

Asset growth anomaly in the UK stock market

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ASSET GROWTH ANOMALY IN THE UK STOCK MARKET

PURPOSE OF THE STUDY

This study examines the existence and the characteristics of the asset growth anomaly in the UK stock market. Especially I concentrate on the asset pricing impact of asset growth on cross-sectional stock returns in the stock market. This study is the first to investigate the asset growth anomaly in this scope in another major stock market, i.e. UK stock market.

DATA

The sample data consists of all UK stocks listed in London stock exchange between January 1982 and June 2009. All financial companies are excluded from the sample. The market data and accounting information are collected from Thomson Reuters Datastream. The final sample consists of 3218 individual stocks.

RESULTS

The results indicate a negative relation between the growth in total assets and expected stock returns in the UK stock market. However the observed impact is not as strong and persisting as the previous studies have shown it to be in the US stock market.

The portfolio sorts reveal strikingly the anomaly profits were strongest among the large companies, though the anomaly was also visible among the small companies. Only among medium sized companies the anomaly are not economically viable. The regression analysis on the individual stock level indicates that the total asset growth is significant determinant of the cross-sectional stock returns. In addition to this the results also indicate that the past performance affects the anomaly profits and the stock prices are strongly reverting among high and low asset growth companies.

KEYWORDS

Asset growth anomaly, asset pricing, total asset growth, expected stock returns

TASEEN KASVUN HINNOITTELU ISO-BRITANNIAN OSAKE- MARKKINOILLA

TUTKIELMAN TAVOITE

Tutkielman tavoitteena on selvittää taseen koon muuttumiseen liittyvän osakemarkkina-anomalian ominaisuuksia Iso-Britannian osakemarkkinoilla. Erityisesti keskityn taseen kasvun ja pienenemisen vaikutusta tuleviin osaketuottoihin ja osakkeiden hinnoitteluun. Tutkielma on ensimmäinen, jossa tutkitaan kyseisen anomalian ominaisuuksia tässä mittakaavassa Iso-Britannian osakemarkkinoilla.

AINEISTO

Tutkielman aineisto koostuu Lontoon pörssissä (LSE) listattujen yritysten osaketuotoista ja tasetiedoista vuosien 1982 ja 2009 välillä. Osakemarkkinatiedot sekä tilinpäätöstiedot on haettu Thomson Reuters Datastream ohjelmasta. Lopullinen aineisto koostuu 3218 yksittäisestä osakkeesta.

TULOKSET

Tulokset osoittavat, että taseen koon muutoksen ja osaketuottojen välillä on negatiivinen suhde Iso-Britannian osakemarkkinoilla. Vaikutus ei ole kuitenkaan yhtä vahva tai kestävä kuin aikaisemmat tutkimukset Yhdysvaltojen osakemarkkinoilla ovat osoittaneet.

Erityisen vahvoja anomaliatuottoja on havaittavissa isojen ja pienten yritysten keskuudessa. Ainoastaan keskisuurten yritysten keskuudessa anomaliatuotot eivät ole taloudellisesti merkittäviä. Havaittuihin anomaliatuottoihin vaikuttaa myös merkittävästi osakkeen aikaisempi hintakehitys taseen kasvun yhteydessä. Tämän lisäksi tulokset regressioanalyysistä yksittäisten osakkeiden tasolla osoittavat, että taseen kasvu on merkittävä tekijä osakkeiden hinnoittelussa.

AVAINSANAT

Osakemarkkinoiden anomalia, taseen kasvu, odotetut osaketuotot

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1. Introduction

One of the most interesting debates in the fields of finance and accounting is the role of fundamental analysis. The possibility to systematically benefit from the analysis of companies' financial statements by forecasting the future stock price performance is by definition a violation of the semistrong form of the efficient market hypothesis (Fama 1965). Nevertheless a vast body of research in this field has linked firm characteristics or various accounting-based valuation ratios, such as earnings, cash flow yields or book-to-market ratio, to cross-sectional average returns. The association between such financial attributes and returns is documented by several researchers, including Basu (1977), Fama and French (1992), Lakonishok, Shleifer and Vishny (1994). As these kinds of relations are not explained by the pre-specified asset pricing equilibrium model or central paradigm theory they are defined as anomaly studies.

A more recent strand has focused on the return predictability of stock returns based on the growth in different balance sheet items. These studies can be divided to three broad categories, which are the growth in accruals (e.g. Sloan 1996), in investments (e.g. Titman et al., 2004) and in external financing (e.g. Pontiff & Woodgate 2008). The main findings of these studies have found a negative relation between the balance sheet items expanding activities of the company and the subsequent company's stock price performance.

In addition to the studies investigating the growth in a single variable in the balance sheet, there is a growing amount of evidence which supports the view that the changes in balance sheet size and the anomalous return patterns are related to broader asset expansion and contraction phenomenon. Cooper et al. (2008) were the first to study this asset growth anomaly by using the change in total assets as a proxy for the company's growth and found convincing evidence that the companies with low asset growth over perform companies with high asset growth. Following the footsteps of Cooper et al. (2008), several research papers (e.g. Fama & French 2008; Chan et al., 2008; Lipson et al. 2010) have found similar evidence on the asset growth anomaly and have provided a vast amount of different potential explanations for the drivers of this anomaly.

However, the previous studies related to the asset growth anomaly and other balance sheet growth anomalies have mostly been conducted in the U.S. market, although some evidence of the existence of the anomaly has also been found from Australian and Pacific-Basin markets. Thus one of the objectives of this study is to expand the current research framework in this field also to a slightly smaller and potentially less efficient stock market, i.e. to the UK stock market. This kind of analysis provides insight if the existence of the anomaly is dependent on the size and the efficiency of the stock markets and thus provides valuable evidence on this research field.

In addition to applying the basic anomaly research framework to UK markets, I will do time-series analysis of the effect to examine the stability and persistency of the effect and the relation between the effect and economic conditions. In my knowledge this kind of study has not been conducted in this context, even though the asset growth effect has been linked to some economic variables in the Pacific-Basin markets to explain the country differences. In addition to this I will also touch the relation between the asset growth effect and the momentum and reversal effects to find support for the potential drivers behind the asset growth anomaly.

1.1 Objectives of the study and the research problems

The main purpose of this study is to provide an in depth analysis on the potential relation between balance sheet growth and subsequent stock returns. In order to achieve this objective I have set for this thesis, I form my main broad research problem as following:

Q: How is balance sheet growth priced in the UK stock market? (See Table 1)

This research problem can be further divided into six separate subcategories. The first problem is to investigate the extensive literature on the growth of balance sheet anomalies in order to decide a suitable proxy for the measurement of the balance sheet growth. The second problem is to apply the current research framework to the UK stock markets in order to find evidence of the existence of the asset growth anomaly. The third problem is to determine whether there is variance in the anomaly profits over time and thus whether the anomaly is stable or potentially dependent on e.g. economic conditions. The fourth problem is to define is

there a relation between the company size and the asset growth anomaly. The fifth problem is related to a reversal effect documented in previous research and the objective is to test if the reversal effect strengthens the profits of the asset growth anomaly portfolios. The final problem is related to the persistency of the profits, which has also been documented previously on other markets. Thus, the research questions are as follows:

1. How is asset growth anomaly defined?
2. Does the asset growth anomaly exist in the UK stock markets?
3. Is the effect stable over time?
4. Does the strength of the asset growth anomaly depend on the company's size?
5. Does the past performance of the high and low asset growth companies affect the asset growth anomaly profits?
6. Is there a momentum effect on the asset growth anomaly profits over the one year time period?

The main research problem and the other sub-questions of this research are presented in Table 1. Table 1 includes also specified objectives for each research question and the methodology used to test each question.

Table 1. Research problems and the methodology of thesis

The table present the main research problem and the sub-problems, which will be studied in this thesis. The table presents also objectives for each sub-question and the methodology used to study the problem.

The research problem	Objective	Methodology
Main research problem		
How is balance sheet growth priced in the UK stock market?		
Sub-questions		
1. How is asset growth anomaly defined?	To summarise the current state of literature and find a suitable proxy for the asset growth	Literature review
2. Does the asset growth anomaly exist in the UK stock markets?	To test if the asset growth anomaly exists in the UK stock markets	Portfolio sorting method and cross-sectional tests
3. Is the effect stable over time?	To find if the asset growth portfolio strategy is affected by seasonality or by the general market condition	Portfolio sorting method and time-series analysis
4. Does the strength of the asset growth anomaly depend on the company's size?	To test if the potential asset growth anomaly is economically material within all company sizes.	Portfolio sorting method
5. Does the past performance of the high and low asset growth companies affect the asset growth anomaly profits?	To find if the portfolio returns are affected by the past performance of the stocks	Portfolio sorting method
6. Is there a momentum effect on the asset growth anomaly profits over the one year time period?	To find if the possible anomaly profits persist over the one year holding period.	Portfolio sorting method and cross-sectional tests

1.2 Limitations to the study

As mentioned in the previous chapter the main objective of this thesis is to examine how the growth in total assets is priced in the UK stock market and thus potentially give evidence of the existence of the asset growth anomaly. Therefore I will not in this thesis perform in depth analysis of potential reasons behind the anomaly and thus the main objective is not the relate the effect to either mispricing or risk-based pricing, even though a brief literature review on the potential explanations of the anomaly is given. It should still be noted that the findings of the thesis might give some evidence to support either of these perspectives.

Other potential methodological limitations are shortly discussed in the section 4.3. These limitations should be considered when interpreting the results from this study-

1.3 Main results

By utilizing the asset growth definition and measure of Cooper et al. (2008), the results from my study indicate a negative relation between the growth in total assets and expected stock returns in the UK stock market. This conclusion is supported by the results from the portfolio sorting method and the regression analysis on the individual stock level, which indicated that the total asset growth is significant and robust determinant of the cross-sectional stock returns. However the observed impact is not as strong as the previous studies have shown it to be in the US stock market. In addition to this the results from the time series analysis of the performance of the asset growth portfolio also reveals that the anomaly profits are not entirely stable during the sample period, even though there has been long periods of solid positive returns.

The multivariate portfolio sorts reveal strikingly that the anomaly profits were actually strongest among the large companies, though the anomaly was also visible among the small companies. Only among medium sized companies the anomaly are not economically viable. The absence of the anomaly profits among medium sized companies is in line with the study of Fama and French (2008), however they argue that the anomaly is only existing within small companies and microcaps. The existence of the anomaly among large companies has been previously been observed e.g. in the US market (e.g. Cooper et al. 2008, Lipson et al. 2010) and in the Australian market (Grey & Johnson 2011).

In addition to this the results from my study also indicate that the past performance affects the anomaly profits and the stock prices are strongly reverting among high and low asset growth companies. Thus by implementing multivariate sorts by past performance and the past asset growth the asset growth anomaly profits are significantly improved. This aspect of the anomaly could support the behavioural finance explanation as the relatively high past performance of the high asset growth stocks could imply an investors' overreaction to growth and vice versa with the low asset growth stocks.

Finally I find that the anomaly are not as persisting as in the other markets suggesting that the asset growth anomaly profits do not support the momentum on the UK market, which is argued by Nyberg and Pöyry (2010) regarding the profits in the US market. This aspect of the anomaly seems to be in the light of the results from this study a unique aspect in the UK stock markets.

1.4 Structure of the study

The structure of the study is as follows. The chapter 1 of the thesis starts with the introduction to the subject, including also the objectives, main results and contribution of the study to the current literature. In the chapter 2, I introduce the existing theoretical framework and empirical literature relevant for my study. This literature review concentrates mostly on financial market anomalies and most importantly introduces the asset growth anomaly framework utilized in this study. The chapter 3 presents the research questions and hypotheses, which will be tested in the study.

The empirical part of this study starts with the chapter 4, which introduces the methods and data, which will be utilized in the tests described in the chapter 5. In the chapter 6 I will analyze and discuss the empirical findings of the tests from the previous section. In the final chapter 7 I will finally summarize the conclusions and present potential extensions to the study.

2. Literature review

This chapter reviews the relevant literature of for my study. The first section briefly defines the basic theoretical framework of the efficient market hypothesis, describes the most discussed anomalies and the relevant studies conducted in this field. The second section describes the different perspectives of how the relation of firm's growth and stock returns has been studied. The third section discusses the studies using a broader measure of asset growth, which has also been adopted for this study. The fourth section provides potential theoretical explanations for the asset growth anomaly frequently used and tested in this field.

2.1 The efficient market hypothesis and capital asset pricing model

The efficient market hypothesis (EMH) has been of the most debated and researched subjects since its introduction in 1960s by the doctoral dissertation of Eugen Fama (1965). The efficient market hypothesis consists of three different forms:

1. The strong form implies that all information in markets is fully reflected in securities prices and thus insider information has no value in the markets and actually by definition does not exist.
2. The semistrong form implies that all publicly available information is fully reflected in securities prices and thus fundamental analysis has no value.
3. The weak form implies that all past market prices and data are fully reflected in securities prices and thus technical analysis has little or no value.

As can be seen from the definitions of the different efficiency forms, the main difference in the forms is how the prices reflect different levels of information. The main implication from the transparency of the information is what kind analysis would be beneficial for the investors to do in order to earn excess returns in the markets. When considering the weakest form of the efficient market hypothesis, the future stock prices cannot be predicted by analyzing past price behavior or performance. This implies that investors are not able to systematically profit from inefficiencies, even though by fundamental analysis unsystematic excess returns are possible to obtain in the short term. The implied role of analysis and the incentives for the

investors to perform different kind of analysis are important questions for the finance industry, thus still inspiring the research in the field with various hypotheses.

Even though the efficient market hypothesis is describing the basic framework and the structure of the financial markets, it does not on its own provide a tool for the asset pricing in the markets. The birth of the asset pricing theory was marked by one of the most prominent theories so far, Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) and Black (1972), which was built on the assumptions of the efficient market theory. CAPM describes the positive relation between the expected return and the beta factor of the security, which according to the principle idea of model should capture all the cross-sectional variation in expected returns. However, several studies following the introduction of CAPM have documented that the beta is not able to all the dimensions of the risk. On the other hand the debate of the suitability of CAPM is overshadowed by the fact that the model is hard to test due to difficulties in defining market portfolio. Even though CAPM has been strongly criticized, it is still widely used four decades later.

2.2 Financial market anomalies

Financial market anomalies are by definition patterns in cross-sectional and time series stock returns that are not predicted by a central paradigm or theory. As described in previous section, the market prices are in theory formed by pre-specified equilibrium model (e.g. capital asset pricing model), which on the other hand is dependent on the central paradigm, in this case on the efficient market hypothesis, and thus a discovery of an anomaly implies either market inefficiency or an incorrect equilibrium model. This duality of a potential explanation or in other words, the joint hypothesis problem, is important as the existence of an anomaly can be easily interpreted only as evidence of market inefficiency by ignoring the possibility of failure in the asset pricing model.

One of the important aspects related to market efficiency and anomalies is the persistency of the discovered anomaly. As the anomaly is discovered and presented in the financial publications, the investors should arbitrage the anomaly away and thus the anomaly should lose its economic significance over time. Therefore if the evidence of the persistency of the anomaly is discovered, this evidence potentially implies that the anomaly does not exist due

to market inefficiencies, but on the contrary due to incorrect asset pricing model used in the studies. That is, investors are pricing some kind of risk premium, which explains the certain expected return patterns in the anomaly.

On the other hand the issue is not as straightforward as presented previously, as there can exist some kind of limits to arbitrage (e.g. De Long, Schleifer, Summers and Waldman 1990 and Schleifer and Vishny 1997) in the real markets that are preventing the rational investors to arbitrage the anomaly away. These limiting factors are according to Schleifer and Vishny (1997) actually in some cases making arbitrage risky and costly, thus preventing the markets being efficient from the information perspective. As examples for these limits to arbitrage, Lam and Wei (2010) are considering in their study the following factors: information costs, transaction costs and arbitrage risk, which is frequently determined with idiosyncratic stock return volatility.

Anomalies tend to be divided in the relevant literature into three categories: fundamental, technical and calendar related. Fundamental anomalies are irregularities that emerge from the fundamental analysis of stocks value and from the factors affecting the value of the company. As mentioned in the section 2.1 if fundamental analysis provides some kind of extra value, it is a violation of the semistrong form of the efficient market hypothesis. Several fundamental anomalies have been discovered over the time, but the most documented anomalies persisting in long-term time series studies are the value anomaly and the market capitalization anomaly.

As mentioned in the previous section one of the most studied fundamental anomaly is the value and glamour stock anomaly. In this context value stocks are defined as stock with certain high price-based accounting ratio. Various ratios have been used to divide value stocks from glamour stocks, e.g. book-to-market (Fama and French 1992), earnings-to-price (Lakonishok, Schleifer and Vishny 1994) or cash-flow-to-price (Chan, Hamao and Lakonishok 1991). The general conclusion of the studies in this field is that value stocks outperform growth stock even when defined with different pricing multiples.

One of the earliest studies done in this context was the study of Basu (1977), who proves in his study that stocks with low price-to-earnings (P/E) ratio earn higher average returns than stock with high price-to-earnings ratio. The same effect has been studied in several influential papers following the framework of Basu (e.g. Fama and French 1992, Chan et al. 1991). Even

though Fama and French (1992) find that size and book-to-market equity capture the cross-sectional variation in average stock returns associated with P/E-ratio, it is still widely used as a part of fundamental analysis conducted in the markets.

The primary debate with value strategies, as also with all financial anomalies, is whether it is created by mispricing or by some risk factor priced in the markets. In the study of Lakonishok, Schleifer and Vishny (1994), they perform multiple tests to see if the good performance of value strategy could be explained by the fundamental risk of the companies, but fail to find any supporting evidence for this. Thus they conclude that it seems that investors are systematically and irrationally extrapolating past growth in the future expected growth, which causes this effect to persist. Thus the mispricing of the firms past performance is causing value-strategy as a contrarian investment strategy to succeed. Risk explanation of the book-to-market ratio is supported e.g. by the studies Fama and French (2002) and Vassalou and Xing (2004), whereas e.g. Griffin and Lemmon (2002) and Ali et al. (2003) find converse evidence supporting the mispricing argument. In the subsection 2.2.4 I will return to the discussion of mispricing and risk-based pricing in the context of asset growth anomaly.

Another important fundamental anomaly is the market capitalization anomaly. The first study to discover and document this effect was conducted by Banz (1981). He finds that stocks with low market capitalization are having much higher average stock returns than large stock, even when the profits are risk-adjusted though their beta-estimates are considered. A large number of studies have followed the study of Banz and scrutinized the anomaly more extensively, providing a large number of potential explanations for the effect. Later studies (e.g. Keim 1983, Reinganum 1983) have also linked the small-firm effect closely to seasonality and more precisely to January-effect as they show that the effect is strongest in the beginning of the year. The potential explanations for the anomaly include among others the tax-loss trading incentive and also the risk-based neglected-firm effect (Arbel and Strebel 1983).

Following the risk-based explanations for the size and book-to-market effects, Fama and French (1993) find that stocks with higher factor loadings for size or market-to-book have also higher average returns, which they interpret as evidence of a risk premium. With this evidence they provide, in the spirit of arbitrage pricing, an extension to the CAPM with inclusion of two additional risk factors: factors for market capitalization and factor for the book-to-market ratio. This model is called Fama-French three-factor model and according to

their study in cross-section, the relation between the market beta and the average stock is flat and their factors for size and book-to-market capture the cross-sectional variation in stock returns. Even though the size and book-to-market ratio are not *per se* risk factors, Fama and French (1993) state that they might be proxies for fundamental determinants of risk and thus these patterns could be consistent with the efficient market hypothesis.

From technical anomalies the most high profile anomaly, which has been shown to have explanatory power in cross-sectional stock return analysis, is the momentum effect (Jegadeesh and Titman 1993). According to the momentum anomaly the future stock returns are explained by the past three to 12 months returns, thus good past returns are explaining good future returns. Unlike many other anomalies the momentum seems to be extremely persistent and has not weakened after the first documentation of the anomaly (Jegadeesh and Titman 2001). With growing evidence of this effect, numerous studies have also extended the framework of the Fama-French three-factor model to include fourth, momentum factor (e.g. Carhart 1997).

2.2 Asset growth anomaly

This section provides more theoretical and empirical foundation to the main research objective of this thesis, the asset growth anomaly. The first subsection provides a definition of the asset growth anomaly, which will be used throughout this thesis. The second subsection introduces the different and the most important studies done on the relation between the growth in balance sheet items and the subsequent stock returns. The third subsection introduces studies done with more broad measure of asset growth. This part is significantly important to this thesis as this method is also utilized in the empirical part of this study. The last subsection provides theoretical framework for the potential explanations of the asset growth anomaly.

2.2.1 The definition of the asset growth anomaly

The previous literature (see subsection 2.2.2) has documented vast evidence on the relation between the growth in the balance sheet and the subsequent stock returns. As can be seen from the studies introduced in the following subsection, the literature has concentrated on the

growth of specific items on the balance sheet and thus has not considered the possibility that the return patterns are not driven by broader phenomenon.

In order to investigate this possibility I will define in this subsection the anomaly, which will be explored in this thesis. This general broad asset growth anomaly (described in the subsection 2.2.3) adopted in this study, will be defined in the spirit of Cooper et al. (2008) and Lipson et al. (2010). In this context I will define the asset growth anomaly, following e.g. the definition of Richardson et al. (2010), as follows:

“Asset growth anomaly is a pattern in cross-sectional and time series stock returns, according to which corporate events associated with asset expansion in the balance sheet tend to be followed by periods of abnormally low returns, whereas events associated with asset contraction in the balance sheet tend to be followed by periods of abnormally high returns.”

Potential asset expansions in the definition can be related to i.e. investment to property, acquisitions, public equity offerings, public debt offerings, and bank loan initiations. Whereas asset contraction in the balance sheet could include i.e. spinoffs, share repurchases, debt prepayments, and dividend initiations. The important aspect of this definition is that the anomaly can be driven by several different factors. These different aspects are in the previous literature linked to investment, accrual and external financing effect. Investment effect is mainly driven by the expansions and contractions in the asset side of the balance sheet, whereas, the financing effect is related to changes in liabilities side of the balance sheet. Accrual effect is related to changes both in assets and liabilities side. The studies related to these different balance sheet items are introduced in the following subsection.

In this study I will use both the terms asset growth anomaly and asset growth effect simultaneously to describe the phenomena defined in this section. In previous studies also terms “investment effect” or “investment anomaly” have been used in the same context, however as this study defines company’s investment activities as a separate subpart of the asset growth anomaly these terms are only used to describe the relation between company’s investment activities, i.e. investments to fixed assets, and stock returns.

2.2.2 Balance sheet growth studies

As mentioned in the previous subsection the studies of the relation between growth in balance sheet and the subsequent stock returns can be divided to three broad categories:

1. Accrual anomaly studies
2. Investment anomaly studies
3. External financing anomaly studies

The accrual anomaly was first documented by Sloan (1996). In his study, Sloan finds that companies with high reported accruals in one period tend to have low stock returns in subsequent period and vice versa. In this context, accruals are defined as non-cash accounting items, which are added to firm's operating cash flows to generate a firm's current reported accounting income. Sloan argues that this anomaly exist due to naïve investors fixating on bottom line earnings thus misinterpreting the cash flow and accrual components of earnings. Hirschleifer, Hou, Teoh and Zhang (2004) provide similar results and support Sloan's (1996) idea of investor fixation hypothesis.

Fairfield, Whisenant and Yohn (2003) examine the accrual anomaly in connection with growth in net operating asset. In their study they argue that according to their findings, accrual anomaly seems to be a subset of a more general growth anomaly as the stock prices act the similar manner regardless of whether the growth emerges from accruals or long-term net operating assets.

The relation between company's balance sheet growth and subsequent stock returns has also been widely studied with different proxies for the firm's investments. Titman, Wei, and Xie (2004) are utilizing capital expenditures (CAPEX) to form their measure of firm's capital investments. They study the relation of the asset growth effect and financial constraints to find evidence, how financial constraints and free cash flows affect the relation between investments and stock returns. They find that firms that are not financially constrained, measured by debt ratios, have incentive to overinvest and that free cash flows consolidate this behavior.

In addition to Titman et al. (2004) also Anderson and Garcia-Feijoo (2006) are using capital expenditures as a proxy for firm's investments. Contrary to the study of Titman et al. (2004)

they are studying the relation between investments and stock returns from the perspective of the growth option model of Berk, Green and Naik (1999), which is briefly introduced in the subsection 2.2.4. With CAPEX as a proxy for investments they also document a significant investment effect. They also find an association between this effect and the book-to-market and the capitalization effect of Fama and French (1992), according to which companies with low-book-to market value have accelerated investments and also experienced increase in market values in prior years. This evidence links the investment effect closely to these two well-known anomalies. Xing (2008) also finds similar results using in addition to growth in CAPEX as explanatory factor but also utilizing the investment-to-capital ratio, which is defined as ratio between capital expenditures and net fixed assets.

Regarding the liabilities side of the balance sheet, several studies (e.g., Ritter 1991 and Loughran and Ritter 1995) have witnessed that equity and debt issuers are underperforming the non-issuers with similar characteristics. To explain this new issues puzzle Lyandres, Sun and Zhang (2008) are in their paper exploring the phenomenon by using an investment-based hypothesis of the underperformance. The main concept behind this study is that the issuers invest more and thus due to q-theory of invest, which is explained more deeply in the section 2.4, the expected return of issuers is lower. They construct an investment factor, which measures the annual change in gross property, plant and equipment and inventories and find that this factor helps to explain the underperformance of both the debt and the equity issues. Lyandres et al. (2008) also find that this investment factor is significant explanatory factor in cross-sectional stock returns and also independent of the HML and SMB factors of Fama and French (1992).

On contrary to issuing shares repurchasing of the shares has been related to high subsequent average stock returns (Ikenberry, Lakonishok and Vermaelen, 1995). On the basis of previous evidence from stock issues and repurchases, Pontiff and Woodgate (2008) find that actually using a factor for net stock issues can capture both the impact of issuing and repurchasing of the stock. With this factor they find a significant negative relation between the net stock issues and average returns. Daniel and Titman (2006) find similar results with using net stock issues as a proxy. This line of study conducts support for the basic idea of this thesis; the asset expansions are related to low stock returns and vice versa.

The relations between these three anomalies (accrual, investment and external financing) have been also discussed in some studies. As mentioned earlier, Fairfield et al. (2003) links the accrual anomaly to larger growth anomaly. Dechow, Richardson and Sloan (2008) find that the accrual anomaly subsume the external financing anomaly as according to their study the use of external financing proceeds is the predictive factor of future returns. Also as mentioned earlier Lyandres et al. (2008) are also explaining the external financing anomaly with the investment activity of company.

As this subsection shows, the relation between the growth in different balance sheet items and the subsequent stock returns has been broadly studied and the empirical evidence is frequently related to definition of asset growth I provided in the subsection 2.2.1, according to which the corporate events associated with asset expansion are followed by periods of low stock returns and vice versa.

2.2.3 Total asset growth studies

One of the most interesting debates currently in this field is related to the question, whether these different anomalies (accrual, investment and financing), are in fact driven by the same asset expansion anomaly, which impact could be measured by using only one definition of the growth of the company. This subsection summarizes the main studies conducted using this general idea.

The first to implement a more broaden definition of the asset growth was to the study conducted by Cooper et al. (2008). In their study they define asset growth with a simple measure of previous years' growth in company's total assets. They argue that by using a broad definition of asset growth their simple measure is able to capture all components of firm's total investment and financing activities. With this simple definition they find, in contrary to the studies using narrower definition of asset growth (e.g. Fama & French 2008, Anderson and Garcia-Feijoo 2006, Xing 2008), evidence of the asset growth effect in all firm sizes, even among large companies, which frequently are left outside of the anomaly studies (see e.g. Fama and French, 2008). Using the U.S. panel data from they find that their equally weighted zero investment portfolio, which goes long in companies with low asset growth and short in companies low asset growth earn annualized risk-adjusted returns of 9.1% on

average. In addition to this the similar value weighted portfolio earned 8.4% on average. They also compare the explanatory power of asset growth factor with previously studied determinants of the cross-section of returns (i.e. book-to-market ratios, capitalization, accruals and other growth determinants). With this comparison they find that total asset growth dominates the other determinants in the predictive abilities of cross-sectional returns.

Cooper et al. (2008) also find that the asset growth effect is persistent and thus it has an impact on the stock returns over the one-year time horizon up to five years. Nyberg and Pöyry (2010) find similar results as they study the relation between momentum returns and firm expansion. In connection to this they find that the asset growth measure of Cooper et al. (2008) is significant and strong predictor of momentum returns in cross-section in the U.S. market.

Fama and French (2008) study the asset growth anomaly in their paper “Dissecting anomalies” simultaneously as they study the size, value, profitability, accruals, net stock issues, and momentum anomalies. In contrast to Cooper et al. (2008) they use total assets with an adjustment of split-adjusted shares outstanding to measure the firm’s asset growth. To avoid the problem of dominance and bias in the results of either microcaps or few large stocks, they choose to examine the average returns from separate sorts of microcaps, small stocks, and big stocks. In their study they find an asset growth anomaly in average returns of microcaps and small stock, but do not find any evidence for the existence of the anomaly for large stocks. Thus they argue that even though the asset growth anomaly is significant, it is not economically material.

Lipson et al. (2010) in their research find support for the principal idea of Cooper et al. (2008), and argues that previous research, which has found contrary evidence of the asset growth effect, e.g. study done by Fama and French (2008), have come to this conclusion due to their adjustment of the total asset growth, which causes the measurement to ignore the external financing effect, which according to them is especially important to large companies. Thus the exclusion of the net stock issuing factor explains according to Lipson et al. (2010), why the study of Fama and French (2008) fail to find the asset growth effect among the large companies.

In their study Lipson et al. (2010) also test different measures of asset growth used in past research papers, and find that the broadest definition of asset growth employed by Cooper et al. (2008), dominates the other measures in previous literature and thus subsumes the explanatory power of other growth measures. They also find that the asset growth effect is strongly linked to the idiosyncratic volatility of the company; portfolios formed of companies with low idiosyncratic volatility do not contribute to the asset growth effect. They consider idiosyncratic volatility as a strong indicator of arbitrage costs thus indicating that the asset growth effect could be explained by mispricing.

Lam and Wei (2010) find, similarly to Lipson et al. (2010) connection between the asset growth anomaly and certain limits of arbitrage: arbitrage risk, information risk and transaction costs. By using these proxies for the limits of arbitrage they find that the asset growth anomaly is stronger when limits of arbitrage are more severe supporting the arguments of Lipson et al. (2010). They also conclude that according to their evidence the asset growth anomaly is mostly driven by the poor performance of the high growth stocks, which implies that investors are overreacting to growth or underreacting to overinvestment. In contrast to studies of Cooper et al. (2008) and Lipson et al. (2010) they find that only high growth stocks are supporting the anomaly and on the basis of this they argue that the anomaly cannot be explained by risk-based arguments, as the effect is one-sided.

In conclusion from this subsection, the studies above using the total asset growth as measure of company's growth have provided robust and significant results from U.S. stock market. The recent studies (e.g. Lipson et al. 2010) have also managed to tackle some of the criticism directed against them. With these arguments, I will adapt this total asset growth measure in this study to examine the asset growth anomaly in the UK stock market.

2.2.4 Potential theoretical explanations for the asset growth effect

The previous studies have put forward several different and partially mutually exclusive arguments for potential theoretical explanations for the asset growth anomaly. The negative correlation between asset growth and stock returns is explained mainly by the two dominant ideas of either by the compensation for the risk of the company due to investments (see e.g. Lyandres et al. 2008) or due to the mispricing of growth in the markets (see e.g. Lakonishok

et al. 1994). Thus the main debate is between the rational or irrational asset pricing models. Table 2 presents an overview of the potential explanations for the asset growth effect.

Table 2. Empirical evidence on the explanations of the asset growth anomaly

The table present an overview of the potential explanations for the asset growth and its subcomponents provided by the previous empirical literature on the different factors of the asset growth anomaly: investment, accrual and external financing factors.

The examined growth factor	The provided explanation for the anomaly	Study
Accruals	Earnings management	Chan, Chan, Jegadeesh and Lakonishok (2006)
	Naïve fixation on earnings	Sloan (1996)
Investment (Capex)	Overinvestment	Titman, Wei and Xie (2004), Lam and Wei (2010)
	Q-theory of investment, stochastic discount rates	Xing (2008)
	Growth options theory	Anderson and Garcia-Feijoo (2006)
External financing	Capital structure market timing	Baker and Wurgler (2002)
	Earnings management	Teoh, Welch, Wong (1998)
Total asset growth	Investors' extrapolation of past growth	Cooper, Gulen and Schill (2008), Lam and Wei (2010)

First I will discuss the rational asset pricing explanations. As described in the section 2.2 one of the potential explanations for an anomaly to exist is a failure in the applied asset pricing model. This aspect could e.g. indicate that CAPM-model (see section 2.1) does not include all the potential risk factors priced in market and thus explaining the expected stock returns. In the context of the asset growth effect this risk-based explanation of the asset growth effect argues that companies with lower past asset growth rates are bearing some kind of risk, which is priced by the investors and due to this should have higher expected returns. In addition to this companies with high past asset growth should have lower risk factor than companies with

low growth, which explains the lower expected return. Thus according to risk-based explanations the effect exists only due to compensation of certain risk factor to investors.

As the priced risk factor is not apparent in the light of traditional asset pricing, the previous studies have provided several potential arguments for what explains the change in company's risk profile due to investments. One potential explanation for the rational asset pricing arises from the Tobin's q-theory framework adjusted by Cochrane (1991, 1996), which provides an argument for the negative expected return-investment relation. According to the investment-based asset pricing model the net present value (NPV) of company's investment is dependant on the discount factor of the project or in other words the cost of capital of the company. The total optimal amount of investments of the company is increased as the NPV increases, thus as the cost of capital, or expected return, decreases. Thus companies with low expected return are companies with high investment, which provides an argument for risk-based explanation of the asset growth anomaly in the presence of a stochastic discount factor.

Another risk-based explanation is related to the real options model (e.g. Berk, Green and Naik, 1999, Carlson, Fisher, and Giammarino, 2006, Lyandres, Sun and Zhang, 2008). According to this model companies are bearing real options related to the expansion of their different assets, thus the value of the firm is equal to the value of the assets in place and growth options. These options are considered to be riskier than the overall general composition of the company due to the uncertainty related to them. In addition to this these growth options can be considered to be "leveraged" on the existing assets (Gomes, Kogan and Zhang, 2003). As companies exercise these expansion options, their overall risk is reduced due to lower amount of options their risk profile is bearing. Thus the companies with larger growth in their assets are associated with lower returns than companies with small growth due to the lowered risk premium.

In addition to the failure in the asset pricing model, an anomaly can be interpreted as an evidence of market inefficiency (see section 2.2). The mispricing explanation of the asset growth effect has its theoretical foundation in the behavioral finance field and the studies of DeBondt and Thaler (1985) and Lakonishok, Shleifer, and Vishny (1994). According to these studies investors tend to overreact to past firm performance thus creating a reversal phenomenon on the firm's stock price. The investors tend to use excessive extrapolation of the past performance on predicting future stock performance, thus creating biased

expectations. In the asset growth framework this would imply that investors are overreacting to companies' announcements including some sort of asset expansion (i.e. acquisitions, investments to properties, public equity offerings and public debt offerings) creating overpricing of these stocks and vice versa.

Another potential explanation for the asset growth argument, partially related to the behavioral finance field, is the management's empire-building theory. This argument, following the framework of Jensen (1986), implies that the excessive accumulation of assets, and thus overinvestment, can be interpreted as impact of agency costs and the empire-building behavior of the management, which serves only their own interest. As the shareholders learn that their investment is not optimally allocated, the price adjusts to this behavior.

Behavioral finance scholars have also studied the market timing effect related to raising and retiring external financing and its relation to the subsequent stock returns (e.g. Baker & Wurgler, 2002). Baker and Wurgler (2002) find in their study that firms are more likely to issue equity when their market value is high relative to book value and to repurchase shares when the equity valuation is low due to market timing activities of the management. Thus with repurchases the stock is more likely to be undervalued and high subsequent stock returns are expected, and vice versa with stock issues.

Also earnings management has been linked to balance sheet growth anomalies. In the context of accruals, Chan, Chan, Jegadeesh and Lakonishok (2006) find that the high accruals capture the earnings management activities of the management and thus this activity explains the accrual anomaly. With the same framework, though in the relation to the external financing anomaly, Teo, Welch and Wong (1998) find that companies are managing their earnings prior to financing activities, which explains the low stock returns in the subsequent periods. Thus by conclusion these studies provide evidence that the earnings management activities can provide a potential explanation for the individual parts of the asset growth anomaly.

The main issue between the most empirical findings of the potential explanations for the asset growth anomaly is that they are mostly consistent with both mispricing and risk-based explanations. Thus it is hard to conclude if the reversal patterns are due to variation in risk or systematic mispricing of growth.

3. Hypotheses

This chapter presents the hypotheses formed in the basis of the previous literature and which will be tested in this study in order to provide sufficient answers to research questions. As defined in section 1.1 the research questions for the thesis are the following:

1. How is asset growth anomaly defined?
2. Does the asset growth anomaly exist in the UK stock markets?
3. Is the effect stable over time?
4. Does the strength of the asset growth anomaly depend on the company's size?
5. Does the past performance of the high and low asset growth companies affect the asset growth anomaly profits?
6. Is there a momentum effect on the asset growth anomaly profits over the one year time period?

As the first research problem is related to literature review, no individual hypothesis will be formed for this question. The results for this research problem are included in the literature review in chapter 2.

The second research question is related to the existence of the asset growth anomaly in the UK stock markets. As mentioned earlier I will conduct the tests in this study using the broad asset growth measure defined by Cooper, Gulen and Schill (2008), which will be introduced in the section 4.2. The studies in this field have concentrated on the U.S. market, but in addition to this also some international studies have been conducted. The empirical results imply that the asset growth anomaly defined in this manner exists in the U.S. market (e.g. Cooper et al. 2008, Lipson et al. 2010), in the Pacific-Basin region (Yao et al. 2008), Australian markets (e.g. Gray & Johnson 2009) and in several other international markets (e.g. Watanabe, Xu, Yu 2009). Thus with this existing empirical evidence, I expect the following hypothesis in relation to the second research question:

H1: The relation between the total asset growth and expected return is negative.

The third research question is related to the stability of the asset growth effect and persistency in the different states of the economy. As the previous literature has found that the asset growth effect has been found to be important explanatory variable in cross-sectional returns, I will expect that the anomaly is rather stable and is not dependent on the economic conditions or stock market development. Thus with this argumentation, I expect the following hypothesis in relation to the third research question:

***H2:** The asset growth anomaly is stable in the portfolio time-series analysis*

The fourth research question is related to the connection between the company's size and the strength or even existence of the asset growth anomaly. Earlier literature (e.g. Fama and French (2008) has provided evidence that certain anomalies are most often absent in large stocks and thus most robust in the microcaps and small stocks. As mentioned in the previous chapter Fama and French (2008) found this to be true also in regards to the asset growth anomaly. However, Lipson et al. (2010) argue that their results are biased by the fact, that the measure of asset growth in their study ignored the growth associated with equity issues, which is an important source of funding growth for large companies. As this study adapts the same measure of the asset growth utilized in the study of Lipson et al. (2010), I form the following hypothesis in relation to the fourth research question:

***H3:** The asset growth anomaly is not dependant on the size of the company.*

The fifth research question is related to interaction between the anomaly and both reversal and momentum effect. As the question consists of two different aspects, I will form two different hypotheses to define the potential effects. Earlier literature (e.g. Cooper et al. 2008, Lipson et al. 2010) document that in the portfolio sorting test the companies with high asset growth have experienced high stock returns in prior year to portfolio formation and thus a part of the asset growth effect in U.S. markets is formed of a large reversal effect in the stock returns. The similar opposite effect is documented with low growth stocks. I will in thesis touch this relation by conditioning the portfolio formation with the past stock price performance. By this method I will try to find evidence, whether the returns of the asset growth effect are stronger if the company has experienced good returns in previous year. If the asset growth effect would be stronger in companies with high past return, this could potentially imply that the investors have overreacted to the growth in total assets.

As previous studies have witnessed that in the portfolios, where asset growth exists, also a large reversal effect is apparent, I form the following hypothesis:

***H4:** Conditioning the reversal effect reinforces the asset growth anomaly.*

In addition to a reversal effect, earlier studies have documented that the asset growth effect is persistent and provides excess returns over the one-year holding period. Cooper et al. (2008) find that the low asset growth firms continue to outperform the high asset growth companies even over five year after the portfolio formation. Also Nyberg and Pöyry (2010) find evidence that asset growth effect is a strong predictor of short-term price momentum. With this evidence I expect the following hypothesis:

***H5:** Asset growth anomaly is followed by the momentum effect.*

The main research problem, sub research questions and the related hypotheses are summarized in Table 3.

Table 3. Summary of research questions and related hypotheses

The table present the main research problem and the related hypotheses, which will be studied in this thesis.

The research problem	Hypotheses
Main research problem	
How is balance sheet growth priced in the UK stock market?	
Sub-questions	
1. How is asset growth anomaly defined?	N/A
2. Does the asset growth anomaly exist in the UK stock markets?	<i>H1: The relation between the total asset growth and expected return is negative.</i>
3. Is the effect stable over time?	<i>H2: The asset growth anomaly is stable in the portfolio time-series analysis</i>
4. Does the strength of the asset growth anomaly depend on the company's size?	<i>H3: The asset growth anomaly is not dependant on the size of the company.</i>
5. Does the past performance of the high and low asset growth companies affect the asset growth anomaly profits?	<i>H4: Conditioning the reversal effect reinforces the asset growth anomaly.</i>
6. Is there a momentum effect on the asset growth anomaly profits over the one year time period?	<i>H5: Asset growth anomaly is followed by the momentum effect.</i>

4. Data and methodology

This chapter introduces the data and methodologies used in this thesis to study asset growth anomaly and to test my research hypotheses. I will start by describing the data used in this thesis. After this, in the second section, I will introduce the total asset growth measure used to define the degree of the asset growth of the company. Finally I discuss on the methodological issues between portfolio sorting method and cross-sectional regressions in examining the effect of the asset growth anomaly on stock returns.

4.1 Outline of the sample

The sample data consists of all UK stocks listed in London Stock Exchange between January 1982 and June 2009. All financial companies are excluded from the sample, which is a common practice in most anomaly studies. One reason for this procedure is that accounting principles are different with these companies and as this study relies on accounting information, this could bias the results. All stock returns and accounting information are collected from Thomson Reuters Datastream.

To ensure the reasonable amount of companies in the sample and the availability of the balance sheet information, the portfolio tests conducted in this thesis start from July 1983 and end in the June 2009. As the utilized methods require data from previous years also the data from the fiscal year 1982 is included in the sample. If company is missing any required data in one period it is excluded from the sample in that period to avoid any biases in this respective.

The descriptive statistics of the market indexes used in this study are presented in Table 4. These equally and value weighted market indexes are formed of the sample data in order to provide suitable baseline for the performance of the different sample portfolios.

Table 4. Descriptive statistics of the sample data

This table presents descriptive statistics for stock market index in UK stock market constituted by using the companies from the sample. The data consists of monthly return observations from June 1983 to July 2009. The days, when the stock exchange in question is closed, are excluded from the sample. All numbers are in decimal format, e.g. 0.01 is 1 %.

Index	Mean	Standard deviation	Minimum	Maximum	Skewness	Kurtosis
<i>Market index</i>						
Equally weighted	0,0105	0,0539	-0,2637	0,2735	-0,3977	4,1662
Value weighted	0,0088	0,0456	-0,2702	0,1253	-0,9713	4,4115

4.2 Broad measure of the asset growth

As mentioned earlier in this study, I will adapt the general asset growth measure defined and used e.g. by Cooper et al. (2008) and Lipson et al. (2010). Thus the total asset growth ratio in June of year t is defined as the percentage change in total assets from fiscal year t-2 to t-1:

$$ASSETG_t = \frac{Total\ assets_{t-1} - Total\ assets_{t-2}}{Total\ assets_{t-2}} \quad (1)$$

Where:

- $ASSETG_t$ = The asset growth ratio of the company at time t;
 $Total\ assets_{t-1}$ = The total assets of the company at time t-1; and
 $Total\ assets_{t-2}$ = The total asset of the company at time t-2.

Even though this thesis adapts the broad asset growth defined above, it is important to understand that this measure can be affected by the change in several different balance sheet items. Cooper et al. (2008) divide the different balance sheet items to asset investment and asset financing compositions. The asset investment composition is further divided as follows:

$$\begin{aligned} & \text{Total asset growth (ASSETG)} && (2) \\ & = \text{Cash growth} \\ & + \text{Noncash current asset growth} \\ & + \text{Property, plant, and equipment growth} \\ & + \text{Other assets growth} \end{aligned}$$

Whereas the financing side of the balance sheet is decomposed as follows:

$$\begin{aligned}
 &\text{Total asset growth (ASSETG)} && (3) \\
 &= \text{Operating liabilities growth} \\
 &+ \text{Retained earnings growth} \\
 &+ \text{Stock financing growth} \\
 &+ \text{Debt financing growth}
 \end{aligned}$$

4.3 Methodological issues between the cross-sectional tests and portfolio sorts

Two different approaches are often used to identify anomalies. These approaches are using either sorts of shares into portfolios based on the anomaly variable or with cross-sectional Fama-MacBeth regressions (1973). As both of the methods have their advantages and disadvantages, many studies have chosen to implement both methods simultaneously, which provides more comprehensive perspective to the research issue and a robust cross check.

The main advantage of the portfolio sorting method is its simplicity and transparency, and therefore the results are easily practically applicable. In addition to this sorts are not dependable on any specific model and thus do not pose any linear restrictions. The main drawback is that the sorting method does not define the functional form of the relation between the variable and stock returns, thus does not provide direct estimates of the marginal effects. Also sorting method allows only testing a limited number of variables thus restricting the possibility to include other potential explanatory variables to tests.

One of the main issues in the portfolio sorts methodology is the choice of the stock weights in the formed portfolios. There are two most commonly used methods for these portfolio weights: equally weighted (EW) or value weighted (VW) methods. However, the choice of method affects the potential problems the tests and the analysis of the results may confront. EW-portfolios may be dominated by micro-capitalization stocks, whereas few large stocks could potentially drive the returns of VW-portfolios. Both of these issues may bias the results and give possibility to draw invalid conclusions from the tests. Naturally these issues are affected by the structure of the sample. (Fama & French, 2008)

The cross-sectional regression provides direct estimates on the marginal effects of the explanatory variable while imposing a linear structure on the functional form of the relation between the variable and stock returns. The main advantage is naturally the possibility to include multiple variables to the equation and simultaneously examine the potential relations. However, for the chosen variable, the assumed linear form might be incorrect, which creates biased results. Also the explanatory variables in the cross-sectional analysis maybe highly correlated, i.e. suffering from multicollinearity, which may lead to invalid interpretations on the explanatory power of individual variables, even though the combined explanatory power might be unbiased.

To avoid the shortcomings of the both methods and to provide extensive overview of the asset growth effect, I will utilize both methods in this thesis. This way I will be able to measure the potential marginal estimates of the effect and also provide more evidence of the existence of the asset growth anomaly with time-series analysis.

5. Tests

This chapter introduces the tests performed in this thesis in order to test the hypotheses, defined in chapter 3. As mentioned also in the section 4.4, I will in this thesis examine the asset growth effect by using both portfolio sorts and cross-sectional stock regressions. These tests are described in the following sections.

5.1 Portfolio sorting tests

The portfolios are formed at the end of the last trading day of June each year by sorting the companies according to the total asset growth ratios of the previous year defined in the section 5.2. June is chosen as the portfolio formation in order to ensure that the investors have received the financial information from the year prior to the portfolio formation. Similar portfolio formation technique is also a convention in prior studies (e.g. Fama & French 2008; Cooper et al. 2008).

After sorting, I allocate the companies to ten equal sized portfolios according to their prior year asset growth and thus e.g. the high asset growth portfolio contains the companies with the highest 10% growth in total assets at the end of the year prior to portfolio sorting. Thereby all together ten different portfolios are formed. Portfolios will be named in a manner that the high asset growth portfolio will be called P10, the next highest asset growth portfolio will be P9 and so forth. I also report a zero investment long-short portfolio, which goes long in the low growth portfolio and short on the high growth portfolio. The holding period for the portfolios is one year and the rebalancing is performed at the end of June each year. For each portfolio I will calculate both the equally weighted and value weighted raw returns over the one-year holding period due to the reasoning presented in section 4.4.

As the number of firms listed on the main list of London Stock Exchange has varied between the sample years, also the number of stock per portfolio between years has changed. In addition to this in each year the number companies in the sample is not always dividable by the number of portfolios, therefore I have chosen that the middle portfolio P5 will include all additional companies or less companies than other companies in each. This adjustments is

done in order to achieve the same number for the high and low asset growth portfolios, which are under the main focus in this portfolio sorting method.

In order to calculate abnormal monthly returns of the portfolios, I regress the monthly excess returns over risk free rate to a simple market model. The regression equation for the model is thus the following:

$$r_{jt} - r_{ft} = \alpha_j + \beta_j (r_{mt} - r_{ft}) + \varepsilon_{jt} \quad (4)$$

where r_{jt} is the monthly return of the portfolio, r_{ft} is the risk-free rate, r_{mt} is market return, and ε_{jt} is the average monthly abnormal return of portfolio j .

In order to control potential priced risk premium I will calculate the abnormal monthly returns for the formed portfolios by regressing the raw portfolio returns to Fama-French (1993) three-factor model. The equation for this model is the following:

$$r_{jt} - r_{ft} = \alpha_j + \beta_j (r_{mt} - r_{ft}) + s_j SMB_t + h_j HML_t + \varepsilon_{jt}, \quad (5)$$

where r_{jt} is the monthly return of the portfolio, r_{ft} is the risk-free rate, r_{mt} is market return, SMB_t is the difference of returns between small and large firms, HML_t is the difference of returns between low and high market-to-book firms and ε_{jt} is the average monthly abnormal return of portfolio j .¹

To test for further robustness I will in addition to this regress the portfolios returns to the following Carhart (1997) four factor model:

$$r_{jt} - r_{ft} = \alpha_j + \beta_j (r_{mt} - r_{ft}) + s_j SMB_t + h_j HML_t + d_t UMD_t + \varepsilon_{jt}, \quad (6)$$

where in addition to the factors in model (X) also a price momentum factor (UMD) is introduced.¹

¹ The Fama-French and Carhart factors, SMB, HML and UMD are downloaded from the University of Exeter website: <http://xfi.exeter.ac.uk/researchandpublications/portfoliosandfactors/index.php>

5.1.1 Portfolio time-series analysis

The main objectives of the portfolio time-series analysis is related to questions, whether the return patterns have been stable during the whole sample time and how the economic conditions influence the return patterns of the different asset growth portfolios. With this test I will analyze the performance of both equally and value weighted long-short asset growth portfolio returns retrieved from tests described in the section 5.1. I will also separately analyze the performance of the high asset growth portfolio P10 and the low asset growth portfolio P1 in order to find if the anomaly is only driven by the performance of one of these portfolios.

The information used in this part of tests regarding economic conditions and recessions are retrieved from the website of Office for National statistics.

5.1.2 Momentum and reversal effects

In order to discover a potential momentum effect related to the asset growth anomaly (see also Cooper et al. 2008; Nyberg and Pöyry 2010), I investigate the portfolio returns also on the following five-year horizon to test if the potential effect persists more than the one-year horizon. This will be done by measuring the portfolio returns obtained from the portfolio sorting method and extending the holding period to five-years without rebalancing the portfolio.

As Cooper et al. (2008) and Lipson et al. (2010) show that the asset growth effect in U.S. stock markets is related to a strong reversal effect prior to the portfolio formation period, thus high asset growth companies have experienced good prior returns and vice versa. I will investigate whether the past performance affect the returns of the asset growth portfolios. Therefore in addition to sorting the companies by total asset growth, I will also after this, sort the stocks according to the last year's stock price performance within the asset growth groups. To ensure equally sized portfolios, the companies will be divided to three equally sized different performance classes, where thus the best performing portfolio includes companies with 33 % highest past performance and the low performing portfolio includes companies with the 33 % lowest past yearly performance. The rest of the companies are naturally allocated to medium performance portfolio. As I am mostly interested in the performance and

the behavior of the portfolios in the extreme asset growth deciles, the two-step sequential sorting method will be applied only to the stock in highest and lowest asset growth portfolios.

Thus these tests will include in total six different portfolios with different past asset growth and performance characteristics. As according to my hypothesis (see chapter 3) the asset growth effect will be accompanied by strong reversal effect, I will also calculate a zero investment portfolio, which goes long in the poor performing low asset growth stocks and goes short for the high performing high asset growth stocks. The rebalancing and the return calculations are then performed in the similar manner than in the asset growth portfolio-sorting test described in the previous chapter.

5.2 Cross-sectional tests

In order to provide more in depth analysis of the marginal effect of the asset growth to stock return, I will, in addition to the portfolio sorting method, employ the two-pass Fama and MacBeth (1973) cross-sectional regressions. In addition to this I will calculate the cross-sectional Pearson correlations in order to gain more insight of the relationships between variables and to identify potential problems of multicollinearity in the regression results.

In Fama-Macbeth cross-sectional regressions, the cross-sections of returns on stocks are on each year regressed on variables hypothesized to explain the expected returns. The obtained time-series means of the yearly regression slopes then provide the final estimates for the slopes of the variables in cross-sectional returns. (Fama and French 1992)

Thus I will run the following regression to calculate the annual estimates for the coefficients:

$$R_{it} = \gamma_{0t} + \sum_{k=1}^K \gamma_{kt} X_{kit} + \varepsilon_{it} \quad i = 1, 2, \dots, N_t, \quad t = 1, 2, \dots, T, \quad (7)$$

where R_{it} is the return on stock i in year t . N_t is the total number of stocks in year t , which may vary from year to year. T is the total number of years in the sample. X_{kit} are the potential explanatory variables in cross-sectional expected returns. As a base set of these determinants of the cross-sections of returns I will use the market beta (BETA) obtained from the full

period regression of equation (5), growth in total assets from the prior fiscal year (TAG), log of book-to-market value (BM), market capitalization (MV), and prior momentum variable 6-month lagged return (RET6M). (Fama & French 1992, Jegadeesh & Titman 1993, DeBondt & Thaler 1985)

In addition to this, to check the robustness of the results I will also include a short term reversal factor to the regressions. For this purpose I will use one month lagged returns (RET - 1). To avoid potential multicollinearity issues, I will in these regressions use the two to seven months lagged cumulative return as a proxy for potential momentum instead of six month lagged return.

To obtain the final estimates $\hat{\gamma}_k$, the time series means are considered as expected values. These values are then divided by the coefficients standard error to perform the standard t-test. The following formula will thus be used for the expected value and the variance:

$$\hat{\gamma}_k = \frac{1}{T} \sum_{t=1}^T \hat{\gamma}_{kt} \quad (8)$$

$$Var(\hat{\gamma}) = \frac{\sum_{t=1}^T (\hat{\gamma}_{kt} - \hat{\gamma}_k)^2}{T(T-1)} \quad (9)$$

The t-test is then calculated with the following formula:

$$t - statistic(\hat{\gamma}) = \frac{\hat{\gamma}_k}{s.e(\hat{\gamma}_k)} \quad (10)$$

The Pearson correlations are calculated for all regression variables used on the Fama-Macbeth regressions on monthly basis and then the time series means of the correlations are presented in the correlation matrix with relevant t-statistics.

6. Analysis and empirical results

In this chapter I present the empirical findings from the tests defined in chapter 5 and provide analysis on the results. The first part of this chapter describes the characteristics of each asset growth portfolio including the number of stock each year and the results from the simple portfolio sorting method, which uses only the total asset growth measure to form the portfolios. In the second section I concentrate on the results from the time series analysis, which is done for the asset growth portfolios. Third section is divided to two subsections and I introduce the results from the momentum and reversal analysis separately. In the final section of this chapter I introduce and discuss the results of cross-sectional Pearson correlations and Fama-Macbeth regressions to evaluate potential marginal effects of the asset growth on cross-sectional stock returns.

6.1 Characteristics and return analysis of portfolios

As the results of the portfolio sorting method can be biased by the different characteristics of the asset growth portfolios, especially if there is some extreme variation between the portfolios, e.g. dominance of small stocks or high differences in book-to-market ratios. Thus it is important to analyze the characteristics, in order to identify potential issues. Table 5 presents the characteristic of the asset growth portfolios formed with one stage portfolio sorting method. Panel A presents financial and past return characteristics of the asset growth portfolios and Panel B shows the number of individual companies in the portfolios across the sample years.

In regards to asset growth Panel A shows that the time series averages of yearly cross-sectional medians on asset growth have quite high variance between the different portfolios. Mostly the high spread between the portfolios P1 and P10 is driven by the extremely high asset growth of P10, in fact the spread between P10 and P9 is also quite high in comparison with the differences of other adjacent portfolios. It is also interesting that the time series averages of the three lowest asset growth portfolios have actually been negative thus the companies of these portfolios have on average reduced their total assets, whereas in the rest of the portfolios the total assets have on average increased.

Panel A shows also that both the low asset growth portfolio P1 and the high asset growth portfolio P10 contain on average smaller stocks in regards to market value than the peer portfolios. The largest companies are on average in the middle portfolio P5. The quite high variation in the average company size between the portfolios requires closer scrutiny, which will be performed in the section 6.2, though it is important to note that between the two portfolios P1 and P10, which are under closer dissection, the difference is not remarkably high.

Book-to-market ratios don't reveal any extreme variation between the asset growth portfolios, even though it seems that on the average book-to-market ratios are higher on the low asset growth portfolios than in the high asset growth portfolios. This characteristic has been also found in previous studies (e.g. Lipson et al. 2010), which also provided evidence that the book-to-market anomaly is separate from the asset growth anomaly. Thus this aspect is not examined more closely in the scope of this thesis, but should be considered when the results of this thesis are scrutinized. Furthermore the past return characteristics are not revealing any significant differences between the portfolios on average, even though the spread between the high and the low asset growth portfolio is slightly negative. Thus indicates that on the portfolio formation year, the low asset growth portfolio has overperformed the high asset growth portfolio and thus if the portfolio sorting would be done earlier, before the end of June, the asset growth anomaly returns could potentially be positively affected.

As can be seen from Panel B, the number of companies in each portfolio has varied across the sample years with the low point being 21 companies in each portfolio in the year 1983. Thus the number of companies should be sufficient enough in order to avoid dominance of single companies in the portfolios and to provide robust results. The one-stage portfolio sorting method allows the companies to be allocated evenly to portfolios, however, if the total number of companies is not dividable by ten then portfolio P5 includes less or more companies than the peer portfolios, which can be seen from Panel B.

The total number of companies in the London stock exchange and thus in the sample has steadily increased with exceptions in 1998 and after the burst of the IT-bubble in 2001. The total number of different individual stocks during the whole sample period is 3218 and thus almost half of these companies were listed in the final portfolio formation year 2008.

Table 5. Asset growth portfolios: Financial and return characteristics

The table presents an overview of the financial and return characteristics of the ten different asset growth portfolios. The portfolios are formed in the end of June each year t over 1983-2008 by sorting the stocks according to their total asset growth (ASSETG), which is defined as the percentage change in total assets from the fiscal year ending in $t-2$ to fiscal year ending in $t-1$. The stocks are then allocated to ten portfolios, thus the 10% highest asset growth are allocated to P10-portfolio, stocks with the 10% lowest growth are allocated to P1 and so forth. Market value (MV), in millions of €, is calculated using the closing price and the number of shares outstanding at the end of June of year t . Book-to-market ratio (BM) is calculated using the financial information from the fiscal year ending in $t-1$. RET6M is the buy-and-hold return over January to June in year t . The numbers in each cell are time series averages of yearly cross-sectional medians. All numbers, with the exception of MV, are in decimal format, e.g. 0.01 is 1 %.

Panel B: Financial and return characteristics											
	P1 (low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (high)	Spread (P10-P1)
ASSETG	-0,23	-0,07	-0,01	0,03	0,07	0,12	0,18	0,27	0,49	1,49	1,72
MV	271	595	696	705	911	777	721	554	616	390	119,08
BM	0,89	0,93	0,92	0,87	0,79	0,78	0,90	0,73	0,82	0,75	-0,14
RET6M	0,07	0,05	0,04	0,05	0,07	0,04	0,08	0,10	0,06	0,05	-0,02

Panel B: Number of stocks in asset growth portfolios											
Date	P1 (low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (high)	Total no. of stocks
1983	21	21	21	21	21	21	21	21	21	21	210
1984	22	22	22	22	26	22	22	22	22	22	224
1985	23	23	23	23	24	23	23	23	23	23	231
1986	24	24	24	24	22	24	24	24	24	24	238
1987	32	32	32	32	32	32	32	32	32	32	320
1988	37	37	37	37	35	37	37	37	37	37	368
1989	40	40	40	40	43	40	40	40	40	40	403
1990	76	76	76	76	76	76	76	76	76	76	760
1991	102	102	102	102	104	102	102	102	102	102	1022
1992	110	110	110	110	109	110	110	110	110	110	1099
1993	112	112	112	112	107	112	112	112	112	112	1115
1994	111	111	111	111	113	111	111	111	111	111	1112
1995	112	112	112	112	109	112	112	112	112	112	1117
1996	112	112	112	112	115	112	112	112	112	112	1123
1997	113	113	113	113	116	113	113	113	113	113	1133
1998	107	107	107	107	111	107	107	107	107	107	1074
1999	126	126	126	126	130	126	126	126	126	126	1264
2000	123	123	123	123	127	123	123	123	123	123	1234
2001	117	117	117	117	117	117	117	117	117	117	1170
2002	120	120	120	120	115	120	120	120	120	120	1195
2003	122	122	122	122	124	122	122	122	122	122	1222
2004	126	126	126	126	124	126	126	126	126	126	1258
2005	131	131	131	131	134	131	131	131	131	131	1313
2006	146	146	146	146	145	146	146	146	146	146	1459
2007	153	153	153	153	149	153	153	153	153	153	1526
2008	154	154	154	154	153	154	154	154	154	154	1539

Next, I will continue to the results from the one-stage portfolio sorting method described in the section 5.1. The Table 6 presents the results and the performance of the trading portfolios based on past asset growth. Panel A presents both value weighted and equally weighted raw returns of ten different asset growth portfolios during the sample period. The Panel B shows the risk-adjusted returns of all ten asset growth portfolios including the simple excess return over the UK government bond yield and the alphas related to the CAPM, the Fama-French three factor model (1993) and the four factor model of Carhart (1997). The final Panel C shows the factor loadings on the factors in Fama-French model.

In accordance with the asset growth anomaly, the high asset growth portfolio has been during the sample period the worst performing portfolio measured in both equally weighted and value weighted average monthly raw returns with 0.62% average equally weighted monthly return and with 0.73% value weighted monthly return. The low asset growth portfolio has been outperforming the high asset growth portfolio in both equally and value weighted raw returns and the low asset growth portfolio has actually been also the most solid performer in the whole group if considering equally weighted raw returns with 1.32% average monthly return. It is interesting that the low asset growth portfolio is only the fourth best performing portfolio in the whole group with 1.07% monthly raw return.

The raw return equally weighted portfolio spread between the highest and lowest asset growth portfolios has been on average 0.70% on monthly basis and it is statistically significant on 10% confidence level. With value weighted monthly raw returns the spread is also positive, even though it is lower, 0.34% and not statically significant on 10% confidence level. The reason for this insignificant result might be due to the relatively low performance of the low asset growth portfolio. This could indicate similar results than in the study of Lam and Wei (2010). They argued that the asset growth anomaly is mostly driven by the poor performance of the high asset growth stocks.

Table 6. Asset growth portfolios raw and risk adjusted returns

The table presents value and equally weighted returns of ten portfolios sorted on the growth of the total assets. All stocks from London stock exchange are included in the sample with the exception of companies from the financial industry. The ten different portfolios are formed in the end of June each year t over 1983-2008 by sorting the stocks according to their total asset growth, which is defined as the percentage change in total assets from the fiscal year ending in $t-2$ to fiscal year ending in $t-1$. Portfolio P1 (P10) consists of the stock with the 10% lowest (highest) total asset growth. EW stands for equally weighted portfolio returns and VW for value weighted portfolio returns. Spread (P1-P10) is the difference on monthly returns between portfolios P1 and P10. The numbers in each cell are averages of time series monthly stock returns. All numbers are in decimal format. e.g. 0.01 is 1%. For each variable of interest, ***, **, and * indicate that the estimate is statistically different from zero at 1%, 5% and 10% confidence levels respectively.

Panel A: Portfolio raw returns												
	P1 (low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (high)	Spread (P1-P10)	t(spread)
Raw returns (EW)	0.0132	0.0125	0.0130	0.0118	0.0117	0.0109	0.0097	0.0091	0.0070	0.0062	0.0070	1.2812*
Std (EW)	0.0690	0.0550	0.0535	0.0507	0.0521	0.0511	0.0522	0.0561	0.0614	0.0684	0.0343	
Raw returns (VW)	0.0107	0.0124	0.0113	0.0108	0.0102	0.0091	0.0094	0.0107	0.0076	0.0073	0.0034	0.6943
Std (VW)	0.0633	0.0690	0.0498	0.0527	0.0539	0.0497	0.0498	0.0563	0.0575	0.0614	0.0482	
Panel B: Portfolio alphas (EW)												
	P1 (low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (high)	Spread (P1-P10)	t(spread)
Mean excess returns	0.0077	0.0074	0.0081	0.0066	0.0067	0.0058	0.0045	0.0035	0.0018	0.0009	0.0068	1.2791*
CAPM alpha	0.0044	0.0047	0.0055	0.0041	0.0042	0.0033	0.0019	0.0008	-0.0011	-0.0024	0.0070	3.4112***
3-factor alpha	0.0068	0.0051	0.0063	0.0043	0.0042	0.0036	0.0022	0.0016	-0.0005	-0.0007	0.0075	2.5504***
4-factor alpha	0.0066	0.0065	0.0071	0.0056	0.0056	0.0051	0.0041	0.0031	0.0013	0.0009	0.0057	1.9534**
Panel C: Three-factor regression coefficients (EW)												
RM	1.2049	0.9794	0.9529	0.8937	0.9084	0.9081	0.9317	0.9838	1.0557	1.1877		
SMB	1.0102	0.6979	0.7391	0.6450	0.5806	0.6146	0.6519	0.7065	0.7933	0.9173		
HML	-0.3836	-0.0564	-0.1302	-0.0309	-0.0025	-0.0412	-0.0454	-0.1330	-0.0870	-0.2670		

In addition to this, when calculating the equally weighted raw returns the performance of the portfolios is increasing in linear fashion from the highest growth portfolio to the lower asset growth portfolios, with the exception of order on P2 and P3 portfolios; Between these portfolios the P2 portfolio has been on average performed slightly worse than the P3 portfolio with 0.5 % average monthly difference. Overall the linear pattern in equally weighted stock returns indicates a negative relation between stock returns and prior year asset growth. On value weighted returns the return pattern also seems to hold some linear structure, even though the pattern is not as coherent as with equally weighted returns. As mentioned previously the lowest asset growth portfolio P1 is only the fourth highest performing portfolio on monthly returns while portfolio P8 is performing surprisingly well compared to other high growth portfolios.

By adjusting the returns with other potential risk premiums of each portfolio the asset growth effect is strengthened, which can be seen from the higher spreads between portfolios P1 and P10 in Panel B. The alpha spreads also show more economically significant results than on the raw return level. The CAPM alpha spread is highly significant on 0.01% confidence level, whereas Fama-French alpha spread is significant on 1% confidence level. With the momentum factor included the spread still remains significant, even though on 2.5% confidence level.

By examining the risk-adjusted individual portfolio alphas, the drivers of the significant spreads are more apparent. Even though the low asset growth portfolio is performing relatively well in the peer group, the wide spreads can be explained by the extremely bad performance of the high asset growth portfolio. The average monthly alpha has been actually negative in CAPM and Fama-French models with -0.2 and -0.1% average monthly returns respectively. The observation, that high asset growth portfolio P10 is not performing outstandingly well in the peer group, is consistent with the results of Lam and Wei (2010).

The general linear negative relationship between asset growth and subsequent stock returns persists in some level also with risk-adjusted returns. The effect is not completely symmetrical; the five portfolios with the highest asset growth companies are the worst performers and the return is linear with the level of asset growth, whereas within the five companies with the highest asset growth the performance does not clearly depend on the asset

growth. Though, the group of five portfolios (from P1 to P5) with the lowest asset growths still outperforms the five portfolios with highest asset growths (from P6 to P10).

6.2 Controlling for size

Prior studies (e.g. Fama & French 2008) have provided evidence that several documented anomalies are mostly driven by extremely small stocks, i.e. microstocks. Therefore to test if the similar effect is also attributable to the sample used in this thesis, I will examine if size has any impact on the existence and the strength of the asset growth effect.

I will perform this robustness check by utilizing sequential portfolio sorting method. First the sample is divided to three different size groups: small, medium and large companies. Allocation is done by using the closing market value of the company from the end of June in each portfolio sorting year and by using 33% limits on the size groups. Thus 33 % smallest companies measured by the market value are allocated to small companies and the companies with 33 % highest market value are allocated to large companies' portfolios. The rest are allocated to medium companies' portfolios.

Table 7 reports the results from the portfolio sorting test utilized to measure asset growth effect inside different size groups. As Table 7 shows the existence and the strength of the asset growth effect is dependent on the size of the companies in the sample. By examining the individual raw average portfolio returns the general negative relationship between asset growth and stock returns is not as apparent as by using the whole sample. Nevertheless, the high asset growth portfolio has been within the three worst performing portfolios in all size groups. Especially within large companies the performance of the high asset growth portfolio has been extremely weak compared to the peer portfolio group and actually the only portfolio yielding negative average monthly excess raw returns during the sample period.

Table 7. Asset growth portfolios raw and risk adjusted returns in different size groups

The table presents equally weighted returns of ten portfolios sorted on the growth of the total assets. The stocks in the sample are in the end of June each year t over 1983-2008 divided to three different size portfolios according to their market value in the end of the year $t-1$ by using the 33 % break points. Then the stock are further sorted according to their total asset growth, which is defined as the percentage change in total assets from the fiscal year ending in $t-2$ to fiscal year ending in $t-1$, and allocated to ten different portfolios. Portfolio P1 (P10) consists of the stock with the 10% lowest (highest) total asset growth. All stocks from London stock exchange are included in the sample with the exception of stocks from the financial industry. Spread (P1-P10) is the difference on monthly returns between portfolios P1 and P10. The numbers in each cell are averages of time series monthly stock returns. All numbers are in decimal format. e.g. 0.01 is 1 %. For each variable of interest, ***, **, and * indicate that the estimate is statistically different from zero at 0.1%, 1% and 5% confidence levels respectively.

Panel A: Small companies portfolio alphas												
	P1 (low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (high)	Spread (P1-P10)	t(spread)
Mean excess returns	0.0090	0.0124	0.0075	0.0084	0.0067	0.0055	0.0048	0.0029	0.0004	0.0023	0.0067	1.0982
CAPM alpha	0.0057	0.0095	0.0050	0.0057	0.0045	0.0032	0.0022	0.0005	-0.0024	-0.0008	0.0065	1.6975 *
3-factor alpha	0.0095	0.0110	0.0059	0.0081	0.0055	0.0036	0.0032	0.0009	-0.0022	0.0013	0.0082	1.9240 **
4-factor alpha	0.0069	0.0106	0.0062	0.0074	0.0055	0.0036	0.0044	0.0013	-0.0016	0.0014	0.0056	1.3160
Panel B: Medium companies portfolio alphas												
	P1 (low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (high)	Spread (P1-P10)	t(spread)
Mean excess returns	0.0057	0.0063	0.0083	0.0054	0.0069	0.0057	0.0042	-0.0002	0.0022	0.0025	0.0032	0.5635
CAPM alpha	0.0022	0.0034	0.0057	0.0030	0.0043	0.0030	0.0016	-0.0033	-0.0010	-0.0009	0.0031	1.1736
3-factor alpha	0.0045	0.0037	0.0059	0.0035	0.0047	0.0032	0.0016	-0.0021	-0.0007	0.0008	0.0038	1.0832
4-factor alpha	0.0051	0.0056	0.0073	0.0044	0.0062	0.0048	0.0035	-0.0008	0.0017	0.0020	0.0031	0.8891
Panel C: Large companies portfolio alphas												
	P1 (low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (high)	Spread (P1-P10)	t(spread)
Mean excess returns	0.0067	0.0071	0.0069	0.0055	0.0048	0.0055	0.0042	0.0058	0.0049	-0.0018	0.0084	1.6197*
CAPM alpha	0.0036	0.0045	0.0043	0.0031	0.0024	0.0029	0.0016	0.0032	0.0021	-0.0048	0.0084	3.3133***
3-factor alpha	0.0040	0.0040	0.0041	0.0025	0.0021	0.0028	0.0016	0.0038	0.0038	-0.0041	0.0080	2.5147***
4-factor alpha	0.0067	0.0065	0.0062	0.0053	0.0044	0.0052	0.0043	0.0061	0.0057	-0.0007	0.0075	2.3774***

Interestingly, Table 7 shows that the low asset growth portfolio P1 does not seem to perform especially well, even though the low asset growth portfolio is in all size groups within the top four portfolios in regards to average yield. This aspect gives more support to the argument that the asset growth anomaly is mostly supported by the poor performance of the high asset growth companies.

By risk-adjusting the returns with similar methods than in the chapter 6.1 the portfolio alphas hold the similar structure than with the mean excess returns. Most importantly the results repeat the results from the section 6.1 and thus show that even though there is some kind of general negative relationship between the asset growth and subsequent stock returns, the pattern is not consistent in the portfolios with low asset growth.

The zero investment long-short portfolio has achieved the best average raw return among the large companies yielding on average 0.84 % excess monthly income. The spread between the low and high asset growth portfolios is also significant on 90 % confidence level, almost at 95 % confidence level. With small and medium companies the mean excess return spreads are not as supportive for the main hypotheses. Even though within the small companies the spread has been 0.67 %, the results are not economically significant. With medium sized companies the spread and significance is even lower, even though the spread is still positive. As mentioned previous in the section, these results are mainly explained by the relatively poor performance of the low asset growth portfolio and thus the positive spreads are mainly driven by the poor performance of the high asset growth portfolios.

Similarly than in the results of chapter 6.1 by risk-adjusting the portfolio returns, the spreads remains positive within all size groups. The risk-adjustments also reveal more significant results. Surprisingly the spread is still the highest within large companies and economically significant by using all risk-adjustment methods chosen for this study; with CAPM the spread is significant on 99.99 % confidence level and with three- and factor model is significant on 99 % confidence level. These results are in contrast with the study of Fama and French (2008). Within small companies the zero investment long-short portfolio CAPM and three-factor alphas are also significant on 95 % significance level, whereas four-factor alpha is less significant with 90 % significance level.

As summary for the results I conclude that the asset growth effect seems to be a bit surprisingly strongest among the large companies, which is consistent with results by Lipton et al. (2010) and Cooper et al. (2008) from the U.S. market, but controversial to the results of Fama and French (2008), who found that the effect is not economically significant with large companies and driven only by so-called microstocks. Also among small companies the asset growth effect seems to hold, even though it is less significant than with large companies. Interestingly, within medium companies the results do not provide as strong evidence of the existence of the asset growth effect than within the two other size groups, though the results indicate some negative relationship between the asset growth and the stock returns.

Another important aspect from the results is that the anomaly seems to be driven mostly by the poor performance of the high asset growth stocks. From the behavioural finance perspective (e.g. Cooper et al. 2008, Lam & Wei 2010) this could indicate that the investors are overreacting to the high asset growth, but are not underreacting to low asset growth. This kind of mispricing could be potentially be indicated by the past stock performance of the companies and this will be discussed later in the subsection 6.4.2.

6.3 Time series development of the asset growth effect

In this section I will perform a simple time series analysis of the asset growth anomaly. As the results from the portfolio sorting could be driven by some extreme and thus unusual years, e.g. the IT bubble and its burst around the year 2000, it is interesting to perform time series analysis to test if the asset growth effect has been stable during the sample period. Thus these results also provide important evidence of the robustness of the results presented previously in this thesis.

I will start by examining the median growth in total assets for all sample companies in order to identify potential trends or extreme periods. This gives also possibility to compare the median level of asset growth to the performance of the portfolios in order to examine, whether the median level of asset growth influences the asset growth anomaly profits.

Figure 1 plots the median asset growth of all companies and the yearly GDP growth in the UK during the sample years. As can be seen from the figure, the median asset growth has

varied quite significantly during the sample years. The median growth in total assets reached its peak point in the year 1990 with the thrust from the Lawson Boom, which ended in the recession of in the third quarter of the year 1990. During the 1990s recession the median total asset growth plummeted from the level of almost 22 % to nearly one % in two years.

After the recession ended the asset growth rate increased steadily until another peak point was reached in the aftermath of the IT bubble in the beginning of 21st century. With the burst of the bubble the asset growth rate plunged in two years reaching the bottom point in 2003, where in fact the median asset growth rate was negative for the only time in the sample period. After reaching the low point, the level of asset growth steadily increased until the beginning of the financial crisis in the year 2008.

The median level of the asset growth during the sample period is influenced by the economic, both the macro economics and stock market conditions. During uncertain times companies tend to lower the level of their investment activities, which could explain the lower asset growth level during the recession in 90s. Also the amount of retained earnings naturally influences the level of the total assets.

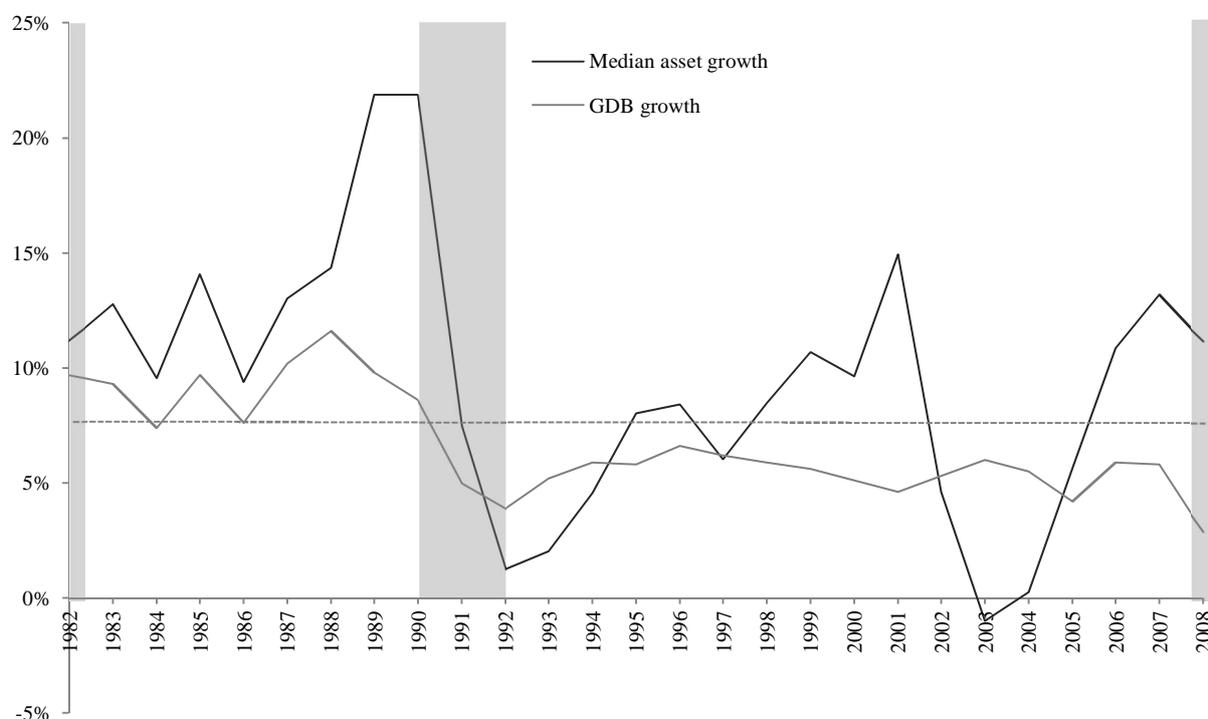


Figure 1. Median asset growth and GDB growth in the sample period.

The figure plots the yearly median of the total asset growth and the yearly growth in GDB in the sample period from 1982 to 2008. Dotted line presents the median asset growth of the whole period. Grey areas present the recessions according to Office for National statistics.

I will continue the time series analysis by examining the performance of the asset growth anomaly portfolio, which goes, as mentioned earlier, long in low asset growth portfolio P1 and short to high asset growth portfolio P10. Both the equally and the value weighted cumulative stock returns of the long-short asset growth portfolio are presented in the Figure 2.

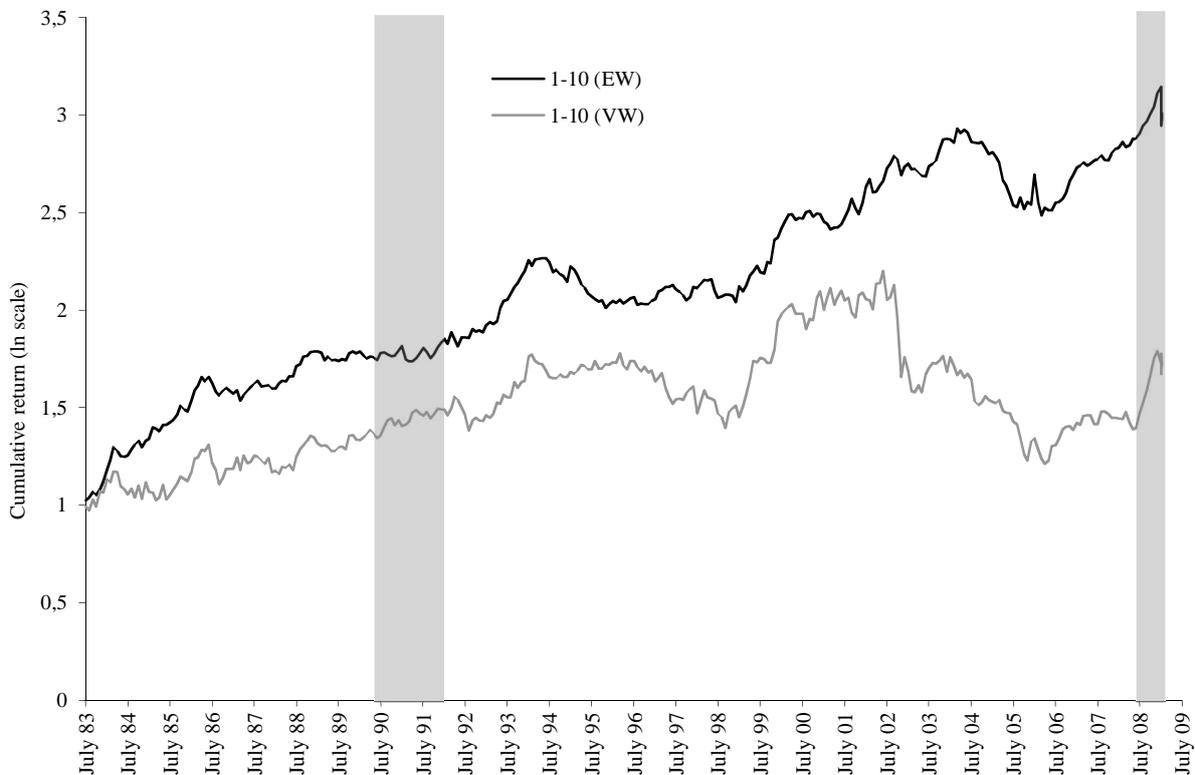


Figure 2. Returns of long-short asset growth portfolios

The figure plots the equally and value weighted cumulative returns of the zero-investment portfolio, which goes long to the companies with 10% lowest asset growth and goes short to the companies with 10% highest asset growth. The companies are sorted on July each year. Grey areas present the recessions according to Office for National statistics.

Figure 2 shows that the equally weighted portfolio returns have been quite stable during the sample time. However, there are two apparent dips in the portfolio performance; one is from the beginning of 1994 to the end of 1995 and the other one from the beginning of 2004 to the middle of 2005. These two plunges have actually quite significant influence on the portfolio performance as after the first dive it takes almost five years to recover to the same portfolio value and in the second case the recovery time is approximately four years.

Interestingly, the burst of the IT-bubble has not negatively influenced the portfolio performance, actually quite the contrary; the performance of the equally weighted portfolio has been very good before and after the IT-bubble. Also the recession in the beginning of the 90s does not have any significant impact on the price development, even though the profits

have been very modest during this period. Actually after the recession the profits have been significant. Also during the beginning of the financial crisis in 2008 the portfolio profits have been quite decent.

With the value weighted long-short asset growth portfolio the price development has been quite similar, although the overall portfolio performance has been less impressive in comparison with the equally weighted returns. One significant difference is the performance between July 2002 and July 2004, during which the value weighted portfolio actually loses almost one fourth of its value, whereas the equally weighted portfolio gains value during this period. With closer scrutiny, it can be concluded that the negative performance of the value weighted portfolio is mostly concentrated on the on the fall of 2002. I will return to this later on this section.

By comparing the portfolio price performance with the median asset growth from the Figure 1, the analysis does not reveal any clear patterns. However, the periods of high profits for equally weighted portfolios are concentrated on the time after the median level of asset growth has peaked and then plunged. One behavioral finance perspective to this could be that on periods when the asset growth is high, also the potential level and probability of mispricing is higher and thus the asset growth portfolio profits are driven by the unwinding mispricing followed by these periods.

On the overall level it could be argued that the asset growth anomaly profits have been most stable during the first ten year period of the sample time period thus from 1983-1993. After this the profits have been more volatile with the following ten year period starting with large dip in the value followed by a significant rise in the late 90s. Almost an identical pattern is repeated in the last periods. However, the value weighted returns have been poorer in the final period.

In order to examine further what drives the long-short asset growth portfolio returns I will examine separately the stock returns of the high asset growth portfolio P10 and the low asset growth portfolio P1. The equally weighted cumulative returns of the portfolios with the comparable market index are presented in the Figure 3 and the value weighted cumulative returns with the market index are plotted in the Figure 4.

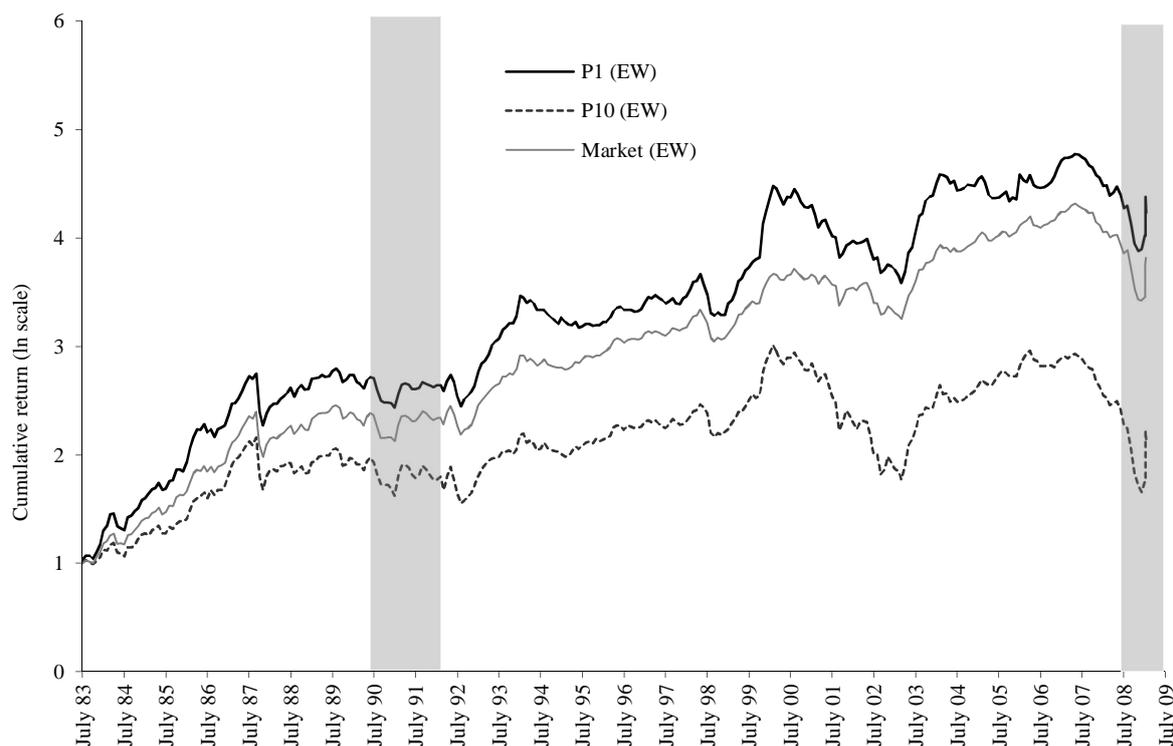


Figure 3. Equally weighted returns of high and low asset growth portfolios. The figure plots the equally weighted cumulative returns of the market index and the two asset growth portfolios P1 and P10. Portfolio P10 includes the companies with the 10% highest asset growth in the previous year and portfolio P1 includes companies with the 10% lowest asset growth. Portfolios are sorted on July each year. Grey areas present the recessions according to Office for National statistics.

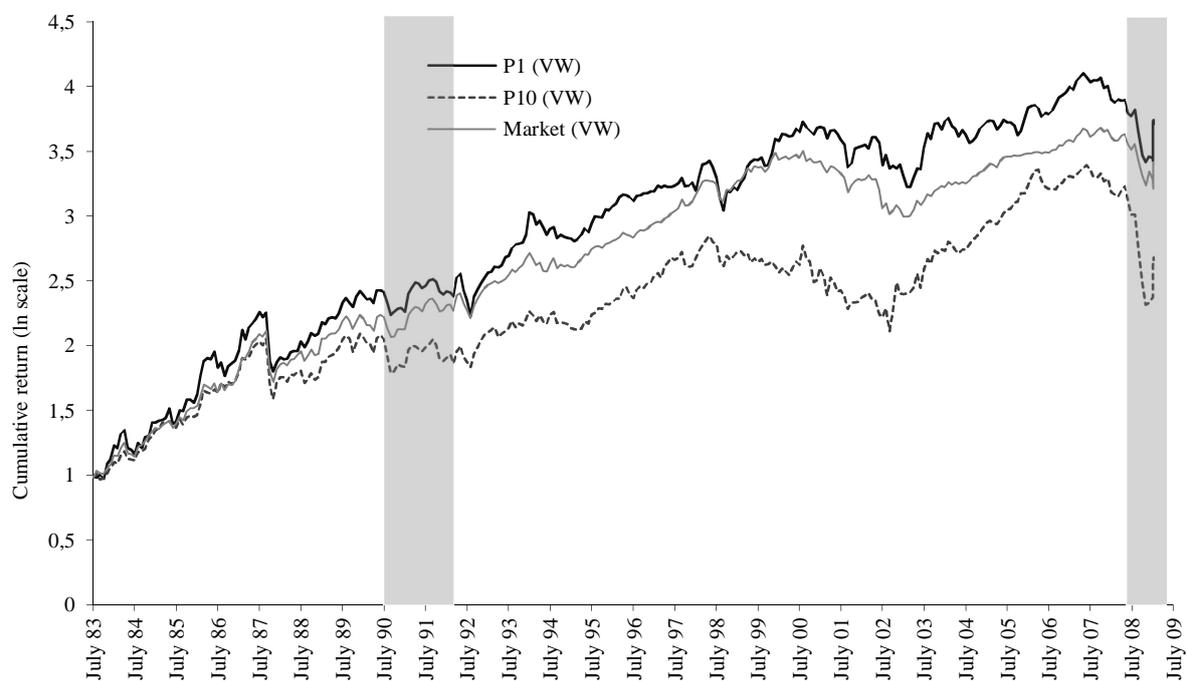


Figure 4. Value weighted returns of high and low asset growth portfolios. The figure plots the value weighted cumulative returns of the market index and the two asset growth portfolios P1 and P10. Portfolio P10 includes the companies with the 10% highest asset growth in the previous year and portfolio P1 includes companies with the 10% lowest asset growth. Portfolios are sorted on July each year. Grey areas present the recessions according to Office for National statistics.

I will start the by analyzing the price performance of the equally weighted asset growth portfolios. Figure 3 shows that the low asset growth portfolio has outperformed the market index during the sample period. As mentioned earlier in the section 6.1, the high asset growth is not performing especially well and is losing significantly also to the equally weighted market index.

By analyzing the good performance periods, Figure 3 shows interestingly that the good performance period of the long-short portfolio following the early 90s recession is driven by low asset growth portfolio if compared to the performance of the market index. In addition to this simultaneously the high asset growth portfolio is losing slightly to the market index thus supporting the solid performance at this point.

In the rise and the crash of the IT-bubble the low asset growth portfolio has also performed very well in comparison with the high asset growth portfolio. In the fall following the IT-bubble burst the difference has been driven mostly by the poor performance of the high asset growth portfolio, which is most likely explained by the fact that of the IT-companies were experienced also relatively large asset growth rates at this stage and thus these companies are driving the losses of the P10 portfolio. Also during the beginning of the financial crisis the high asset growth profits have plummeted supporting the performance of the long-short portfolio.

The results from the value weighted portfolio analysis are quite different as can be seen from the Figure 4. On the overall level the low asset growth portfolio is barely beating the market index during the sample time period, whereas the high asset growth portfolio is losing to market index, even though not with as big margin as with equally weighted returns. Interestingly the performance of the high asset growth portfolio has been almost at the same level than the market index from the beginning of the sample period until the fall of 1987 and the Black Monday. During this time the modest profits were driven by the good performance of the low asset growth portfolio, which beat the market index clearly during this time period.

From the year 1988 onwards the asset growth anomaly profits have been mostly driven by the ghastly performance of the high asset growth portfolio. Especially during the rise and the fall

of the dot-com bubble the high asset growth portfolio has almost systematically lost to the market index and low asset growth portfolios.

The following period from July 2002 to July 2004, which was extremely poor period for the asset growth anomaly portfolio, is actually driven by the relatively high stock price performance of the high asset growth portfolio P10. Also the bull market performance of the P10 portfolio starts earlier than for the P1 portfolio with a sharp spike which explains the sudden extreme losses of the long-short portfolio.

As summary of the time series analysis, I can conclude that on the basis of these results it is hard to argue that the asset growth anomaly is stable during the whole sample period, even though positive trends and certain periods can be quite easily identified. The equally weighted returns have been more stable than the value weighted returns and actually by examining solely the last ten year performance there is actually no anomaly profits with the value weighted portfolio. However, during the last five years and in the beginning of the financial crisis the anomaly profits have clearly outperformed the market index both with equally and value weighted profits. In addition to this, the anomaly profits do not change systematically during bear or bull markets, even though the results indicate that the highest profits are made on the periods including extreme stock price movements.

6.4 Momentum and reversal analysis

The first part of this section concentrates on the persistency of the asset growth anomaly. It describes the returns of the asset growth portfolios in years following the construction of portfolio without rebalancing the portfolio annually, thus giving potential evidence if the asset growth anomaly is joined with persistent momentum returns as has been indicated by the results from other stock markets (e.g. Grey & Johnson 2011, Cooper et al. 2008)

The second part of this section presents the results from two-stage portfolio sorting method, in which the companies are first sorted according to their prior year asset growth and then according to the past year stock price performance. The objective of the results is to provide potential evidence of relation between the asset growth anomaly and stock price reversal effect.

6.4.1 Persistency of the asset growth portfolio returns

The previous studies have provided evidence that the asset growth anomaly persists over the one year sample period and thus would potentially be a significant factor in explaining these kinds of medium term momentum returns (e.g. Nyberg & Pöyry 2010, Cooper et al. 2008, Lipson et al. 2010, Grey & Johnson 2011). This subsection presents the results from the portfolio sorting method with the extended time scope.

Table 8 reports the results of extending the holding period of the asset growth portfolios up to five years without rebalancing the portfolios. As can be seen from the results in Table 8 the anomaly profits diminish right after the first year from the portfolio formation. The second year has some positive returns, but the returns are quite close to zero in both equally and value weighted portfolios and the spread is not significant. After the third year the profits actually turn negative in the equally weighted returns and very close to zero or even negative with the value weighted returns.

With these results it can be concluded that potential anomaly profits are achievable only in the first year after the portfolio formation and thus are not persisting. These results are actually contrarian to the results of Cooper et al. (2008), who found that in the U.S. market the anomaly profits were persisting even 5 years after portfolio formation.

Table 8. The persistence of asset growth portfolio returns after portfolio formation

The table present equally weighed returns on 5-year horizon on portfolios formed on the basis of asset growth. All stocks from London stock exchange are included in the sample with the exception of companies from the financial industry. The ten different portfolios are formed in the end of June each year t over 1983-2008 by sorting the stocks according to their total asset growth, which is defined as the percentage change in total assets from the fiscal year ending in $t-2$ to fiscal year ending in $t-1$. Portfolio P1 (P10) consists of the stock with the 10% lowest (highest) total asset growth. The returns for each portfolio are calculated on the following 6 years after the portfolio formation year t . The numbers in each cell are time series averages of yearly cross-sectional medians. All numbers are in decimal format, e.g. 0.01 is 1 %.

Panel A: Equally weighted returns

Portfolio	Year relative to portfolio formation					
	1	2	3	4	5	6
P1	0.2081	0.1134	0.1078	0.0843	0.1006	0.0986
P2	0.1732	0.1494	0.1379	0.1199	0.0680	0.0886
P3	0.1862	0.1721	0.1401	0.0996	0.0884	0.1012
P4	0.1602	0.1436	0.1310	0.1052	0.0916	0.1076
P5	0.1782	0.1351	0.1299	0.1155	0.0930	0.1030
P6	0.1593	0.1568	0.1317	0.1207	0.0731	0.0979
P7	0.1387	0.1593	0.1027	0.1209	0.1041	0.0970
P8	0.1264	0.1174	0.1145	0.1072	0.0945	0.1033
P9	0.1124	0.1132	0.0998	0.1154	0.0946	0.1068
P10	0.1002	0.1085	0.1079	0.0870	0.0485	0.0635
Spread (P1-P10)	0.1079	0.0048	-0.0001	-0.0027	0.0520	0.0350
t(spread)	1.1098	0.0634	-0.0013	-0.0189	0.9808	0.5406

Panel B: Value weighted returns

Portfolio	Year relative to portfolio formation					
	1	2	3	4	5	6
P1	0.1527	0.1177	0.1268	0.0432	0.0624	0.1181
P2	0.1883	0.1104	0.1378	0.0897	0.0732	0.0693
P3	0.1629	0.1711	0.1066	0.0701	0.0622	0.0828
P4	0.1496	0.1145	0.1349	0.1083	0.0757	0.0694
P5	0.1455	0.1039	0.1667	0.0685	0.0594	0.0917
P6	0.1239	0.0979	0.1085	0.1007	0.0972	0.0901
P7	0.1207	0.1139	0.0732	0.1226	0.0749	0.0887
P8	0.1526	0.0942	0.1105	0.0653	0.0474	0.0549
P9	0.1291	0.0966	0.0425	0.1138	0.0382	0.0857
P10	0.1213	0.1034	0.1207	0.0754	0.0833	0.0977
Spread (P1-P10)	0.0314	0.0143	0.0062	-0.0322	-0.0208	0.0203
t(spread)	0.6112	-0.0716	-0.1626	-0.6253	-0.3330	0.6180

6.4.2 Reversal portfolio performance

This subsection presents the results from the two-staged portfolio sorting method investigating the possible relation between the past performance and the asset growth anomaly. As from the behavioral finance perspective the asset growth effect could be driven by investors overreacting to high asset growth and underreacting to low asset growth, it is reasonable to test whether this behavior could be seen in the past stock performance of the companies. If investors are overreacting or underreacting this could indicate that there is a significant reversal pattern related to the asset growth anomaly, thus asset growth effect would be strongest by comparing companies with high past stock performance and asset growth with companies with low past performance and low asset growth.

Table 9 reports the performance of the portfolios based on prior year asset growth and past performance. In Panel A, I present the raw monthly returns from the two-stage portfolio sorting method. Panel B shows the performance of portfolio based on both asset growth anomaly strategy and reversal, thus by going short on high past performers with high asset growth and by going long to low past performers with low asset growth.

Panel A shows that among the companies which have experienced the lowest asset growth rates in prior year, the companies with lowest past performance are significantly outperforming the companies with high past performance, thus illustrating a reversal effect inside the low asset growth portfolios. This raw return spread is economically significant on 95 % confidence level and risk-adjusted spread provides more robust results with spread, which is significant on 99 % confidence level. In addition to this the companies with medium performance have outperformed the past winners, but have on average lost to past losers providing a pattern across the different performance groups.

Among the companies with highest asset growth rates in prior fiscal year, the reversal effect is also apparent as during the portfolio holding period the companies with lowest return are performing better than the companies with high past return, even though it is not as strong as inside the low asset growth P1 portfolio and thus the spread are not economically significant. In addition to this the effect is not linear as the companies with medium past performance are the worst performers inside the high asset growth portfolio.

Table 9. Asset growth reversal portfolios

The table present raw and risk adjusted equally weighted returns on portfolios formed on the basis of past asset growth and past stock price performance. The portfolios are formed in the end of June each year t over 1983-2008 by sorting the stocks according to their total asset growth, which is defined as the percentage change in total assets from the fiscal year ending in t-2 to fiscal year ending in t-1. P1 (P10) consists of the stock with the 10% lowest (highest) total asset growth. The companies in these portfolios are then further categorized on the basis of last year's stock price performance. The breakpoints of 33% are used to define companies with high, medium or low past performance. The numbers in each cell are time series averages of yearly cross-sectional medians. All numbers are in decimal format. e.g. 0.01 is 1 %. For each variable of interest, ***, **, and * indicate that the estimate is statistically different from zero at 1%, 5% and 10% confidence levels respectively.

Panel A: Equally weighted returns

Asset growth	Past performance			Spread Low-High	t(spread)	Risk adjusted spread	t(spread)
	High	Medium	Low				
P10	0.0056	0.0030	0.0087	0.0032	0.4908	0.0028	0.1696
P1	0.0080	0.0132	0.0188	0.0108**	1.6955	0.0106***	3.0706
Spread (P1-P10)	0.0024	0.0103**	0.0101*				
t(spread)	0.4624	1.8285	1.4890				
Risk adjusted spread	0.0025	0.0104***	0.0103***				
t(spread)	0.98163	4.0437	2.7535				

Panel B: Equally weighted returns of the reversal portfolio

	Panel B: Reversal asset growth portfolio performance			
	Mean excess returns	CAPM alpha	3-factor alpha	4-factor alpha
Alpha	0.0125**	0.0129***	0.0103***	0.0123***
t-stat	(2.1346)	(3.6891)	(3.1432)	(2.6210)

In all of the equally weighted portfolios, the low asset growth portfolios have higher average monthly returns than high asset growth portfolios across all performance classes. Thus even the worst performing portfolio, high past performance portfolio, within the low asset growth portfolios has been able to yield higher average monthly returns than the best performing portfolio, low past performance portfolio, within the high asset growth portfolios. Within the same performance class the lowest difference is between the stocks which have the highest past performance in year prior to portfolio formation. The best performing portfolio is the portfolio with low asset growth and low past return, while the worst performers are the companies with high asset growth and medium or high past performance. This supports the argument that investors are overreacting to high asset growth and underreacting to low asset growth, if assumed that the mispricing is realized in the previous year stock performance.

Panel B shows the portfolio alphas of the zero-investment reversal asset growth portfolio, thus a strategy investing in companies with low asset growth and low past performance and shorting companies with high asset growth and high past performance. The results are robust and strong showing that the alphas from the risk-adjusted models are significant on 99 % confidence level with monthly return varying from 1.03 to 1.29 %.

Figure 5 plots the times series returns of long-short asset growth portfolio and the reversal based asset growth portfolio. Figure X shows that the reversal portfolio returns are significantly higher during the time period than the profits of the long-short portfolio from the section 6.1. Especially during the last 10 years the reversal based portfolio returns have been quite solid in comparison with the returns of the asset growth portfolio from the one-stage portfolio sorting method, even though the pattern of the figure implies that the volatility of the returns is also higher. If compared to the portfolio alphas from the one-stage portfolio sorting method in section 6.1, the yields are significantly on a higher level indicating that the asset growth anomaly is strengthened by conditioning on the reversal effect. These results support also the mispricing argument of behavioral finance for the asset growth anomaly as the reversal effect can be conceived as a correction for the pricing error in the markets.

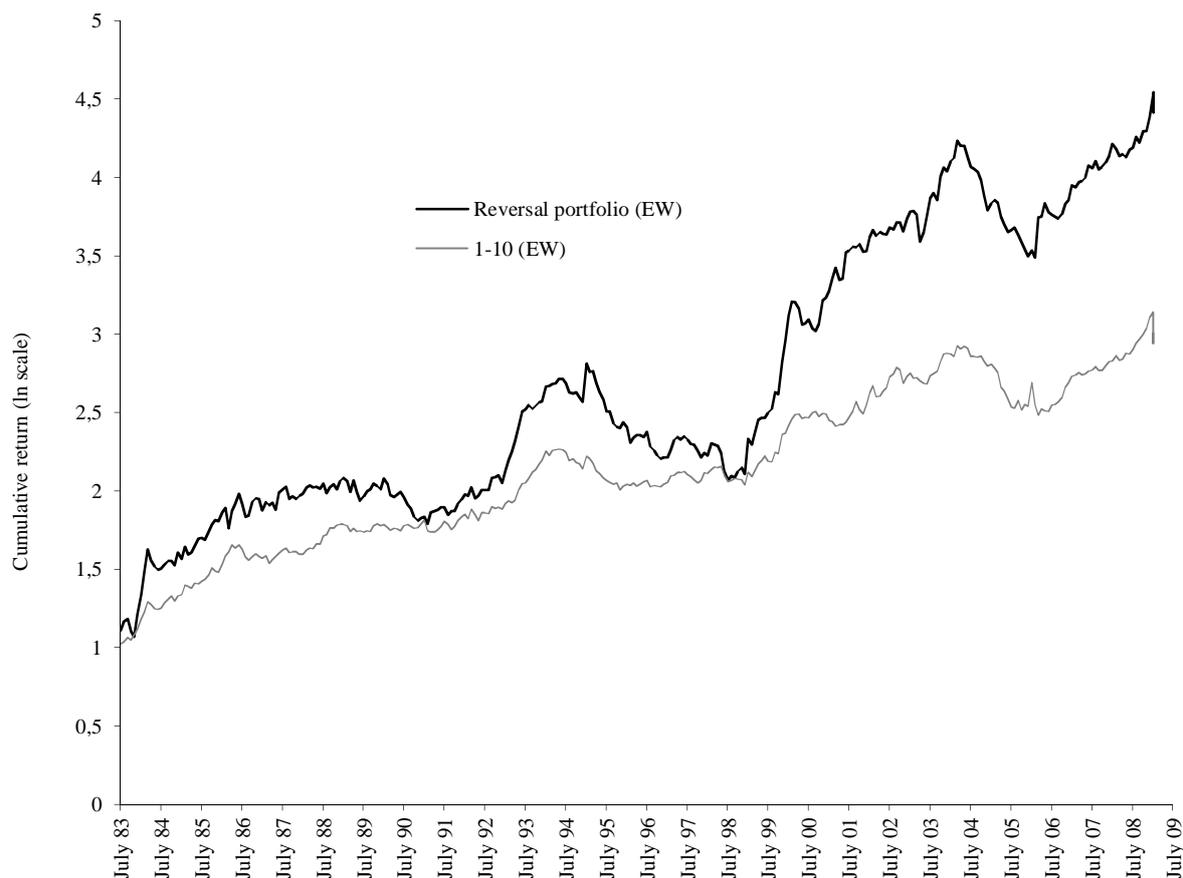


Figure 5. Returns of long-short asset growth portfolio and reversal based asset growth portfolio.

The figure plots the equally weighted cumulative returns of the zero-investment portfolio, which goes long to the companies with 10% lowest asset growth and goes short to the companies with 10% highest asset growth, and the reversal based asset growth portfolio, which goes long to companies with low 10% lowest asset growth and 33% lowest prior year stock return and short to companies with 10% highest asset growth and 33% highest stock return. The companies are sorted on July each year.

6.3 Cross-sectional correlations and regressions

In this section I present the results from the cross-sectional tests performed to provide deeper insight of the asset growth anomaly by delivering direct estimates of the marginal effects. I start by introducing the results of the cross-sectional Pearson correlations between the determinants and I continue to the results of the two-pass cross-sectional Fama-Macbeth regressions in the second part.

6.3.1 Cross-sectional Pearson correlations

Simple cross-sectional Pearson correlations are calculated in order to gain insight of the interactions of the different determinants and thus also to identify possible multicollinearity issues, which could bias the results of the two-pass cross-sectional Fama-Macbeth regressions presented in the second part of this section. The Pearson correlation matrix is presented in Table 10. In this matrix I have calculated the cross-sectional Pearson correlations each year and the time series means of these correlations are reported with relevant t-statistics.

Table 10. Correlation matrix of the regression variables

The table presents cross-sectional Pearson correlations for regression variables. Book-to-market equity (BM) is the latest available quarterly book equity divided by market value of equity in the previous month. Market value (MV) is the market value of equity in the previous month. Total asset growth (TAG) is defined as the percentage change in total assets from the fiscal year ending in t-2 to fiscal year ending in t-1. RET (-6M) is the cumulative return from the past 6 months. TAG (-2) is defined as the percentage change in total assets from the fiscal year ending in t-3 to fiscal year ending in t-2. RET(-2,-7M) is the cumulative return from month t-7 to t-2 and RET(-1M) is return on the previous month. The sample period is from July 1983 to July 2009. For each variable of interest. ***, **, and * indicate that the estimate is statistically different from zero at 1%, 2.5% and 5% confidence levels respectively. The relevant t-stats are in the parentheses.

	BM	MV	TAG	RET(-6M)	TAG(-2)	RET(-1M)	RET(-2, -7M)
RET	0,060 (3,590)***	-0,021 (1,481)	-0,058 (-4,177)***	0,145 (6,582)***	-0,056 (-3,950)***	0,08 (4,35)***	0,13 (6,51)***
BM		-0,034 (-5,781)***	-0,036 (-2,888)***	0,060 (3,624)***	-0,048 (-3,757)***	0,06 (3,73)***	0,05 (2,79)***
MV			0,004 (0,508)	0,014 (1,481)	0,006 (0,641)	0,02 (2,10)*	0,02 (2,21)*
TAG				-0,056 (-4,228)***	0,086 (2,999)***	-0,03 (-3,00)***	-0,05 (-3,72)***
RET(-6M)					-0,050 (-4,770)***	0,47 (29,69)***	0,85 (132,42)***
TAG(-2)						-0,03 (-3,49)***	-0,05 (-4,61)***
RET(-1M)							0,10 (5,18)***

In line with the existence of the asset growth anomaly the simple correlation between the prior year asset growth (TAG) and the annual stock return (RET) of the subsequent period is negative and statistically significant from zero at 0.01 % confidence level. TAG also correlates negatively with the past return measures RET(-6M), RET(-1M) and RET(-2,-7M), thus implying that the negative correlation relationship already holds from the beginning of the sorting year. Similar findings were already provided in the section 6.1.

Interestingly, the correlation between market value (MV) and TAG is almost nonexistent with insignificant measure of 0.004, thus there does not seem to be any direct relationship between the size of the company and the asset growth rate. This is also in line with the results from the section 6.1 according to which the high and low asset growth portfolios had almost the same average company size in the portfolio. However, there seems to be negative correlation between book-to-market value (BM) and TAG measure, which is also significant on 0.5 % significance level.

Total asset growth is also positively correlated with the asset growth from the previous year TAG(-2) implying some persistency in the growth. Furthermore, TAG(-2) also correlates negatively with the annual stock returns, even though the significance is slightly less than with the TAG measure. The correlation coefficients between TAG(-2) and past stock return measures are also negative and significant, which supports the robustness of the results by being in line with the asset growth anomaly. Thus this implies that the negative relationship between asset growth and stock returns would persist at least the one and half year time period.

In accordance with earlier literature book-to-market value (BM) is positively correlated with the returns and the correlation is significant on 0.5 % confidence level. In addition to this, also in accordance with previous studies on cross-sectional stock returns, market value is slightly negatively correlated with the returns, even though the statistic is only significant on 10 % confidence level.

In regards to multicollinearity issues, only RET(6M) and other past return measures RET(-1M) and RET(-2,-7M) are highly correlated respectively 0.47 and 0.87, which is explained by the overlapping sample periods in the cross-sectional calculations and thus the results are not surprising. This aspect is considered in the Fama-Macbeth cross-section regressions and thus these measures are not simultaneously used as potential determinants of stock returns. The correlation between RET(-1M) and RET(-2,-7M) is on reasonable level, which justifies the use of these two measures in the same model. The correlation coefficients of other measures do not imply issues of multicollinearity.

6.3.2 Fama-Macbeth cross-sectional regressions

Finally to provide more direct estimates of the marginal effects of asset growth anomaly on cross-sectional stock returns, I will present the results from the two-pass cross-sectional Fama-Macbeth regressions. These results are presented in Table 11.

Table 11. Fama-Macbeth regressions

The table presents the results of cross-sectional Fama-MacBeth regressions. BETA is the stock beta estimated from the full period regression for each firm. Book-to-market equity (BM) is the latest available quarterly book equity divided by market value of equity in the previous month. MV is the market value of equity in the previous month. Total asset growth (TAG) is defined as the percentage change in total assets from the fiscal year ending in t-2 to fiscal year ending in t-1. RET (-6M) is the cumulative return from the past 6 months. TAG (-2) is defined as the percentage change in total assets from the fiscal year ending in t-3 to fiscal year ending in t-2. RET(-2,-7M) is the cumulative return from month t-7 to t-2 and RET(-1M) is return on the previous month. The sample period is from July 1983 to July 2009. For each variable of interest. ***, **, and * indicate that the estimate is statistically different from zero at 1%, 2.5% and 5% confidence levels respectively. The relevant t-stats are in the parentheses.

Model	BETA	BM	MV	TAG	RET(-6M)	TAG (-2)	RET(-1M)	RET(-2, -7M)
1	-0,009 (-0,382)	0,011 (2,723)***	-1,134 (-2,782)***					
2	-0,009 (-0,389)			-0,013 (-2,213)**				
3	-0,008 (-0,337)	0,010 (2,577)***	-1,209 (-2,992)***	-0,013 (-2,239)**	0,005 (0,519)			
4	-0,008 (-0,357)	0,010 (2,529)***	-1,156 (-2,974)***	-0,013 (-2,258)**	0,004 (0,462)	-0,004 (-1,373)		
5	-0,007 (-0,314)	0,009 (2,436)**	-1,096 (-3,077)*	-0,014 (-2,282)**			0,002 (0,65)	0,003 (3,273)***

The model 1 shows that size and book-to-market ratios are important determinants of cross-sectional stock returns also in the UK stock market during the sample period, which thus replicates the results of Fama and French (1992) from the U.S. stock market. Also in line with the results of their study, these determinants also indicate similar directions of relations as according to results from my regressions small companies tend to have higher returns than large companies and also value companies overperform growth companies during the sample period. In addition to this, in accordance with their study, also beta is not statistically significant determinant of the cross-sectional returns.

The model 2 shows that the total asset growth of the previous fiscal year is negatively related to the subsequent stock returns and is a statistically significant determinant in the model,

where only beta is included as additional control variable. The constant for the asset growth is -0.013 and thus this would imply that e.g. a 50 % growth would have a negative impact of 0.65% on the monthly subsequent stock return. In comparison with the results from the earlier studies, the marginal effect of the asset growth is smaller than e.g. U.S. markets. In the study of Cooper et al. (2008) the constant was on average -0.08 depending on the regression model.

By including additional control variables in model 3, book-to-market, size and the lagged six months stock return, the total asset growth still remains as a significant determinant of the stock returns. Size and book-to-market ratios are also, in accordance with the results from model 1, still highly significant determinants, whereas beta and the lagged six month stock return do not have significance in this model, indicating that there is no significant price momentum by using lagged six month return as a proxy for momentum.

Model 4 includes the total asset growth from the period t-2 as a control variable and thus this model tests the persistency of the asset growth variable. The results from the model show that even though the coefficient is of the correct sign, negative, it is not significant on the 95 % confidence level. This also supports the results from the subsection 6.4.1 thus persistency of the asset growth anomaly is mostly related to subsequent stock returns of the following year without significant momentum effect.

In the model 5, I have divided the past six month return to separate momentum factor and short term reversal factor to test if the prices are reverting at short term. The results indicate that with these proxies there is no significant price reversal at one month level. However, the momentum factor is positive and highly significant indicating persistency in the past share price development. This provides also additional robustness check for the asset growth anomaly results, as the lagged asset growth remains still as a significant determinant of the cross-sectional returns in the model.

In conclusion, the cross-sectional tests provide robust evidence on the existence of the asset growth anomaly, even though the marginal effect of asset growth on the cross-sectional stock returns is rather modest in comparison with the results from the U.S. markets (e.g. Cooper et al. 2008, Lam & Wei 2010) and from the other international markets (e.g. Watanabe et al. 2009). Also the results from the cross-sectional Pearson correlations support this argument. The quite modest constant for the asset growth factor implies that on the individual stock

level only extreme growth or diminution of assets has large economic effect on the stock returns. Nevertheless, the impact of the asset growth is still significant determinant on the cross-sectional returns for the whole sample and in addition to this it is robust for the inclusion of additional control variables.

7. Conclusion

This study examines the existence and the characteristics of the asset growth anomaly in the UK stock market. Especially I concentrate on the asset pricing impact of asset growth on cross-sectional stock returns in the stock market. The proxy for asset growth in this thesis is adapted from Cooper et al. (2008) and is measured as a lagged growth in total assets of the balance sheet. In addition to investigating the potential negative relation between lagged total asset growth and subsequent stock returns, I examine the persistency of the anomaly returns, touch the base on the interaction with reversal effect and analyze the asset growth anomaly with time-series analysis. Furthermore, as the impacts of several anomalies have been proven to be dependent on the size of the sample company, I will company size as a control variable. According to my knowledge, this thesis is the first to study the potential existence and features of the asset growth anomaly in UK markets in this scope and scale. In order to test my hypotheses I implement the two-pass cross-sectional Fama-MacBeth regressions, one- and two-stage portfolio sorting methods.

The summary of the main results is presented in Table 12. Consistent with the studies of Cooper et al. (2008) and Lipson et al. (2010) from the U.S. market the results from the one-stage portfolio sorting method and the two-pass Fama-Macbeth cross-sectional regressions indicate that there is a negative relation between the total asset growth and the expected stock return. I find also that the asset growth as a determinant of the cross-sectional stock returns is also robust for the inclusion of other well-known factors of the cross-sectional stock returns; size, book-to-market, beta, momentum and reversal effects. However, the impact on the yearly stock return is rather modest and thus the results imply that only significant changes in the level of assets have viable economic effects on the stock price performance.

Table 12. Summary of the results

The table present the hypotheses tested in this study and the main empirical findings related to them.

Expected relation		Empirical evidence
Hypothesis	Formulation of the hypothesis	Summary of the key findings
H1	The relation between the total asset growth and expected return is negative.	Medium support. Negative relationship exists and is visible in the results of the portfolio sorting method. Asset growth is also a significant determinant of the cross-sectional returns, even though marginal effect is quite modest.
H2	The asset growth anomaly is stable in portfolio time-series analysis	Partially rejected. The asset growth anomaly profits are not stable during the sample period from July 1983 to July 2009, even though there exists long and stable periods of high returns.
H3	The asset growth anomaly is not dependant on the size of the company.	Rejected. The asset growth anomaly is not apparent in all size groups and is thus dependant on the size of the company. The asset growth anomaly is strongest among large companies and also apparent within small companies. Within medium sized companies the asset growth anomaly is not apparent even though the results indicate to some extent a negative relation between past growth and subsequent stock returns.
H4	Conditioning the reversal effect reinforces the asset growth anomaly.	Strong support. The results indicate that there is a significant reversal effect, which affect positively the profits from the asset growth anomaly.
H5	Asset growth anomaly is followed by the momentum effect.	Rejected. The results indicate that the anomaly profits rapidly diminish in the years following the initial portfolio holding period. The profits are in the following years closely to zero or even negative and do not hold any significant pattern.

I find also that the asset growth anomaly is dependent on the size of the company, which is consistent with the results of the Fama & French (2008), but contrary to the studies of Cooper et al. (2008) and Lipson et al. (2010). However Fama & French (2008) find that the anomaly exists only among small and microstocks, whereas according to the results from my thesis the anomaly exists also among large companies and thus is only not visible among medium sized companies. Strikingly, the profits are the largest among large companies, which is not typical for most of the anomalies as many small anomalies are driven by small or microstocks (Fama & French, 2008). In line with the results from my study, Gray and Johnson (2011) also find similar results regarding the existence of the anomaly within large companies from the

Australian stock markets. The lack of the existence of asset growth anomaly among the medium sized companies in the UK stock market could also explain why the results from the value weighted portfolio sorting method fail to provide significant and robust results of the anomaly profits.

The time-series analysis of the asset growth portfolio profits reveals that the anomaly profits in the UK stock market are not entirely stable during the sample period from July 1983 to July 2009 as there has been extended periods where the asset growth anomaly profits have been actually negative. Both the equally and value weighed anomaly profits have been the most stable during the first ten years of the sample period after which the profits have more volatile. Especially the value weighted profits have been quite poor from this period onwards. However, the anomaly profits have not still vanished as e.g. in the last five years of the sample period the anomaly profits very good and stable measured both with equally and value weighted profits. In addition to this, the results provide evidence that the asset growth anomaly profits does not seem to be dependent on the economic or stock market conditions.

The results from the one-stage portfolio sorting method indicate also that the portfolio profits could potentially be driven mostly by the poor performance of the high asset growth portfolio, which is argued also by Lam and Wei (2010) in their study of the asset growth anomaly in the U.S. market. The time-series analysis supports this argument, even though I find that also this is not the case during the whole sample period as also the good performance of the low asset growth portfolio in relation to the development of the market index supports the divergence of the spread between the high and low asset growth portfolios.

I also present results in regards to relationship between asset growth anomaly and reversal effect, which has been noticed also in earlier studies (e.g. Cooper et al. 2008), but has not been studied further in these studies. I find that the profits from the asset growth anomaly are significantly improved, when conditioning the reversal effect to the asset growth anomaly. Thus by constructing a portfolio, which goes short in companies with high asset growth and high past performance and goes long in companies with low asset growth and low past performance, the asset growth anomaly profits are significantly improved. These findings support the mispricing explanations of the asset growth anomaly (see subsection 2.2.4) as the rational pricing explanations do not provide any framework, which would explain this kind of behavior. According to behavioral finance explanations this could implicate that investors are

overreacting to certain high asset growth stocks and underreacting to low asset growth stocks and the asset growth anomaly profits are driven by the correction of prices in the markets.

Finally I also present results regarding the relation between the price momentum effect and the asset growth anomaly. I find that in the UK stock market the asset growth anomaly profits do not persist over the one year holding period and thus do not indicate any momentum tendency, even though cross-sectional tests indicate some short-term momentum of returns. These findings are contrary to the earlier findings of Cooper et al. (2008) and Nyberg and Pöyry (2010). Nyberg and Pöyry (2010) found asset growth anomaly profits to be significant determinant of the momentum profits in the U.S. market and thus my results indicate this could not be the case in UK market with the absence of the persisting profits in the asset growth anomaly.

The main contribution of this thesis to the current literature framework is that this thesis provides evidence of the existence of asset growth anomaly in the UK stock market, which is according to my knowledge previously unstudied market in this context. Importantly it shows that even though the anomaly exists in some extent in the markets, it is not as strong as the previous studies have shown it to be in the U.S. market providing important evidence on the global scale. In addition to this the thesis shows that there exists important features in the asset growth anomaly in the UK market, that are drastically different from the results in other markets, e.g. the dependence on the size and the non-existent momentum profits following the asset growth anomaly.

Another main contribution is that results provide evidence that the anomaly profits are significantly affected by the past performance of the companies. Thus the profits seem to be driven by large reversal effect and thus companies with high growth and high stock price performance are the worst stock in the future and companies with low growth and poor stock price performance are the best performers. I feel that this aspect of the asset growth anomaly requires also further attention in future studies.

In the interpretation of the results the methodological issues mentioned in the section 4.3 should be considered as limitations. Even though I have chosen to utilize both methods in this study to avoid potential drawback and biases in the results, the principal methodological limitations could still affect the results. In addition to this as the drivers of the asset growth

anomaly are not known, the possibility of an omitted variable bias in the regressions could affect the results. However, I have tested the regressions with several known factors affecting the cross-sectional stock returns and the results were robust for the inclusion of such variables.

For additional future research, it could be interesting to examine more carefully the components of the total asset growth driving the performance and to compare whether these drivers vary depending on the size of the company. The specific drivers in the balance sheet have already been identified (Cooper et al. 2008), however according to my knowledge the relation to size has not been studied further. It could be argued in theory that the drivers could significantly vary between different size groups as different sizes of companies are dependent on different sources of financing affecting the financing side of the balance sheet (see section 4.2). This aspect could also potentially explain why the strength of the asset growth anomaly profit varies between different size groups and actually are non-existent in some size groups as was according to the results of this study the case with the medium-sized companies in the UK stock market.

Another interesting aspect could also be to examine the distress risk in relation to the asset growth anomaly. Financial distress risk has been examined in relation to several different anomalies; however it has not been according to my knowledge applied to the framework of the asset growth anomaly. Distress risk could explain partly the anomaly profits in theory, as the high asset growth could be associated e.g. with an extreme growth in total debt level and the profits could be compensation for the higher distress risk. Also the role of idiosyncratic risk in the anomaly should be assessed more thoroughly as previous studies (Lam & Wei, 2010; Lipson et al., 2010) have shown that the existence of the anomaly is dependent on the idiosyncratic risk.

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