Making Smart Money
- An Evaluation of Fundamental Smart Beta Investment Strategies

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Abstract
In recent decades, many investors have abandoned hopes of achieving above market returns through active management, and consigned themselves to passive investing in the form of market capitalization based portfolios. Using Swedish stock exchange data from 2002-2016, this thesis investigates if there is a way to harmonize the strengths of active management, yielding potential above market returns, and passive index investing, implying lower fees and transparency. Based on observations from 275 companies, analysed through market model regressions, the results suggest that fundamentally invested value and quality portfolios create an alpha of 1-2 percent quarterly relative the market capitalization benchmark portfolio. Moreover, the results constitute basis for performing real investments, as they take into consideration the transaction costs implied by portfolio turnover. Furthermore, the findings of greater risk-adjusted returns through fundamentally weighted portfolios stand in opposition to the efficient market hypothesis.

Keywords: Alpha, Abnormal Returns, Smart Beta, Fundamental Indexation, Market Model, Value Investing, Swedish Stock Exchange
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1. Introduction
To be at the market seems to be every investor’s biggest wish, but to do so have proven difficult, if not even impossible. Therefore, making consistent above market returns is often considered more a product of luck than of skill (Malkiel, 1973). Instead of attempting to beat the market many institutional and retail investors have over the past decades been content with average returns in the form of index investing. These traditional equity indexes are constructed based on market capitalization, implying that the larger a company is the greater weight it is given in the index. In return, anyone chasing the index will own a portfolio with greater allocation to larger, more expensive, companies which have performed well in the past. This passive investment approach has historically given a stable profit in return for moderate risk. Consequently, the strategy results in investors buying high and selling low. The most prominent argument against index investing is thus; in the presence of mispricing, a traditional capitalization weighted index overweights overpriced stocks and underweights underpriced stocks, causing a suboptimal portfolio (Ross, 1977).

During the DotCom bubble in the late 1990’s and early 2000’s, these types of market capitalization indexes were heavily tilted towards non-profitable companies with high market capitalization, blown up entirely by speculations and expectations in the market (Clare et al., 2013). As the market capitalization of these companies grew, investors tracking market cap indexes were effectively obliged to buy more of these stocks at the expense of those companies with a longer and more profitable history. When the bubble eventually burst, and it became clear to investors what had caused it, it appeared obvious that the Internet related equities constituting the market cap indexes had been overvalued. Until not long ago, it was assumed that active management, which most of the time is quite expensive, was the only way to take advantage of market mispricing to outperform these passively invested portfolios. However, in line with previous studies, researchers and investors started to discuss whether more fundamental measures of a company’s size could possibly help to avoid this type of bubble experience (Clare et al., 2013).

Understanding what factors drive an asset’s risk and return allows an investor to create optimal portfolios when seeking higher returns. William F. Sharpe recognised risk factors to be the primary drivers of equity returns, by construction of the capital asset pricing model (CAPM) (1964). Eugene Fama and Ken French (1993) built on this model by developing the widely recognised multi-factor model aiming to explain the return of the US equity market based on three factors; the market, the size factor (large versus small capitalization stocks) and the value factor.
factor (low versus high book to market ratio). Moreover, what is in common for these models is the distinction between alpha and beta. Alpha characterizes the active part of an investment. This return is attained by actively picking mispriced stocks, thereby potentially outperforming index at the same risk level as the market (Placera, 2015). Beta, on the other hand, represents the passive part of an investment, where return tracks the development of the overall market. Hence, based on these streams of research and past events, investors and scholars commenced to investigate in what alternative ways company size could be measured, without relying exclusively on market capitalization. Consequently, in 2005 Arnott et al. presented their study on so called fundamental investment. This type of investment, also referred to as smart beta investment, constituted a hybrid between alpha and beta, and represented strategies which intended to merge together the most profitable parts of active and passive management. Like traditional (beta) investment strategies, these fundamental strategies also applied transparent rule-based portfolios, decreasing both management fees and information asymmetry between investors and managers (Hsu et al., 2012). However, these strategies sought to outperform the traditional benchmarks by targeting exposure to specific factors proven to be drivers of return (BlackRock, 2016). The study indicated that investing in factor-driven portfolios through smart beta strategies could be used tactically to seek improved returns, i.e. to get more out of beta, as well as to reduce risk and to enhance diversification – all in accordance with the investor’s current market view, demonstrating the active management. Furthermore, by investing in indexes based on factors related to company performance, Arnott et al. (2005) concluded that the fundamentally invested portfolios delivered consistent, significant benefits relative to capitalization weighted portfolios.

Recently, an increased interest in smart beta strategies has been noted in the market. As index based investments gather great volumes of assets, due to the transparent and rule-based strategy performed at a low fee, investors are now shifting their capital to more cost-effective structures (BlackRock, 2016). Initially being a tool for institutional investors with access to sophisticated investment models, smart beta strategies today make factor investing affordable and accessible to all. Nevertheless, the question remains whether this type of fundamental investing truly outperforms traditional market capitalization investing. Moreover, the intrinsic risk in smart beta investments relative market capitalization investments has been discussed (Clare et al., 2013). If greater risk-adjusted returns were proven possible through alternative portfolios, prominent theories regarding the pricing of assets, such as the efficient market
hypothesis and the CAPM, clearly would deserve further scrutiny.

The purpose of this study is to investigate if fundamental smart beta investment strategies, operationalized through five different factor based portfolios, over time have been able to outperform the generally accepted and applied market capitalization weighted portfolio. If this proves to be true one question remains; what drives alpha? The research question is henceforth formulated to answer if fundamentally constructed portfolios have generated greater return than capitalization constructed portfolios during the period 2002-2016 on the Swedish stock exchange. Furthermore, the study aims to investigate what drives this potential additional return, and whether the return compensates for the risk of the investment. In order to give an explanation to the questions, five separate market model regressions have been made with the return of the respective fundamentally constructed portfolios as the dependent variable, and the return of the market capitalization constructed benchmark portfolio as the independent variable. Based on data from 275 companies during the period 2002-2016, this study provides a unique Swedish perspective on the matter. The results indicate that fundamental investment strategies based on value and quality factors outperform the market capitalization benchmark, in some cases even after transaction costs have been accounted for. These results in turn provide a generalizable perspective to further apply on other Nordic countries with similar financial markets.

The outline of this paper is as follows; in part two, previous research and literature is presented and discussed, a research question is put forward and the two hypotheses of the study are formulated. In part three the reader is familiarized with the data applied in the investigation, and the method of the report is thoroughly reviewed. In the fourth segment the results of the study are presented and analysed, where after a conclusion of the main findings along with their implications is conducted in part five. Lastly, in section six a discussion of the thesis’ validity and reliability is presented.
2. Theoretical Background

2.1 Efficient Market Hypothesis

An abundant stream of research has been put forward asserting that passive investing is profitable, in the form of market capitalization weighted portfolios, since it in the long run is impossible to outperform the market. Eugene F. Fama (1970) was the first scholar to lay out a solid theory regarding information on the stock market, presenting the efficient market hypothesis (EMH). The theory states that an asset’s price reflects all publicly available information, implying that all stocks trade at their fair value, indicating that the market is efficient. This in turn, Fama (1970) states, would make it impossible for investors to purchase or sell under- or overvalued securities to receive a greater return than the passive investor holding the market portfolio. Consequently, given the randomness in future market prices, due to them continually reflecting all available information, the only way to obtain higher return is by pure, short-term, luck or by purchasing riskier assets. Furthermore, the efficient market hypothesis only holds when investors act rationally by trying to maximize the risk-return relationship in a security. Thus, all investors value financial assets in a similar rational manner, cancelling out the unpredictable behaviour of irrational traders (Fama, 1970).

Three forms of market efficiency are put forward by Fama (1970), each indicating different implications for how financial markets work; the weak-form, the semi-strong-form and the strong-form. The weak form of efficiency indicates that today’s prices reflect all historic publicly available information. This implies that prices must follow an unpredictable random walk (Malkiel, 1973), making technical analysis\(^1\) useless when searching for excess return. The semi-strong form specifies how today’s prices, in addition to historical prices, incorporate and effectively adjust to all publicly available information, making both technical as well as fundamental analysis\(^2\) techniques ineffective when seeking greater return. Lastly, the strong form of efficiency establishes that share prices reflect all information, public as well as private. This in turn makes it consistently impossible for investors to outperform the market, without taking on extra risk, since prices are merely based on future events which no one per definition can predict.

\(^1\) Analysis based on past security price movement in order to predict future prices.  
\(^2\) Analysis based on relevant economic, financial and other qualitative and quantitative factors in order to produce a quantitative fair value of a security.
2.1.1 Criticism of the Efficient Market Hypothesis

During the twenty-first century, several scholars as well as investors began to reason that stock prices at least partially were predictable, and hence that the financial markets were not entirely efficient. Malkiel (2003) asserts that market participants sometimes act irrationally, due to collective misjudgement, thus resulting in short term pricing irregularities and even predictable patterns in stock returns. Grossman and Stiglitz (1980) claim that there would be no incentive for market participants to uncover the information which quickly gets reflected in market prices if the financial markets are perfectly efficient. In addition, behavioural economists such as Kahneman and Tversky (1972) dispute the efficient market hypothesis by claiming that people are not rational – instead, investors are driven by psychological and cognitive factors. This stream of research suggests that these consequences lead to imperfections in the financial markets, attributed to a combination of biases such as overconfidence, overreaction, information bias, myopic loss aversion and representativeness bias. These ideas consequently led Andrew Lo (2004) to launch the concept of the adaptive market hypothesis in an attempt to reconcile traditional models of financial economics with behavioural theories. The model manifests implications such as that the risk-reward relationship is unstable over time, that opportunities for arbitrage exist, that specific investment strategies perform well in certain environments and poorly in others and that the key to survival in financial markets is innovation in the sense of adapting to changing market conditions in order to achieve consistent market returns.

Furthermore, the “noisy market hypothesis” has put pressure on the previous efficient market hypothesis, both empirically as well as theoretically (Arnott et al., 2005; Asness, 2006). This theory claims that prices of securities not always reflect the fair underlying value of the asset, since prices possibly can be influenced by momentum traders, speculators, insiders and institutions trading for strategic placement reasons rather reasons related to the fundamental value.

2.2 Market Capitalization Investment

Fama (1970) states that if the financial markets are efficient, anything but passive investment, operationalized by investment in the market portfolio, results in less return or excess unnecessary risk. Moreover, investors and scholars have raised criticism concerning this type

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3 Here entitled anomalies, discussed more thoroughly below.
of portfolio construction, by arguing that a market capitalization weighted index will be heavily
tilted towards large capitalization companies with high liquidity, undervaluing companies
constituting a smaller share of the total weight (Ross, 1977; Arnott et al., 2005). Furthermore,
the same researchers point out that the market portfolio, in order to be theoretically correct and
mean-variance efficient, should include all assets, including financial instruments as well as
nontraded capital assets. Consequently, the accurate market portfolio should incorporate
domestic as well as international stocks, plus corporate bonds, real estate, commodities and the
value of human capital (Mayers, 1976).

In sum, assuming all available financial information is already reflected in stock prices,
long-term mispricing should not be able for investors to detect, therefore demonstrating it
impossible to gain excess return relative market benchmark. If, however, a portfolio based on
factors other than the traditional market capitalization would prove to outperform the
popularized passive market portfolio, this in turn could indicate that markets are in fact not
efficient. This suggests the main research question of this thesis;

Is it possible for fundamentally weighted portfolios to create excess return relative a market
capitalization weighted benchmark?

2.3 Capital Asset Pricing Model

Markowitz (1952) puts forward a model regarding portfolio theory, describing the risk-return
relationship and how efficient portfolios can be constructed by diversification. Building on this
previous work, Treynor (1961, 1962) and Sharpe (1964) inter alia independently form the
capital asset pricing model (CAPM), establishing the drivers of stock return. According to the
CAPM, assets have merely two main drivers: systematic and idiosyncratic risk. Systematic risk
represents the risk inherent in the market, such as political risk or risk for inflation, and is
captured by the beta. Since it is not possible to diversify away the systematic risk every investor
is, according to the CAPM, compensated with a risk premium for holding that specific risky
security.

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

The above equation states the CAPM relationship, where the risk-free return (R_f) denotes the
return from a risk-free asset, normally represented by the yield of short-term bonds. Further on,
the beta (\(\beta_i\)) signifies the relationship between the security’s and the market’s risk, where
market risk corresponds to 1. Lastly, \(E(R_m)\) implies the expected return of the market, which
in combination with the risk-free return denotes the market premium for bearing market risk. Consequently, this equation summarizes the expected return of the specified asset \( E(R_t) \).

2.3.1 Criticism of the Capital Asset Pricing Model

Fama and French (2004) state that “the failure of the CAPM in empirical tests implies that most applications of the model are invalid”. Prior to this criticism, Fama and French (1992, 1993, 1996) as well as researchers such as Roll (1977), Black, Jensen and Scholes (1972) performed several tests on the CAPM and concluded it to be insufficient. The scholars argue, for example, that the market return applied in the CAPM equation comes from an inadequate market portfolio, as discussed above, thus producing too high cost of equity estimates for high beta stocks and vice versa. Further on, critique has been directed towards the model concerning the assumption that all investors have access to the same information and share homogeneous expectations about the risk and expected return of an asset (Sharpe, 1964). Despite these repeatedly failing assessments, as well as the existence of more modern approaches to security pricing and portfolio theory such as the arbitrage pricing theory, the CAPM remains the most widely applied technique for estimating an asset’s cost of capital.

2.4 Multi-Factor Models

Dissatisfied with the empirical performance of the CAPM, Fama and French (1993) proposed that asset returns were a result from two additional factors besides idiosyncratic and systematic risk; size and book-to-market value. While the traditional assumptions of the efficient market hypothesis and the CAPM suggested a direct link between stock return and degree of risk, a growing stream of research advocated additional factors to have explanatory power of the relationship. Fama and French continued to search for factors delivering a more optimal explanation of an asset’s return, producing additional models including factors such as investments and profitability (Fama and French, 1992, 1993, 2015).

Three main categories of factors have eventually been concluded; macroeconomic, statistical and fundamental (Connor, 1995). The macroeconomic factors include measures of for example inflation, GDP and yield curve, while the statistical models identify certain statistical techniques where the factors are not specified in advance (Bender et al., 2013). Moreover, the most widely used factors are the fundamental factors, capturing stock

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4 Expected returns of an asset is a function of various macroeconomic factors (Ross, 1976).
characteristics related to e.g. value, momentum and volatility. When Arnott et al. (2005) revealed their research they argued, based on empirical testing, that portfolios constructed based on a few specific fundamental factors could produce above market return, thus delivering a risk premium above that predicted by the previously established CAPM portfolio, without taking on extra risk. Consequently, the reasoning behind this investment strategy was later referred to as fundamental smart beta investing.

2.5 Fundamental Investing and Smart Beta

Ever since Ross (1976) presented his study, where he concludes that return premiums are associated with various risk factors, researchers have been trying to establish and document the positive relationship between risk-adjusted return and these types of drivers. Today, the factors most well-known to investors and scholars when investing in equities are fundamental factors related to size, value, quality, momentum and volatility. What a smart beta investment strategy then offers is a rule-based and transparent strategy, comparable to traditional market capitalization indexes. By constructing indexes based on specified factors, such as those fundamental drivers of return mentioned above, investors can still perform effective passive management while more efficiently exploiting the beta (Kahn and Lemmon, 2016). Moreover, by applying rule-based strategies investors are able to use their active, alpha related, knowledge to create a selection in which the market participant then passively invests (Placera, 2015). Consequently, this leads to one of the definitions of the strategy; a hybrid of active and passive management producing greater return at a lower or comparable level of risk, by focusing on one or a few factors measuring size in ways other than market capitalization (Wood, 2016).

Furthermore, several evaluations have been conducted on smart beta strategies (Amenc et al., 2013; Jacobs and Levy, 2014). Results discussing the outperformance over time of portfolios invested according to specific factors, analyses of the investor’s possibility to adapt the portfolio risk exposure depending on future market expectations, as well as assessment of what fundamental factors should be applied are all topics examined in these studies.

2.5.1 Criticism of Smart Beta Investing

In his study Malkiel (2014) primarily argues that proponents of smart beta compare their factor based portfolios with investors invested in suboptimal portfolios — so called “dumb beta” portfolios. In fact, Malkiel claims, the market capitalization weighted portfolio does give a
correct estimation of the market return. Therefore this implies that smart beta investments outperform poorly managed active portfolios, invested in anything else but the market portfolio, rather than the passively managed market portfolio itself. Furthermore, Malkiel (2014) contends that smart beta investments have historically underperformed the traditional market capitalization index during long periods. This in turn indicates that this type of portfolio too suffers from reversion to the mean, where phases of excess return are followed by those of more modest return, thus implying that the average return for the factor portfolio could be smoother than previously suggested.

In line with Malkiel (2014), Arnott et al. (2016) argues that a smart beta invested portfolio’s historical performance not necessarily indicates a future similar behaviour, assuming varying achievement depending on the different phases of the economy. Lastly, Arnott et al. (2016) state that the smart beta investment strategy perhaps has become an exaggerated trend, which investment managers take advantage of when raising capital, without either intention of following or profound knowledge of the theory behind factor investing.

2.6 Jensen’s Alpha as a Tool for Evaluating Performance

In his study, Michael Jensen (1968) applies the now called Jensen’s alpha as a tool for evaluating mutual fund managers. Assuming the previously presented CAPM correctly predicts a security’s return, as well as that a riskier asset results in a higher risk premium, Jensen reasons that an asset producing return greater than its expected risk-adjusted return yields abnormal return – or positive alpha. Jensen’s alpha is applied in empirical finance when assessing if an investment strategy has generated return in addition to, or below, that predicted by the factors included in the CAPM or multi-factor model.

2.7 Anomalies

When discussing the efficient market hypothesis in conjunction with the CAPM and Jensen’s alpha, the concept of anomalies is often brought up in order to explain occurrences which the models have not predicted. Ball (1978) discusses the negative relationship between market capitalization and risk-adjusted return implying that smaller firms on average give a higher return, indicating that the CAPM is misspecified. This anomaly, referred to as the small cap premium, is partly motivated by the lack of information coming from smaller firms, resulting in investors less likely to invest in those than in common stock of larger firms with a more
generous supply of information (Ball, 1978). Moreover, authors claim, the securities invested in by only a subset of market participants create a higher risk-adjusted return than those considered by all investors, entailing higher returns for the “undesirable” stocks of small firms (Banz, 1981). Furthermore, Malkiel (2003) claims, in line with the previously mentioned behavioural finance research, that people are driven by psychological and cognitive factors rather than rational behaviour, leading financial actors to sometimes act illogically. Thus, disturbance of the market efficiency can occur due to anomalies, leading to potential mispricing of securities. In sum, the concept of anomalies possibly gives an improved understanding of the alpha obtained from certain investments, as well as a perspective on how this knowledge can be exploited within capital management.

2.8 Fundamental Factors
Assuming financial markets to be not entirely efficient, and that market participants are able to detect and exploit irrational security pricings, a possibility arises to receive excess return. By holding portfolios constructed based on certain fundamental factors, which historically have earned risk premium for being exposed to systematic sources of risk, investors are able to receive this risk premium. The opinions regarding what motivates factor returns can be divided into two main categories. On the one hand, there are scholars who consider markets to be entirely efficient, in line with the efficient market hypothesis, and who state that the factors reflect sources of risk not possible to diversify away (Ross, 1976), thus compensated thereafter (Dichev, 1998). On the other hand, factors are thought to produce extra return due to investors’ systematic errors (Bender et al., 2013). Below, a selection of these fundamental factors is presented, divided into two categories, and motivation is given to why investment based on specific stock characteristics could potentially result in greater return.

2.8.1 Value
The group of factors entitled value factors are reasoned to capture the excess return, relative the capitalization weighted benchmark, of securities traded at prices lower than their fundamental values (Bender et a., 2013). Assuming markets to be efficient the value premium is compensation for increased real or perceived risk related to a stock, since value companies have less flexibility to adjust to unfavourable economic environments relative their growth counterparts (Zhang, 2006).
2.8.1.1 Book Value
The most well-known value factor is the one introduced by Fama and French (1992, 1993) in the multi-factor model – the high versus low book-to-market factor. One explanation to why investment based on a book-to-market strategy could produce additional return is that investors tend to overreact to events related to growth stocks, i.e. stocks expected to have their earnings grow faster than that of the average company in the same industry, resulting in value stocks being undervalued. Furthermore, an additional explanation presented is that the book-to-market ratio is a type of risk measure, indicating that companies with high proportions simply are compensated for its risk, since a high book-to-market ratio is more likely to indicate that a company is experiencing financial distress (Dichev, 1998; Griffin and Lemmon, 2002).

2.8.1.2 Dividends
Miller and Modigliani (1961) conclude in their study that a company’s dividend policy in no way should affect its value, given frictionless market assumptions. Nevertheless, researchers have thereafter claimed that a dividend premium does exist, since it is argued that a company paying dividends is a well-being company. By giving out dividends to its shareholders, the corporation signals that it not necessarily needs to reinvest all its earnings similar to a growth company, but rather is able to distribute it to its owners (Graham, 1949; p. 132). Thus, according to previous reasoning, this indicates a successful company worth investing in. Furthermore, Gordon and Shapiro (1956) popularized the well-known dividend discount model (Fisher, 1930), by developing the less complex version of it – the Gordon Growth Model (GGM)\(^5\). The model explains the value of a stock as the future dividend discounted by the required rate of return minus the dividend growth. Rearranging this expression, and assuming a company’s stock price reflects its fair value, the authors receive an equation where it is clear that the dividend yield is an essential component for producing higher returns.\(^6\)

2.8.1.3 Cash Flow
According to the discounted cash flow model, the value of a company is equal to its expected future cash flow discounted back to today, similar to the GGM. Investors forecast the future cash flow in part by looking at historical cash flow, gathered from the company's financial

\(^5\) Stock value = \(D_1/(k - g)\)
\(^6\) Required/expected return = dividend yield + sustainable growth rate
report. A higher expected cash flow should therefore lead to a higher price, thus also producing a higher return.\textsuperscript{7} Furthermore, studies made by Cohen et al. (2002) find that higher cash flow-to-market ratios and positive news regarding cash flows result in greater return. This abnormal return is attributed to investor conservatism, implying that market participants not fully and immediately incorporate the new information, such as positive news regarding cash flow, in the prices they bid or ask for securities. Thus, this leads to future price movements yielding greater return (Barberis et al., 1998). Consequently, these value factors conclude in the first hypothesis of the thesis;

_Hypothesis 1: it is possible for portfolios weighted based on fundamental value factors to create excess return relative a market capitalization benchmark._

**H0:** \( \alpha = 0 \): it is not possible for portfolios based on value factors to create excess return relative capitalization weighted portfolios

**H1:** \( \alpha > 0 \): it is possible for portfolios based on value factors to create excess return relative capitalization weighted portfolios

2.8.2 Quality

To capture the additional return produced by high quality firms relative the market benchmark, the quality term has been developed to assess the financial health of a company. However, since it is argued that the measurement of company quality is of a subjective matter, perhaps more likely to be explained by behavioural aspects of the investors than the value factors, a few specific factors related to firm superiority have been established. Below, two quality factors are discussed and motivated in their relationship with return.

2.8.2.1 Investments

One of the factors believed to deliver equity premium is investments. For a company to be able to make investments, it must also have the assets to do this with. Increased investments should indicate a well-being quality company with the possibility to dispose its own money (Aharoni et al., 2013). One of the explanations to why this specific factor could have an impact on stock prices, and thus future returns, is that a well-run quality company often manages its capital in a professional manner, reducing the risk of having too much debt or being over-capitalized (Bender, 2013). Qualitative capital management in turn implies a steady earnings growth,

\[ \text{Stock value} = \frac{E(CF_1)}{(1+r)} + \frac{E(CF_2)}{(1+r)^2} + \ldots + \frac{E(CF_n)}{(1+r)^n} \]

\textsuperscript{7} Stock value = E(CF_1)/(1+r) + E(CF_2)/(1+r)^2 + \ldots + E(CF_n)/(1+r)^n
further reducing the need of external financing, which additionally supports the market price of the stock. Consequently, this generates a positive spiral, making the firm more competitive in the eyes of customers and investors. On the other hand, Titman et al. (2004) suggest that a company increasing its investments will experience future negative return, since that company likely is managed by individuals with a tendency to overinvest when empire building. Accordingly, increased investments should indicate aversion to portfolio inclusion.

2.8.2.2 Profitability

Examining the profitability of a company, i.e. a corporation’s ability to produce earnings relative its employed equity, indicates the quality of an entity. Researchers argue that profitable firms tend to grow faster due to this capability, up until a threshold where profits are forced to more normalized levels due to competition (Haugen and Baker, 1996). Thus, currently profitable firms seem to have greater potential for future growth, indicating greater expected returns to investors (Haugen and Baker, 1996). Furthermore, the profitability factor is closely linked to investments, since profitable corporations tend to invest more than their less profitable competitors – hence the arguments for the investment-return relationship apply (Hou et al., 2015). Lastly, firms experiencing financial distress are intuitively less profitable, indicating that more profitable firms should earn higher expected returns, as a result of the market rewarding a company’s current financial capabilities (Hou et al., 2015). The quality factors conclude in the second hypothesis of the thesis;

\textit{Hypothesis 2: it is possible for portfolios weighted based on fundamental quality factors to create excess return relative a market capitalization benchmark.}

\textit{H0:} \( \alpha=0 \): it is not possible for portfolios based on quality factors to create excess return relative capitalization weighted portfolios

\textit{H1:} \( \alpha>0 \): it \textit{is} possible for portfolios based on quality factors to create excess return relative capitalization weighted portfolios

2.9 Previous Studies

A review of the studies performed related to fundamental investing is below concluded in three evaluations. Arnott et al. (2005) criticize the effectiveness of traditional portfolios, by showing how investments based on six separate fundamental factors deliver consistent and significant benefits relative the standard capitalization weighted portfolio. The authors construct stock portfolios by giving companies operating on the American market weights based on selected
fundamental factors other than company size, rebalancing the portfolio annually during the period 1962-2004. Evaluating the portfolios using different measures such as the Sharpe ratio and volatility comparisons, Arnott et al. (2005) conclude that the investments, on average, outperform the S&P 500 by 1.97 percentage points annually over the tested time span, regardless of bear and bull markets or various interest rate regimes. Superior market portfolio construction, price inefficiency, additional exposure to distress risk or a combination of these three are the main points discussed to be potential explanations to the results. Consequently, much of the following research is based on this study.

Moreover, Hemminki and Puttonen (2008) display in their revision how fundamental portfolio construction can outperform market capitalization based investments, pointing at evidence from the European stock market between 1996-2006. Six different fundamental portfolios are constructed, demonstrating the possibility for investors to produce consistently higher risk-adjusted returns relative its capitalization weighted benchmark.

Lastly, Mar et al. (2009) conduct a similar examination based on the Australian stock market during 1995-2006. The authors conclude that fundamentally constructed investments outperform market capitalization based portfolios, finding much of its explanation in the same reasons presented previously. However, Mar et al. (2009) assert the bias towards value stocks to be a major contributor in explaining the fundamental portfolios' superior performance.

Considering these previous studies, in conjunction with theories regarding factor premiums as well as ideas relating to anomalies, one can conclude that the subsequent evaluation of factor based portfolios will give an indication of the efficiency of financial markets.

2.10 Our Contribution

The contribution of this thesis is a Swedish perspective on the factor based investing previously tested on American, European and Australian stock markets. By evaluating this investment strategy on a notably smaller market than the preceding ones, motivating the applied fundamental factors in advance rather than trying to find an explanation for them in the results, it is possible to draw more generalizing conclusions to the other Nordic economies, as well as to other markets of similar size. If the results are found to be in line with preceding ones, this could imply interesting input for investors seeking to invest in the Swedish stock market.

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8 These factors included book value, cash flow, revenue, sales, dividends and employment.
9 Companies performing well in factors such as book value, cash flow and dividends.
3. Methods, Data and Portfolio Construction

3.1 Research Methods

Having developed two hypotheses in the theory section, this deductive study utilizes a quantitative approach. To test the previously presented hypotheses linear regression is used. This systematic approach, where a research question is formulated prior to collecting data and running regressions, limits data-mining issues. Also, the approach allows for conclusions regarding the magnitude of the different fundamental factors studied, by comparing the results of different regressions. Furthermore, linear regression is the most commonly used method in research to determine the effects of fundamental differences on asset returns (Hou et al., 2012; Fama and French 1994, 2014). Finally, using linear regression makes comparison of the results of this study and others more straightforward.

3.2 Data and Sample Selection

Swedish data have been collected from Thomson Reuter’s Datastream. Datastream contains data regarding historical prices, accounting information, exchange rates, etc., which all are needed to shed light on the effects of fundamental differences of stock on returns. A proxy for the risk-free rate, 1-month Swedish treasury bills, has been collected from Riksbanken (2017).

The fundamentally weighted portfolios constructed in this thesis are created from the constituents of the main Swedish stock exchange, specifically Nasdaq Stockholm. While the Swedish stock exchange is not theoretically ample as a proxy for the market return in financial models, as previously discussed in section 2.2 of the thesis, it is a practical measure of benchmarking for investors looking to invest in the Swedish markets. All the stocks listed on the exchange at the end of 2016 are included, however, companies with more than one class of shares have only the most liquid share included in the data. Because of the study’s aim to research asset returns the illiquid share is less suitable than their more liquid counterparts, since investors prefer the more liquid share while those wanting control of the company prefer the share with more voting rights. Voting rights and company control are outside the scope of this study, leading to the exclusion of these shares. A positive effect of using data downloaded from a database such as Datastream is that the same information is available for future use. However, the data are only available to subscribers of Datastream or comparable services.

The collected data covers the period from 2002 up to and including 2016, a total of 15 years. The period has been chosen based on the amount of data available on a quarterly basis.
from Datastream. Before 2002 there is little to no quarterly data available for the constituent companies of Swedish stock exchange. Annual data is available from 1982, but using annual data would lead to fewer observations than quarterly data. Quarterly data is therefore used in the study, giving a larger number of observations in a shorter period of time. During the 15 years data are collected from, it is likely that the constituent list has changed vastly, thus containing a large amount of survivorship bias. A study by Thomsen and Vinten (2014) finds that around 30 percent of constituents in the Stock exchanges of Europe has changed during the years 1995-2005, mainly due to mergers and acquisitions. To prevent this survivorship bias from creating a benchmark differing greatly from the constructed portfolios, this study uses a market capitalization benchmark created through the same process used for creating the factor portfolios. The constructed market capitalization benchmark will differ in an a priori unknowable way from actual returns for investors from the Swedish stock exchange index, but will allow for a more precise comparison of the strategies used. It is possible to eliminate the occurrence of survivorship bias by manually reconstructing the Swedish stock exchange constituent list quarter by quarter, but doing so would require more time than available for this thesis.

Further preparatory measures regarding the data have been made including exchanging currencies based on historical exchange rates from other currencies to SEK where necessary, making the accounting information comparable between different companies. Out of the 300 constituents 275 are used in the study, where 25 shares of illiquid classes have been removed. A summary of the number of listed companies is shown in table 1.

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</tr>
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<tbody>
<tr>
<td>Constituents</td>
<td>119</td>
<td>151</td>
<td>152</td>
<td>164</td>
<td>181</td>
<td>194</td>
<td>208</td>
<td>215</td>
<td>222</td>
<td>229</td>
<td>230</td>
<td>233</td>
<td>249</td>
<td>268</td>
<td>275</td>
</tr>
</tbody>
</table>

Table 1. Number of listed companies at the end of each year.

Studying capital market returns in relation to accounting data requires consideration regarding how new information reflects upon asset returns. Look-ahead bias becomes an issue if there is no lag allowed for accounting data to be available for investors (Hou et al., 2012). To prevent look-ahead bias this study uses a 90-day lag to measure the effects of fundamental data upon stock returns. For instance, accounting information for a company presented during the first quarter will have their investment weights calculated and invested in at the start of the
second quarter. These investments made in the second quarter yield returns for the portfolio in the third quarter. This process is repeated for each quarter during the studied period. An illustration of the process is shown in figure 1.

Figure 1. Portfolio construction and return time frame.

### 3.3 Operationalization and Implementation of the Theory

The hypotheses set up in sections 2.8.1 and 2.8.2 must be operationalized in such a way that they are testable. For this purpose, accounting values have been found valid proxies for these different aspects of a company’s characteristics (Barberis et al., 1998).

To measure return, the change in stock price has been used, adding back any dividends paid during the holding period. The price data is adjusted for splits, thereby differing from the historical prices, reflecting actual return for shares held. The general case for calculating percentage return is shown in the formula:

\[
\text{Return}_{t_1} = \frac{\text{Price}_{t_1} + \text{Dividend}_{t_1} - \text{Price}_{t_0}}{\text{Price}_{t_0}}
\]

Equation (1)

To measure the value of a company the book value, dividends paid and net cash flow from operations accounting items are used. Book value is defined as common stock accounting value and retained earnings. Dividends are defined as any dividends paid out during the quarter. Net cash flow from operations is defined as the cash made available through business operations during the quarter. These value measures are then divided by the company market capitalization, i.e. the price per share at time \( t \) multiplied by the number of outstanding shares at time \( t \). Dividing the companies accounting figures by the total market capitalization creates a ratio for each characteristic, company and quarter. A stock with a relatively high book value, dividend or cash flow per market value is thus expected to have relatively high future returns. To capture the quality of a company a profitability ratio and an investment ratio are used. In
this case return on equity (ROE) is used for profitability, defined as earnings divided by book value for the period. The investment ratio is defined as total investments made in the business divided by the total assets of the firm. A company with a high ROE or low investments to assets ratio is consequently expected to have a relatively high return going forward, as explained in the theory section. A more detailed description of how the accounting data are defined is found in the appendix.

**3.4 Portfolio Construction**

Presented in table 2 is a descriptive summary of the data used for constructing the portfolios and the portfolio returns.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookvalue</td>
<td>11,956</td>
<td>.7996866</td>
<td>.968239</td>
<td>0.0002261</td>
<td>18.00329</td>
</tr>
<tr>
<td>Cashflow</td>
<td>5,855</td>
<td>.0511289</td>
<td>.0884012</td>
<td>0.00000667</td>
<td>1.798727</td>
</tr>
<tr>
<td>Dividend</td>
<td>7,627</td>
<td>.0358767</td>
<td>.258771</td>
<td>0.0004</td>
<td>.5102</td>
</tr>
<tr>
<td>Investments</td>
<td>7,228</td>
<td>.0231754</td>
<td>.0414954</td>
<td>0.00000217</td>
<td>.7414606</td>
</tr>
<tr>
<td>Profitability</td>
<td>8,821</td>
<td>.2036057</td>
<td>.4242051</td>
<td>.0001</td>
<td>29.5567</td>
</tr>
<tr>
<td>Marketcap</td>
<td>12,145</td>
<td>15300000</td>
<td>42500000</td>
<td>5068</td>
<td>52100000</td>
</tr>
<tr>
<td>Return</td>
<td>12,461</td>
<td>.0444153</td>
<td>.2353649</td>
<td>-.8041344</td>
<td>4.069118</td>
</tr>
</tbody>
</table>

Table 2. Descriptive statistics for accounting data ratios used to construct portfolios. Marketcap in SEK thousands.

The fundamentally weighted portfolios have been constructed by investing in shares according to the relative sizes of the company’s fundamental ratio for that quarter. For instance, if company C’s cash flow to market value ratio makes up 52.2 percent of the total cash flow to market value ratio in a quarter, it is given a 52.2 percent weight in the cash flow portfolio the next quarter when accounting information is made public. An example of the procedure is provided in table 3.
If a company has accounting information available but is not yet listed the accounting information will be set to zero, thereby not interfering with weights of other stocks in the portfolio. If the company is not among the investable universe it is assumed investors cannot obtain any returns from it. Moreover, it is not uncommon to find quarters where a company has sustained losses, negative free cash flows or divestment of assets. A negative accounting value would be given a negative weight in the portfolio, suggesting to short sell the stock. However, due to the impracticality of selling short, such as regulations, costs of borrowing, etc., a shorting restriction is assumed. A negative accounting value will therefore be ignored and a long only portfolio is constructed for each fundamental variable.

### 3.5 Model Specification

Testing whether a certain portfolio has a higher return than the market benchmark is done by using the market model in a two-sided t-test, as suggested by MacKinlay (1997). The market model, which is an empirically implemented version of the CAPM, assumes a linear relationship between the asset return and the return of the market. By separating the effect of the market return on the asset return the abnormal return of the specified asset in question is made clear, as put forward by Brown and Warner (1985). This model is used separately for each fundamentally weighted portfolio return to determine whether it is statistically significantly different from the return of the market capitalization benchmark. The market model is specified as follows:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_i$$

Equation (2)

The model calculates the return of portfolio \( i \), \( R_i \) at time \( t \) as \( \alpha \), or Jensen’s alpha. This implies the portion of return that is not attributable to the return of the market. Along with \( \alpha \),

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9 In this case a factor-based portfolio.
the return of the asset is also a result of its systematic risk, which is found in the β-estimate, and the error term $\varepsilon$. The market model is used to determine the abnormal returns of each factor-based portfolio. For the purpose of this study, $\alpha$ is the measure of interest, since this is what represents any excess return obtained by the fundamental portfolio being studied.

To determine the highest returning portfolio the difference in alpha is tested by running a one-sided $t$-test on the difference of portfolio returns. For instance, if the dividend portfolio is expected to deliver superior alpha to that of the cash flow portfolio, the regression will produce a statistically significant positive alpha. This procedure is repeated for the different portfolios to determine which portfolio produces the greatest, statistically significant, return. The test for determining whether a portfolio produces greater return compared to another is specified as:

$$R_{i,t} - R_{j,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_i$$

Equation (3)

Finally, to gauge the viability of the different strategies, the turnover implied by each portfolio and the costs of trading must be accounted for. Transaction costs consist of direct costs, such as commission charges and other fees, and indirect costs such as lack of liquidity, where a purchase of an illiquid stock leads to price advancement. These costs are hard to estimate, but do reasonably have considerable effect on the actual performance of the investment strategies other than market capitalization strategy. A market capitalization strategy has lower costs than any other strategy, since there is likely a low turnover in the portfolio and because stocks with a large market capitalization are likely to be liquid. Assessing the effect of transaction costs is done in two ways; firstly, similar to Clare et al. (2013), a comparison is made by calculating how high transaction costs may be in order for any excess return to be zero. Secondly, by deducting transaction costs each period for all portfolios except for the market capitalization portfolio, depending on how much turnover there was in that period, similar to Arnott et al. (2005). The turnover rate for a portfolio is calculated by taking the absolute sum per period of all changes in the portfolio weights. An example of the turnover rate calculation, which is done for all stocks and all periods, is provided in table 4.
Table 4. Example of portfolio turnover rate calculation.

The maximum one-way transaction cost for a given portfolio to have no excess return is determined by dividing the turnover rate by the portfolio excess return (Clare et al., 2013).  

Measuring the effect of transaction costs on excess performance is done by calculating the implied costs of turnover and reducing the return by the cost of turnover for every period, yielding a net return for each portfolio and period. For this calculation a one percent one-way transaction cost is assumed (Arnott et al. 2005).

<table>
<thead>
<tr>
<th></th>
<th>Stock A</th>
<th>Stock B</th>
<th>Stock C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1 weight</td>
<td>0.05</td>
<td>0.15</td>
<td>0.10</td>
</tr>
<tr>
<td>Period 2 weight</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Stock Turnover</td>
<td>0.05</td>
<td>0.05</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Portfolio Turnover Period 2 (0.05+0.05+0.00) = 0.10

\[ \text{Maximum one-way transaction cost} = \frac{\text{one-way turnover rate}}{\text{estimated excess return}} \]

\[ \text{Portfolio Cost}_{t,i} = 1\% \times \text{Portfolio Turnover}_{t,i} \times 2 \]

\[ \text{Net Portfolio Return}_{t,i} = \text{Portfolio Return}_{t,i} - \text{Portfolio Cost}_{t,i} \]
4. Empirical Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookvalue</td>
<td>60</td>
<td>0.4447688</td>
<td>0.1223483</td>
<td>-0.2714136</td>
<td>.3692761</td>
<td>-0.3471608</td>
<td>3.133676</td>
</tr>
<tr>
<td>Cashflow</td>
<td>60</td>
<td>0.0609067</td>
<td>0.1261429</td>
<td>-0.276692</td>
<td>.4321573</td>
<td>-0.0182869</td>
<td>3.645014</td>
</tr>
<tr>
<td>Dividend</td>
<td>60</td>
<td>0.0461272</td>
<td>0.1148453</td>
<td>-0.276692</td>
<td>.4321573</td>
<td>-0.0182869</td>
<td>3.645014</td>
</tr>
<tr>
<td>Investments</td>
<td>60</td>
<td>0.037058</td>
<td>0.112358</td>
<td>-0.2831917</td>
<td>.2576798</td>
<td>-0.5671989</td>
<td>3.078696</td>
</tr>
<tr>
<td>Profitability</td>
<td>60</td>
<td>0.0560462</td>
<td>0.1067366</td>
<td>-0.220676</td>
<td>.2305606</td>
<td>-0.513964</td>
<td>2.623665</td>
</tr>
<tr>
<td>Marketcap</td>
<td>60</td>
<td>0.0294596</td>
<td>0.098295</td>
<td>-0.2346271</td>
<td>.2130965</td>
<td>-0.6397545</td>
<td>2.785832</td>
</tr>
</tbody>
</table>

Table 5. Detailed descriptive statistics of the constructed portfolios’ returns.

The descriptive statistics presented in table 5 reveal that all portfolio returns are approximately normally distributed. The skewness is approximately normally distributed (values between .5 and -.5) in all portfolios, however it might be argued that Marketcap has too great a negative skew. All portfolios have kurtosis values considered approximately normally distributed, being in the acceptable range of 2 and 4 (Hamberg, 2013).

It is common in finance research to adjust the data by trimming or winsorizing the sample in order to perform parametric tests, such as t-tests (Hamberg, 2013). However, this thesis refrains from adjusting the data to reproduce more realistic investment outcomes. Therefore, the data used has a slight negative skew, which is common in asset return data.

Further, the statistics for standard deviation and return in table 5 are similar to what is found in Arnott et al. (2005) and Clare et al. (2013). However, the European stock market standard deviations found by Hemminki and Puttonen (2008) are higher.

<table>
<thead>
<tr>
<th>Residual of portfolio return</th>
<th>Adj. chi^2(2)</th>
<th>Prob&gt;chi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookvalue</td>
<td>0.33</td>
<td>0.8468</td>
</tr>
<tr>
<td>Cashflow</td>
<td>3.73</td>
<td>0.1549</td>
</tr>
<tr>
<td>Dividend</td>
<td>4.15</td>
<td>0.1257</td>
</tr>
<tr>
<td>Investment</td>
<td>0.84</td>
<td>0.6577</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.63</td>
<td>0.7295</td>
</tr>
</tbody>
</table>

Table 6. Results of a Jarque-Bera test of normality on the residuals of the portfolio returns. Each variable has 60 observations.

To test whether an assumption of normality is rejected, a Jarque-Bera test has been performed on the residuals, evaluating equation (2) for each portfolio. The results of these Jarque-Bera tests are shown in table 6, and the P-values of above 0.05 in column 3 conclude that an assumption of normality is not rejected for any variable. The data is thereby deemed to be suitable for parametric tests.
### Table 7. Pearson correlations between portfolio returns.

The correlations of the portfolio returns are shown in table 7. The correlation values presented, being above or close to 0.90, suggest that returns of different portfolios move in the same direction to a slightly varying degree. Due to the high correlation between the dependent variables, i.e. the five fundamental portfolios, it is plausible that a multiple regression will have issues with near perfect multicollinearity, rendering a potential multiple regression analysis unsuitable for determining the interaction between the different variables (Stock and Watson, 2015, p. 251). Thus, the market model applied in this thesis will likely give more rigorous estimates.

<table>
<thead>
<tr>
<th></th>
<th>Marketcap</th>
<th>Bookvalue</th>
<th>Cashflow</th>
<th>Dividend</th>
<th>Profitability</th>
<th>Investments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketcap</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bookvalue</td>
<td>0.9270</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cashflow</td>
<td>0.8800</td>
<td>0.9585</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividend</td>
<td>0.9183</td>
<td>0.9626</td>
<td>0.9623</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profitability</td>
<td>0.9132</td>
<td>0.9503</td>
<td>0.9404</td>
<td>0.9527</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Investments</td>
<td>0.9084</td>
<td>0.9417</td>
<td>0.9095</td>
<td>0.9097</td>
<td>0.9361</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Graph 1. Value of portfolio, in SEK

Above, in graph 1, the values of the portfolios are presented, assuming 100 SEK was invested in each portfolio in the beginning of Q2 2002.
Table 8. Results from the market model regression, test of Jensen’s alpha of portfolios.  

The results found in column 3 in table 8 show that the alpha, represented by the constant related to the dividend portfolio, is significantly different from zero on a five percent level. The alpha estimate of 0.0145 shows an average positive abnormal return of 1.45 percent per quarter relative the market benchmark, while the explanatory power of the market model is considered high, reflected by a $R^2$ value of 84.3 percent. This $R^2$ value in turn implies that the variation in the market benchmark portfolio explains 84.3 percent of the variation in the dividend portfolio. Furthermore, the regression of the cash flow weighted portfolio, found in column 2 of table 8, state an alpha of 2.76 percent, statistically significant at one percent level. In line with the results of the dividend and the cash flow portfolios, the regression of the profitability weighted portfolio, found in column 5, delivers an alpha of 2.68 percent, similarly statistically significant at one percent level. Moreover, both models seem to be explained in large proportions by the market portfolio, with $R^2$ values of approximately 80 percent.

In column 1 of table 8, the results from the book value regression are presented. With an alpha of 1.08 percent, statistically significant only at the ten percent level, this portfolio is considered irrelevant for further analysis. Additionally, the same holds for the investment portfolio, which in its regression render a statistically insignificant alpha, contradicting the belief that this constant would be significantly separate from zero. Lastly, the coefficients of the five portfolios, all statistically significant at one percent level, represent the beta coefficients. Thus, this implies that when the market portfolio moves one percent, the
profitability portfolio for example moves 0.992 percent.

Considering the alpha of the cash flow portfolio, which should be regarded as economically significant given its 2.76 percent excess quarterly return, this verifies the predictions given above in the theory section. In line with the by Bender et al. (2013) previously discussed value factors, the outperformance of the cash flow portfolio relative the market benchmark is likely attributed to its ability to invest in value companies rather than growth companies, delivering stable return over time. The cash flow portfolio was predicted to produce alpha, since it is common for investors to estimate the fair value of a security by applying the discounted cash flow model, and this therefore indicates the essential role cash flow has in explaining future price movements and consequently return. Lastly, as pointed out by Barberis et al. (1998), the cash flow factor is subject to investor conservatism, resulting in positive cash flow information more slowly being incorporated into security prices. Consequently, in line with this theory, it is possible that a cognitive price time lag exists in the cash flow portfolios, yielding future price movements and accordingly future return after observing positive cash flow in a company.

Moreover, the alpha of the dividend portfolio is considered economically significant as well. In line with theory, the dividend portfolio has likely outperformed the market portfolio due to similar reasons as for the cash flow portfolio. Given the extensive application of the dividend discount model, estimating the fair value of a security, this too predicted the alpha of the dividend portfolio. Furthermore, in line with the previously discussed reasoning, a value premium has potentially been given to companies giving out dividend, as a compensation for increased real or perceived risk related to the company. In addition, the payment of dividends to shareholders is according to Graham (1949; p. 132) an indication of a well-being company, which is able to distribute its earnings rather than reinvest it. Therefore, the companies paying out more dividends signify sustainable investment, being profitable in the long run. The superior performance of the dividend portfolio relative the market benchmark also finds its explanation in the relationship between investors and internal stakeholders. Assuming an information gap regarding the current financials of the company, the dividend acts as a signal of future profitability and thus return of the firm, to which investors seem to have been quick to react if interfered with.

Finally, the alpha produced by the profitability portfolio should be considered of economic significance as well, yielding a return greater than what its beta predicts according to the market model. Assuming that the profitability variable is a quality factor, the profitability constructed
portfolio gives a good assessment of the financial health of a company, investing a larger share in those firms considered financially stronger by investors. The results regarding the performance of the portfolio were forecasted in line with the theories of Haugen and Baker (1996), stating that qualitative firms tend to grow faster due to their capability to produce earnings relative expenses, indicating greater potential for future growth and consequently return. Finally, according to Hou et al. (2015) the outperformance of the profitability weighted portfolio relative the market weighted benchmark was anticipated, since profitable firms are less likely to experience financial distress, and therefore earn higher expected returns as a result of the market rewarding the company’s financial capabilities.

In terms of the book value and investment weighted portfolios, none of these two strategies managed to produce statistically significant alpha relative market benchmark. Regarding theories arguing for the potential drivers of return relating to the book value factor, these seem to be invalid or at least not applicable to this specific sample. Furthermore, the ideas regarding the investment factor do not motivate the outcome of this thesis’ regression; neither a statistically significant positive nor negative alpha appear to be produced by the specified portfolio. Hence, a fundamentally based investment strategy does not seem to deliver satisfying results when focusing on either investment or book value data.

In sum, our results of the regressions have implications for the interpretation of the efficient market hypothesis. If we assume financial markets to be efficient in its semi-strong form, our results suggest the assumption to be partly invalid since an investment strategy based on publicly available accounting data does seem to produce alpha. Moreover, the concept of anomalies, in terms of investors acting irrationally, have likely some disturbing effect on the market efficiency, resulting in potential mispricing of securities. Additionally, in line with the noisy market hypothesis (Arnott et al., 2005), the reality could be that prices not always reflect the fair value of securities, due to speculators and other strategic or irrational investors. Assuming these mispriced securities are subject to interrelated inefficiencies, this consequently implies that market participants would be able to detect and exploit these inaccuracies by applying appropriate investment strategies, thus gaining alpha. The fundamental investment approach presented and analysed above presents an example of one such strategy.

With the results presented in table 8, we reject the null hypotheses presented in section 2.8, and assert that it is possible for portfolios weighted based on fundamental value and quality factors to create alpha relative a market capitalization weighted portfolio.
Based on equation (3), the results of the one-sided t-tests comparing the alphas of portfolios with excess return are found in table 9. In column 1 of table 9 a comparison of the two best performing portfolios from the market model regressions are compared; Cash flow and Profitability. The results found in column 1 show that there is no clear excess return from investing in Cash flow when compared to Profitability. However, looking at the results from column 2 and 3 in table 9, it is found that the third best portfolio from the market model regressions, the dividend portfolio, is statistically significantly worse at providing excess return. The statistically significant alpha found in column 2 of table 9 shows that Cash flow has a greater return than Dividend. Similarly, Profitability has statistically significantly greater returns than Dividend, as shown in column 3 of table 9. The alpha estimates found in column 2 and 3 in table 9 suggest that the difference also is economically significant, with superior returns of more than one percent per quarter. In sum, the results imply that cash flow and profitability weighted portfolios provide the highest investment returns per quarter, without a statistically significant difference in alpha.

<table>
<thead>
<tr>
<th></th>
<th>(1) Cashflow-Profitability</th>
<th>(2) Cashflow-Dividend</th>
<th>(3) Profitability-Dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td>β</td>
<td>0.138*</td>
<td>0.0564</td>
<td>-0.0813</td>
</tr>
<tr>
<td></td>
<td>(0.0763)</td>
<td>(0.0485)</td>
<td>(0.0624)</td>
</tr>
<tr>
<td>α</td>
<td>0.000804</td>
<td>0.0131***</td>
<td>0.0123***</td>
</tr>
<tr>
<td></td>
<td>(0.00490)</td>
<td>(0.00454)</td>
<td>(0.00376)</td>
</tr>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.092</td>
<td>0.025</td>
<td>0.052</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9. Results from market model regressions, comparing portfolio’s with positive alpha.

Table 10. Sharpe ratios, average geometric quarterly returns and volatility of the portfolio returns.
Having statistically determined the portfolios yielding above market returns, the question of the best risk-adjusted portfolio remains. The Sharpe ratio\(^\text{13}\) is a measure of excess return relative the volatility of the return, and as Markowitz (1952) explains, a high return to risk is what an investor should strive for. In row 1 of table 10 the Sharpe ratios of the portfolios are found. The profitability portfolio has the highest Sharpe ratio of 0.317, outperforming the cash flow portfolio with a ratio of 0.291, on a risk-adjusted basis. Risk-averse investors should therefore invest in portfolios weighted by profitability rather than portfolios weighted by cash flow, even though the cash flow portfolio has a slightly greater quarterly return.

However, it should be noted that transaction costs have not been taken into account thus far.

<table>
<thead>
<tr>
<th></th>
<th>Cashflow</th>
<th>Dividend</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>2.76 %</td>
<td>1.45 %</td>
<td>2.68 %</td>
</tr>
<tr>
<td>Average Turnover</td>
<td>63.80 %</td>
<td>10.47 %</td>
<td>18.94 %</td>
</tr>
<tr>
<td>Transaction Cost for alpha to be 0</td>
<td>4.33 %</td>
<td>13.85 %</td>
<td>14.15 %</td>
</tr>
</tbody>
</table>

Table 11. Portfolio alphas, average turnover and the transaction cost required to eliminate alpha.

Looking at column 2 in table 11, the transaction costs, including commission and indirect costs, would have to be 13.85 percent per quarter for the dividend strategy to provide equal returns to the market capitalization strategy. Due to the low average turnover rate of the dividend portfolio it outperforms the market capitalization benchmark if the round-trip fees are less than 13.85 percent. The cash flow portfolio, found in column 1 of table 11, has a 63.80 percent turnover, much higher than the dividend portfolio. Due to this higher turnover, transaction costs of 4.33 percent would bring the portfolio alpha to zero. In column 3 of table 11 the profitability portfolio turnover is found to be 18.94 percent. This implies that transaction costs would need to be 14.15 percent in order for the profitability portfolio to provide returns equal to the market capitalization portfolio. Having taken transaction costs into consideration, the cash flow investment strategy is plausibly not lucrative. Should the portfolios be exposed to illiquid stocks a transaction cost above 4.33 percent is not unreasonably high.

\(^{13}\) Sharpe ratio = \(\frac{R_p - R_l}{\sigma}\)
Table 12. Market model test of Jensen’s alpha on previously significant portfolios, after transaction costs.

<table>
<thead>
<tr>
<th></th>
<th>(1) NetCashFlow</th>
<th>(2) NetDividend</th>
<th>(3) NetProfitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>β</td>
<td>1.128***</td>
<td>1.074*</td>
<td>0.997***</td>
</tr>
<tr>
<td></td>
<td>(0.101)</td>
<td>(0.0851)</td>
<td>(0.0616)</td>
</tr>
<tr>
<td>α</td>
<td>0.0150*</td>
<td>0.0124**</td>
<td>0.0229***</td>
</tr>
<tr>
<td></td>
<td>(0.00790)</td>
<td>(0.00620)</td>
<td>(0.00603)</td>
</tr>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.774</td>
<td>0.843</td>
<td>0.837</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Graph 2. Value of net portfolio, in SEK

Above, in graph 2, are the net values of the portfolios presented, assuming 100 SEK was invested in each portfolio in the beginning of Q2 2002.

The results from the market model test of Jensen’s alpha after round-trip transaction costs of 2 percent are accounted for are found in table 12. If total round-trip transaction costs of 2 percent were the case, as suggested by Arnott et al. (2005), only the dividend portfolio and profitability portfolios, found in column 1 and 3 respectively of table 12, are found to be statistically significant. The dividend portfolio is estimated to yield an excess return of 1.24 percent per quarter after costs, and an alpha of 2.29 percent is estimated for the profitability.

Considering both risk-adjusted returns and transaction costs, our results indicate that a
profitability investment strategy is preferable when compared to market capitalization or other fundamentally weighted strategies, since this investment strategy provides the highest net-return and the highest Sharpe ratio.
5. Conclusion

The purpose of this thesis was to investigate if fundamental smart beta investment strategies provide a way to create portfolios that in the long run produce higher returns than its market capitalization weighted benchmark. Furthermore, we set out to determine whether the returns were due to greater risk, or if they provided higher risk-adjusted returns.

Having examined the returns of fundamentally weighted portfolios compared to a market capitalization weighted portfolio, formed from the constituent companies of the Swedish stock exchange during the period from 2002 up to and including 2016, we find that fundamentally weighted smart beta portfolios are superior to their market capitalization benchmark. This superior return is estimated to be around two to three percent per quarter for the best performing fundamentally weighted portfolios. Moreover, the return is greater on a risk-adjusted basis, as measured by higher Sharpe ratios.

The first hypothesis presented in the study tested whether value weighted portfolios, invested more heavily in companies with high cash flow-, dividend- or book value-to-market ratios, outperform a traditional market capitalization portfolio in the long run. The results support the proposition this proposition. However, book value weighting did not provide enhanced investment performance, possibly due to it being a widely recognized and simplistic strategy. With regards to the theoretical framework concerning value presented above, our conclusion is that certain value oriented investment strategies provide a greater return than do market capitalization strategies.

The second hypothesis tested if investment returns from a portfolio formed by overweighting quality stocks, defined as stock of those companies having a high return on equity or a low investment ratio, are greater than the return of market capitalization portfolios. The results regarding quality portfolios are mixed; while profitability was found to deliver excess return, investment ratios were not. Our conclusion is that certain quality-focused investment strategies do outperform their market capitalization benchmark.

The findings, which are in line with the previously discussed similar studies made in the US, Europe and Australia, indicate that there are anomalies in financial market returns, and therefore asset pricing inefficiencies. These results can plausibly be attributed to the fact that the market capitalization weighted portfolio overweights highly priced growth stocks while underweighting low priced value stocks, leading to suboptimal investments.
To sum up, our findings support the notion that fundamentally weighted portfolios provide a better risk-adjusted return relative the market capitalization weighted portfolio in the long run. Even after taking into account the implied transaction costs of the fundamentally weighted portfolios, the profitability strategy outperformed the other fundamental strategies as well as the market capitalization portfolio. Considering this consistent outperformance of the profitability weighted portfolio, looking at both gross and net return, we find it likely that this strategy will provide lucrative investment opportunities in the future.

6. Validity and Reliability

When operationalizing the method of this thesis, the study performed by Arnott et al. (2005) has been of great inspiration. By constructing portfolios in a similar matter, the results produced in this thesis should be comparable to those of previous evaluations, improving both reliability and validity. Furthermore, the data collected from Thomson Reuters Datastream has occasionally proven insufficient, requiring manual data gathering in order to correct these errors. Moreover, the data material left the thesis without choice of making the cut-off point in time at Q1 2002, due to inadequate accounting data prior this. Thus, these potential inaccuracies as well as the relatively short time period evaluated might be the explanation to why two out of the five constructed portfolios produced statistically insignificant results, rather than it being explained by no actual relationship.

The validity of the capital asset pricing model is further questioned after analysing the results of this thesis. Evaluating the three fundamental portfolios delivering alpha, we can carefully conclude that additional fundamental factors have explanatory power of asset returns. Consequently, the capital asset pricing model as such is perhaps not an appropriate model for this type of assessment.

Lastly, the question of survivorship bias is present in this thesis, briefly discussed in section 3.2. In previous similar studies a market capitalization index has been applied as the market benchmark, without further discussion regarding the delistings, buyouts, mergers and acquisitions which have occurred during the period. When constructing the market capitalization weighted benchmark of this thesis, the problem of these “dead” companies was brought up, and whether these should be included in hindsight. However, due to the inconveniency as well as the time consumption this would have implied, the problem was solved by building a market benchmark based on the same constituents composing the five
fundamental portfolios, i.e. those companies still listed on the Swedish stock exchange today. Thus, survivorship bias poses no threat of error in our results. Nevertheless, if more time had been at hand, the issue could have been completely adjusted for in order to create a more accurate picture of actual financial market return.

6.1 Generalizability
In terms of the generalizability of this thesis, some minor drawbacks are present due to the previously discussed restrictions in the dataset. A larger sample containing additional observations provides a more solid basis from which a similar survey could draw more general conclusions, containing less standard error in the data. In addition, the general application of this thesis’ results could potentially be questioned since it applies back testing of data, i.e. the regressions are based on historical returns. However, this applies to any study of ex-post asset returns. Furthermore, assessing Swedish data, when similar preceding studies have evaluated the American, European and Australian market, brings beneficial perspectives to investors as well as scholars. Being a smaller economy than those previously evaluated, several differences regarding both fiscal as well as regulatory systems are present, making the results of this Swedish study more suitable for application especially on other Nordic economies such as Norway and Finland.

7. Future Research
Having reached a conclusion regarding our results, a few suggestions are presented for future research in line with this thesis. It would be interesting to evaluate the relationship between market and fundamentally constructed portfolio return if additional multi-factor model variables were included. These models could include variables such as size, momentum, volatility, mean reversion and industry. In addition, a dataset with a larger amount of observations, including delisted companies, and a longer period of time would be of interest. Furthermore, having established that strong fundamental accounting data provide better returns, it would be interesting to discern whether weak fundamental accounting data make for shorting opportunities. If a strategy was built on this assumption exclusively, a portfolio only selling securities short could potentially reap significant returns.
References
Asness, C., 2006. The Value of Fundamental Indexing, s.l.: Euromoney Institutional Investor PLC.


## Appendix

### Definition of Fundamental Factors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Worldscope code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow</td>
<td>4860</td>
<td>Net cash receipts and disbursements resulting from the operations of the company. Sum of funds from operations, funds from/used for other operating activities and extraordinary items</td>
</tr>
<tr>
<td>Dividend</td>
<td>749488</td>
<td>[Dividends paid out during fiscal period]</td>
</tr>
<tr>
<td>Bookvalue</td>
<td>3501</td>
<td>[Common stock value + retained earnings + capital surplus + capital stock premium + cumulative gain or loss of foreign currency translation]</td>
</tr>
<tr>
<td>Investments</td>
<td>2255</td>
<td>[Net investments / (current assets + long term receivables + investment in unconsolidated subsidiaries + other investments + net property plant and equipment + other assets)].</td>
</tr>
<tr>
<td>Profitability</td>
<td>8301</td>
<td>[(Net income before preferred dividends - preferred dividend requirement) / average of last year's and current year’s common equity * 100]</td>
</tr>
</tbody>
</table>
Density Plots of Portfolio Returns

Kernel density estimate

Density

Profitability

Kernel density estimate

Density

CashFlow

Kernel density estimate

Density

BookValue

Kernel density estimate

Density

Dividend

Kernel density estimate

Density

Investments

Kernel density estimate

Density

MarketCap
Graph over quarterly portfolio returns for each portfolio