the first quintile are those that have had the lowest asset growth rates in year *t*-1 and firms in the fifth are those with the highest asset growth rate in year *t*-1. After portfolio construction, monthly returns for Equal-weighted portfolios and Value-weighted portfolios are calculated. Monthly returns are calculated for the next 12 months, starting in July of year *t* and ending in June of year *t*+1. This same procedure is done yearly. At the end of June each year *t*, portfolios are restructured and weighted.

For both EW and VW portfolios, stocks are also divided into three size groupings based on their market value. Size groupings are used to investigate if the asset growth exists only among small or big firms, or if the volume of effect varies between groups. It is also crucial to analyze the anomaly across different size groups because there's a risk that small-cap stocks influence the results too much. While small-cap stocks are numerous, they still represent only a small part of the total market capitalization. (Gray & Johnson 2011).

Following the methodology of Cooper et al. (2008), stocks are divided into three size groups based on their market values. The 30th market value percentile is classified as small firms and the 70th percentile as big firms. Market values are observed in June of year t. Companies in each size group are subsequently assigned into one of five quintiles based on their asset growth rates. Portfolios, both equally weighted (EW) and value-weighted (VW), are then constructed for the following 12 months. Thus, the Asset growth effect is studied for all stocks with EW and VW quintile portfolios and separately for small, medium, and big firms with EW and VW quintile portfolios.

The asset growth effect is measured by a zero-cost portfolio. The zero-cost portfolio is constructed with extreme quintiles 1 and 5. It consists of a long position in low growth firms (quintile 1) and a short position in high growth firms (quintile 5). This possible positive spread between low and high-growth firms refers to the occurrence of an asset growth effect. Spread can also be justified by risk factors at least partially. Risk factors and the model to examine them at the portfolio level is described in Section 4.2.2

In addition to the average monthly return investigation, 12 months rolling stock returns are also examined. My sample size for each year is quite small and as a result, portfolios are also small. Thus, returns vary a lot between months and volatility is high. This can affect the significance of results in portfolio regressions. 12 months rolling average monthly returns are calculated by first calculating the average of all stock returns each month in a certain quintile portfolio and then taking an average of the past 12 months' quintile portfolio returns. This method decreases the effect of volatility in returns. This method is not used before, or at least I could not find any study that uses 12 months rolling returns in portfolio regression analysis. Thus, my intention is to represent how small portfolio sizes effect on results and volatility, rather than proving the existence or non-existence of the anomaly based on these results.

Cooper et. al (2008) documented that the asset growth effect exists even 5 years after sorting stocks into portfolios. Thus, in this thesis, I will investigate the long-run effect by also sorting portfolios into quintiles based on lagged asset growth rate (L2ASSETG). L2ASSETG is calculated as a change in total assets from the fiscal year ending in year *t*-3 to the fiscal year ending in year *t*-2. This procedure is otherwise the same as done with ASSETG, but the lagged asset growth rate is considered: portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year and EW and VW returns are calculated for each portfolio.

The third portfolio return test is examined with changes in capital expenditures (CAPEX). As done with ASSETG and L2ASSETG, stocks are sorted into five portfolios based on their capital expenditures growth rates in June of each year *t* from 2003 to 2021. Sorting is based on the year-on-year percentage change in capital expenditures from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year and EW and VW returns are calculated for each portfolio.

4.2.2 Fama-French three-factor model

Risk-adjusted predictive volume of asset growth effect is also examined in portfolio-level tests. I control risk-adjusted returns by Fama and French (1993) three-factor model. The model is described as:

$$r_{it} - r_{ft} = \alpha_i + \beta_i\left(r_{mt} - r_{ft}\right) + s_i SMB_t + h_i HML_t + \varepsilon_{it},$$

where *ri* is the monthly portfolio return, *rf* is the monthly risk-free rate, rm is the monthly market return, SMB is the average total return difference between small and large market value firms and HML is the average total return difference between low and high book-to-market firms (AQR data library 2023).

Factor data is downloaded from the AQR Data Library (2023). They provide county-specific monthly factors to utilize when controlling Fama and French (1993) three-factor model. I merge and filter monthly factor returns with the monthly total returns of quintile portfolios. In this thesis, monthly factor returns are used from 30.6.2003. I downloaded data for market return (MKT), Small Minus Big (SMB), and High Minus Low (HML) from AQR Data Library (2023).

The Market Factor (MKT) is the total market returns of all available stocks minus the one-month Treasury bill rate. Thus, MKT is the excess return of the overall market. The other factors, SMB and HML, are constructed by using six portfolios. First stocks are assigned into two portfolios based on their market capitalization. This assignment is done at the end of each month. The size breakpoint is the 80th percentile by OMX Helsinki meaning that the 80th percentile are "Big" stocks, and the rest are "Small". After size sorting the second variable is divided into three sorts within both size groups. Breakpoints for other variables are the 30th and 70th percentiles of relevant value measurement for that variable. In Fama and French three-factor model, the other variable is book-to-market. After this two-step shorting method, 2x3 portfolios are constructed. Portfolios are divided into two size groups, with the second variable determining how the portfolios are further sorted into three groups. The factors are rebalanced monthly to have correct value weights. (AQR Data Library 2023).

The value factor (HML) is calculated as the average return on the two value-portfolios minus the average return on the two growth-portfolios. Value portfolios include stocks above the 70th book-to-market percentile and growth portfolios stocks below the 30th book to market percentiles. Small Minus Big (SMB) is the average return on the three small portfolios minus the average return of the three big portfolios. (AQR Data Library 2023).

4.2.3 Fama-MacBeth regressions

I follow Cooper et al. (2008) and Lipson et al. (2011) and further examine the asset growth effect from the Fama-MacBeth framework (Fama & MacBeth 1973). Regressions are conducted at the individual stock level in this method. The Fama-MacBeth regression model is a two-step approach to estimate the relationship between independent variables and a dependent variable. The Fama-MacBeth method combines elements of time-series analysis and cross-sectional analysis to address the potential issues of both approaches. In the first step of this model, time-series regressions are conducted for each stock in my sample over a time-period between 2003 and 2021. Stock returns are regressed against a selection of variables. By estimating these individual regressions, I obtain time-series estimates of the factor risk premia, which reflect the relationship between the variables and asset returns over time. (Fama & MacBeth 1973).

After obtaining the time-series estimates, I proceed to the second step, which is the cross-sectional regression. In this step, I aggregate the time-series estimates of the factor risk premia obtained from the individual security regressions. The dependent variable in the cross-sectional regression is the return of each security over the time period, and the independent variables are the average factor risk premia estimated in the first stage.

The dependent variable is the average annual total return for each stock on each time period. The time period is the same as in portfolio regression, starting at the beginning of July in year *t* and ending at the end of June in year *t*+1. The independent variables are, as described in 4.1.1 and 4.1.2., BHRET06, BHRET36, IVOL, AMIHUD, ASSETG, L2ASSETG, L3ASSETG, L4ASSETG, LCAPEX, CAPEX and PS.

In both Fama-MacBeth regression tables and in every model, the base set of independent variables are the market value of the company and book-to-market value. Asset growth rate (ASSETG) is as well used in both Fama-MacBeth regression but not in every model. Lagged asset growth rates, capital expenditures and lagged capital expenditures are the other independent variables used in Fama-MacBeth regression 1. In Fama-MacBeth regression 2, the independent variables are idiosyncratic volatility, transaction costs, and capital expenditures divided by net property, plant and equipment, and momentum variables.

I will conduct 12 different models in both Fama-MacBeth regression tables to examine the effect of each independent variable both individually and with asset growth rate. Book-to-market at the year ending *t*-1 and the market value of the company at the end of June in year t is included in every model as risk factors. Fama-MacBeth regressions are examined with annual data.

There have been some issues with data quality in Datastream, such as decimal problems in return data (Ince & Porter 2006). Following previous research, I winsorize all variable data at the 1st and 99th percentiles to avoid distortion in data. In addition, total return data is removed at the 1st and 99th percentiles. To get data for all independent variables, there is also a restriction that stocks must be listed at least 5 months before a time period the stock is included in the test. In other words, each stock must have stock return data before January in year t to be included in the sample in a particular year.

4.2.4 Double-sorted portfolio tests

After the Fama-MacBeth regressions, we continue observing the relationship between asset growth, other growth-related factors, and stock returns at the portfolio level again. I am following the approach of Lipson et al. (2011) and examining how the asset growth effect interacts with other company characteristics by using double-sorted portfolios. This method is like the one described in section 4.2.1 when stocks are divided into three size groupings based on their market value. This time companies are not divided based on market values, but companies are divided into three groupings based on other characteristics. The characteristics investigated in these double-sorted portfolios are IVOL, AMIHUD, CAPEX, and BHRET06.

The first step in this portfolio sorting is to examine the characteristic variable results. When IVOL is the characteristic variable under investigation, portfolios are sorted based on monthly average idiosyncratic volatility from July on year t-1 to June on year t. In AMIHUD sorting, the focus is on the average daily illiquidity of stock from July in year t-1 to June in year t. CAPEX sorting is based on changes in capital expenditures from year t-2 to year t-1. When BHRET06 is the characteristic variable under investigation, portfolios are sorted based on total stock returns from January in year t to June in year t.

The 30th percentile of the characteristic variable value in question is classified as group 1 and the 70th percentile as a group 3. Group 2 includes the firms between group 1 and 3. Firms in each group are further assigned to one of 5 quintiles based on asset growth rates and then EW and VW portfolios are formed for the next 12 months.

The asset growth effect is measured again by a zero-cost portfolio. The zero-cost portfolio is constructed with extreme quintiles 1 and 5. It consists of a long position in low growth firms (quintile 1) and a short position in high growth firms (quintile 5). This possible spread between low and high growth firms refers to the occurrence of the asset growth effect when a characteristic variable in question is also considered. The portfolios are held for one year, from July of year t to June of year t+1. The portfolios are restructured every year and EW and VW returns are calculated for each portfolio.

4.2.5 Subcomponent tests

After examining the asset growth effect as a whole with various tests, I will focus on subcomponents of asset growth and balance sheet. I follow Cooper et al. (2008) and decompose balance sheet items into the major accounting components. By decomposing the asset growth, it is possible to observe if any major balance sheet components have a relationship with future stock returns.

Fama-MacBeth (1973) regressions are employed to examine the relationships between subcomponents and stock returns. First, I run the regression for each subcomponent individually and the results are reported. Finally, all subcomponents for both parts are regressed together on annual stock returns.

4.3 Descriptive financial and return statistics

Table 2 Panel A presents the summary numbers for the main firm characteristic variables used in analysis. Values are presented as time-series averages of yearly cross-sectional medians in each variable and quintile. Medians are the median numbers of each portfolio.

Asset growth (ASSETG) increases quite monotonically from quintile 1 to quintile 4. There is the biggest growth gap between quintiles 4 and 5, the time-series average of annual median of quintile 5 being 19,85 % higher than the time-series average of annual median of quintile 4. The two lowest growth quintiles seem to have negative time-series averages of yearly cross-sectional median growth rates. A similar trend is observed when comparing lagged asset growth rates (L2ASSETG), with high-growth firms having the highest rate of 8,17 percent and low-growth firms having the lowest rate of -1,75 percent. Cooper et al. (2008) also observed that high-growth firms are firms that have also had higher growth rates prior to the fiscal year ending in *t*-2.

When comparing total assets between quintiles, it is interesting to notice that extreme quintiles have the lowest amount of total assets in the fiscal year ending t-1. High growth rate firms' time-series average of yearly cross-sectional median total assets is €125M, while the same median for quintile 2 is €374M. Low growth rate firms have the lowest median being €121,57M. These variations are in line with Cooper et al. (2008) observations.

Quintiles 2, 3, and 4 tend to be the firms with the highest market value. Time-series average of the annual cross-sectional median market value is the highest for quintile 3, being €360,33M. The lowest market value firms are the firms with the lowest asset growth rates as well. This is in line with the results of total assets since in both variables medium-growth rate firms seem to be bigger firms.

Book-to-market time-series averages of annual cross-sectional medians seem to grow monotonically from quintile 1 to quintile 5. This is in line with the results of Cooper et al. (2008) since they documented a book-to-market rate of 0,8156 for the lowest growth firms and 0,4256 for the highest growth firms. However, it is important to recognize that they sorted firms into deciles, not into quintiles, and therefore their extreme portfolios have experienced also higher (lower) asset growth rates. That can describe their higher spread. When observing prior buy-and-hold returns in both terms of 6 and 36 months, high-growth firms overperform against low-growth firms. High-growth firms have the highest prior returns of all quintiles.

Idiosyncratic volatilities (IVOL) seem to be quite stable between asset growth rate quintiles. This is not in line with the results of Lipson et al. (2011), who found that IVOL was greater for the quintile 1 portfolio. In their study, monthly average IVOL was 19,5% for quintile 1, 10,5% for quintile 3, and 14,8% for quintile 5. Their sample period was between 1968 and 2006 and idiosyncratic volatility in general may have declined over time. It is also important to notice that they studied firms in US Differences in IVOL might result in different results in asset growth effect regressions as well since they found that the asset growth effect is particularly strong for firms with high IVOL, and it does not exist among low IVOL firms.

Table 2 Panel B presents the summary numbers for the main growth variables used in asset growth effect analysis. Values are presented as time-series averages of yearly cross-sectional medians in each variable and quintile. Medians are the median numbers of each portfolio. 1-5 row presents the spread between low and high asset growth quintiles and the average row presents the average of all quintile portfolios.

L2ASSETG seems to grow monotonically from low growth quintile to high growth quintile. When comparing the results with ASSETG in Panel A, we can see that the spread is not as great as the spread of ASSETG. This difference is in line with Cooper et al. (2008). They identified a five times greater spread for ASSETG than for L2ASSETG.

The spread is even smaller for L3ASSETG and L4ASSETG, but it remains negative being -5% for L3ASSETG and -5,5% for L4ASSETG.

CAPEX seems to grow quite monotonically from quintile 1 to quintile 5. The spread is -57,7% and it is greater than the one of ASSETG, which is -44,1%. CAPEX behaves similarly to ASSETG in the long run. The Spread of LCAPEX is significantly lower compared to CAPEX, but still negative. PS results are in line with other characteristics, increasing monotonically from quintile 1 to quintile 5. AMIHUD is significantly higher for quintile 1 firms compared to others. The spread for AMIHUD is 0,54.

Table 2. Firm characteristics of quintile portfolios

This table presents the characteristics of stocks in each quintile portfolio. Stocks are sorted into quintiles according to their asset growth rate (ASSETG) at the end of each June of year t from 2003 to 2021. ASSETG is defined as the change in the firm's total assets from the fiscal year ending in calendar year t-2 to the fiscal year ending in t-1, L2ASSETG is the change from t-3 to t-2, L3ASSETG is the change from t-4 to t-3 and L4ASSETG is the change from t-5 to t-4. ASSETS refers to total assets in millions of euros and it is from the fiscal year ending in t-1. MV is the market value of the company in millions of euros at the portfolio formation date (end of June in year t). BM refers to book-to-market ratios and they are calculated in fiscal year ending t-1. BHRET06 is a total return from January to June in year t (before the portfolio formation date). BHRET36 is the 36-month buy-and-hold total return from July in year t-3 to June of year t (before the portfolio formation date). IVOL refers to idiosyncratic volatility and it is calculated as the standard deviation of the residuals from a regression of daily stock returns on an equal-weighted market index from July 1 in year t-1 to the end of June in year t. IVOL is multiplied by the square root of 255 to get annual IVOL. AMIHUD is the ratio of the absolute daily stock return value to the daily euro trading volume. CAPEX refers to capital expenditure growth rate and it is calculated as the percentage change in capital expenditures from the fiscal year ending in t-2 to the fiscal year ending in t-1. LCAPEX refers to lagged capital expenditure growth rate and it is calculated as the percentage change in capital expenditures from the fiscal year ending in t-3 to the fiscal year ending in t-2. PS is the ratio of capital expenditures to net property, plant, and equipment in the year ending t-1. The numbers reported in this table, are time-series averages of yearly cross-sectional medians. ASSETS and MV are presented in millions of euros. Numbers in other cells are presented in decimal form.

Panel A: Firm characteristics

Quintile	ASSETG	ASSETS	MV	BM	BHRET06	BHRET36	IVOL
1 (Low)	-0,1286	121,57	71,48	0,7438	0,0445	-0,1438	0,1033
2	-0,0272	373,78	266,17	0,6661	0,0514	0,1660	0,0788
3	0,0287	373,61	360,33	0,6263	0,0777	0,3127	0,0773
4	0,1040	274,29	307,91	0,5451	0,0781	0,4757	0,0795
5 (High)	0,3125	125,39	168,21	0,5149	0,0823	0,5374	0,0834
1-5	-0,4411	-3,82	-96,74	0,2290	-0,0378	-0,6812	0,0199
Average	0,0579	253,73	234,82	0,6192	0,0668	0,2696	0,0845

Panel B: Asset growth variables

Quintile	L2ASSETG	L3ASSETG	L4ASSETG	LCAPEX	CAPEX	PS	AMIHUD
1 (Low)	-0,0175	0,0013	0,0148	-0,0523	-0,2030	0,1308	0,7465
2	0,0096	0,0161	0,0278	0,0037	-0,0188	0,1586	0,3398
3	0,0168	0,0210	0,0276	0,1172	-0,0272	0,1850	0,2248
4	0,0587	0,0539	0,0409	0,0934	0,0978	0,2476	0,1599
5 (High)	0,0817	0,0519	0,0697	0,0164	0,3738	0,3619	0,2024
1-5	-0,0992	-0,0506	-0,0550	-0,0687	-0,5768	-0,2311	0,5441
Average	0,0298	0,0288	0,0362	0,0357	0,0445	0,2168	0,3347

5 Empirical results

5.1 Portfolio results

Raw returns for all quintile portfolios are reported in Table 3. Table 3 consists of two panels, one for EW returns (Panel A) and one for VW returns (Panel B). Raw returns mean that only monthly Total returns are compared between portfolios. I consider risk factors later in Table 4. Numbers present average monthly raw returns that are calculated for each portfolio over the period from July 2003 to June 2022. The spread portfolio reports differences in returns for low and high growth firms. If the spread portfolio is positive, it indicates that an Asset growth effect might exist.

For both types of portfolios, returns are calculated for all, small, medium, and big firms separately. I sort firms into groups using 30th and 70th market value percentiles in June of year t. I assign then each size group to quintile portfolios based on asset growth rates and construct VW and EW portfolios for the next year. After that monthly raw returns are calculated.

When observing EW portfolio returns for all stocks in Panel A, high-growth firms have an average monthly return of 0,90% while low-growth firms have an average monthly return of 0,94%. Low-growth firms overperform high growth firms with a 0,04% monthly spread. The annual spread return is 0,52% for all stocks in EW portfolios.

Using Value weights in portfolio construction (Panel B), all low-growth firms have average monthly returns of 1,37% while high-growth firms have 1,02%. The monthly average spread is 0,34%. When calculating annual returns, the spread portfolio return is 4,22%. It means that high-growth firms overperform low-growth firms when portfolios are formed using equal weights with a 0,52% annual spread and with zero-cost portfolio investing one can earn 4,22 % when stocks are sorted into value-weighted portfolios.

I further discuss the result in three size groups. In EW portfolios, the spread is positive for small-sized and big-sized firms. Small low-growth firms have 0,38% greater average monthly returns compared to high-growth firms. For big firms, the monthly spread is 0,44%. These two results calculated as annual returns are 4,68% (Small) and 5,38% (Big). When observing medium-sized firms, we can see that low-growth firms have average monthly returns of 0,66% while high-growth firms have average monthly returns of

1,12%. The average spread portfolio monthly return is -0,45% and annual return is -5,29%.

When examining results for VW portfolios, we can see similar results as EW portfolios resulted. Small low-growth firms earn average monthly returns of 1,22% while high-growth firms earn 0,88%, the spread being 0,34% per month and 4,19% per annum. The spread is greater for big portfolios, resulting in 0,54% monthly and 6,67% annually. In medium firms, high-growth firms overperform low-growth firms with an average monthly spread of 0,43%.

12 months rolling spread returns are in line with the results of monthly portfolio returns. The spreads are positive for small, and big EW and VW portfolios and for all VW portfolios. The difference is significant when comparing to average monthly returns. The results are highly significant for medium and big EW portfolios and also for big VW portfolios. Meaning that when rolling 12 months average stock returns are under observation, the asset growth effect seems to exist among big companies.

These results of the effect existence between size groups follow results by Gray and Johnson (2011), who studied the asset growth effect in the Australian equity market. They documented that the relationship between asset growth and future stock returns is substantial for large capitalization firms. On the other hand, Fama and French (2008) proposed that the asset growth effect exist only among small firms.

The significances between monthly return test and 12-month rolling returns tests are different. To understand these results, I have calculated standard deviations (st. dev) for all portfolios. We can see that standard deviations are way lower for 12 months rolling portfolio returns. The possible reason for the nonexistence of a significant asset growth effect in Finland might be the fact that returns vary a lot between months. Variation might result from the number of stocks per portfolio.

Table 3. Asset growth quintile portfolio raw returns

This table reports raw quintile portfolio returns. Stocks are sorted into five portfolios based on their total asset growth rates in June of each year *t* from 2003 to 2021. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year. Equal-weighted average monthly portfolio raw returns are reported in Panel A, and Panel B reports average monthly value-weighted raw portfolio returns. Spread portfolio reports the difference in raw returns of extreme portfolios. 12-month rolling returns present average monthly returns from the previous 12 months, and they are calculated for each month. Extreme portfolios are low growth portfolio (quintile 1) and high growth portfolio (quintile 5). Returns for small-sized firms, medium-sized firms, big-sized firms, and all firms are reported separately. Size groups are classified in June of each year *t*. Firms are ranked into one of three size groups based on 30th and 70th market value percentiles.

	Asset Growth Quintiles					Spread	t (spread)	*p* value	st.dev	12 months rolling returns			
	1 (low)	2	3	4	5 (high)					Spread	t (spread)	*p* value	st.dev
Panel A: Equal-weighted portfolio returns													
Small	0,0121	0,0012	0,0107	0,0157	0,0083	0,0038	0,6648	0,5068	0,0868	0,0018	1,1942	0,2337	0,0218
Medium	0,0066	0,0106	0,0102	0,0118	0,0111	-0,0045	-1,3045	0,1934	0,0523	-0,0054	-4,0065	0,0001	0,0200
Big	0,0131	0,0090	0,0085	0,0136	0,0087	0,0044	1,4258	0,1553	0,0463	0,0042	4,1968	0,0000	0,0147
All	0,0094	0,0083	0,0107	0,0127	0,0090	0,0004	0,1523	0,8791	0,0430	-0,0009	-1,1424	0,2546	0,0113
Panel B: Value-weighted portfolio returns													
Small	0,0122	-0,0002	0,0081	0,0146	0,0088	0,0034	0,5643	0,5731	0,0917	0,0004	0,2778	0,7814	0,0198
Medium	0,0061	0,0084	0,0116	0,0120	0,0104	-0,0043	-1,1755	0,2410	0,0554	-0,0050	-1,7810	0,0763	0,0219
Big	0,0134	0,0089	0,0071	0,0102	0,0080	0,0054	1,1412	0,2550	0,0714	0,0046	3,5877	0,0010	0,0191
All	0,0137	0,0089	0,0080	0,0070	0,0102	0,0034	0,6847	0,4942	0,0760	0,0020	1,4877	0,1383	0,0197

When observing p values of average monthly spread returns, we can see that none of them are significant. Furthermore, monthly spread returns vary between -0,45% and 0,54% and annual between -5,29% and 6,67%. These results are not in line with Cooper et al. (2008). They examine a monthly average spread of 1,73% (t-statistic = 8,45) for all firms formed into EW portfolios. Their spread between low and high growth firms in VW portfolios is 1,05% (t-statistic = 5,04). In their study, the negative association between asset growth and subsequent returns is monotonic across all ten deciles. In my study, there is no positive or negative monotonic relation in any perspective or any way.

In VW returns for all firms, results are close to Watanabe et al. (2013), who studied the asset growth effect in 43 different countries between 1982 and 2010. During this time, they observed a positive spread in 30 and 25 countries when EW and VW portfolios were constructed. The equal-weighted annual spread returns varied from -10,92% to 10,53%. Annual spread returns in VW portfolios varied from -14,12% in the Czech Republic to 15,38% spread in France. In Finland, the annual EW spread return was 3,36% (t-statistic = 0,48) while the annual VW spread return was 5,00% (t-statistic = 0,64). These results in Finland are in line with my VW results. Differences might be partly due to the time period and sample size. The average number of Finnish firms per year in their sample is 92 and their first portfolios are constructed 20 years before and the last portfolios 11 years before than the ones in this study.

Even though none of the spreads is statistically significant, the average monthly spread is positive for Small, Large, and All portfolios in both Equal and value weightings. In Figure 4, the monthly average returns of All VW and EW quintile 1 portfolios are compared to the Total return of OMX Helsinki from the beginning of July 2003 through the end of June 2022. In Figure 4, low-growth portfolios and market index are indexed to 100 in July 2003. From Figure 4, we can see that the VW portfolio experience over 1100% growth, and the EW portfolio grow 453% during the period under observation while the market index growth is 322%.

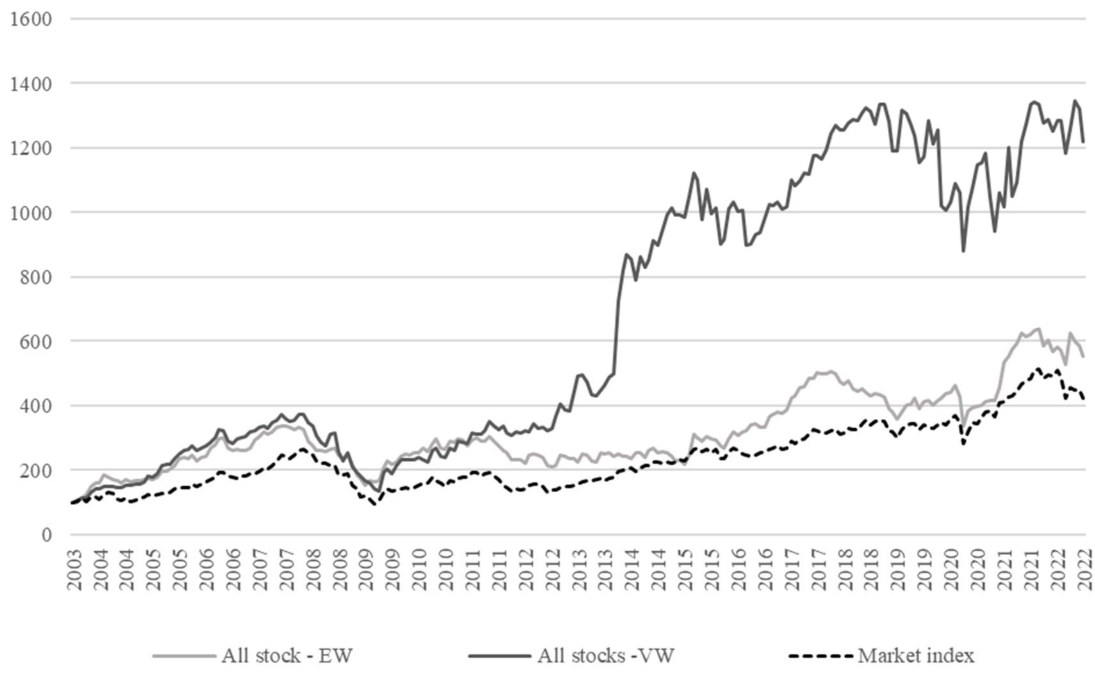

Figure 4. Portfolio performance compared to the market index.

After observing average monthly raw returns, it is important to examine if results differ when I control risks with Fama and French (1993) three-factor model. This is important because it is likely that at least part of the spreads in raw returns are explained by the book-to-market and size factors (Cooper et al. 2008). Three-factor alphas are reported in Table 4 across the same three size groupings as in sorting firms in the test of raw returns.

When observing EW portfolio monthly alphas for all stocks in Panel A, high-growth firms have an average monthly return of 0,20% while low-growth firms have an average monthly return of 0,23%. Low-growth firms overperform high growth firms with a 0,03% monthly spread. The annual alpha spread is 0,35% for all stocks in EW portfolios.

Using Value weights in portfolio construction (Panel B), all low-growth firms have average monthly alphas of 0,62% while high-growth firms have 0,28%. The monthly average spread is 0,35%. When considering annual risk-adjusted returns, the spread equals 4,26%. It means that low-growth firms' risk-adjusted returns overperform high-growth firms when portfolios are formed using equal weights and value weights.

I further discuss the risk-adjusted returns in three size groups. In EW portfolios, the spread is positive for small-sized and big-sized firms. Small low-growth firms have 0,32%

greater average monthly risk-adjusted returns compared to high-growth firms. For big firms, the monthly spread is 0,42%. These two results calculated as annual risk-adjusted returns are 3,87% (Small) and 5,12% (Big). When observing medium-sized firms, we can see that low-growth firms have negative alpha being -0,07% while high-growth firms have average monthly risk-adjusted returns of 0,40%. The average risk-adjusted spread portfolio monthly return is -0,47% and the annual return is -5,50%.

When examining results for VW portfolios, we can see similar results to EW portfolios' results. Small low-growth firms earn average monthly risk-adjusted returns of 0,59% while high-growth firms earn 0,26%, the spread being 0,33% per month and 4,00% per annum. The spread is a little bit greater for big firms, resulting in 0,52% monthly and 6,42% annually. In medium size group, high-growth firms overperform low-growth firms with an average monthly spread of -0,42%.

Table 4. Fama-French three-factor risk-adjusted portfolio returns

This table reports risk-adjusted quintile portfolio alphas. Stocks are sorted into five portfolios based on their total asset growth rates in June of each year *t* from 2003 to 2021. Sorting is based on the year-on-year percentage change in total assets from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year. Equal-weighted average monthly Fama and French (1993) three-factor alphas are reported in Panel A, and value-weighted average monthly Fama and French (1993) three-factor alphas are reported in Panel B. Spread portfolio reports the difference in alphas of extreme portfolios. Extreme portfolios are low growth portfolio (quintile 1) and high growth portfolio (quintile 5). Alphas for small-sized firms, medium-sized firms, big-sized firms, and all firms are reported separately. Size groups are classified in June of each year *t*. Firms are ranked into one of three size groups based on 30th and 70th market value percentiles.

	Asset Growth Quintiles					Spread	t (spread)	*p* value
	1 (low)	2	3	4	5 (high)			
Panel A: Equal-weighted portfolio returns								
Small	0,0055	-0,0053	0,0045	0,0095	0,0023	0,0032	0,5471	0,5849
Medium	-0,0007	0,0042	0,0039	0,0058	0,0040	-0,0047	-1,3544	0,1770
Big	0,0052	0,0020	0,0017	0,0065	0,0011	0,0042	1,3721	0,1714
All	0,0023	0,0018	0,0044	0,0061	0,0020	0,0003	0,1013	0,9194
Panel B: Value-weighted portfolio returns								
Small	0,0059	-0,0067	0,0023	0,0085	0,0026	0,0033	0,5324	0,5950
Medium	-0,0010	0,0024	0,0050	0,0056	0,0032	-0,0042	-1,1522	0,2505
Big	0,0063	0,0026	0,0010	0,0039	0,0011	0,0052	1,1212	0,2634
All	0,0062	0,0030	0,0024	0,0005	0,0028	0,0035	0,7240	0,4698

The next portfolio returns under investigation are quintile portfolios that are constructed based on changes in CAPEX from year *t*-2 to year *t*-1 and L2ASSETG, referring to asset growth rate from fiscal year ending in *t*-3 to fiscal year ending in *t*-2. This is the last one-way portfolio test and for both CAPEX and L2ASSETG portfolios, returns are calculated for EW and VW portfolios and again also 12-month rolling returns are examined.

As we can see from Table 5 Panel A and B, the spreads are slightly positive for both EW and VW portfolios. It means that growth in capital expenditures results in negative future stock returns. The average monthly spread portfolio return is 0,06% in equal-weighted portfolios and the spread in value-weighted portfolios is 0,21% on average. It means that there is no big variation in subsequent stock returns between firms that have increased their capital expenditures and firms that have decreased their capital expenditures. It is important to notice that result with CAPEX quintile portfolios is not significant either with monthly returns (t-stat EW = 0,2623, VW = 0,6132) or 12-month rolling average monthly returns (t-stat EW = -0,3248, VW = 1,6685)

Panels C and D in Table 5 present corresponding results when quintile portfolios are constructed based on L2ASSETG. In some previous studies, it has been examined that the anomaly is not restricted to exist only for one year after growth in total assets (Cooper et al. 2008). When observing EW portfolio monthly returns in panel C, high-growth firms have an average monthly return of 0,69% while low-growth firms have an average monthly return of 1,07%. Low-growth firms overperform high growth firms with a 0,38% monthly spread. The annual spread is 4,68% for all stocks in EW portfolios. The monthly average spread is not significant (t-stat = 1,7028) but 12 months rolling returns spread is highly significant (t-stat = 5,3038).

When observing results with VW portfolios, we can see that low-growth firms tend to overperform high-growth firms with a significant 1,31% monthly spread (t-stat = 2,7671). This spread is 16,85 % annually. The spread remains quite similar with 12 months rolling average returns, resulting significant 1,31% monthly spread (t-stat = 8,932)

To sum up the result from portfolio-level tests, it seems that asset growth rate alone does not have a statistically significant connection with stock returns one year after asset growth. When adjusting the volatility of portfolios by calculating 12-month rolling average returns, it seems that an asset growth effect might exist among big companies.

Growth in total assets seems to have a negative relationship with total returns if a one-year lagged growth rate is considered.

Table 5. CAPEX and L2ASSETG quintile raw portfolio returns

This table reports raw quintile portfolio returns. Stocks are sorted into five portfolios based on their growth rates in capital expenditures (Panel A and B) and lagged asset growth rates (Panel C and D) in June of each year *t* from 2003 to 2021. Sorting is based on year-on-year percentage change from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year. Equal-weighted average monthly portfolio raw returns are reported in Panels A and C, and Panels B and D report average monthly value-weighted raw portfolio returns. Spread portfolio reports the difference in raw returns of extreme portfolios. 12-month rolling returns present average monthly returns from the previous 12 months, and they are calculated for each month. Extreme portfolios are low growth portfolio (quintile 1) and high growth portfolio (quintile 5).

CAPEX

	CAPEX Growth Quintiles					Spread	t (spread)	*p* value	12 months rolling returns		
	1 (low)	2	3	4	5 (high)				Spread	t (spread)	*p* value
Panel A: Equal-weighted portfolio returns											
1	0,0086	0,0102	0,0103	0,0110	0,0080	0,0006	0,2623	0,7933	-0,0002	-0,3248	0,7457
Panel B: Value-weighted portfolio returns											
1	0,0086	0,0104	0,0071	0,0104	0,0065	0,0021	0,6132	0,5404	0,0016	1,6685	0,0967

L2ASSETG

	Lagged Asset Growth Quintiles					Spread	t (spread)	*p* value	12 months rolling returns		
	1 (low)	2	3	4	5 (high)				Spread	t (spread)	*p* value
Panel C: Equal-weighted portfolio returns											
1	0,0107	0,0055	0,0117	0,0113	0,0069	0,0038	1,7028	0,0900	0,0032	5,3038	0,0001
Panel D: Value-weighted portfolio returns											
1	0,0156	0,0046	0,0099	0,0091	0,0025	0,0131	2,7671	0,0061	0,0131	8,9832	0,0001

5.2 Fama-MacBeth regressions results

Next, I will move on from portfolio tests to stock-level regressions. In this section, the focus is on individual stock levels rather than on quintile portfolios. Fama-MacBeth cross-sectional regressions are performed to determine if an asset growth effect exists at the individual stock level. I also seek to determine if any other growth-related, or return-based firm characteristics have a relationship with stock returns individually or with asset growth rate.

Fama-MacBeth regressions results are reported in Table 6 and Table 7. Both regression tables include 12 regression models with a variety of independent variables. The annual total return for an individual stock is the dependent variable in every regression and model. My sample period is 19 years, so there is a maximum of 19 observations per stock, depending on the delisting or listings of individual stocks. Following Jegadeesh & Titman (1993), Fama & French (1993), and Cooper et. al. (2008), book-to-market and market value are base control factors that are included in every model.

In Table 6, annual stock returns are regressed on asset growth rate, lagged asset growth rates, capital expenditures, and lagged capital expenditures. In model 2, the coefficient of asset growth rate (ASSETG) is positive but statistically insignificant, with a p value of 0,232. Asset growth seems to have a positive relation with future stock returns at individual stock level when market value and book-to-market are used as control factors. Unlike the portfolio test in Table 5, L2ASSETG has a positive coefficient estimate in model 3 regardless of being highly insignificant.

L4ASSETG in model 5 and LCAPEX in model 7 have positive coefficient estimates but they are statistically insignificant. CAPEX has as well insignificant negative coefficient, which is not in line with Lipson et. al. (2011) who documented that CAPEX has a significant negative impact on future stock returns. In model 4, when L3ASSETG is added to regression, we can see a statistically significant positive coefficient, the estimate being 0,056 with a p value of 0,031. This indicates that lagged asset growth rate results in higher stock returns with 3 years lag. Significance disappears when L3ASSETG is regressed together with ASSETG in model 9.

The coefficient estimate of market value is positive and statistically significant in most of the models, indicating that firms with greater market values tend to achieve higher returns in the future. The book-to-market ratio has as well positive relationship with future returns, but this relation is not statistically significant in any model.

Table 6. Fama-MacBeth regressions of annual stock returns on Asset growth and other measures I

This table presents estimate coefficient and *p* values from Fama-MacBeth regressions at an individual stock level. All stocks listed in OMX Helsinki stock exchange market between 2003-2021 are included in the sample, except stocks that have been listed under 5 months before the time period under observation. For every stock each year, average annual returns are regressed on lagged financial characteristics. The two-step Fama-MacBeth regression is repeated every year. Variable formulas are presented in more detail in Appendix. The *p* values are reported in parentheses.

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Intercept	0,047	0,044	0,053	0,045**	0,048	0,046	0,044	0,050	0,043	0,045	0,045	0,041
	(0,331)	(0,352)	(0,029)	(0,348)	(0,315)	(0,357)	(0,364)	(0,298)	(0,364)	(0,330)	(0,352)	(0,384)
BM	0,011	0,140	0,011	0,013	0,010	0,010	0,012	0,013	0,015	0,013	0,012	0,014
	(0,521)	(0,425)	(0,533)	(0,443)	(0,571)	(0,558)	(0,513)	(0,471)	(0,371)	(0,467)	(0,470)	(0,425)
MVALUE	0,010*	0,010*	0,010*	0,010*	0,010*	0,010*	0,010*	0,010*	0,010*	0,010*	0,010	0,010
	(0,032)	(0,026)	(0,034)	(0,033)	(0,0411)	(0,033)	(0,027)	(0,031)	(0,026)	(0,034)	(0,030)	(0,023)
Asset growth rate measures												
ASSETG		0,069						0,073	0,060	0,067	0,078	0,064
		(0,232)						(0,190)	(0,297)	(0,242)	(0,202)	(0,244)
L2ASSETG			-0,001					-0,012				
			(0,994)					(0,805)				
L3ASSETG				0,056*					0,051			
				(0,031)					(0,071)			
L4ASSETG					0,038					0,042		
					(0,490)					(0,464)		
CAPEX						-0,009					-0,015	
						(0,548)					(0,328)	
LCAPEX							0,003					0,003
							(0,790)					(0,789)

***, ** and * indicate significance at the 0,1%, 1% and 5% levels, respectively.

I have done the similar Fama-MacBeth two-step regressions in Table 7, with same base factors and ASSETG as one of the independent variables. The other independent variables that are regressed on average annual returns each year are average idiosyncratic volatility from July in year *t*-1 to June in year *t* (IVOL), illiquidity measure AMIHUD, the ratio of capital expenditures to net property, plant, and equipment in year ending *t*-1 (PS) and momentum factors BHRET06 and BHRET36.

Base factor MV remains statistically significant and positive in models 1, 2, 5, and 10. In model 3, when I add idiosyncratic volatility (IVOL) to regression, the IVOL coefficient is negative and statistically significant with a *p* value of 0,013. IVOL coefficient remains statistically significant when it is regressed together with ASSETG in model 8. These results are similar to Lipson et al. (2011) who documented that IVOL, as a proxy for holding costs, has a great impact on stock returns. In model 5 we can see a positive coefficient for PS, but the results are insignificant. Both momentum factors have positive and statistically significant coefficient estimates individually and together with ASSETG.

With these results, it can be said that there is no statistically significant link between future stock returns and asset growth rate in Finland over the period July 2003 through June 2022. Contrariwise, ASSETG has a positive coefficient estimate in every model. L3ASSETG results in a positive coefficient with a statistically significant p value. Table 6 documents a statistically significant positive relationship between both momentum factors (BHRET06 and BHRET36) and stock returns and a negative relationship between idiosyncratic volatility (IVOL) and stock returns. The link between base factor MV and stock returns is positive and statistically significant in most of the models

Table 7. Fama-MacBeth regressions of annual stock returns on Asset growth and other measures II

This table presents estimate coefficient and *p* values from Fama-MacBeth regressions at an individual stock level. All stocks listed in OMX Helsinki stock exchange market between 2003-2021 are included in the sample, except stocks that have been listed under 5 months before the time period under observation. For every stock each year, average annual returns are regressed on lagged financial characteristics. The two-step Fama-MacBeth regression is repeated every year. Variable formulas are presented in more detail in Appendix. The *p* values are reported in parentheses.

Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Intercept	0,047	0,044	0,143**	0,047	0,028	0,048	0,041	0,126*	0,043	0,033	0,045	0,039
	(0,331)	(0,352)	(0,01)	(0,311)	(0,596)	(0,337)	(0,402)	(0,015)	(0,333)	(0,525)	(0,356)	(0,413)
BM	0,011	0,140	0,004	0,009	0,017	0,010	0,022	0,007	0,012	0,015	0,012	0,021
	(0,521)	(0,425)	(0,810)	(0,605)	(0,366)	(0,579)	(0,221)	(0,709)	(0,509)	(0,393)	(0,484)	(0,229)
MVALUE	0,010*	0,010*	0,004	0,008	0,011*	0,008	0,006	0,004	0,008	0,010*	0,008	0,006
	(0,032)	(0,026)	(0,338)	(0,218)	(0,027)	(0,076)	(0,195)	(0,314)	(0,120)	(0,023)	(0,071)	(0,200)
Asset growth rate measures												
ASSETG		0,069						0,048	0,055	0,065	0,063	0,012
		(0,232)						(0,404)	(0,326)	(0,273)	(0,262)	(0,839)
IVOL			-0,787*					-0,751*				
			(0,013)					(0,022)				
AMIHUD				-0,002					-0,002			
				(0,588)					(0,597)			
PS					0,046					0,023		
					(0,278)					(0,620)		
BHRET06						0,125**					0,127**	
						(0,008)					(0,007)	
BHRET36							0,051*					0,048*
							(0,017)					(0,033)

***, ** and * indicate significance at the 0,1%, 1% and 5% levels, respectively.

5.3 Double-sorted portfolio results

Next, I will move back to portfolio-level tests to examine further the results from the Fama-MacBeth regressions. These next regressions are done with double-sorted portfolios. The first step is to sort all firms each year based on prior results of characteristics under observation into three groups. The characteristics investigated in these double-sorted portfolios are IVOL, AMIHUD, CAPEX, and BHRET06.

The second step is to further allocate stocks into five portfolios based on total asset growth rates. There are 15 portfolios for each year and each model. This method is similar to a method done with three size groupings before. Border values for groupings are again 30th percentile and 70th percentile.

Table 8 represents double-sorted raw portfolio returns when stocks are first sorted based on their idiosyncratic volatility (IVOL). Idiosyncratic volatility is an important measure of holding costs and previous studies have demonstrated its importance when explaining mispricing (Pontiff 2006). The asset growth effect should be greater for high IVOL stocks according to Lipson et. al (2011), who examined the double-sorting portfolio tests with the same procedures.

In Panel A, the asset growth effect does not exist at any level of IVOL. Spread is negative for every group when portfolios are equally weighted. Monthly spreads are between -0,03% and -0,50%. Monthly results are statistically insignificant, but significant when 12 months rolling average returns are considered for groups 1 and 2. Interestingly, the spread results are different when portfolios are value-weighted in Panel B. Spreads are positive at medium and high levels of IVOL, being 0,36% for group 2 and 0,22% for group 3. Nevertheless, these monthly return results remain insignificant. 12 months rolling average return spreads are positive for groups 2 and 3 and statistically significant in group 2 (t-stat = 2,6343).

These results do not follow results from Lipson et al. (2011) in the US market. They examined a 1,7% monthly spread with high IVOL stocks and a 0,1% monthly spread with low IVOL stocks. Possible reasons behind variation are time-period, market characteristics, and stock characteristics. They observed results in different stock markets and during different time-period. They also found that monthly IVOL varied from 19,5% to 10,5% in different asset growth quintiles. Compared to statistics represented in Table

2, in my sample, IVOL varied between 7,23% and 10,33%. It means that IVOL is much lower, and the variation is not that great between asset growth quintiles. If the asset growth effect is greater when IVOL is high (Lipson et al. 2011), the nonexistence of the asset growth effect might be due to the low level of idiosyncratic volatility and so on the low level of holding costs in OMX Helsinki marketplace.

Table 9 represents double-sorted raw portfolio returns when stocks are first sorted based on the variable AMIHUD, which is a variable to measure the illiquidity. AMIHUD represents the transaction costs, and it considers trading volume and stock returns. Lipson et al. (2009) discovered a positive relationship between AMIHUD and returns, which is in line with expectations given that the variable is transaction cost measure.

Results in Table 9 do not directly prove that the higher level of AMIHUD increases the monthly stock returns. In Panel A, the monthly spread is positive only when AMIHUD loading is low. But the monthly return result is insignificant. 12 months rolling average monthly return spreads are significant in groups 1 and 2, but the only positive spread is still in group 1. When portfolios are value-weighted in Panel B, monthly spread returns are positive in group 1 and the result is statistically significant (t-stat = 2,0419). In groups 2 and 3, spread returns remain negative but statistically insignificant. 12 months rolling average monthly returns are again statistically significant, but the spread is positive only for group 1.

Like the results with IVOL, the results with AMIHUD double-sorted portfolio returns are not in line with Lipson et al. (2011). Again, it is necessary to compare variable statistics to better understand the difference. In Table 2, where averages of annual portfolio medians are represented, AMIHUD values decrease from 0,75 in quintile 1 to 0,20 in quintile 5. Meaning that AMIHUD is higher for quintile 1 portfolios and then declines when asset growth rates increase. Lipson et al. (2011) report a higher variety in AMIHUD measure values. In their study, the average of annual medians for quintile 1 is 4,2, 0,8 for quintile 2, 0,3 for quintile 3 and 4, and then 0,4 for quintile 5. The Illiquidity in their quintile 1 is way much greater than in my sample and the difference between quintile 1 illiquidity and the illiquidity of other quintiles. This is probably one reason for the different results. Once again, it is also important to remember that liquidity in general has been different in the time under their investigation (1968-2006).

Table 8. Double-sorted portfolio returns - IVOL

This table reports raw double-sorted quintile portfolio returns. Stocks are first sorted into three portfolios based on their monthly average IVOL from July in year *t*-1 to June in year *t*. After that stocks are sorted into five portfolios based on asset growth rate from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. Sorting is done in June of each year *t* from 2003 to 2021. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year. Equal-weighted average monthly portfolio raw returns are reported in Panels A and Panel B reports average monthly value-weighted raw portfolio returns. Spread portfolio reports the difference in raw returns of extreme portfolios. 12-month rolling returns present average monthly returns from the previous 12 months, and they are calculated for each month. Extreme portfolios are low growth portfolio (quintile 1) and high growth portfolio (quintile 5).

IVOL

		Asset Growth Quintiles					Spread	t (spread)	*p* value	12 months rolling returns		
		1 (low)	2	3	4	5 (high)				Spread	t (spread)	*p* value
	Panel A: Equal-weighted portfolio returns											
	1 (low)	0,0048	0,0080	0,0061	0,0107	0,0098	-0,0050	-1,9426	0,0533	-0,0054	-6,0476	0,0001
IVOL	2	0,0072	0,0123	0,0127	0,0110	0,0111	-0,0038	-1,3240	0,1868	-0,0042	-4,5580	0,0001
	3 (high)	0,0079	0,0100	0,0070	0,0129	0,0082	-0,0003	-0,0539	0,9571	-0,0008	-0,5242	0,6007
	Panel B: Value-weighted portfolio returns											
	1 (low)	0,0093	0,0082	0,0044	0,0085	0,0105	-0,0011	-0,2328	0,8161	-0,0024	-2,2308	0,0267
IVOL	2	0,0139	0,0128	0,0083	0,0157	0,0104	0,0036	0,7176	0,4738	0,0041	2,6343	0,0090
	3 (high)	0,0045	0,0117	0,0108	0,0067	0,0023	0,0022	0,3273	0,7437	0,0008	0,3763	0,7070

Table 9. Double-sorted portfolio returns - AMIHUD

This table reports raw double-sorted quintile portfolio returns. Stocks are first sorted into three portfolios based on their AMIHUD result from July in year *t*-1 to June in year *t*. After that stocks are sorted into five portfolios based on asset growth rate from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. Sorting is done in June of each year *t* from 2003 to 2021. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year. Equal-weighted average monthly portfolio raw returns are reported in Panels A and Panel B reports average monthly value-weighted raw portfolio returns. Spread portfolio reports the difference in raw returns of extreme portfolios. 12-month rolling returns present average monthly returns from the previous 12 months, and they are calculated for each month. Extreme portfolios are low growth portfolio (quintile 1) and high growth portfolio (quintile 5).

AMIHUD

		Asset Growth Quintiles					Spread	t (spread)	*p* value	12 months rolling returns		
		1 (low)	2	3	4	5 (high)				Spread	t (spread)	*p* value
	Panel C: Equal-weighted portfolio returns											
	1 (low)	0,0128	0,0072	0,0138	0,0130	0,0062	0,0066	1,8620	0,0639	0,0060	5,6156	0,0001
AMIHUD	2	0,0083	0,0076	0,0096	0,0148	0,0111	-0,0028	-0,7880	0,4315	-0,0049	-5,3121	0,0001
	3 (high)	0,0069	0,0092	0,0085	0,0129	0,0077	-0,0008	-0,1570	0,8754	-0,0015	-0,9130	0,3622
	Panel D: Value-weighted portfolio returns											
	1 (low)	0,0151	0,0074	0,0097	0,0105	0,0041	0,0110	2,0419	0,0423	0,0100	6,7078	0,0001
AMIHUD	2	0,0068	0,0108	0,0082	0,0135	0,0115	-0,0047	-0,9667	0,3347	-0,0059	-4,2186	0,0000
	3 (high)	0,0053	0,0111	0,0067	0,0085	0,0093	-0,0041	-0,6331	0,5273	-0,0051	-2,2037	0,0286

Next, I will move on from arbitrage cost sorting to double-sorting with momentum factor BHRET06 and capital expenditure growth rate CAPEX. The procedure for portfolio sorting and construction is done similarly to IVOL and AMIHUD before.

Table 10 represents results from double-sorted portfolio returns, when the first step sorting is done according to buy-and-hold stock returns 6 months before portfolio construction. Results in panel A suggest that BHRET06 increases future stock returns in all quintiles when portfolios are equally weighted. It can also be seen that the spreads between extreme portfolios are negative in all groups, spreads being statistically insignificant. Monthly average spreads vary between -0,06% and -0,19%. 12 months rolling average returns seem to have statistically significant spread in group 2.

When portfolios are value-weighted in Panel B, average monthly spreads are positive in groups 1 and 2. Meaning that low asset growth in year *t*-1 combined with low momentum stock returns seem to overperform against stocks with high asset growth rates and low momentum returns. In general, returns seem to increase in all quintiles from group 1 to group 3. This suggests that the momentum factor is important when seeking abnormal stock returns. 12 months rolling average monthly return spread is positive and statistically significant for group 2 and negative and statistically significant for group 3.

In Table 11, stocks are first sorted based on capital expenditure growth rate into three groups and then again into five portfolios. The monthly average spread is positive for groups 1 and 2, but both are statistically insignificant in EW portfolios. In group 3, the 12-month average monthly return spread is -0,66% and statistically significant (t-stat = -5,5892). Other 12-month average monthly spreads are insignificant.

In value-weighted portfolios, the quintile 1 portfolio overperforms quintile 5 by 1,64% monthly spread in group 1 and this result is statistically significant (t-stat = 2,1897). The other monthly spreads are statistically insignificant. In 12-month average monthly return spreads, there are statistically significant results in groups 1 and 3.

The results in Table 11 suggest that capex and asset growth rates together have a negative relationship with future stock returns when capital expenditures growth has been at a low level. The conclusion from VW group 1 spread return might be that when total assets increase, but it is not due to capital expenditures, the result is lower stock returns in the future. In this scenario, total assets grow because of the growth in other balance sheet items, such as loans, accruals, account payables, account receivables, or some other. These might not be positive for investors and thus results in lower future stock returns. This is observed further in subcomponent tests in Section 5.4.

Table 10. Double-sorted portfolio returns – BHRET06

This table reports raw double-sorted quintile portfolio returns. Stocks are first sorted into three portfolios based on their buy-and-hold stock returns from January to the end of June in year *t*. After that stocks are sorted into five portfolios based on asset growth rate from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. Sorting is done in June of each year t from 2003 to 2021. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year. Equal-weighted average monthly portfolio raw returns are reported in Panels A and Panel B reports average monthly value-weighted raw portfolio returns. Spread portfolio reports the difference in raw returns of extreme portfolios. 12-month rolling returns present average monthly returns from the previous 12 months, and they are calculated for each month. Extreme portfolios are low growth portfolio (quintile 1) and high growth portfolio (quintile 5).

BHRET06

		Asset Growth Quintiles					Spread	t (spread)	*p* value	12 months rolling returns		
		1 (low)	2	3	4	5 (high)				Spread	t (spread)	*p* value
	Panel A: Equal-weighted portfolio returns											
	1 (low)	0,0050	0,0040	0,0083	0,0102	0,0063	-0,0013	-0,2203	0,8754	-0,0027	-1,9366	0,0541
BHRET06	2	0,0088	0,0079	0,0096	0,0127	0,0107	-0,0019	-0,6628	0,5081	-0,0030	-3,0792	0,0023
	3 (high)	0,0113	0,0117	0,0153	0,0128	0,0120	-0,0006	-0,1564	0,8758	-0,0016	-1,3470	0,1794
	Panel B: Value-weighted portfolio returns											
	1 (low)	0,0081	0,0103	0,0043	0,0071	0,0063	0,0018	0,2666	0,7901	0,0015	0,9225	0,3573
BHRET06	2	0,0179	0,0075	0,0073	0,0102	0,0093	0,0086	1,6571	0,0989	0,0077	5,3322	0,0000
	3 (high)	0,0053	0,0112	0,0120	0,0139	0,0139	-0,0086	-1,6271	0,1051	-0,0098	-5,5216	0,0001

Table 11. Double-sorted portfolio returns – CAPEX

This table reports raw double-sorted quintile portfolio returns. Stocks are first sorted into three portfolios based on their growth rate in capital expenditures. After that stocks are sorted into five portfolios based on asset growth rate from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. Sorting is done in June of each year *t* from 2003 to 2021. The portfolios are held for 1 year, from July of year *t* to June of year *t*+1. The portfolios are restructured every year. Equal-weighted average monthly portfolio raw returns are reported in Panels A and Panel B reports average monthly value-weighted raw portfolio returns. Spread portfolio reports the difference in raw returns of extreme portfolios. 12-month rolling returns present average monthly returns from the previous 12 months, and they are calculated for each month. Extreme portfolios are low growth portfolio (quintile 1) and high growth portfolio (quintile 5).

CAPEX

		Asset Growth Quintiles					Spread	t (spread)	*p* value	12 months rolling returns		
		1 (low)	2	3	4	5 (high)				Spread	t (spread)	*p* value
Panel A: Equal-weighted portfolio returns												
	1 (low)	0,0105	0,0061	0,0109	0,0150	0,0058	0,0047	1,0134	0,3120	0,0025	1,8103	0,0716
CAPEX	2	0,0112	0,0110	0,0092	0,0113	0,0108	0,0004	0,1400	0,8888	-0,0001	-0,1436	0,8860
	3 (high)	0,0032	0,0105	0,0082	0,0122	0,0084	-0,0052	-1,3437	0,1804	-0,0066	-5,5892	0,0000
Panel B: Value-weighted portfolio returns												
	1 (low)	0,0177	0,0061	0,0064	0,0118	0,0012	0,0164	2,1897	0,0296	0,0138	6,2400	0,0001
CAPEX	2	0,0138	0,0107	0,0034	0,0101	0,0135	0,0003	0,0571	0,9545	0,0003	0,1830	0,8550
	3 (high)	0,0074	0,0102	0,0101	0,0078	0,0119	-0,0045	-0,7729	0,4404	-0,0053	-2,8508	0,0048

5.4 Subcomponent tests results

After examining the asset growth effect as a whole with various tests, I will next focus on subcomponents of asset growth and balance sheet. I follow Cooper et al. (2008) and decompose balance sheet items into the major accounting components. My previous tests do not suggest that the asset growth effect exists in Finland. Thus, by decomposing the asset growth, it is possible to observe if any major balance sheet components have a negative relationship with subsequent stock returns.

I separate the balance sheet into two parts: the asset investment and asset financing part. This decomposition is similar to accounting principles. The asset investment consists of the left-hand side of the balance sheet and asset financing consists of the right-hand side of the balance sheet. I mainly follow Cooper et al. (2008) in decomposition. The only exception is in intangible assets, which are separated from Property, plant, and equipment in my thesis. I decompose the asset investment as follows:

Total asset growth (ASSETG)
= Cash growth (CASH)
+ Noncash current assets (CA)
+ Property, plant and equipment growth (PPE)
+ Intangible assets growth (IA)
+ Other assets growth (OA)

Other assets are calculated as total assets minus all other above-mentioned accounting groups. Noncash current assets are defined as current assets minus cash. All groups are defined in appendices in more detail. A similar process is repeated with the right-hand side of the balance sheet. I decompose the asset financing as follows:

Total asset growth (ASSETG)
= Stock financing growth (STOCK)
+ Retained earnings growth (RE)
+ Debt financing growth (DEBT)
+ Operating liabilities growth (OPL)

Stock financing variable includes common equity, preferred stocks, and minority interests, but retained earnings are excluded from this subcomponent. Debt is calculated from short-term and long-term interest-bearing liabilities. Operating liabilities are calculated as total assets less all other subcomponents. Again, more detailed definitions are in Appendix.

Fama-MacBeth (1973) regressions are employed to examine the relationships between subcomponents and stock returns. First, I run the regression for each subcomponent individually and the results are reported in Table 12 (model 1-5 in panel A and model 1-4 in panel B). Finally, all subcomponents for both parts are regressed together on annual stock returns (model 6 in panel A and model 5 in panel B). For each growth subcomponent, the growth ratio is calculated as a change in balance sheet value from the fiscal year ending in *t*-2 to the fiscal year ending in *t*-1. All data is from Refinitiv eikon datastream.

Results from investment assets regressions on annual stock returns are reported in Table 12, panel A. These results suggest that cash growth and intangible assets growth have positive coefficients, but only change in cash has a statistically significant relationship with stock returns (p value = 0,019). Interestingly, the growth in cash was the only investment subcomponent that did not have a statistically significant coefficient in Cooper et al. (2008) study. Growth in noncash current assets, property, plant and equipment, and other assets in turn have negative coefficients. These coefficients are still statistically insignificant. When all subcomponents are regressed together with annual stock returns in model 6, it seems that none of the components have a statistically significant relationship with stock returns.

Turning to the right-hand side of the balance sheet, we can see that growth in interest-bearing liabilities (DEBT) is the only financing asset that has a statistically significant coefficient estimate (p value = 0,013). The coefficient estimate for Debt is -0,020. This is in line with Spiess and Affleck-Graves (1999), who documented the long-run underperforming of companies that have issued new debt. Other operating liabilities and retained earnings have as well negative coefficients, while stock financing is the only subcomponent with positive coefficients. The negative coefficient for debt remains statistically significant when the regression on all financing subcomponents is performed in model 5.

Table 12. Fama-MacBeth regressions of annual stock returns on subcomponent growth rates

This table represents coefficient estimates from Fama-MacBeth regressions of annual stock total returns on subcomponents of growth in total assets. Time-period is from July 2003 to June 2022 and the two-step regression is calculated each year. Asset investment decomposition is reported in Panel A, and it is defined as cash (CASH) + Noncash current assets (CA) + Property, plant, and equipment (PPE) + intangible assets (IA) + Other assets (OA). In panel B, asset financing decomposition consists of Stock financing (STOCK), Retained earnings (RE), Debt financing (DEBT), and Operating liabilities (OPL). The *p* values are reported in parentheses.

Panel A: Asset investment decomposition

Model	1	2	3	4	5	6
Intercept	0,135*	0,144*	0,143*	0,140*	0,138*	0,136*
	(0,026)	(0,018)	(0,021)	(0,023)	(0,023)	(0,022)
Investment subcomponents						
CASH	0,013*					0,012
	(0,019)					(0,142)
CA		-0,037				-0,219
		(0,149)				(0,567)
PPE			-0,009			0,004
			(0,414)			(0,808)
IA				0,001		-0,007
				(0,908)		(0,584)
OA					-0,001	-0,001
					(0,659)	(0,796)

Panel B: Asset financing decomposition

Model	1	2	3	4	5
Intercept	0,141*	0,141*	0,141*	0,144*	0,144*
	(0,022)	(0,021)	(0,022)	(0,019)	(0,019)
Financing subcomponents					
STOCK	0,001				-0,004
	(0,909)				(0,648)
RE		-0,011			-0,009
		(0,103)			(0,163)
DEBT			-0,020*		-0,020*
			(0,013)		(0,019)
OPL				-0,005	0,001
				(0,739)	(0,978)

***, ** and * indicate significance at the 0,1%, 1% and 5% levels, respectively.

6 Summary

In this thesis, the asset growth effect was studied in Finnish Stock Exchange. I have conducted different regressions, some at portfolio level and some at individual stock level. When the asset growth effect is measured as a negative relation between asset growth from the financial year ending in *t*-2 to *t*-1 and total stock returns from the beginning of July in year *t* to the end of June in year *t*+1, my results do not suggest the existence of the anomaly. On a portfolio level, there are signs of the asset growth effect in both equal-weighted and value-weighted portfolios. However, these results do not reach statistical significance. The only exception is the medium-sized grouping where the spread is negative. Further, the results remain similar when returns are risk-adjusted with the Fama and French three-factor model.

Possible reason for non-existence of the asset growth effect is in idiosyncratic volatilities. Lipson et al. (2011) documented that the asset growth effect exists only among stocks with high idiosyncratic volatility. The idiosyncratic volatilities are overall low for stocks in my sample compared to Lipson et al. (2011) sample. The other difference is in idiosyncratic volatility levels between asset growth quintiles. They detected greater variation in extreme quintile portfolio medians.

Interestingly, Fama-MacBeth regressions even suggest that asset growth has a positive relationship with subsequent stock returns. This result from individual stock-level tests is the opposite of what is expected and what is documented in most of the previous studies. It is still important to understand that results differ between countries in previous studies. Watanabe et al. (20113) and Titman et al. (2013) both documented insignificant results in Finland and their portfolio spreads were smaller than the spreads observed in this thesis. Thus, the most of my results are in line with previous literature even though time periods vary.

When asset growth is measured with lagged growth rate and portfolios are value-weighted, there is a statistically significant negative relationship with subsequent stock returns. This is the only significant result from one-way sorted portfolio tests, and it suggests the Titman et al. (2013) proposition of investors' tendency to misprice past growth. A high asset growth rate may be a sign of overinvestment and investors may not realize the agency problem associated with overinvestment. Thus, they overvalue a company with high investment levels since they overvalue the future cash flows from upcoming projects. The low returns following asset growth are a consequence of the market correcting the initial overpricing. (Titman et al. 2013). The market correction might take place two years after growth in my sample.

In double-sorted portfolios, a low capital expenditures growth rate combined with a low asset growth rate seems to overperform against low capital expenditures combined with a high asset growth rate. The conclusion might be that when total assets increase, but it is not due to capital expenditures, the result is lower stock returns in the future. In this scenario, total assets grow because of the growth in other balance sheet items than fixed assets. Decomposed asset growth regressions suggest that such a negative impact subcomponent might be growth in total debt. The results from AMIHUD double-sorted portfolio tests suggest that the asset growth effect exists in Finland among stocks with high liquidity. The possible explanation for the result is that among more liquid stocks' submarket is more efficient and thus stock prices are closer to their actual values. Watanabe et al. (2013) documented in their international study that the magnitude of the asset growth effect is greater in more efficient markets.

When considering the research questions, it can be said that statistically significant Asset growth effect do not exist in Finland without controlling. The size of the company has an impact on portfolio spreads, but the results are still insignificant. When using lagged asset growth rate as a proxy for growth, the asset growth effect exists and is significant. Transaction costs impact on asset growth effect and the effect exists with significant results when portfolios are first sorted based on illiquidity and then based on asset growth rates. Asset growth effect exists among liquid stocks. The results suggest that when asset growth is based on growth in other than fixed assets, the growth has a negative relationship with future stock returns. Debt seems to have negative and cash positive relation with subsequent stock returns.

The findings in my thesis raise a few future research questions. First, as seen in my results, the asset growth effect does not exist in the Finnish stock market while the effect is strong in Sweden and Denmark (Watanabe et al. 2013). One could investigate if there any country-specific characteristics among Nordic markets, industries, or companies that explain the variation in results. Secondly, one could examine if there are some specific industries where this anomaly exists or on the other hand industries that cause the nonexistence in the whole market.

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Appendices

Appendix 1: Definitions of asset growth and other growth measures

All data codes refer to data items in Refinitiv Eikon Datastream.

ASSETG: ((WC02999, t-1) / (WC02999, t-2) -1), where WC02999 is the total assets.

L2ASSETG: ((WC02999, t-2) / (WC02999, t-3) - 1), where WC02999 is the total assets.

L3ASSETG: ((WC02999, t-3) / (WC02999, t-4) - 1), where WC02999 is the total assets.

L4ASSETG: ((WC02999, t-4) / (WC02999, t-5) - 1), where WC02999 is the total assets.

CAPEX: ((WC04601, t-1) / (WC04601, t-2) -1), where WC04601 is the capital expenditures.

LCAPEX: ((WC04601, t-2) / (WC04601, t-3) -1), where WC04601 is the capital expenditures.

PS: ((WC04601, t-1) / (WC02501, t-2)), where WC04601 is the firm's capital expenditures and WC02501 is the net property, plant, and equipment of the firm.

BM: ((WC03501, t-1) / (P, t-1 * WC05301, t-1)), where WC03501 is common shareholders equity, P is the share price and WC05301 is common shares outstanding.

Appendix 2: Definitions of balance sheet subcomponents

All data codes refer to data items in Refinitiv Eikon Datastream.

CASH: ((WC02005, t-1) / (WC02005, t-2) - 1), where WC02005 is the amount of cash.

CA: ((WC02201 – WC02005, t-1) / (WC02201 – WC02005, t-2) – 1), where WC02005 is the amount of cash and WC02201 is total current assets.

PPE: ((WC02501, t-1) / (WC02501, t-2)), where WC02501 is the net property, plant, and equipment of the firm.

IA: ((WC02649, t-1) / (WC02649, t-2)), where WC02649 is the total intangible assets of the firm.

OA: ((WC02999 – WC02005 – WC02201 – WC02501 – WC02649, t-1) – (WC02999 – WC02005 – WC02201 – WC02501 – WC02649, t-2) – 1), where WC02005 is the amount of cash, WC02201 is total current assets, WC02501 is the net property, plant, and equipment of the firm and WC02649 is the total intangible assets of the firm.

STOCK: ((WC03501 + WC03426 – WC03495, t-1) / (WC03501 + WC03426 – WC03495, t-2) -1), where WC03501 is common shareholders' equity, WC03426 is minority interest and WC03495 is retained earnings.

RE: ((WC03495, t-1) / (WC03495, t-2) -1), where WC03495 is retained earnings.

DEBT: ((WC03255, t-1) / (WC03255, t-2) -1), where WC03255 is total debt.

OPL: ((WC02999 – WC03501 + WC03426 - WC03495 + WC03495 + WC03255, t-1) / ((WC02999 – WC03501 + WC03426 - WC03495 + WC03495 + WC03255, t-2) – 1), where WC03501 is common shareholders' equity, WC03426 is minority interest, WC03495 is retained earnings and WC03255 is total debt.