More Green through a Better Screen?

-A statistical study based on Greenwald's value investing model

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Abstract

This thesis examines whether it is possible to mechanically synthesize the valuation framework developed by Bruce Greenwald in order to identify undervalued stocks. An initial sorting of stocks into portfolios based on their price-to-earnings and market-to-book ratios is showed to generate risk adjusted returns in excess of the OMX Stockholm PI market index, thus supporting the existence of a value premium on the Stockholm Stock Exchange. Further, we identify five accounting based ratios that are key value drivers in the Greenwald model and use these to perform a more specific sorting of stocks. Our results from the final sorting show that we are able to increase returns somewhat but at the cost of higher overall risk. However, a substantial part of this risk is showed to be non-systematic.

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1. Introduction

The main purpose of this chapter is to introduce the value investing approach and previous studies that support or contradict this approach. Our discussion will lead to a framing of two hypotheses. Further, an outline of our study will be presented.

1.1 Background and Previous Studies

Benjamin Graham, who was a famous Columbia Business School professor, is widely recognized as the founder of the investing discipline referred to as value investing. His book *Security Analysis* (Graham and Dodd [1934]) had an immediate impact on the financial industry when it was published in the mid thirties, and it is still one of the most influential books on investing. Benjamin Graham's most famous student and the most famous value investor of today, Warren Buffet, has referred to Benjamin Graham's second book, The *Intelligent Investor* (Graham [1973]), as the best book on investing ever written. By simplifying this book into three core principles one could say that Benjamin Graham's most important advice was as follows; First of all, a stock represents a part of a business with an underlying value that is independent of the current stock price. Secondly, the market swings are due to unsustainable optimism or unjustified pessimism and should therefore be used by the investor rather than followed. Finally, Benjamin Graham insisted on the fact that an investor should use a margin of safety on every investment, to make sure that the investor never overpays and thus minimize his odds of error.

Bruce Greenwald, a current Columbia Business School professor, is the main author of the book *Value Investing: From Graham to Buffet and Beyond* (Greenwald et. al. [2001]). While the book is based on the ideas of Benjamin Graham it also explicitly presents the value investing valuation model that our study is based on. Although Greenwald mainly emphasizes the importance of fundamental analysis when valuing companies he does state that an investor could increase his chances of finding undervalued stocks by applying a proper screening

process. This first step of Greenwald's value investing approach includes a narrowing of the potential investment candidates by applying for example mechanical strategies such as sorting stocks based on price-to-earnings or market-to-book ratios. These mechanical strategies are in line with the value investing theory that suggests that stocks that are moderately valued based on different indicators of value, such as a low market-to-book ratio, generally outperform their counterparts, often referred to as growth stocks.

As with all financial theories, the best proof of whether the theory works or not is its historical results. In this case, one usually compares the historical results of so called value stocks and growth stocks. Value stocks are stocks with a relatively low market price in relation to some accounting figure, for example their earnings per share or book value per share. They might also include stocks that have recently experienced low growth rates. Growth stocks are stocks that have the opposite characteristics. In 1951, David Babson claimed that by investing in well managed firms that experienced above average growth rates, i.e. growth stocks, an investor could achieve superior portfolio performance (Babson [1951]). However, since then, numerous studies using US data has shown that a mechanical selection process that use the market-to-book ratio as a measure of value outperform the market (e.g. Fama French [1992], Rosenberg et. al. [1985], Lakonishok et. al. [1994]). Other studies have shown that this strategy also holds in an international setting (e.g. Capaul et. al. [1993] and Bauman et. al. [1998]). More recent studies on the Swedish stock market show the same pattern (e.g. Carlström et. al. [2005] and Carlsson et. al. [2008]). The results differ somewhat between different studies and consequently it is difficult to draw any major conclusions about the outperformance of value stocks in different countries. However, the results from the above mentioned Swedish studies do not significantly differ from the results of the international studies and it is therefore fair to conclude that Swedish data supports the same pattern as international data does. The superior performance of stocks with a low market-to-book ratio has also been proven to hold when using data samples free from different selection biases (Chan et. al. [1994]). Other studies has shown that stocks with low price-to-earnings ratios outperform stocks with high price-to-earnings ratios (e.g. Nicholson [1960], Basu [1977] and Anderson and Brooks [2007]). It has also

been shown that positive and negative earnings surprises affect stocks asymmetrically in a way that favors stocks with a low price-to-earnings ratio (Dreman and Berry [1995]).

Some researchers would claim that such abnormal returns can only be explained by increased systematic risk (e.g. Sharpe [1964] Lintner [1965] and Black [1972]). Chen and Zhang (1998) do find that value stocks are riskier due to factors such as financial distress and high financial leverage. On the other hand, since most studies show that these abnormal results are not due to increased levels of risk, researchers often refer to them as market anomalies that clearly contradict the Efficient Market Hypothesis (Lakonishok et. al. [1994], Chan and Lakonishok [2004] and Capaul et. al. [1993]). As these market anomalies has become widely known there is also numerous studies that tries to explain them -both directly and indirectly- and there are numerous explanations for these results. Bartov and Kim (2004) claim that financial analysts are overly pessimistic about value stocks at the same time as they are overly optimistic about growth stocks. Other studies have shown that stock markets overreact to information (Barberis et. al. [1998], Jegadeesh and Titman [1995] and DeBondt and Thaler [1985, 1987]) which could imply that stocks that have low market-to-book or low price-to-earnings ratios due to past events might be undervalued by overreacting investors. Lakonishok et. al. (1994) suggests that value strategies earn superior returns due to the fact that investors' expectations are extrapolated from recent past performance. This could imply that stocks that have temporary problems or poor performance suffers from investors that have unrealistically low expectations of the companies' future performance. Further, Dreman and Berry (1995) show that earnings announcements have a systematically more positive effect on value stocks suggesting that there is a mispricing (overreaction) prior to the announcement and a corrective movement after the surprise. This systematically more positive effect of earnings announcements for value stocks is also supported by La Porta et. al. (1997).

There have also been numerous studies that have tried to further enhance the superior returns of mechanical strategies of investing in stocks with low market-to-book or price-to-earnings ratios where the authors use historical financial information to further separate stocks from each other (e.g. Piotroski [2000] and Bartov and Kim [2004]). Bartov and Kim (2004) used a joint

classification system to classify stocks as value stocks or growth stocks based on both market-to-book ratios and accounting accruals. This joint classification excluded stocks with extreme market-to-book ratios that were the result of wrongly measured book values due to limitations in the accounting system. The result was substantially higher returns with no evidence of increased risk. Piotroski (2000) showed that by selecting financially strong firms with a low market-to-book ratio an investor could increase his/her annual return with at least 7.5%. This is due to the fact that even though value stocks as a group achieve superior performance, less than half of the stocks that he classified as value stocks outperformed the market while the others underperformed the market index. Consequently, by distinguishing between these two types of value stocks an investor could earn even better returns from the strategy of investing in stocks with low market-to-book ratios.

1.2 Problem Discussion and Hypothesis

As already mentioned there is an abundance of studies showing that mechanical strategies of investing in value stocks outperform the market. These studies contradict the Efficient Market Hypothesis, which in turn is a necessity in order to support an active investment approach of value investing. Also, some studies that do go further in order to investigate how to improve the value premium use financial analysis based on historical data in their research (e.g. Piotroski [2000]). On the other hand the financial analysis in these studies is not based on the fundamentals of value investing as taught by for example Benjamin Graham and Bruce Greenwald and could be considered as somewhat arbitrary. Consequently, even though these studies show how one could improve the value premium further by not only sorting stocks based on their market-to-book ratio, but other financial ratios as well, they do not provide empirical input on the more practical perspective of the value investing approach as practiced by investors around the world. By applying Greenwald's valuation model our study is better supported by a widely recognized theoretical framework, i.e. value investing as it is thought by Benjamin Graham and used by value investors today.

Given the strong empirical results of previous studies showing that there exist a value premium on the stock markets around the world our first hypothesis is the following:

H1: By applying a sorting method on the Swedish stock market where stocks are selected based on their price-to-earnings and market-to-book ratios, an investor can generate returns in excess of market index returns without increasing the level of idiosyncratic and systematic risks.

Further, given the success of value investors such as Warren Buffet and Benjamin Graham that apply fundamental analysis when investing in stocks, there is no doubt that the value investing approach to investing has been successful historically. Since Greenwald's valuation model is based on the value investing approach as taught by Benjamin Graham, our second hypothesis is the following:

H2: By applying a scoring system based on Greenwald's valuation method on the stocks selected based on their price-to-earnings and market-to-book ratios, an investor can generate returns in excess of market index returns, without increasing the level of idiosyncratic and systematic risks, which cannot be achieved by sorting on price-to-earnings and market-to-book ratios alone.

1.3 Purpose and Thesis Contribution

The purpose of this thesis is to empirically study the valuation model as proposed by Greenwald (Greenwald et. al. [2001]) in order to improve the screening process that an investor could apply as a first step before conducting valuations based on fundamental analysis. By identifying some key drivers of value in the valuation model we believe that an investor could further narrow down the number of potentially undervalued stocks than what is possible through a screen that is merely based on the stocks' price-to-earnings and market-to-book ratios alone. Studies on mutual funds have shown that these funds, by using fundamental analysis, usually cannot achieve superior returns but rather underperform compared to the market returns (e.g. Carhart [1997] and Malkiel [1995]). However, a recent study conducted in Canada at the Richard Ivey School of Business, that uses a screening process based on price-to-earnings and

market-to-book ratios, as well as a fundamental valuation using the Greenwald valuation model, shows that while using fundamental analysis within this framework, one could achieve 1.1% higher annual returns between 1985-1998 and 13.2% higher annual returns between 1998-2007 than the returns that one could achieve while merely buying stocks with low price-to-earnings and market-to-book ratios (Athanassakos [2009]). The success of applying the valuation model could be due both to the power of applying fundamental analysis when valuing a company as well as to some built-in mechanical strategy that comes into play when applying Greenwald's model. To the extent that the latter is true you cannot really give credit to the fundamental analysis of the investor for those parts of the returns that are attributed to market anomalies that could be exploited in a screening process mechanically, i.e. applying the valuation model empirically rather than fundamentally.

1.4 Outline

The outline of our thesis is as follows: In chapter 2 we will describe the theoretical framework behind our empirical study. In chapter 3 we will explain the methodology used and the tests we have conducted. An explanation of the data sampling, as well as some data descriptives and a short data discussion is provided in chapter 4. In chapter 5 we present our results. The results are analyzed in chapter 6. In chapter 7 we conclude our study.

2. Theoretical Framework

This chapter starts with a brief explanation of the value investing approach and continues with a more in depth summary of Greenwald's valuation model. Finally, we will present what we believe are the key value drivers in the model and why. The explanation of Greenwald's valuation model is given in order to clarify the key value drivers and the theoretical framework behind our study.

2.1 Value Investing

The basic idea of value investing is very simple: an investor can obtain superior returns by buying underpriced stocks, i.e. stocks with prices that diverge from their fundamental values. This idea relies on one main assumption; markets are not efficient. Value investors do not believe in the Efficient Market Hypothesis as proposed by Fama (1970) and hence they do believe in the existence of market anomalies. Consequently, the market should not be followed; it should be used in order to earn excess returns. By this reasoning, a completely diversified portfolio is undesirable, since it by definition is highly correlated with the market. Value investors also add a substantial margin of safety when investing in different stocks, i.e. they only invest in stocks that is priced at a certain, predetermined percentage under its intrinsic or fundamental value (Greenwald et. al. [2001]).

Generally, value investors look especially at stocks that are obscure or undesirable in the eyes of many other investors. Typical characteristics of obscure stocks can be small cap stocks that large institutions cannot invest in, spin-offs that investors lack information about, and stocks that are covered by a low number of analysts. Undesirable stocks are for example stocks of companies in financial distress, companies with low growth or companies with problems such as lawsuits and poor subsidiary performance (Greenwald et. al. [2001]). The reasons to why the market might undervalue this kind of stocks include behaviors such as for example overreaction to information and extrapolation of past performance as mentioned in the previous studies

section above. Two financial ratios that often reflect the characteristics mentioned above are a low price-to-earnings ratio and a low market-to-book ratio. Value investors therefore often use these ratios as tools for screening stocks, but for the purpose of narrowing down the number of potentially undervalued stocks rather than for stock selection in itself (Greenwald et. al. [2001]).

2.2 Greenwald's Value Investing Valuation Model

When valuing a stock, Greenwald uses a method that combines a valuation of the company's assets (net asset value) with the value of its current cash flows (earnings power value). Any discrepancy between these values is then explained through fundamental analysis after which the investor assesses the probability that the earnings power value moves towards the net asset value, i.e. what is the probability of the company's return on invested capital going towards its weighted average cost of capital. Since the discrepancy between the net asset value and the earnings power value depends on the discrepancy between the company's return on invested capital and its weighted average cost of capital, the probability of the earnings power value going towards the net asset value equals the probability of the company's return on invested capital going towards its weighted average cost of capital. According to economic theory the return on invested capital should equal the weighted average cost of capital on a competitive market in the long run. If it does not, the company must have some sort of comparative advantage or disadvantage compared to its competitors. Consequently, the analysis that assesses the probability that the earnings power value moves towards the net asset value is based on whether, and to what extent, the company is considered to have a comparative advantage or a disadvantage. With the probability being decided, the investor can then compute the intrinsic value of the stock (Greenwald et. al. [2001]).

Greenwald's valuation model tries to avoid "good information" being affected by "bad information". Examples of "bad information" are uncertain information such as forecasts about for example margins and growth, and therefore Greenwald's valuation model does not use forecasts and in most cases does not account for growth. "Good information" on the other

hand is information that is more certain and stable. Examples of "good information" are information that is given in the companies' financial statements. However, although the model avoids "bad information" it relies on some industry knowledge and strategic analysis (Greenwald et. al. [2001]).

2.2.1 Stock Screening

Although Greenwald only regards the screening process as a first step before the investor conducts the valuation in itself, he does emphasize the value and importance of applying a screening process. Since stocks that are generally undesirable and obscure have given better returns historically, these are the types of stocks that the investor should look for. Greenwald does not explicitly suggest any particular screening process but rather see it as a mix of using mechanical strategies as well as some fundamental analysis to end up with a small group of potentially undervalued stocks. One way of narrowing the group is by sorting stocks based on their price-to-earnings or market-to-book ratios (Greenwald et. al. [2001]).

2.2.2 Net Asset Value

When valuing a firm, all value investors rely solely or partly on some sort of value of the company's assets. The net asset value does not rely on any forecasts but rather on the value of the assets that exists in the company today, and it is therefore a more reliable and restrictive approach to valuing a company than most traditional valuation such as a discounted cash flow model. However, the approach requires some strategic judgments as well as judgments about the reliability of the information going into the model (Greenwald et. al. [2001]).

The most important strategic judgment is whether you expect the industry that the firm operates in to be economically viable or not. If the industry is not economically viable, the assets in the company should be valued at their liquidation value. However, if the industry is expected to be economically viable the assets should be valued at their reproduction cost, i.e. the costs for the company or a competitor of replacing the assets today. This decision is very important when it comes to estimating the value of assets such as property, plant and

equipment, inventory and goodwill although most companies' assets will be valued at their replacement cost (Greenwald et. al. [2001]).

The most important source of information for the net asset valuation is the balance sheet where the values of the assets are given as they are determined by the accountants. This information is more or less reliable and correct for different kinds of assets. Current assets such as cash, marketable securities, accounts receivables and inventories are more likely to be accounted for in a way that accurately reflects their true value compared to other assets such as property, plant and equipment and hidden assets such as goodwill. Assets such as property, plant and equipment and goodwill therefore demand more adjustments in order to reflect a true replacement cost, adjustments that require both industry knowledge and strategic analysis (Greenwald et. al. [2001]). ***Table 1*** shows our interpretation of how Greenwald suggests that you should adjust different types of assets in order to compute the replacement value of assets.

Table 1: Adjustments of asset types in order to compute the reproduction value of assets

Type of asset	Adjustment to arrive at reproduction cost
Current assets	
Cash	None
Marketable securities	None
Accounts receivable (net)	Add bad debt allowances; adjust for collections
Inventories	Add LIFO reserve if any; adjust for turnover
Prepaid expenses	None
Deferred taxes	Discount to present value
Total current assets	Approximately book value
Property, plant and equipment (net)	Original cost plus adjustments
Goodwill	Book value related to product portfolio and customer relations
Product portfolio	Depends on level of R&D expenses and product cycle
Customer relations	Depends on level of SGA and some multiple
Total assets	Reproduction value

When accounting for property, plant and equipment companies depreciate assets such as buildings and land, although the real reproduction value of these assets are probably increasing

rather than decreasing. Also, a lot of the plants and equipment are depreciated at a higher rate than what is suggested by their economic life. On the other hand, some types of equipment for example could be less costly to reproduce today than is suggested by the accounted value. Consequently, the value of the company's property, plant and equipment has to be adjusted for. When reproducing a company's assets one must also take into consideration the hidden value of the company's product portfolio. This value should reflect the cost of reproducing the portfolio and it therefore depends on the company's research and development expenses and the product life cycle of the products it produces, e.g. it takes company A 10 million a year during 10 years to come up with a new generation of products and consequently the reproduction value of this portfolio is 100 million. Also, the value of the company's customer relations, another hidden asset, has to be accounted for. Greenwald suggests that this value should be reflected by some multiple of the amount that the company spends on selling, general and administrative expenses (Greenwald et. al. [2001]).

In order to reach the value of equity one must deduct the reproduction value of the company's liabilities from the reproduction value of assets. The value of most types of liabilities can be approximated to equal their book values. However, liabilities in the form of debt should preferably be assigned their current market value if possible (Greenwald et. al. [2001]). ***Table 2*** shows our interpretation on how Greenwald suggests that you should adjust different types of liabilities in order to compute the replacement value of liabilities.

Table 2: Adjustments of liability types in order to compute the reproduction value of liabilities

Type of liability	Adjustment to arrive at reproduction cost
Current liabilities	
Accounts payable	None
Accrued expenses	None
Deferred tax liabilities	Discount to present value
Total current liabilities	Approximately book value
Debt	Market value or if not applicable book value
Total liabilities	Reproduction value

When deducting the total reproduction value of the company's liabilities from the total reproduction value of the company's assets, one reaches the company's net asset value. If we believe that the company does not have any competitive advantage or disadvantage the company's intrinsic value should equal the company's net asset value (Greenwald et. al. [2001]).

2.2.3 Earnings Power Value

If the company has a competitive advantage or disadvantage it is important to account for the company's earnings power value. The earnings power valuation is quite similar to a standard discounted cash flow valuation, except for a few but important exceptions. Since Greenwald's valuation model tries to avoid the usage of "bad information" it does not include any forecast period and it does not usually account for growth. Instead, the earnings power valuation relies on the company's current cash flows. Although the earnings power valuation will be less reliable than the net asset valuation, mainly because it assumes that the current earnings levels will be sustained in eternity, it will be more certain than a present value valuation that relies on forecasts of margins, growth and the cost of capital for many years into the future (Greenwald et. al. [2001]).

Basically the earnings power value is computed by estimating the company's adjusted earnings and discounting these in eternity using a proper discount rate. The discount rate is the company's weighted average cost of capital. This can be compared to the use of a Gordon Growth formula (which is commonly used for calculating terminal value in traditional discounted cash flow models) with zero growth. After discounting the adjusted earnings one has to add the value of non-operating assets such as excess cash and deduct the value of debt to end up with the value of the company's equity (Greenwald et. al. [2001]). ***Table 3*** shows our interpretations of how Greenwald suggests that you compute the adjusted earnings. As can be noted there is no item that accounts for the change in net working capital since we do not expect to have such a change when the growth of the operations is assumed to be zero. Due to

the same reason, only an item called maintenance CAPEX is included, instead of the whole CAPEX amount. This corresponds to the part of CAPEX that is required to only sustain the current operations, not grow them (Greenwald et. al. [2001]).

Table 3: Calculation of adjusted earnings

Type of income/expense	Adjustment to arrive at adjusted earnings
EBIT adjusted for cyclicality	EBIT that is normalized over a business cycle
-/+ One-time adjustments	Account for frequent "exceptional" charges
- Tax on EBIT	Deduct tax according to statutory tax rate
- Depreciation and amortization	Add back depreciation and amortization
- Maintenance CAPEX	Deduct CAPEX necessary to sustain current operations
= Adjusted earnings	

2.2.4 Intrinsic Value

If the earnings power value equals the net asset value, it can be concluded that the company performs in a way that companies in an industry without competitive advantages are expected to perform in the long run. This might also confirm that the estimation of the intrinsic value is correct since the intrinsic value is the same as both the net asset value and the earnings power value (Greenwald et. al. [2001]).

If the earnings power value falls below the reproduction value of assets there are two possible reasons for this. The first reason could be that the management is doing something wrong and as a result do not succeed in earning as high levels of cash flows on the company's assets as it should. The other reason could be that there is excess capacity in the industry. The intrinsic value in this case should generally be considered to be the earnings power value. However, one should be aware of the fact that there are both possibilities and threats for the investor when investing in these types of companies. There is a probability that the situation might change and the value of the company increase, either due to a change in management or due to a change in the industry demand and supply. On the other hand, there is also a risk that the company will take on more capital and invest in expanding its business, growth that destroys

capital since the company generates a value of cash flows that is lower than the value of capital (Greenwald et. al. [2001]).

If the earnings power value exceeds the net asset value, the investor has to figure out whether the company operates on a market where the barriers to entry are sufficient in order for such a situation to be sustained. In this case the difference in values is called franchise and the question is whether it can be sustained in the indefinite future. There are only a few companies that enjoy infinitely sustainable franchises and consequently the value investor is likely to only pay for some of the earnings power value that exceeds the net asset value. In the case of a growing firm that has a sustainable franchise one could also account for growth in the valuation (Greenwald et. al. [2001]). However, we will not account for that in this study.

Consequently, the final determination of the stock's intrinsic value is based on judgment and is therefore subjective. These judgments are based on the investor's knowledge and expectations about the company and the industry. Therefore parts of the valuation will be subjective. However, this study will focus on the key value drivers in the valuation that are not subjective but are fundamental parts of Greenwald's valuation model.

2.3 Key Value Drivers

Since the purpose of this thesis is to empirically study the valuation model as proposed by Greenwald (Greenwald et. al. [2001]) in order to improve the screening process that an investor could apply as a first step before conducting valuations based on fundamental analysis, we want to identify and examine some key value drivers in the model that could help us in creating a better screening process. By identifying some key drivers of value in the valuation model we believe that an investor could further narrow down the number of potentially undervalued stocks than what is possible through a screen that is merely based on the stocks' price-to-book and market-to-book ratios.

We have identified a total of five financial ratios that are important in driving value in the model. Of these five, three are related to the net asset valuation and two are related to the earnings power valuation.

2.3.1 Key Value Drivers in the Net Asset Valuation

For the valuation of the net assets, one indicator of undervaluation would be if the market value per share is lower than the book value per share. This dimension is already captured by the fact that our initial screening is based on the companies' market-to-book values. However, what are not captured by the market-to-book ratio are the companies' market values of assets and hidden assets. Important asset classes in the net asset valuation model that are not captured by the book values in the accounting are the value of property, plant and equipment, the value of the company's product portfolio as well as the value of the company's customer relations.

In accounting, the plants and equipment are often depreciated at a faster rate than their economic life would suggest. Another, even more misleading accounting effect is the fact that buildings and land are depreciated although these assets probably increase in value over time rather than decrease, at least at the rate of inflation. Therefore, Greenwald's valuation model generally values companies with a lot of property, plant and equipment higher than their respective book value. Consequently, one of the ratios used in our statistical study is the original cost of property, plant and equipment divided by the book value of total assets.

Every year companies put large amounts of money into research and development of new technology, methodology and products for one single reason: it creates value for the company. However, from an accounting perspective these costs are most often expensed rather than balanced. Consequently, there are often huge product portfolio values that are not accounted for in the book value of the companies' assets. However, in the net asset value model these values are accounted for through the identification and analysis of the products, patents or other cash flow generating assets that are created through research and development. Since the model generally implies a higher value for companies with high costs for research and

development, our second ratio is the annual research and development expense divided by the book value of total assets.

Another cost that creates value for the company without being accounted for as an asset in the balance sheet is marketing expenses. Different types of marketing efforts create customer relations which drives cash flows for the company in the future. In the net asset value model these values are accounted for through the identification and analysis of assets that are important for customer relations such as brand name, distribution channels and customer awareness. Consequently, the model generally values companies with high marketing expenses (often included in the selling, general and administrative expenses) higher. Therefore, our third ratio is the annual selling, general and administrative expense divided by the book value of total assets.

2.3.2 Key Value Drivers in the Earnings Power Valuation

An important indicator of undervaluation in the earnings power valuation would be if the market value per share is low relative to the earnings per share. This is however already captured by the fact that our initial screening only included the companies with the lowest price-to-earnings ratios. On the other hand, the original screening based on price-to-earnings ratio has not fully captured the implications of the assumptions in Greenwald's valuation model of which the assumption of no growth is the most important. Due to this assumption, Greenwald's model value companies in a slightly different manor than traditional valuation models. Therefore, our ratios should be based on factors that give a higher valuation in the earnings power valuation than in traditional valuation models, which would increase the chance of an undervaluation according to our model.

One factor that is highly valued on the financial markets is growth. In traditional valuation, growth is included in the perpetuity formula, reducing the discount rate with the level of growth. Also, the growth in sales is one of the most important factors in the forecasts that traditional models are based on. Consequently, companies with high growth are often highly valued on the financial markets. However, in Greenwald's earnings power valuation one

normally does not account for growth. It is easily presumed that companies with a low level of growth will have a higher value in Greenwald's model than what the consensus is on the market. Therefore, our fourth ratio will be the last three year's compound annual growth rate (CAGR).

By the same reasoning, since the earnings power valuation do not account for changes in net working capital, companies with a high increase in net working will be relatively higher valued by the earnings power valuation compared to the market. Consequently, our fifth ratio will be the change in net working capital divided by the book value of total assets.

3. Methodology

This chapter focuses on the statistical approach we have chosen in this study. We will explain the initial stock screening and portfolio sorting, the rationale behind the scoring system as well as the regressions that we have conducted. Finally we explain the descriptive tests that we have used in order to test and explain the data.

3.1 Statistical Approach

The empirical studies will be performed on two portfolios. First, we will have a portfolio consisting of 20 stocks based on an initial sorting on price-to-earnings and market-to-book ratios which is rebalanced yearly. The return of this portfolio will be compared to the return on the market index, the broad OMXSPI index which is a value weighted index that includes all the stocks listed on the Stockholm Stock Exchange. We will use a time series regression to see if the portfolio produces any significant positive alpha when we regress the excess portfolio return on the excess market return.

Then we will use our scoring system based on the key value drivers of Greenwald's valuation model (section 3.3) in order to divide the initial portfolio into two new portfolios with 10 stocks in each. The return of the 10-stock portfolio with the highest rank will then be compared with the return of the market index as well as the low ranked portfolio. We will use another time series regression to see whether the high ranked portfolio produces any significant positive alpha when regressing the excess portfolio return on the excess market return as well as whether it produces a different alpha than our low ranked portfolio.

As a last step we will use cross sectional regressions on all the 20 stocks included in our initial portfolio each year where we regress the returns on the stocks on the ratios used in our scoring system. This will be done in order to evaluate the scoring system to see which ratios, if any, that produce a better, or worse, screening process.

3.2 Stock Screening and Portfolio Sorting

The initial stock screening is based on the price-to-earnings and market-to-book ratios of all the stocks on the Swedish NASDAQ OMX index (Large, Mid and Small cap). However, all financial companies such as banks, insurance companies and investment companies are excluded. The reason for this is the fact that banks and insurance companies have too complex structures which results in the fact that most value investors avoid to invest in these types of companies. Investment companies are excluded since they mostly consist of investments in other listed companies, which in turn are also included in the screening and that we rather include directly than indirectly. Investment companies also often trades at a discount for other reasons than potential undervaluation.

The sorting is made on the first trading day in April every year after which we invest in the selected stocks according to a one year buy and hold strategy. The sorting is made in two steps; First, all companies are sorted on their price-to-earnings ratio after which companies with a negative price-to-earnings ratio or a ratio above 50 are excluded. Finally, the remaining stocks are split in half, of which the stocks with lowest price-to-earnings are sorted on their market-to-book ratio[1]. The 20 stocks with the lowest market-to-book each year are included in our 20-stock portfolio. There are several reasons for sorting the stocks based on both price-to-earnings and market-to-book ratios according to this methodology instead of just using one of the ratios. First of all, Greenwald mentions price-to-earnings and market-to-book ratios as two of the most popular and efficient fundamental ratios to screen stocks on. Further, the methodology is inspired by the study conducted at the Richard Ivey School of Business that used a very similar approach (Athanassakos [2009]). This study shows that by looking at the stocks that have the lowest price-to-earnings ratios one can significantly improve the results that stocks with a low market-to-book ratio outperform their counterparts.

[1] We also controlled for this sorting methodology by sorting using the lowest one third of the stocks based on price-to-earnings ratios and then sort for market-to-book as well as only sorting for market-to-book without considering the price-to-earnings ratios. These different types of sorting methodologies gave similar results except for the fact that the risk-adjusted results were better when taking account for the price-to-earnings ratios in the sorting.

3.3 Scoring System

The scoring system is based on the five key value drivers that we identified when studying Greenwald's valuation model and the methodology of the scoring system in itself is inspired by Piotroski (Piotroski [2000]). The five key value drivers are:

1. Property, plant and equipment divided by the book value of total assets
2. The annual research and development expense divided by the book value of total assets
3. The annual selling, general and administrative expense divided by the book value of total assets
4. A low historical growth as given by the last three year's compound annual growth rate (CAGR)
5. A high historical change in net working capital as given by the last year's change in net working capital divided by the book value of total assets

All the 20 stocks in the initial portfolio will be sorted based on each of these five key value drivers. Points of 1-20 will then be distributed between these stocks where the stock with the best prospects within each value driver is given 20 points and the worst is given 1 point. Stocks that have values of zero under any value driver are given 0 points from that specific criterion. The reason for this is that many companies do not have for example research and development expenses and by not giving these companies 0 points under this criteria, the total points given under the criteria would be much higher when the companies get joint ranks than under other criteria, e.g. if 15 companies during a single year do not have any research and development expenses these companies all get 14 points for the joint 6^{th} rank which would imply that the total points under this criteria would be much higher than under the other criteria. The drawback with this methodology is that it usually requires very high levels of for example property, plant and equipment to get a high score under that criteria while it sometimes only requires a very small amount of research and development expenses to get a high score under this criteria.

3.4 Regressions

In order to control whether higher returns are just an effect of loading our portfolios with systematic risk, we perform regressions of the excess returns of our portfolios on the excess market return. Under the assumption that the CAPM beta proxy for systematic risk, a significant value of alpha in the regression would imply abnormal returns that cannot be explained by higher levels of systematic risk. This would support our hypothesis that the initial price-to-earnings and market-to-book sorting and the sorting using the ranking system based on Greenwald's value investing model indeed is capable of finding outperforming stocks.

First we run the regression using portfolios based on the initial price-to-earnings and market-to-book sorting and secondly we run the same regression but this time on the portfolios based on the scoring system which is based on the Greenwald model. The regressions can be written as:

$$r_{p,t} - r_{f,t} = \alpha + \beta[r_{omx,t} - r_{f,t}] + \varepsilon_{,t}$$

Where $r_{p,t}$ is the portfolio return, $r_{f,t}$ is the risk free rate (ten year Swedish treasury bonds) and $r_{omx,t}$ is the market return (OMXSPI) at time t.

Next, we perform cross sectional regressions for each year, in order to evaluate the explanatory power of the ratios used in the scoring system on the stock returns of the stocks included in the portfolios. This results in nine cross sectional regressions that can be written as:

$$r_i = \alpha + \beta_1 * fa_i + \beta_2 * sga_i + \beta_3 * rnd_i + \beta_4 * cwc_i + \beta_5 * cagr_i$$

Where r_i is the stock return, *fa* is fixed assets / book value of total assets, *sga* is selling, general and administrative expenses / book value of total assets, *rnd* is research and development / book value of total assets, *cwc* is the change in working capital / book value of total assets and *cagr* is the compound annual growth rate. In order to adjust for heteroscedasticity we use robust standard errors in all regressions.

We are aware that these cross sectional regressions are unlikely to provide very strong results due to the small amount of data (only 20 stocks in each year), however we believe them to be of interest to include since they might result in significant results given that the power of the ratios to explain returns is strong enough. Further, these regressions provide a framework for potential future studies.

3.5 Descriptive Tests

One of the most important issues when working with time series is to check for stationarity in the data. In finance, even though prices are not stationary, returns are and we should thereby be fine since we are working with portfolio returns. However, to further address this issue we perform the Augmented Dickey-Fuller test of unit root. If we find evidence of a unit root, we can conclude that the series are not stationary. The null hypothesis in the Dickey-Fuller test is that there is a unit root; therefore if we can reject the null we can conclude that the series is indeed stationary.

Further, in order to test for the presence of autocorrelation in returns, we perform the Ljung-Box test. Under this test, the null hypothesis is that the data is random and H1 is that there is some lag structure so that past returns explain future returns, i.e. autocorrelation in the data series.

In order to further describe the data we have plotted the excess returns of each portfolio in histograms as well as performed a normality test based on skewness and kurtosis for each of the portfolios. We also drew all the portfolio returns against the normal distribution in a quantile-quantile plot to get a visual interpretation of the distribution of our data.

To ensure the validity of the time series regressions we have performed the White test to check for heteroscedasticity as well as the Durbin-Watson test for autocorrelation in the residuals. These tests address the OLS assumptions that the error terms are homoscedastic and not correlated across observations. Further, in order to correct for the presence of heteroscedasticity we use robust standard errors in the regressions, i.e. the Newey-West

method. In order to check the OLS assumption that the residuals are normally distributed we plotted the residuals against the normal distribution in histograms and performed a quantile-quantile plot of residuals against the normal distribution as well as performed a normality test based on skewness and kurtosis on the residuals in each regression.

We perform these tests in order to identify any potential severe problems with our data sample from a statistical point of view. The results from these tests are included in the appendix and as can be seen, there are no severe problems in using this data.

4. Data

In this chapter we will explain the sampling and selection of the data. We will also present some data statistics. Finally, we will discuss the data and some weaknesses and uncertainties with the data that should be considered when interpreting the results.

4.1 Data Sampling

The primary source for our data is Bloomberg®. The price-to-earnings ratio is a twelve month trailing price-to-earnings ratio (PE_RATIO) calculated as the last price divided by the twelve month trailing earnings per share before extraordinary items. However, the fact that the ratio is based on the trailing earnings per share does not have an effect since the data is collected from the companies' last annual report, independent of whether the companies' fiscal year ends at the end of December or earlier during the year. This is also true for the market-to-book ratio which is computed after downloading the current market capitalization (CUR_MKT_CAP) as well as the total shareholders equity (TOT_SHRHLDR_EQY) from Bloomberg®.

Bloomberg® is also the source for the information used to rank the portfolios according to our key value drivers. Property, plant and equipment (BS_GROSS_FIX_ASSET) is defined as depreciable and non-depreciable fixed assets held gross of depreciation. This figure includes capitalized leases, assets under construction and advance payments for fixed assets as well as revaluation of fixed assets. It also includes capitalized exploration and development costs for mining companies and may include intangible fixed assets such as easements and land rights for natural resources companies. The research and development expenses (IS_RD_EXPEND) is defined as the research and development expenditures incurred in the fiscal period. Selling, general and administrative expenses (IS_SGA_OTHER_OP_DEPR_OP_MAINT) are defined as indirect operating expenses after costs of goods sold. If there is no breakdown between costs of goods sold and selling, general and administrative expenses, it includes the entire amount

which represents total operating expenses. It also includes amortization of intangibles including goodwill. The book value of total assets (BS_TOT_ASSET) is defined as the total of short-term and long-term assets as reported on the balance sheet. Sales (SALES_REV_TURN) are defined as the total of operating revenues less various adjustments to gross sales. It excludes inter-company revenue and revenues from discontinued operations. Working capital (WORKING_CAPITAL) is defined as current assets reported minus current liabilities. Information that has been missing from Bloomberg® has, when applicable, been collected manually by using the companies' annual reports.

All the data for stock and index prices are given by the NASDAQ OMX stock exchange. All the stock prices are adjusted for events such as stock splits. As a market index we chose to use the OMX Stockholm PI index which is an index that includes all the stocks that are listed at the Swedish NASDAQ OMX stock exchange, i.e. the same companies that are included in our sorting.

By applying a one year buy and hold strategy from the 1st of April to the 31st of March each year, one can be quite certain that the information used in the sorting was available at the time of each sorting.

4.2 Data statistics

Table 4: Some data statistics of the initial data set

Data statistics										
Portfolio	Entire Period	2000	2001	2002	2003	2004	2005	2006	2007	2008
# of companies	180	20	20	20	20	20	20	20	20	20
# of unique companies	85	20	20	20	20	20	20	20	20	20
Max PE	16,697	10,279	13,860	14,814	16,049	13,938	16,697	16,602	10,818	7,473
Min PE	0,023	2,469	0,023	0,724	4,91	2,309	2,433	0,057	1,553	2,258
Mean PE	7,627	6,937	7,906	7,259	11,345	9,200	7,823	7,600	5,571	5,003
Max MB	1,488	1,115	1,278	1,115	1,465	1,327	1,488	1,440	1,087	0,741
Min MB	0,073	0,387	0,263	0,477	0,531	0,568	0,603	0,073	0,555	0,227
Mean MB	0,928	0,753	0,946	0,828	1,112	1,042	1,216	1,088	0,876	0,493

See ***Tables 2*** and ***3*** in the appendix for a detailed list of the companies included in the different portfolios.

4.3 Data Discussion

Our study is dependent on, and limited to, the information that is available to us in the form of data from Bloomberg®, the NASDAQ OMX stock exchange, and the companies' annual reports. Obviously, we have to rely on the fact that the information given to us is correct although it can never be guaranteed. Bloomberg® is in our minds one of the most reliable sources when it comes to financial data and therefore we have deliberately chosen Bloomberg® to be our primary source for financial statement data. When it comes to stock prices we further believe that the stock exchange itself is the most reliable source. Finally, by manually adding to the information we feel confident that our data is as reliable as is realistically possible. However, there are some limitations in the data that should be pointed out. First of all, some of the financial statement information is not as precise as one could wish. For example, it would be better if there were items such as property, plant and equipment as well as selling, general and

administrative expenses available from Bloomberg® that does not, possibly, include other items. Further, one could argue that for companies having a fiscal year that ends before the end of December, the information from the annual reports is "old" when sorting the portfolios on the first trading day in April next year. However, in our minds there is not any other practical way of solving this while still making sure that this mechanical sorting strategy would be practically feasible.

5. Empirical Results

In this chapter we present the empirical results from the study. First we present the results from the initial sorting based on the price-to-earnings and the market-to-book ratios of the companies, then the results from the scoring system, and finally the results from the cross sectional regression.

5.1 Results from Initial Sorting

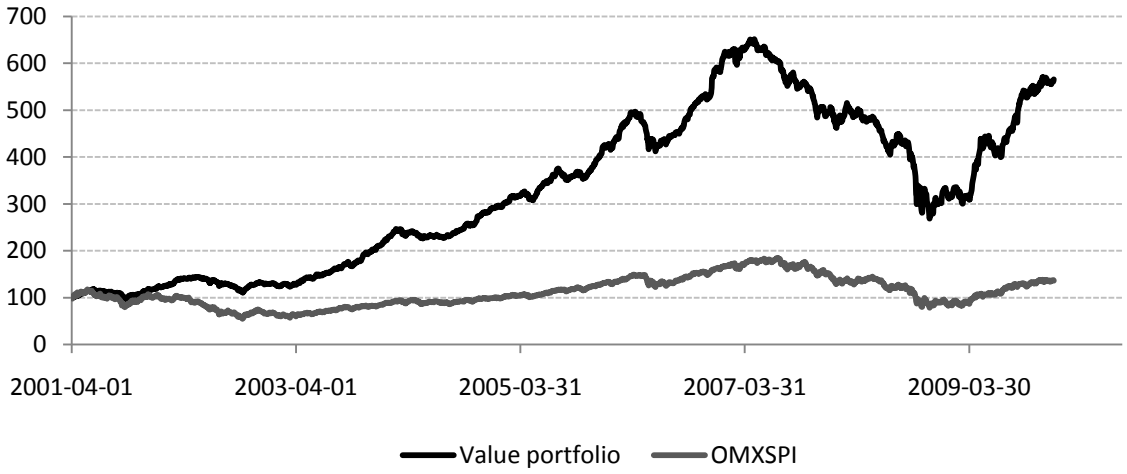
The results from the initial sorting based on the stocks' price-to-earnings and market-to-book ratios in order to select a value portfolio of 20 stocks were very positive. Looking at ***Table 5*** one can notice that the average annual return of the value portfolio was 28.7 percent per year from the 1st of April 2001 to the 31st of December 2009. During the same period the average annual return on the market index was only 8.9 percent, implying a 19.8 percent average annual excess return for the value portfolio over the market index. One can also notice that the over performance is consistent; the value portfolio beats the market index all nine years except one.

Table 5: Returns and standard deviations for the value stock portfolio and the market index

Year	Value portfolio		Market index		Difference	
	Return	**Standard deviation**	**Return**	**Standard deviation**	**Return**	**Standard deviation**
2001	40.7%	13.6%	-1.6%	26.5%	42.4%	-12.9%
2002	-9.6%	14.2%	-40.5%	30.3%	30.9%	-16.1%
2003	87.3%	13.5%	52.0%	16.2%	35.4%	-2.7%
2004	33.7%	8.1%	14.8%	13.1%	18.9%	-5.0%
2005	54.8%	10.0%	40.8%	10.7%	14.0%	-0.7%
2006	27.8%	13.6%	16.8%	19.8%	11.0%	-6.2%
2007	-21.0%	12.8%	-21.1%	22.5%	0.1%	-9.7%
2008	-37.8%	27.9%	-34.5%	39.8%	-3.3%	-11.9%
2009	82.4%	19.9%	53.4%	22.8%	29.0%	-2.9%
Average	**28.7%**	**14.8%**	**8.9%**	**22.4%**	**19.8%**	**-7.6%**

At the same time, the annual standard deviation of the value portfolio of 14.8 percent is 7.6 percent lower than the 22.4 percent standard deviation for the market index during the period. Consequently, if one would use some sort of risk-adjusted performance measurement such as the Sharpe ratio (excess return over risk-free rate divided by the standard deviation), the value portfolio would significantly over perform the market index.

Graph 1: The performance of the value stock portfolio compared to the market index



Graph 1 describes the indexed price development of the value portfolio as well as the market index. The value portfolio fell a bit more than the market index during the financial crisis turmoil from the 1st of April 2008 to the 31st of March 2009, but besides that it had a tremendous performance during the period of our study.

To further evaluate our results we controlled for systematic risk in the returns by applying a time series regression of the excess value portfolio return on the excess market return. ***Table 6*** shows that the results from this regression clearly indicate a statistically significant alpha of 0.0653 percent per day, which corresponds to 16.325 percent per year when applying 250 trading days as we have done in our study. The statistical significance of the alpha is very strong with a t-statistics of 4.18. The statistically significant beta of the value portfolio is only 0.45 which is much lower than then market average of 1. Thus, the impressive performance of the value portfolio is clearly not due to an increase level of either idiosyncratic or systematic risk.

Table 6: Results from the time series regression of excess portfolio returns on the market risk premium

Linear regression	Coef.	Std.	t-stat	P>|t|	95% conf. Int.	
Number of observations =	2188					
R-squared =	0.4671					
Excess portfolio return						
Market premium	0.450276	0.017004	26.48	0.000	0.416931	0.483622
Alpha	0.000653	0.000156	4.18	0.000	0.000347	0.000959

5.2 Results from Scoring System

The results from the sorting based on our scoring system, constructed by using the key value drivers of Greenwald's valuation model, were also very interesting. Looking at ***Table 7***, one can notice that the highly ranked portfolio had an average annual return of 31.6 percent which was on average 6.0 percent better than the average annual return of 25.6 percent for the low

Table 7: Returns and standard deviations for the highly ranked portfolio and the low ranked portfolio

Year	Highly ranked portfolio		Low ranked portfolio		Difference	
	Return	**Standard deviation**	**Return**	**Standard deviation**	**Return**	**Standard deviation**
2001	46.5%	18.3%	34.1%	13.9%	12.4%	4.4%
2002	-9.9%	18.7%	-9.9%	14.5%	0.0%	4.2%
2003	95.8%	18.0%	77.6%	14.8%	18.2%	3.2%
2004	16.7%	10.9%	52.7%	8.6%	-36.0%	2.3%
2005	63.4%	12.9%	45.6%	12.9%	17.8%	0.0%
2006	23.6%	16.5%	31.6%	13.8%	-8.0%	2.7%
2007	-18.0%	15.1%	-24.4%	14.9%	6.4%	0.2%
2008	-39.9%	38.7%	-37.0%	23.0%	-2.9%	15.7%
2009	106.2%	27.0%	60.0%	17.4%	46.2%	9.6%
Average	**31.6%**	**19.6%**	**25.6%**	**14.9%**	**6.0%**	**4.7%**

ranked portfolio. However, we can also notice that in this case the standard deviation of the highly ranked portfolio was also 4.7 percent higher. If applying a Sharpe ratio for example this would imply that the Sharpe ratio for the low ranked portfolio would actually be higher than the Sharpe ratio for the highly ranked portfolio. A lot of the difference in return between the portfolios was also achieved during the period between the 1st of April 2009 and the 31st of December 2009. At the same time, a lot of the difference in standard deviation can be attributed the period between the 1st of April 2008 and the 31st of March 2009, a period characterized by financial turmoil.

Table 8 shows that when comparing the performance of the highly ranked portfolio to the performance of the market index during the period, the results are quite similar to the results for the initial sorting. The main difference is that the average annual excess returns compared

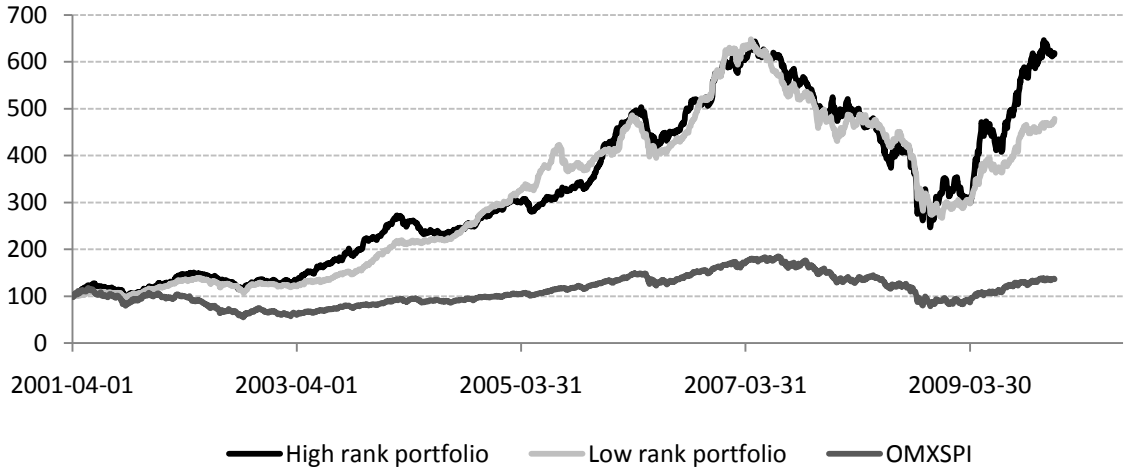
Table 8: Returns and standard deviations for the highly ranked portfolio and the market index

Year	Highly ranked portfolio		Market index		Difference	
	Return	**Standard deviation**	**Return**	**Standard deviation**	**Return**	**Standard deviation**
2001	46.5%	18.3%	-1.6%	26.5%	48.1%	-8.2%
2002	-9.9%	18.7%	-40.5%	30.3%	30.5%	-11.6%
2003	95.8%	18.0%	52.0%	16.2%	43.9%	1.8%
2004	16.7%	10.9%	14.8%	13.1%	1.9%	-2.2%
2005	63.4%	12.9%	40.8%	10.7%	22.6%	2.2%
2006	23.6%	16.5%	16.8%	19.8%	6.8%	-3.3%
2007	-18.0%	15.1%	-21.1%	22.5%	3.1%	-7.4%
2008	-39.9%	38.7%	-34.5%	39.8%	-5.5%	-1.1%
2009	106.2%	27.0%	53.4%	22.8%	52.8%	4.2%
Average	**31.6%**	**19.6%**	**8.9%**	**22.4%**	**22.7%**	**-2.8%**

to the market return is a bit higher; the returns are also less consistent than for the initial portfolio. The highly ranked portfolio still only underperforms the market index one year out of nine, but there are more years where the excess return compared to the market index is close to 0. As expected, the reduction in standard deviation compared to the market index is also smaller than for the initial portfolio, only 2.8 percent instead of 7.6 percent.

Graph 2 illustrates the performance of the highly ranked portfolio compared to the low ranked portfolio and the market index. Looking at the graph, one can notice that even though the difference in indexed price changes compared to the market index is big, the difference compared to the low ranked portfolio is small. Also, one can notice that much of this difference arises during the last year.

Graph 2: The performance of the highly ranked portfolio compared to the low ranked portfolio and the market index



When controlling for systematic risk in the two portfolios by applying a time series regression of the excess portfolio returns on the excess market return, we can notice that the result differs a bit between the two portfolios. ***Table 9*** shows that the low ranked portfolio has a statistically significant beta of only 0.33 and a statistically significant alpha of 0.058 percent per day which corresponds to 14.525 percent per year when applying 250 trading days. Consequently, as with the value portfolio, the excess return of the low ranked portfolio compared to the market index cannot be explained by an increased level of systematic risk. Looking at ***Table 10***, one can notice that the beta of the highly ranked portfolio is also statistically significant but a little bit higher than the low ranked portfolio beta, 0.57 compared to 0.33. At the same time, the alpha is also higher at 0.0724 percent per trading day which corresponds to 18.1 percent annually. Given the higher alpha, one could claim that the abnormal return is higher for the highly ranked portfolio, which in turn would support the scoring system methodology. Although, by investing

in the highly ranked portfolio you take on more risk, the increase in systematic risk is more than compensated for. However, it is much likely that the high returns and the high standard deviation of the highly ranked portfolio during the last couple of years of the period affected these results somewhat and that the performance of the two portfolios during the other part of the period is more similar.

Table 9: Results from the time series regression of excess returns for the low ranked portfolio on the market risk premium

Linear regression	Coef.	Std.	t-stat	P>|t|	95% conf. Int.	
Number of observations =	2188					
R-squared =	0.2664					
Excess return low rank portfolio						
Market premium	0.330377	0.016507	20.01	0.000	0.298007	0.362748
Alpha	0.000581	0.000178	3.27	0.001	0.000232	0.000931

Table 10: Results from the time series regression of excess returns for the highly ranked portfolio on the market risk premium

Linear regression	Coef.	Std.	t-stat	P>|t|	95% conf. Int.	
Number of observations =	2188					
R-squared =	0.4238					
Excess return high rank portfolio						
Market premium	0.570176	0.024715	23.07	0.000	0.521709	0.618642
Alpha	0.000724	0.000216	3.36	0.001	0.000301	0.001147

5.3 Results from Cross Sectional Regression

Although the highly ranked portfolio generated a slightly higher alpha than the low ranked portfolio, we further evaluated the scoring system ex post by applying a cross sectional regression of the stock returns of the stocks included in the value portfolio on the key value drivers of the valuation model. We have included the results from this regression in ***Table 11***. Looking at this table one can see that the coefficients are not statistically significant for the key value drivers for most of the years. There are more statistically significant coefficients for the first four years between 2001 and 2004, however they are not in majority and they are sometimes positive and sometimes negative, even for the same key value driver. Consequently, we cannot say much about the explanatory power of the key value drivers except the fact that it is not statistically significant.

Table 11: Results from the cross sectional regression on stock returns towards the key value drivers

Cross sectional regression	Fixed assets/ total assets		R&D expenses/ total assets		SG&A expenses/ total assets		Change NWC/ total assets		CAGR	
	Coef.	**t-stat**	**Coef.**	**t-stat**	**Coef.**	**t-stat**	**Coef.**	**t-stat**	**Coef.**	**t-stat**
2001	0,0933	0,18	3,9979	2,04	-0,4354	-2,40	1,6476	2,44	-0,2462	-1,09
2002	0,1174	0,75	-5,7865	-0,96	-0,1331	-2,82	0,1923	0,40	-0,1175	-0,69
2003	0,2728	0,57	9,2404	4,99	0,0907	2,57	0,5144	0,79	0,5302	0,83
2004	-0,3223	-2,27	-16,1131	-1,77	-0,1960	-1,31	-2,1491	-2,21	-0,7176	-1,08
2005	0,7319	1,46	10,0839	0,62	0,1050	1,12	0,4113	1,17	0,7058	1,03
2006	-0,0420	-0,13	0,8755	0,08	-0,2787	-0,83	-0,3367	-0,17	0,0022	0,01
2007	-0,0095	-0,06	-32,5051	-3,16	0,1659	1,36	0,3608	1,47	-0,0670	-0,75
2008	-0,1167	-0,55	-1,1679	-0,35	0,0167	0,08	-0,2328	-0,63	0,0250	0,31
2009	0,8331	1,17	-6,3355	-1,44	0,5672	0,89	5,6796	1,72	1,0505	1,24

6. Analysis and Discussion

The results from the initial sorting based on the companies' price-to-earnings and market-to-book ratios are very positive. The value stock portfolio clearly outperforms the market index while taking on less risk. Consequently, the portfolio also produces a highly significant alpha. These results are therefore in line with a lot of the previous research on this field and there is clearly a value premium on the Swedish market in the period between the 1st of April 2001 and the 31st of December 2009. In fact, the results are so strong that it is difficult to see how you could dispute the fact the there existed a value premium on the Swedish stock market during this period, although the size of the premium could be subject to discussion.

First of all, one could question CAPM as an asset pricing model and how well it actually proxy for systematic risk. If using another asset pricing model such as the Fama French 3 factor model or the 4 factor model as revised by Carhart the results would probably be different, especially due to the fact that these asset pricing models include a risk premium for value stocks defined as the excess return of stocks with a high book-to market ratio compared to the return of their counterparts. Also, if the sorting that we performed generates a bias towards small stocks, parts of the excess return generated could be due to some sort of risk premium due to size. Such a bias could for example come from the fact that the market index that we used as a market proxy, the OMXSPI, is a value-weighted index rather than equally weighted whereas our portfolio allocates equal weights on each included stock. On the other hand, the economic interpretation of the Fama French factors are highly disputed and it is questionable whether the factors actually proxy for any form of systematic risk. The fact that our value portfolio has a lower standard deviation than the market index, although it is significantly biased towards the Fama French factors, further indicates that there is no real relation between returns and risks in this case. Because of this, we find it reasonable to only use the CAPM beta (which is well acknowledged by most researchers to proxy for systematic risk held by the investor) as a measurement for systematic risk and thus motivating our use of the CAPM rather than any other asset pricing model in our analysis.

Another observation that could motivate a discussion regarding the size of the value premium is the fact that the initial sorting resulted in a value portfolio that included a lot of real estate companies. This category of stocks performed very well during the period between the 1st of April 2001 and the 31st of December 2009 in line with the real estate prices in Sweden and since the value portfolio contain a lot of these stocks this might have affected the performance positively. On the other hand, this can also be seen as an example where the investment in value stocks outperform the market because the strategy indeed leads to investments in companies that are systematically undervalued by the financial markets.

Also, there might be some bias in our results due to the fact that we have excluded financial companies from the study, especially during the recent financial crisis. This might have the effect that our portfolios over perform the market index in periods when financial companies performed badly in a biased way. However, looking at our results we can see that our portfolios actually perform the worst compared to the market during the financial turmoil of 2007-2008. This observation somewhat indicates that any potential positive bias is small or non-existent.

The results from our scoring system based on Greenwald's valuation model are less obvious. Although the highly ranked portfolio generates higher returns than the low ranked portfolio, it is also riskier if considering its standard deviation, leading to a lower Sharpe ratio for the highly ranked portfolio compared to the low ranked one. When controlling for systematic risk however, it is obvious that the extra return from the highly ranked portfolio more than compensates for the part of the risk that is systematic risk, as shown by a higher alpha. Consequently, the highly ranked portfolio would be a better investment as a part of a well-diversified investment portfolio while the low ranked portfolio would be a better stand alone investment.

Looking at our evaluation of the key value drivers that were the foundation of our scoring system, the results were not statistically significant. When considering the small difference in performance between the highly ranked portfolio and the low ranked portfolio this is not that surprising. However, one problem with the cross sectional regression is the fact that we only have 20 observations per year. This is quite few observations and there is a possibility that we

would have got better results if we had been able to include more observations. For this reason, one could argue that we should have included all stocks listed at the Swedish NASDAQ OMX stock exchange. On the other hand, this would not be in line with the purpose of this study since we wanted to investigate whether an investor could use a better screening process that was based on the theoretical framework of value investing after using a traditional screening based on price-to-earnings and market-to-book ratios. Therefore, we could only include the stocks that are still subject of interest to the investor after that initial screening.

Also, we would like to mention the risk of endogeneity problems in our cross sectional regression. When studying the correlations between the key value drivers we find that these are relatively small maybe with the exception of the correlation coefficient between the selling, general and administrative expenses/ total assets ratio and the research and development expenses/ total assets ratio. Consequently, there might be some small endogeneity problems but these are difficult to control for. On the other hand, endogeneity creates positively biased t-statistics but in our case this does not matter since we did not get statistically significant results in the cross-sectional regression anyways.

7. Conclusion

In this paper we start from the value investing framework laid out by Bruce Greenwald which is based on Benjamin Graham's theories regarding company valuation. Based on these valuation models we outline five accounting ratios that are based on the key value drivers in the model. These ratios are based on fixed assets, sales, general and administration expenses, research and development, change in working capital and compound annual growth rate (CAGR). Using Swedish data between 2000 and 2009 we perform a study aimed at investigating whether it could be possible for an investor to exploit a potential value premium on the Stockholm stock exchange by ranking stocks based on their price-to-earnings and market-to-book ratios. Further, we investigate if the accounting ratios derived based on the Greenwald valuation model could further explain stock returns and thus be used by an investor to, in a mechanical way, identify undervalued stocks and thus earn abnormal returns. In order to make sure that our portfolio sorting is not just simply accumulating more risk, we run a CAPM regression which in fact does generate significant alphas, indicating that risk adjusted abnormal returns does exist. As a final step in our analysis we perform a cross sectional regression of stock returns on the identified accounting ratios to see what explanatory power these ratios have over stock returns.

Preceding the study we outlined two hypotheses;

1) By applying a sorting method where stocks are selected based on their price-to-earnings and market-to-book ratios, an investor can generate returns in excess of market index returns without increasing the level of idiosyncratic and systematic risks.

2) By applying a scoring system based on Greenwald's valuation method on the stocks selected based on their price-to-earnings and market-to-book ratios, an investor can generate returns in excess of market index returns without increasing the level of idiosyncratic and systematic risks that cannot be achieved by only sorting on price-to-earnings and market-to-book ratios alone.

Our results show that a significant value premium, that cannot be explained by higher systematic risk (assessed by using the CAPM), does indeed exist on the Stockholm stock exchange when performing the initial sort, thus we find strong evidence of the accuracy of our first hypothesis.

However, after the secondary ranking using the accounting ratios our results are a bit more ambiguous. It seems that the sorted portfolio indeed earns higher returns but is also more volatile, indicating a higher risk level. Therefore we cannot clearly conclude that our second hypothesis holds true even though our results gives some support for it in terms that the returns did indeed increase and a large part of the increased risk seemed to be idiosyncratic, illustrated by a higher alpha in the CAPM regression.

In the light of this study we conclude that a screening based on value investing indeed should be a profitable strategy for investors to undertake. However, it might be hard to substitute a fundamental analysis only by using a mechanical screening process even though it could provide a useful tool for investors looking for undervalued stocks in the spirit of Benjamin Graham.

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Appendix

Tests on portfolio returns

White test, Durbin-Watson d statistic, Portmanteu (Q) test, Dickey Fuller unit-root test

Portfolio	White_P	DW_dstat	LjBo_P	DiFu_P
Initial	1.29E-28	1.8472605	6.32E-25	0
Low ranked	2.02E-16	1.901922	3.40E-11	0
High ranked	9.92E-37	1.9127117	1.08E-19	0

Skewness and Kurtosis test for normality

Portfolio	Pr_Skew	Pr_Kurt	Pr_norm
Initial	0.00280718	0	0
Low ranked	0	0	0
High ranked	5.37E-10	0	0

Breusch-Godfrey test for higher-order serial correlation (H0 : no serial correlation)

	B-G P-value		
lags	Low ranked	High ranked	Initial
1	0.0398496	0.0829797	0.0008863
2	0.0811136	0.0596813	0.0004322
3	0.124964	0.0591861	0.0000947
4	0.1294119	0.0606286	0.0002752
5	0.2021213	0.0407098	0.0003047
6	0.1671671	0.0010315	0.0006336
7	0.2441292	0.0020818	0.0011741
8	0.3322307	0.0029439	0.0015409
9	0.4126358	0.001519	0.0027937
10	0.4824781	0.0027944	0.0046665

Tests on residuals in time series regression

Skewness and Kurtosis test for normality

Portfolio	**Pr_Skew**	**Pr_Kurt**	**Pr_norm**
Initial	0.00213269	0	0
Low ranked	0	0	0
High ranked	2.03E-09	0	0

Ljung Box test (to test for stationarity)

Portfolio	**P-value**
Initial	9.97E-07
Low ranked	3.51E-15
High ranked	0.00007249

Table 2; Companies included in initial data set

Year	Company	Ticker	PE	MB
2000	The Empire AB	EMPB	6.433	0.387
2000	Rederi AB Transatlantic	RABTB	9.774	0.388
2000	Broström AB	BROB	2.507	0.459
2000	Concordia Maritime AB ser. B	CCORB	3.600	0.491
2000	Klippan AB	KLIP	3.410	0.500
2000	Esselte AB	SLTB	10.021	0.630
2000	Scribona AB	SCRIB	4.196	0.665
2000	Borås Wäfveri AB ser. B	WAFVB	10.266	0.688
2000	KABE AB ser. B	KABEB	5.893	0.743
2000	NCC AB ser. B	NCCB	5.013	0.756
2000	Fabege AB	FABG	8.725	0.785
2000	Kungsleden AB	KLED	7.551	0.820
2000	Trelleborg AB ser. B	TRELB	9.315	0.824
2000	Rottneros AB	RROS	2.469	0.854
2000	Haldex AB	HLDX	8.754	0.942
2000	Nilörngruppen AB	NILGB	10.279	0.961
2000	Beijer AB, G & L ser. B	BEIJB	6.632	0.984
2000	SSAB AB	SSABA	7.469	1.004
2000	Mandamus Fastigheter AB	MFAS	8.167	1.055
2000	SKF, AB ser. B	SKFB	8.268	1.115
2001	Realia AB	REAL	0.023	0.263
2001	Rederi AB Transatlantic	RABTB	10.052	0.458
2001	Concordia Maritime AB ser. B	CCORB	3.065	0.466
2001	Klippan AB	KLIP	3.974	0.626
2001	Fabege AB	FABG	8.378	0.806
2001	KABE AB ser. B	KABEB	5.719	0.817
2001	Broström AB	BROB	3.933	0.825
2001	Tornet, Fastighets AB	TORN	5.789	0.911
2001	Kungsleden AB	KLED	8.345	1.014
2001	Geveko, AB ser. B	GVKOB	8.711	1.037
2001	Pandox AB	PAND	9.791	1.054
2001	Mandamus Fastigheter AB	MFAS	9.350	1.055
2001	Hexagon AB ser. B	HEXAB	13.561	1.094
2001	Rottneros AB	RROS	12.978	1.164
2001	Svenska Orient Linien AB	SOLB	2.629	1.185
2001	Hufvudstaden AB ser. C	HUFVC	11.485	1.198
2001	Castellum AB	CAST	10.443	1.214
2001	SkiStar AB	SKISB	13.860	1.226
2001	Lammhults Design Group AB ser. B	LAMM	9.837	1.227
2001	Peab AB ser. B	PEABB	6.201	1.278
2002	Boliden AB	BOL	7.446	0.477
2002	Fast Partner AB	FPAR	10.714	0.487
2002	Artimplant AB ser. B	ARTIB	1.562	0.556
2002	Acando AB	ACANB	3.338	0.683
2002	RNB RETAIL AND BRANDS AB	RNBS	9.135	0.736
2002	NCC AB ser. B	NCCB	6.562	0.740
2002	Fabege AB	FABG	4.910	0.778
2002	Broström AB	BROB	11.688	0.789
2002	RaySearch Laboratories AB	RAYB	10.135	0.797
2002	BioGaia AB ser. B	BIOGB	2.662	0.802
2002	Tornet, Fastighets AB	TORN	7.580	0.844
2002	Trelleborg AB ser. B	TRELB	14.814	0.862
2002	Klövern AB	KLOV	0.724	0.897
2002	KABE AB ser. B	KABEB	5.524	0.968
2002	Ticket Travel Group AB	TICK	3.838	0.972
2002	Pandox AB	PAND	9.733	0.980
2002	Klippan AB	KLIP	6.954	1.014
2002	Malmbergs Elektriska AB ser. B	MEABB	8.367	1.024
2002	Beijer AB, G & L ser. B	BEIJB	10.863	1.036
2002	Holmen AB ser. B	HOLMB	8.637	1.115
2003	Bergs Timber AB	BRGB	14.033	0.531
2003	Boliden AB	BOL	5.565	0.540
2003	Concordia Maritime AB ser. B	CCORB	10.712	0.804
2003	Fabege AB	FABG	7.933	0.904
2003	JM AB	JM	16.049	0.906
2003	AddNode AB	ANODB	6.291	0.937
2003	Tornet, Fastighets AB	TORN	5.882	0.951
2003	Brinova Fastigheter AB ser.B	BRINB	11.193	0.954
2003	Gambro AB	GAMBB	14.421	1.031
2003	Klövern AB	KLOV	9.238	1.188
2003	Beijer AB, G & L ser. B	BEIJB	14.655	1.253
2003	SSAB AB	SSABA	14.422	1.260
2003	Kungsleden AB	KLED	4.910	1.294
2003	VBG AB	VBGB	13.197	1.328
2003	Holmen AB ser. B	HOLMB	14.087	1.339
2003	Svenska Cellulosa AB SCA ser. B	SCAB	13.411	1.368
2003	B & B Tools AB	BBTOB	11.487	1.368
2003	Broström AB	BROB	11.726	1.402
2003	Trelleborg AB ser. B	TRELB	13.950	1.407
2003	XANO Industri AB	XANOB	13.737	1.465
2004	AddNode AB	ANODB	8.744	0.568
2004	Duroc AB ser. B	DURCB	4.172	0.587
2004	Boliden AB	BOL	5.702	0.786
2004	Scribona AB	SCRIB	12.595	0.789
2004	Wallenstam AB	WALLB	3.152	0.835
2004	Bong Ljungdahl AB	BONG	8.686	0.892
2004	Klövern AB	KLOV	9.220	1.005
2004	Concordia Maritime AB ser. B	CCORB	2.309	1.057
2004	Fabege AB	FABG	7.255	1.119
2004	Geveko, AB ser. B	GVKOB	10.636	1.122
2004	Brinova Fastigheter AB ser.B	BRINB	10.820	1.134
2004	Fast Partner AB	FPAR	7.356	1.143
2004	Atrium Ljungberg AB	LJGRB	11.240	1.165
2004	Tele2 AB	TEL2B	11.235	1.171
2004	Kungsleden AB	KLED	11.574	1.203
2004	Svenska Cellulosa AB SCA ser. B	SCAB	12.814	1.211
2004	SSAB AB	SSABA	6.078	1.217
2004	Hufvudstaden AB ser. C	HUFVC	12.728	1.239
2004	Trelleborg AB ser. B	TRELB	13.938	1.261
2004	XANO Industri AB	XANOB	13.750	1.327
2005	Borås Wäfveri AB ser. B	WAFVB	4.573	0.603
2005	Rederi AB Transatlantic	RABTB	3.523	0.884
2005	Wallenstam AB	WALLB	3.826	1.020
2005	Tele2 AB	TEL2B	16.085	1.068
2005	Rörvik Timber AB	RTIMB	6.118	1.071
2005	Brinova Fastigheter AB ser.B	BRINB	5.589	1.103
2005	Home Properties AB	HOPR	2.433	1.114
2005	Geveko, AB ser. B	GVKOB	5.547	1.148
2005	AddNode AB	ANODB	11.377	1.204
2005	Heba Fastighets AB ser. B	HEBAB	8.461	1.223
2005	Hufvudstaden AB ser. C	HUFVC	8.041	1.285
2005	Wihlborgs Fastigheter AB	WIHL	7.762	1.298
2005	Klövern AB	KLOV	7.492	1.302
2005	Fabege AB	FABG	5.465	1.358
2005	Castellum AB	CAST	9.062	1.376
2005	Atrium Ljungberg AB	LJGRB	5.983	1.407
2005	Fast Partner AB	FPAR	4.583	1.412
2005	TeliaSonera AB	TLSN	16.697	1.471
2005	VLT AB	VLTB	9.604	1.476
2005	ElektronikGruppen BK AB ser. B	ELGRB	14.243	1.488
2006	Dagon AB	DAG	0.057	0.073
2006	Home Properties AB	HOPR	5.672	0.691
2006	Bergs Timber AB	BRGB	5.446	0.840
2006	Diös Fastigheter AB	DIOS	4.412	0.868
2006	Din Bostad Sverige AB	DIN	5.776	0.933
2006	Klövern AB	KLOV	5.957	0.933
2006	AcadeMedia AB ser. B	ACADB	10.104	1.003
2006	Sagax AB	SAGA	4.930	1.099
2006	Fastighets AB Balder	BALDB	3.627	1.102
2006	Geveko, AB ser. B	GVKOB	7.727	1.108
2006	AddNode AB	ANODB	16.602	1.143
2006	Brinova Fastigheter AB ser.B	BRINB	8.047	1.166
2006	Wallenstam AB	WALLB	4.435	1.194
2006	Intellecta AB ser. B	ICTAB	16.202	1.245
2006	Aspiro AB	ASP	12.351	1.256
2006	Hufvudstaden AB ser. C	HUFVC	3.529	1.405
2006	Catena AB	CATE	4.569	1.411
2006	Intoi AB	INTOB	13.218	1.427
2006	Svenska Cellulosa AB SCA ser. B	SCAB	15.367	1.430
2006	Atrium Ljungberg AB	LJGRB	3.977	1.440
2007	Din Bostad Sverige AB	DIN	4.817	0.555
2007	Fastighets AB Balder	BALDB	1.653	0.568
2007	Sagax AB	SAGA	1.553	0.604
2007	Intoi AB	INTOB	6.404	0.753
2007	Diös Fastigheter AB	DIOS	7.436	0.759
2007	Duroc AB ser. B	DURCB	10.818	0.766
2007	Dagon AB	DAG	5.985	0.788
2007	Klövern AB	KLOV	3.461	0.873
2007	Wallenstam AB	WALLB	7.320	0.905
2007	Atrium Ljungberg AB	LJGRB	5.072	0.917
2007	AddNode AB	ANODB	6.440	0.938
2007	Biotage AB	BIOT	7.658	0.956
2007	Home Properties AB	HOPR	2.954	0.959
2007	Brinova Fastigheter AB ser.B	BRINB	6.592	0.993
2007	Wihlborgs Fastigheter AB	WIHL	3.980	0.994
2007	Rederi AB Transatlantic	RABTB	6.577	1.006
2007	Castellum AB	CAST	7.417	1.032
2007	Fast Partner AB	FPAR	4.584	1.034
2007	Fabege AB	FABG	6.607	1.036
2007	Kungsleden AB	KLED	4.096	1.087
2008	New Wave Group AB ser. B	NEWAB	2.868	0.227
2008	Intoi AB	INTOB	4.594	0.267
2008	Boliden AB	BOL	5.207	0.302
2008	Cyber Com Consulting Group Sc	CYBE	3.596	0.315
2008	Semcon AB	SEMC	2.258	0.346
2008	Concordia Maritime AB ser. B	CCORB	7.473	0.364
2008	Billerud AB	BILL	7.182	0.414
2008	Home Properties AB	HOPR	6.917	0.431
2008	Anoto Group AB	ANOT	7.118	0.477
2008	XANO Industri AB	XANOB	4.555	0.510
2008	Know IT AB	KNOW	2.432	0.525
2008	MultiQ International AB	MULQ	6.556	0.526
2008	Electra Gruppen AB	ELEC	5.418	0.579
2008	Brinova Fastigheter AB ser.B	BRINB	3.600	0.594
2008	SSAB AB	SSABA	3.417	0.615
2008	KABE AB ser. B	KABEB	5.147	0.626
2008	Rederi AB Transatlantic	RABTB	3.344	0.636
2008	Gunnebo AB	GUNN	6.140	0.657
2008	Nobia AB	NOBI	5.044	0.702
2008	Sigma AB	SIGMB	7.202	0.741

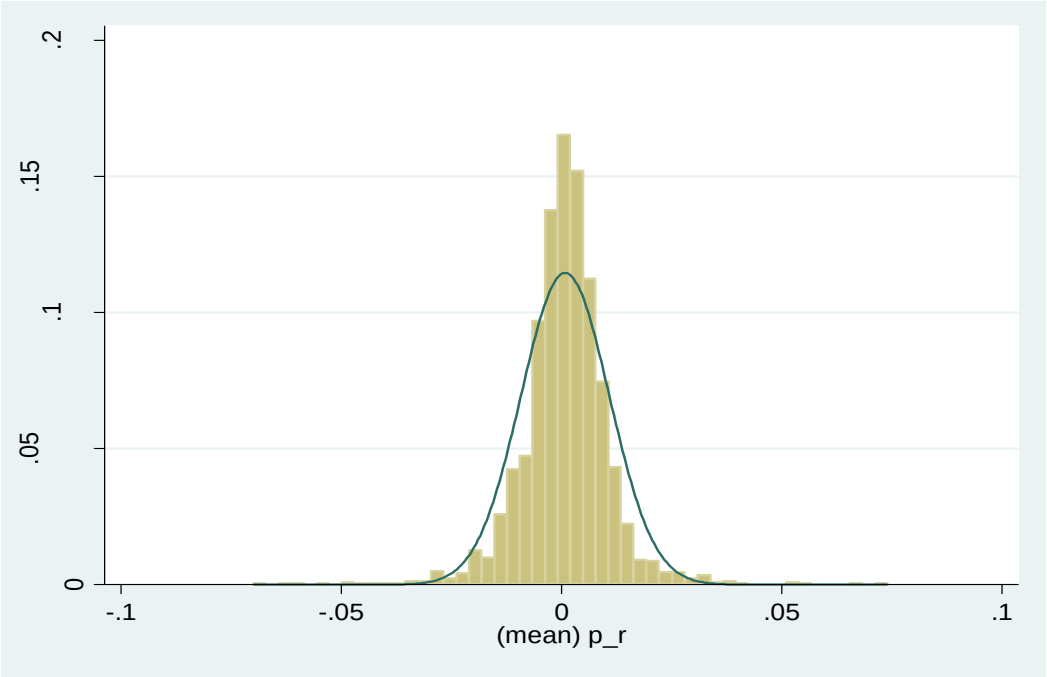
Table 3; Initial data sorted into portfolios based on accounting ratios

Year	Portfolio	Company	Ticker	PE	MB	Rank-fa	Rank-sga	Rank-rnd	Rank-cwc	Rank-cagr	Total score
2000	1	Kungsleden AB	KLED	7.551	0.820	15	2	0	2	4	23
2000	1	Nilörngruppen AB	NILGB	10.279	0.961	10	13	0	3	3	29
2000	1	Fabege AB	FABG	8.725	0.785	17	1	0	10	2	30
2000	1	Scribona AB	SCRIB	4.196	0.665	2	10	0	8	13	33
2000	1	KABE AB ser. B	KABEB	5.893	0.743	4	7	0	17	8	36
2000	1	Mandamus Fastigheter AB	MFAS	8.167	1.055	18	3	0	14	1	36
2000	1	SSAB AB	SSABA	7.469	1.004	16	4	0	5	14	39
2000	1	Beijer AB, G & L ser. B	BEIJB	6.632	0.984	6	19	0	4	12	41
2000	1	Rederi AB Transatlantic	RABTB	9.774	0.388	13	16	0	11	5	45
2000	1	Borås Wäfveri AB ser. B	WAFVB	10.266	0.688	14	9	0	6	16	45
2001	1	Kungsleden AB	KLED	8.345	1.014	11	4	0	1	5	21
2001	1	Peab AB ser. B	PEABB	6.201	1.278	2	10	0	5	11	28
2001	1	Realia AB	REAL	0.023	0.263	10	8	0	12	1	31
2001	1	Mandamus Fastigheter AB	MFAS	9.350	1.055	14	3	0	7	10	34
2001	1	KABE AB ser. B	KABEB	5.719	0.817	3	11	0	13	8	35
2001	1	Tornet, Fastighets AB	TORN	5.789	0.911	12	1	0	6	16	35
2001	1	Lammhults Design Group AB ser. B	LAMM	9.837	1.227	6	14	0	10	6	36
2001	1	Rottneros AB	RROS	12.978	1.164	8	19	0	2	7	36
2001	1	Fabege AB	FABG	8.378	0.806	13	2	0	3	19	37
2001	1	Pandox AB	PAND	9.791	1.054	17	6	0	15	4	42
2002	1	RaySearch Laboratories AB	RAYB	10.135	0.797	1	8	0	0	0	9
2002	1	Tornet, Fastighets AB	TORN	7.580	0.844	16	1	0	4	9	30
2002	1	Pandox AB	PAND	9.733	0.980	18	3	0	8	2	31
2002	1	KABE AB ser. B	KABEB	5.524	0.968	9	9	0	11	3	32
2002	1	Broström AB	BROB	11.688	0.789	12	12	0	3	6	33
2002	1	RNB RETAIL AND BRANDS AB	RNBS	9.135	0.736	6	18	0	10	1	35
2002	1	Fabege AB	FABG	4.910	0.778	14	2	0	13	10	39
2002	1	Fast Partner AB	FPAR	10.714	0.487	17	4	0	6	13	40
2002	1	Klippan AB	KLIP	6.954	1.014	15	7	0	15	4	41
2002	1	Ticket Travel Group AB	TICK	3.838	0.972	5	20	0	12	5	42
2003	1	JM AB	JM	16.049	0.906	1	17	0	2	7	27
2003	1	Kungsleden AB	KLED	4.910	1.294	12	3	0	15	1	31
2003	1	Tornet, Fastighets AB	TORN	5.882	0.951	14	1	0	12	5	32
2003	1	XANO Industri AB	XANOB	13.737	1.465	9	10	0	7	8	34
2003	1	Fabege AB	FABG	7.933	0.904	11	2	0	8	14	35
2003	1	Beijer AB, G & L ser. B	BEIJB	14.655	1.253	5	20	0	1	10	36
2003	1	Brinova Fastigheter AB ser.B	BRINB	11.193	0.954	15	4	0	18	0	37
2003	1	Broström AB	BROB	11.726	1.402	8	14	0	13	3	38
2003	1	Gambro AB	GAMBB	14.421	1.031	4	8	18	6	6	42
2003	1	B & B Tools AB	BBTOB	11.487	1.368	3	13	0	10	17	43
2004	1	Atrium Ljungberg AB	LJGRB	11.240	1.165	1	10	0	4	9	24
2004	1	Kungsleden AB	KLED	11.574	1.203	10	3	0	13	1	27
2004	1	Tele2 AB	TEL2B	11.235	1.171	5	17	0	6	3	31
2004	1	Fast Partner AB	FPAR	7.356	1.143	9	6	0	3	15	33
2004	1	Fabege AB	FABG	7.255	1.119	14	2	0	9	10	35
2004	1	Klövern AB	KLOV	9.220	1.005	11	5	0	1	18	35
2004	1	Brinova Fastigheter AB ser.B	BRINB	10.820	1.134	17	7	0	14	0	38
2004	1	Hufvudstaden AB ser. C	HUFVC	12.728	1.239	16	4	0	12	7	39
2004	1	SSAB AB	SSABA	6.078	1.217	12	9	0	19	6	46
2004	1	Wallenstam AB	WALLB	3.152	0.835	15	1	0	17	16	49
2005	1	Tele2 AB	TEL2B	16.085	1.068	4	16	0	2	3	25
2005	1	Brinova Fastigheter AB ser.B	BRINB	5.589	1.103	6	6	0	16	0	28
2005	1	VLT AB	VLTB	9.604	1.476	5	19	0	1	8	33
2005	1	Rörvik Timber AB	RTIMB	6.118	1.071	12	12	0	6	4	34
2005	1	Klövern AB	KLOV	7.492	1.302	15	10	0	8	2	35
2005	1	Heba Fastighets AB ser. B	HEBAB	8.461	1.223	19	0	0	0	17	36
2005	1	Fabege AB	FABG	5.465	1.358	13	3	0	14	10	40
2005	1	Atrium Ljungberg AB	LJGRB	5.983	1.407	1	11	0	17	13	42
2005	1	Wallenstam AB	WALLB	3.826	1.020	16	2	0	5	19	42
2005	1	Home Properties AB	HOPR	2.433	1.114	8	7	0	18	12	45
2006	1	Dagon AB	DAG	0.057	0.073	12	12	0	0	0	24
2006	1	Atrium Ljungberg AB	LJGRB	3.977	1.440	1	10	0	1	12	24
2006	1	Brinova Fastigheter AB ser.B	BRINB	8.047	1.166	9	5	0	2	11	27
2006	1	Fastighets AB Balder	BALDB	3.627	1.102	19	4	0	3	3	29
2006	1	Diös Fastigheter AB	DIOS	4.412	0.868	13	7	0	10	0	30
2006	1	Catena AB	CATE	4.569	1.411	11	2	0	20	0	33
2006	1	Sagax AB	SAGA	4.930	1.099	14	8	0	11	2	35
2006	1	Intoi AB	INTOB	13.218	1.427	4	14	0	13	5	36
2006	1	Klövern AB	KLOV	5.957	0.933	17	11	0	4	7	39
2006	1	Wallenstam AB	WALLB	4.435	1.194	18	3	0	6	14	41
2007	1	Fastighets AB Balder	BALDB	1.653	0.568	12	4	0	8	1	25
2007	1	Diös Fastigheter AB	DIOS	7.436	0.759	16	8	0	3	0	27
2007	1	Dagon AB	DAG	5.985	0.788	13	3	0	13	0	29
2007	1	Brinova Fastigheter AB ser.B	BRINB	6.592	0.993	6	5	0	10	9	30
2007	1	Intoi AB	INTOB	6.404	0.753	3	18	0	4	6	31
2007	1	Home Properties AB	HOPR	2.954	0.959	7	7	0	1	20	35
2007	1	Fast Partner AB	FPAR	4.584	1.034	10	9	0	6	13	38
2007	1	Din Bostad Sverige AB	DIN	4.817	0.555	19	15	0	5	0	39
2007	1	Duroc AB ser. B	DURCB	10.818	0.766	4	16	0	15	4	39
2007	1	Atrium Ljungberg AB	LJGRB	5.072	0.917	1	14	0	19	5	39
2008	1	Cyber Com Consulting Group Scandinavia AB	CYBE	3.596	0.315	4	17	0	4	1	26
2008	1	Know IT AB	KNOW	2.432	0.525	2	19	0	3	3	27
2008	1	Brinova Fastigheter AB ser.B	BRINB	3.600	0.594	15	1	0	7	6	29
2008	1	Concordia Maritime AB ser. B	CCORB	7.473	0.364	16	7	0	1	5	29
2008	1	XANO Industri AB	XANOB	4.555	0.510	18	5	0	5	2	30
2008	1	SSAB AB	SSABA	3.417	0.615	12	4	0	9	7	32
2008	1	Electra Gruppen AB	ELEC	5.418	0.579	3	14	0	2	18	37
2008	1	Home Properties AB	HOPR	6.917	0.431	14	2	0	8	20	44
2008	1	Sigma AB	SIGMB	7.202	0.741	6	8	0	18	13	45
2008	1	Intoi AB	INTOB	4.594	0.267	7	16	0	6	19	48

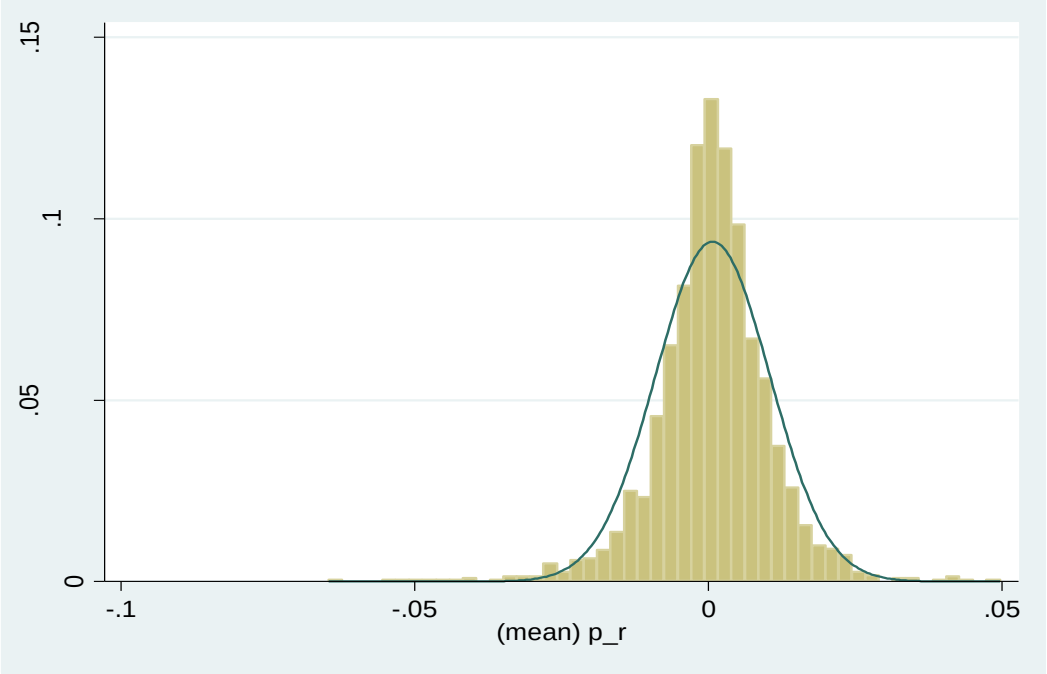
Table 3 continued;

Year	Portfolio	Company	Ticker	PE	MB	Rank-fa	Rank-sga	Rank-rnd	Rank-cwc	Rank-cagr	Total score
2000	2	NCC AB ser. B	NCCB	5.013	0.756	8	18	0	12	10	48
2000	2	The Empire AB	EMPB	6.433	0.387	3	20	0	7	20	50
2000	2	Trelleborg AB ser. B	TRELB	9.315	0.824	7	6	18	1	19	51
2000	2	Broström AB	BROB	2.507	0.459	11	15	0	19	9	54
2000	2	Haldex AB	HLDX	8.754	0.942	9	12	20	9	6	56
2000	2	Rottneros AB	RROS	2.469	0.854	12	17	0	20	7	56
2000	2	Klippan AB	KLIP	3.410	0.500	20	5	0	15	17	57
2000	2	Concordia Maritime AB ser. B	CCORB	3.600	0.491	19	14	0	16	11	60
2000	2	SKF, AB ser. B	SKFB	8.268	1.115	0	8	19	18	15	60
2000	2	Esselte AB	SLTB	10.021	0.630	5	11	17	13	18	64
2001	2	Castellum AB	CAST	10.443	1.214	16	5	0	11	12	44
2001	2	Rederi AB Transatlantic	RABTB	10.052	0.458	9	18	0	16	2	45
2001	2	Geveko, AB ser. B	GVKOB	8.711	1.037	4	9	20	4	9	46
2001	2	SkiStar AB	SKISB	13.860	1.226	19	17	0	8	3	47
2001	2	Hufvudstaden AB ser. C	HUFVC	11.485	1.198	15	7	0	9	17	48
2001	2	Broström AB	BROB	3.933	0.825	7	16	0	17	14	54
2001	2	Svenska Orient Linien AB	SOLB	2.629	1.185	1	20	0	20	20	61
2001	2	Concordia Maritime AB ser. B	CCORB	3.065	0.466	18	15	0	14	15	62
2001	2	Klippan AB	KLIP	3.974	0.626	20	12	0	18	18	68
2001	2	Hexagon AB ser. B	HEXAB	13.561	1.094	5	13	19	19	13	69
2002	2	Beijer AB, G & L ser. B	BEIJB	10.863	1.036	10	16	0	7	12	45
2002	2	Malmbergs Elektriska AB ser. B	MEABB	8.367	1.024	8	17	0	14	7	46
2002	2	NCC AB ser. B	NCCB	6.562	0.740	7	15	0	16	8	46
2002	2	Klövern AB	KLOV	0.724	0.897	13	5	0	20	19	57
2002	2	Trelleborg AB ser. B	TRELB	14.814	0.862	11	10	18	2	16	57
2002	2	Acando AB	ACANB	3.338	0.683	4	19	0	17	18	58
2002	2	Artimplant AB ser. B	ARTIB	1.562	0.556	3	14	20	1	20	58
2002	2	BioGaia AB ser. B	BIOGB	2.662	0.802	2	11	19	18	17	67
2002	2	Holmen AB ser. B	HOLMB	8.637	1.115	19	13	16	9	15	72
2002	2	Boliden AB	BOL	7.446	0.477	20	6	17	19	14	76
2003	2	SSAB AB	SSABA	14.422	1.260	16	7	0	16	12	51
2003	2	Bergs Timber AB	BRGB	14.033	0.531	20	19	0	5	9	53
2003	2	Concordia Maritime AB ser. B	CCORB	10.712	0.804	19	12	0	4	18	53
2003	2	Svenska Cellulosa AB SCA ser. B	SCAB	13.411	1.368	13	16	17	3	4	53
2003	2	Trelleborg AB ser. B	TRELB	13.950	1.407	6	9	19	17	2	53
2003	2	Klövern AB	KLOV	9.238	1.188	10	6	0	20	20	56
2003	2	VBG AB	VBGB	13.197	1.328	7	11	20	9	15	62
2003	2	Boliden AB	BOL	5.565	0.540	17	5	15	14	16	67
2003	2	Holmen AB ser. B	HOLMB	14.087	1.339	18	15	14	11	11	69
2003	2	AddNode AB	ANODB	6.291	0.937	2	18	16	19	19	74
2004	2	Scribona AB	SCRIB	12.595	0.789	2	20	0	16	12	50
2004	2	XANO Industri AB	XANOB	13.750	1.327	18	11	0	2	19	50
2004	2	AddNode AB	ANODB	8.744	0.568	3	18	15	5	11	52
2004	2	Geveko, AB ser. B	GVKOB	10.636	1.122	7	13	19	11	4	54
2004	2	Trelleborg AB ser. B	TRELB	13.938	1.261	6	15	20	8	5	54
2004	2	Concordia Maritime AB ser. B	CCORB	2.309	1.057	4	12	0	20	20	56
2004	2	Svenska Cellulosa AB SCA ser. B	SCAB	12.814	1.211	13	19	16	7	8	63
2004	2	Boliden AB	BOL	5.702	0.786	20	8	17	18	2	65
2004	2	Bong Ljungdahl AB	BONG	8.686	0.892	19	14	0	15	17	65
2004	2	Duroc AB ser. B	DURCB	4.172	0.587	8	16	18	10	14	66
2005	2	Wihlborgs Fastigheter AB	WIHL	7.762	1.298	20	4	0	7	14	45
2005	2	Fast Partner AB	FPAR	4.583	1.412	11	8	0	13	16	48
2005	2	Hufvudstaden AB ser. C	HUFVC	8.041	1.285	17	5	0	11	15	48
2005	2	ElektronikGruppen BK AB ser. B	ELGRB	14.243	1.488	3	17	18	4	7	49
2005	2	Geveko, AB ser. B	GVKOB	5.547	1.148	7	14	19	3	6	49
2005	2	Castellum AB	CAST	9.062	1.376	18	9	0	12	11	50
2005	2	Borås Wäfveri AB ser. B	WAFVB	4.573	0.603	10	15	0	9	20	54
2005	2	AddNode AB	ANODB	11.377	1.204	2	18	17	19	1	57
2005	2	TeliaSonera AB	TLSN	16.697	1.471	9	13	20	15	5	62
2005	2	Rederi AB Transatlantic	RABTB	3.523	0.884	14	20	0	20	9	63
2006	2	Aspiro AB	ASP	12.351	1.256	2	16	18	5	1	42
2006	2	Din Bostad Sverige AB	DIN	5.776	0.933	16	9	19	0	0	44
2006	2	AcadeMedia AB ser. B	ACADB	10.104	1.003	5	19	0	15	6	45
2006	2	Hufvudstaden AB ser. C	HUFVC	3.529	1.405	10	1	0	17	19	47
2006	2	Home Properties AB	HOPR	5.672	0.691	8	6	0	19	20	53
2006	2	Intellecta AB ser. B	ICTAB	16.202	1.245	6	20	0	18	9	53
2006	2	AddNode AB	ANODB	16.602	1.143	3	17	16	16	4	56
2006	2	Bergs Timber AB	BRGB	5.446	0.840	20	18	0	14	8	60
2006	2	Geveko, AB ser. B	GVKOB	7.727	1.108	7	13	20	12	10	62
2006	2	Svenska Cellulosa AB SCA ser. B	SCAB	15.367	1.430	15	15	17	9	13	69
2007	2	Kungsleden AB	KLED	4.096	1.087	8	10	0	20	3	41
2007	2	Sagax AB	SAGA	1.553	0.604	11	11	0	17	2	41
2007	2	Klövern AB	KLOV	3.461	0.873	14	13	0	7	8	42
2007	2	Wihlborgs Fastigheter AB	WIHL	3.980	0.994	18	2	0	11	11	42
2007	2	Wallenstam AB	WALLB	7.320	0.905	15	6	0	12	15	48
2007	2	AddNode AB	ANODB	6.440	0.938	2	20	19	2	7	50
2007	2	Fabege AB	FABG	6.607	1.036	17	1	0	16	19	53
2007	2	Castellum AB	CAST	7.417	1.032	20	12	0	9	14	55
2007	2	Rederi AB Transatlantic	RABTB	6.577	1.006	9	19	0	18	10	56
2007	2	Biotage AB	BIOT	7.658	0.956	5	17	20	14	12	68
2008	2	New Wave Group AB ser. B	NEWAB	2.868	0.227	8	11	0	20	11	50
2008	2	Nobia AB	NOBI	5.044	0.702	13	12	0	15	12	52
2008	2	Semcon AB	SEMC	2.258	0.346	9	20	0	19	4	52
2008	2	Anoto Group AB	ANOT	7.118	0.477	1	9	20	14	9	53
2008	2	MultiQ International AB	MULQ	6.556	0.526	5	13	19	13	8	58
2008	2	Rederi AB Transatlantic	RABTB	3.344	0.636	17	15	0	10	16	58
2008	2	KABE AB ser. B	KABEB	5.147	0.626	10	6	16	17	14	63
2008	2	Boliden AB	BOL	5.207	0.302	19	3	17	16	10	65
2008	2	Gunnebo AB	GUNN	6.140	0.657	11	10	18	11	17	67
2008	2	Billerud AB	BILL	7.182	0.414	20	18	15	12	15	80

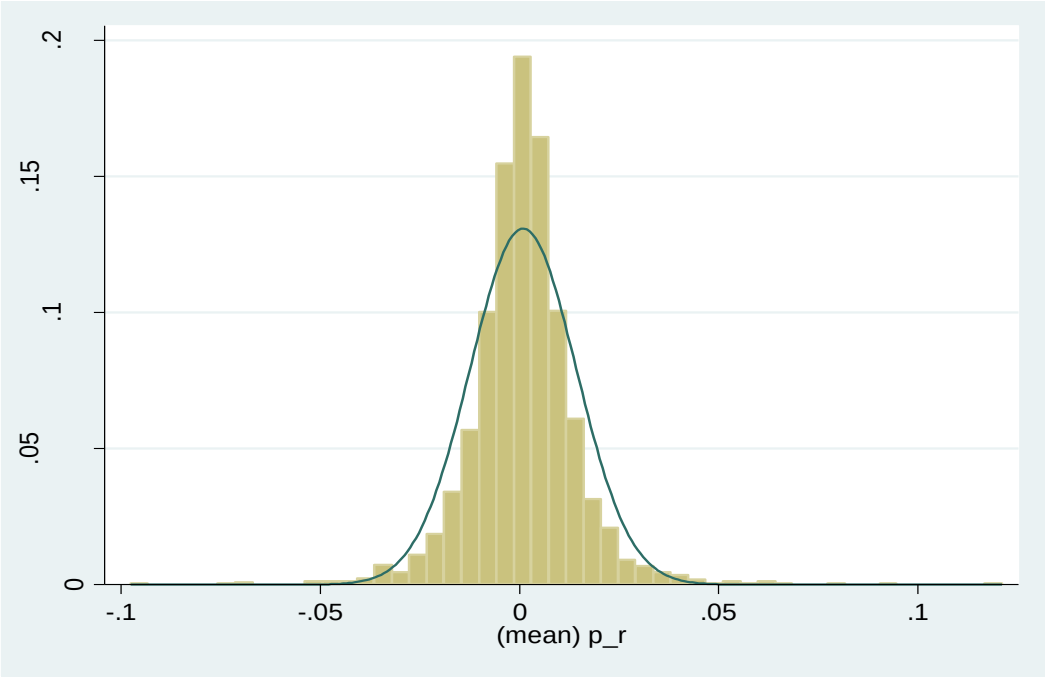
Graph 1; Histogram of returns of the Initial portfolio



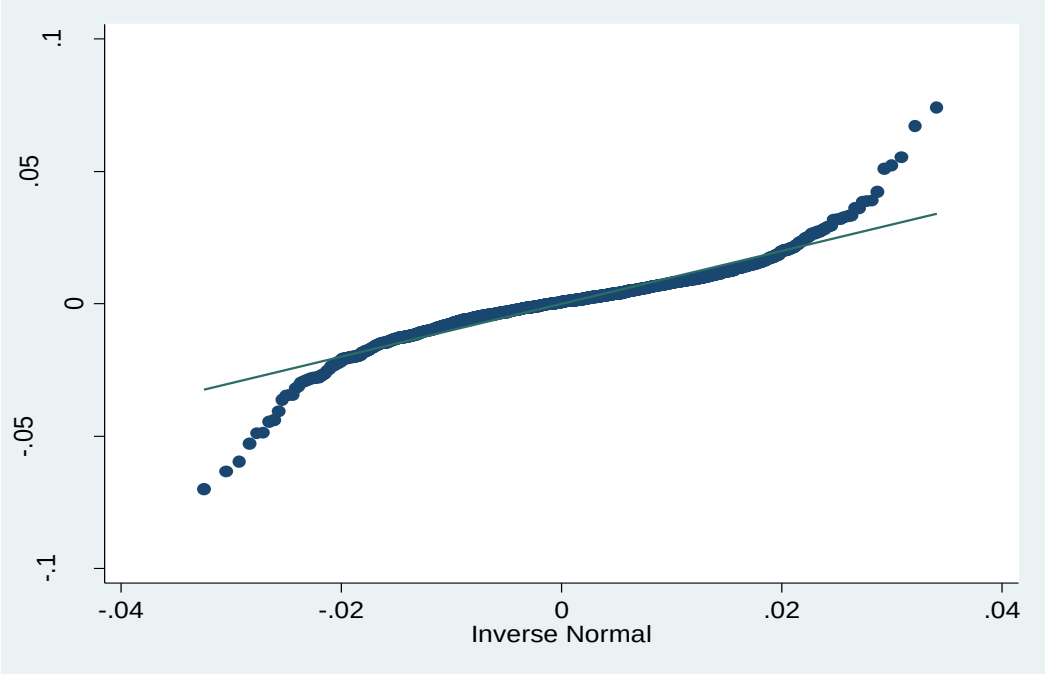
*Graph 2; Histogram of returns of the Low ranked portfolio*9,2 cm



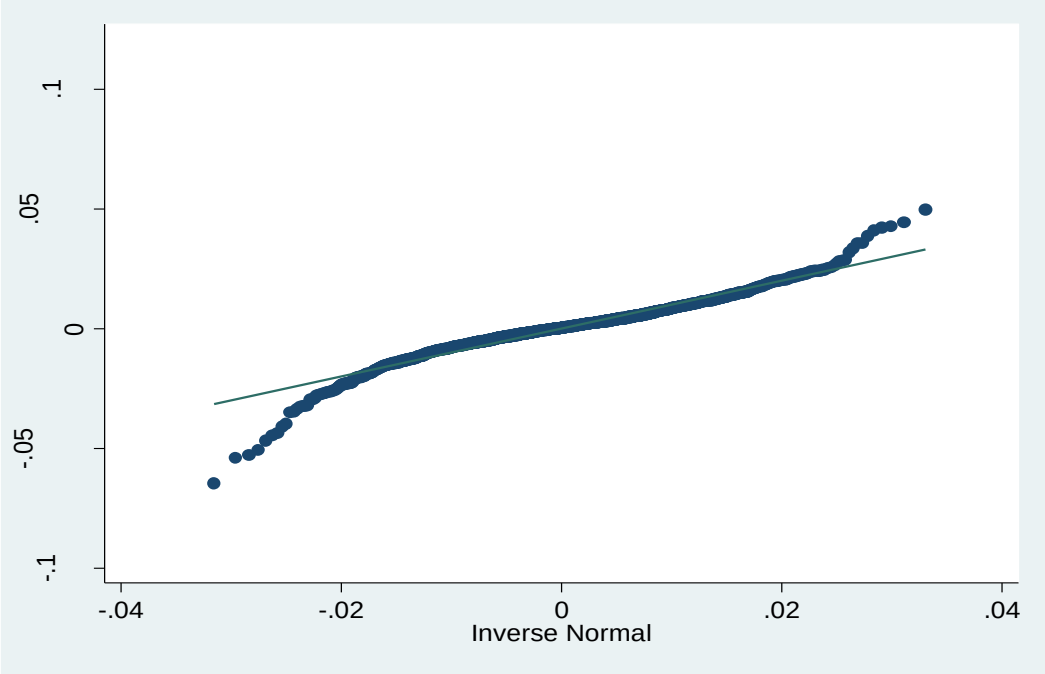
Graph 3; Histogram of returns of the High ranked portfolio



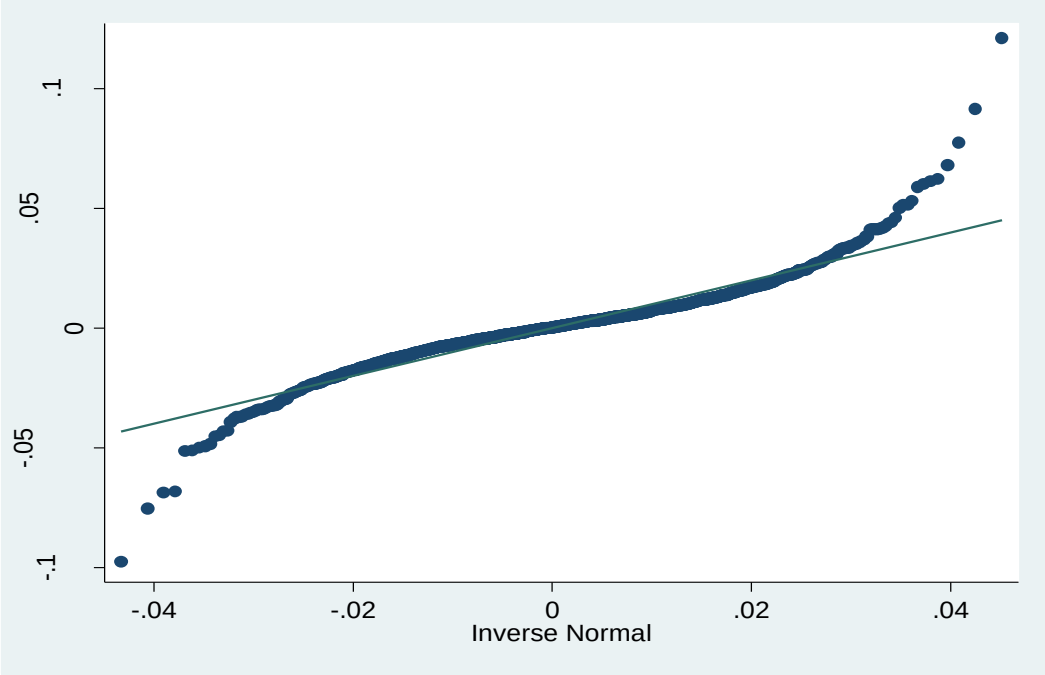
Graph 4; Quintile Quintile plot of returns of the Initial portfolio



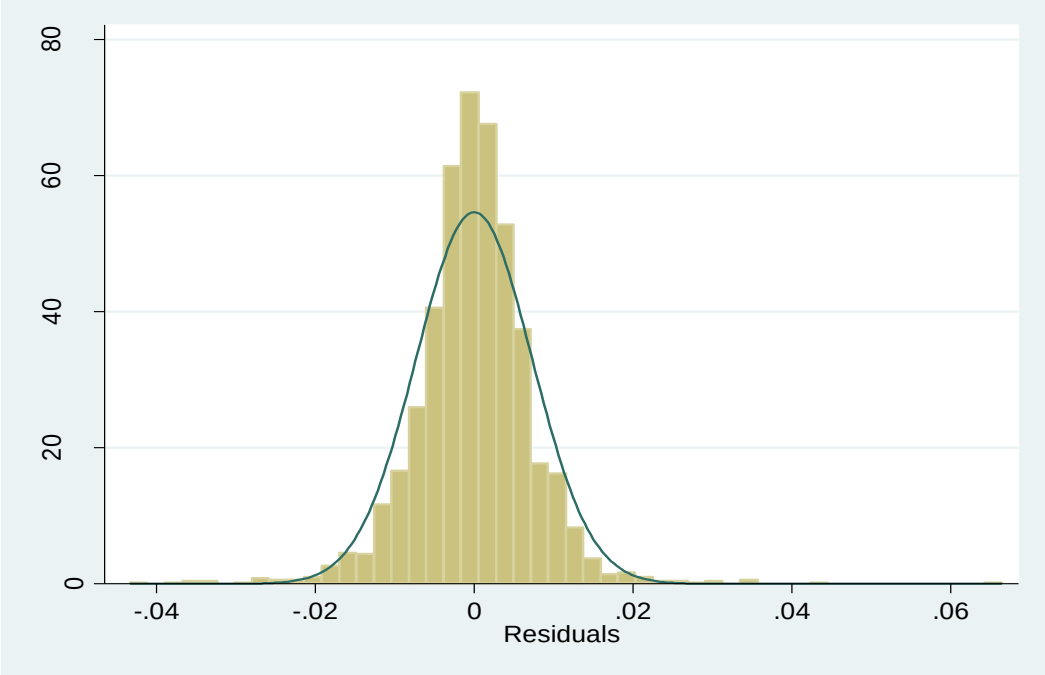
Graph 5; Quintile Quintile plot of returns of the Low ranked portfolio



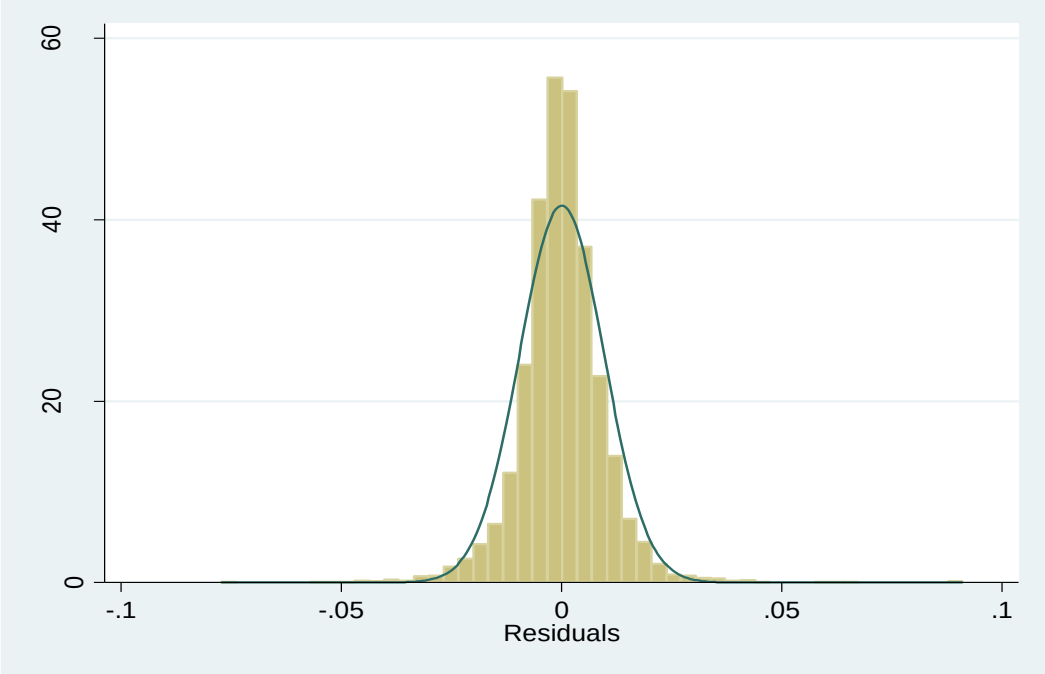
Graph 6; Quintile Quintile plot of returns of the High ranked portfolio



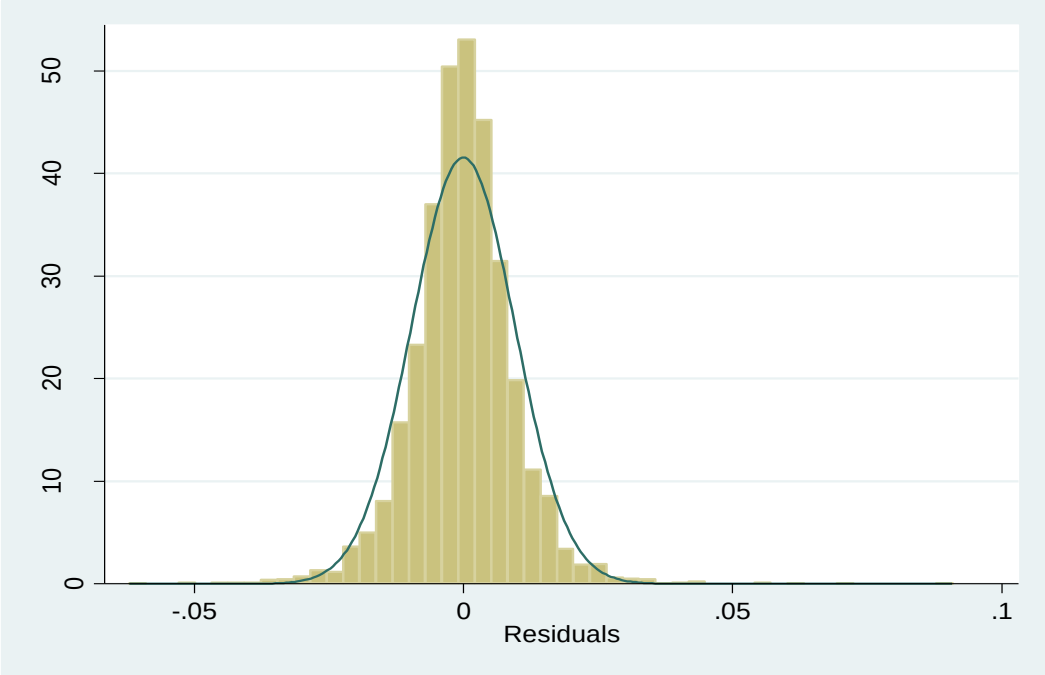
Graph 7; Histogram of the residuals from the time series regression of Initial portfolio excess-returns on the excess returns of the market index



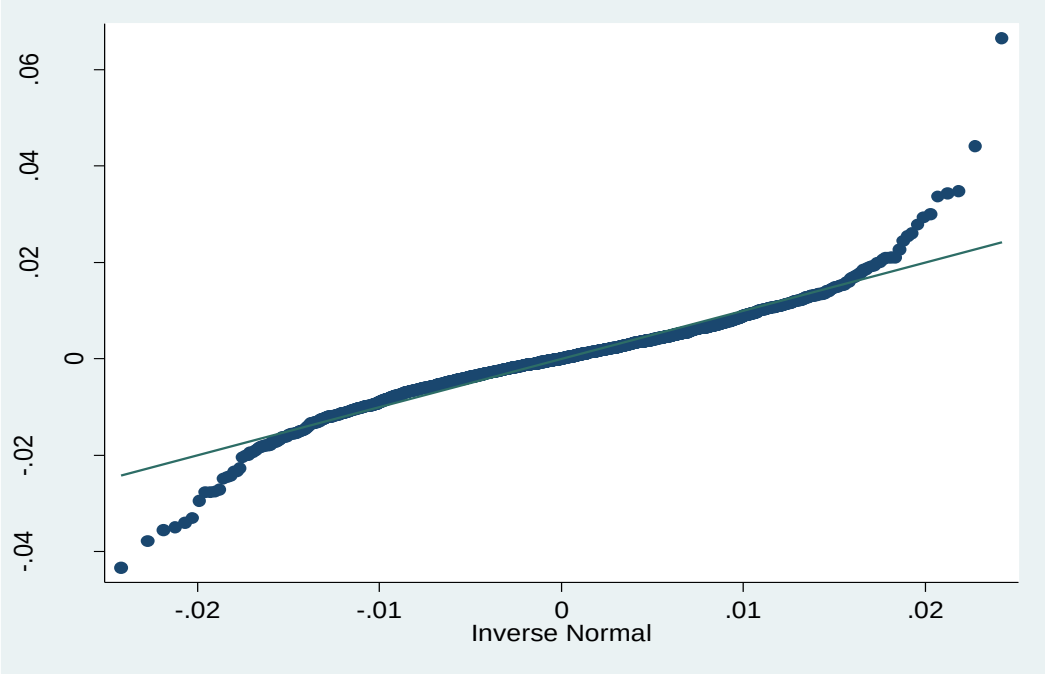
Graph 8; Histogram of the residuals from the time series regression of Low ranked portfolio excess-returns on the excess returns of the market index



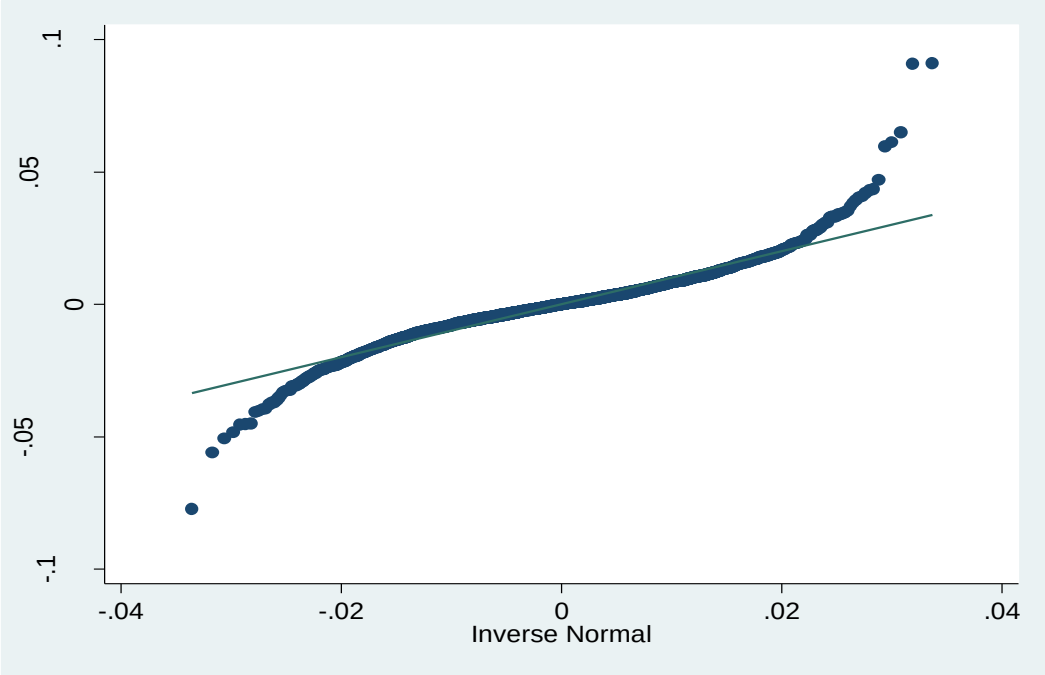
Graph 9; Histogram of the residuals from the time series regression of High ranked portfolio excess-returns on the excess returns of the market index



Graph 10; Quintile quintile plot of the residuals from the time series regression of Initial portfolio excess-returns on the excess returns of the market index



Graph 11; Quintile quintile plot of the residuals from the time series regression of Low ranked portfolio excess-returns on the excess returns of the market index



Graph 12; Quintile quintile plot of the residuals from the time series regression of High ranked portfolio excess-returns on the excess returns of the market index