Stockholm School of Economics
Department of Accounting
Master Thesis in Accounting and Financial Management
Spring 2017

Fundamental Valuation and Abnormal Returns: An Empirical Comparison of Fundamental Valuation Models

Carl Johansson* Gustav Lengholt†

Abstract

This paper empirically compares three different fundamental valuation models – AEG, DDM and RIV – by examining the models' abilities to predict future abnormal returns. Previous research on the comparison of fundamental valuation models assumes that the market is efficient in the semi-strong form and therefore focuses on the models' abilities to predict stock prices at the valuation date. By focusing on the ability to predict future returns, this paper opens up for the possibility that the market might not be efficient in the semi-strong form, without relying on an assumption of market inefficiency. We find that DDM and RIV are able to predict future returns, whereas AEG can only predict returns to the long portfolios, mainly due to its inability to value high-ROE stocks with rapid mean reversion of ROE.

Furthermore, portfolios of stocks deemed undervalued generate positive abnormal returns which cannot be explained by risk factors such as correlation with the market index, B/P, or size. In addition, portfolios of the undervalued stocks have lower risk measures than the portfolios of overvalued stocks, despite yielding greater returns. Even though the possibility of an unobservable risk factor cannot be ruled out, our findings indicate a value premium that raises questions regarding market efficiency.

Keywords:	Fundamental valuation; value premium; dividend discount model; residual income valuation model; abnormal earnings growth model
Tutor:	Kenth Skogsvik, Professor
Date:	24 May 2017

*40873@student.hhs.se
†40861@student.hhs.se

Acknowledgements

First and foremost, we would like to thank our tutor Kenth Skogsvik for valuable discussions and insightful comments throughout the development of this thesis.

We also want to express our appreciation for the database related support by Erik Eklund, without which the thesis would not have been made possible.

Finally, we are grateful for the feedback provided by our fellow students Jakob Kyllenbeck and Wilhelm Börjesson.

Carl Johansson Gustav Lengholt

Stockholm, 15 May 2017

Contents

1 Introduction

> *"Nowadays people know the price of everything and the value of nothing."*
>
> — Oscar Wilde, *The Picture of Dorian Gray*

> *"You're dealing with a lot of silly people in the marketplace; it's like a great big casino and everyone else is boozing. If you can stick with Pepsi, you should be O.K."*
>
> — Warren Buffett, *Forbes,* 1 November 1974

The ability to correctly value equities has several important implications for practitioners, as it can guide analysts in issuing recommendations, investors in asset allocation and managers of companies to derive what the market is expecting of them. Under the assumption that the capital value of a stock is the present value of all dividends ever to be paid upon it, several valuation models have been derived that are theoretically equivalent to each other, as long as one forecasts the input for the models into infinity (see e.g. Ohlson, 1995; Ohlson and Juettner-Nauroth, 2005). However, due to peculiarities in the mechanics of each model, the introduction of a truncation point in the forecast horizon causes different fundamental valuation models to yield different estimates of fundamental value (Penman and Sougiannis, 1998). Typically, valuation models are compared to each other by determining a fundamental value and relating that to the prevailing stock price at the time, the so-called value-to-price (V/P) ratio, in order to evaluate how well a valuation model explains the stock price, see e.g. Penman and Sougiannis (1998) and Penman (2005). The idea is that the closer the value is to the stock price, i.e. the closer V/P is to 1, and the lower the variability in the observed V/P, the better the model. In previous research, the residual income valuation (RIV) model is shown to be better at explaining stock prices than other models (Bernard, 1995; Francis, Olsson and Oswald, 2000; Penman, 2005), which is often attributed to the fact that RIV "anchors" on book value, which can be observed today, whereas other models are more dependent upon future payoffs that are more uncertain (Penman, 2005). Despite RIV's superiority in those tests, RIV consistently undervalues stocks (Dechow, Hutton and Sloan, 1999). Interestingly, Dechow, Hutton and Sloan (1999) find that the versions of RIV that are the best at predicting the current stock price are the worst at predicting future returns and vice versa, which raises the question if the observed stock prices are the same as the fundamental values.

A comparison focusing on V/P is based on the assumption that the prevailing stock price equals the fundamental value, i.e. that the market is efficient. However, the efficient market hypothesis is not undisputed, which has allowed for the emergence of research on value versus growth. For instance, stocks with low multiples of e.g. P/E and P/B, so-called value stocks, have been shown to earn greater returns than stocks with high multiples, so-called growth stocks (Basu, 1977; Fama and French, 1992; Lakonishok, Shleifer and Vishny, 1994). This "value premium" cannot be explained by normal risk measures, and so two opposing explanations have arisen: The first considers the value premium to be caused by risk not captured by the normal risk measures, see e.g. Fama and French (1992), and the second considers the value premium to be caused by mispricing, see e.g. Lakonishok, Shleifer and Vishny (1994).

Considering the ongoing debate on the efficient market hypothesis, the possibility that the market is not efficient in the semi-strong form would render a comparison by examination of the V/P ratio obsolete. This study compares fundamental valuation models to each other while opening up for the possibility that the market is not efficient in the semi-strong form by examining the models' abilities to predict future returns. If prices occasionally deviate from fundamental values and then revert back, the models that are the best at predicting fundamental values should be the best at predicting future returns. To our knowledge, this is the first study to compare different fundamental valuation models in this way. The purpose is to test if any valuation model is better or worse than the others and because of the method of this study, the study will also be a test of market efficiency. However, this study is not dependent upon an assumption of mispricing, since a model's ability to predict future returns could stem from its ability to identify risk, i.e. that the V/P ratio would be a risk factor.

To test the models' abilities to predict future returns, valuations are performed on all Swedish stocks listed on OMX Stockholm in the years 2002-2013. The stocks are then ranked according to their V/P ratio and sorted into quintiles, with each quintile representing an equally weighted portfolio. The portfolios are rebalanced every 36 months as to allow ample time for price correction to occur. Five alternative valuation models are tested: one "full-fledged" valuation where all valuation models yield equal fundamental values, the dividend discount model (DDM), two versions of the residual income valuation model (RIV), and the abnormal earnings growth model (AEG).

We find that all valuation models are able to predict future returns except AEG, which generates sell signals to the stocks that yield the highest future returns. All long portfolios (most undervalued quintiles) yield significant, positive abnormal returns, whereas the short portfolios (most overvalued quintiles) only generate non-significant, positive abnormal returns, except for AEG. Consequently, we find a value premium that is not explained by market risk, B/P or size. Furthermore, the long portfolios have lower betas and standard deviations than the short portfolios and the long portfolios outperform the short portfolios more often than not, indicating that the long portfolios have lower risk despite generating greater returns.

In our study, RIV with terminal values determined by Gordon growth ("RIV GG") is able to predict the highest future abnormal returns and AEG the lowest. RIV GG's superiority is related to its "anchoring" on book value and its determination of a terminal value that does not assume a competitive equilibrium. AEG's inferiority is related to its dependence on changes in earnings and of capitalising, whereby unsustainable abnormal earnings growth is amplified through an application of Gordon growth followed by capitalisation. This causes AEG to give irrational and inaccurate estimates of fundamental values when there is a strong mean reversion in return on equity (ROE), which can explain AEG's tendency to give sell signals to stocks with high profitability.

The rest of the thesis is structured as follows: section 2 elaborates on the previous research which is the theoretical framework of the study; section 3 describes the method employed in the study; the data is described in section 4; the results are presented in section 5 and discussed in section 6; section 7 concludes the thesis and presents suggestions for future research.

2 Previous research

2.1 Valuation models

2.1.1 Theories on DDM

While dividend-based models became a topic of research only in the last few decades, the linkage between equity values and dividends has long been used by investors and analysts. Perhaps the first explicit connection between dividends and stock prices was made in *The Theory of Investment Value* by Williams (1938), who stated that "a stock is worth the present value of all the dividends ever to be paid upon it [...]" or equivalently

$$V_0 = \sum_{t=1}^{\infty} \frac{DPS_t}{(1+\rho_e)^t} \tag{1}$$

where DPS_t is the dividend per share in year t and ρ_e is the cost of equity. This specification of the model requires a determination of DPS_t for $t = 1, 2, \cdots$. As the firm is assumed to be a going concern, practical limitations arise. Gordon and Shapiro (1956) and Gordon (1959) use growth as an explicit parameter in the model, thereby solving this issue. The underlying assumption is that the future sequence of payments investors pay for is represented by two quantities, with one being the current dividend and the other a measure of the expected growth in the dividend. Instead of estimating the dividend for each year in the sequence, one only has to estimate the dividend for the next period, the cost of equity and the rate at which dividends are estimated to grow in the future. Gordon and Shapiro (1956) arrive at the Gordon growth formula, specified as

$$V_0 = \frac{DPS_1}{\rho_e - g} \tag{2}$$

where dividends grow uniformly and continuously at a constant rate g. The growth rate is assumed to be constant, which is why the model is more suitable for companies expected to grow at a fixed growth rate in perpetuity, and neglects instances where growth is expected to vary until a steady state is reached. The limitation that only one growth rate is considered is only briefly touched upon in the original model specification, with argumentation along the lines of it nevertheless being superior to an alternative method where DPS_t has to be estimated for each year (Gordon, 1959). Another limitation of the model is instances where the stock does not currently pay a dividend, which is the case for many growth stocks.

In addition to the practical limitations of DDM, the most important criticism is perhaps the findings of Miller and Modigliani (1961), in what would come to be a landmark contribution to capital market research. Their dividend irrelevance proposition nullifies DDM by neutralising the value relevance of dividends, as the firm's value is unaffected by choices whether to finance new investments using retained earnings without any dividends being paid or through a combination of a new equity issue and a dividend payment. The suggestion is thus that there is no reason to expect a direct relationship between dividends and value. This problem has been labelled by Penman (1992, p. 467) as "the dividend conundrum", whereby "price is based on future dividends but observed dividends do not tell us anything about price". At large, there was a subsequent paradigm shift from the estimation of dividends towards the understanding of the potential impact of accounting information on valuation.

2.1.2 Theories on RIV

The idea of capital values translated from accounting information has its foundation in Preinreich's (1938) discussion on capital values as a function of an asset's book value and earnings less a required rate of return, i.e. residual income or residual earnings. Edwards and Bell (1961) and Peasnell (1982) also made important contributions to the development of the original RIV, by way of presenting an explicit link between a firm's economic value and yield and accounting numbers. The latter moves away from the conventional definition of income as an accounting profit, and instead defines it as the excess of accounting profit over the opportunity cost of capital invested in the business. RIV rests upon two assumptions; firstly, analogous to DDM, market value is the present value of expected dividends. Secondly, the clean surplus relation is assumed to hold, with dividends reducing book value and thereby future expected earnings. Thus, the Miller and Modigliani (1961) properties are satisfied. These two assumptions lead to the RIV model, specified as

$$V_0 = BV_0 + \sum_{t=1}^{\infty} \frac{E_0[RI_t]}{(1+\rho_e)^t} \tag{3}$$

where V_0 is the intrinsic value of equity, BV_0 is the current book value of equity, $E_0[RI_t]$ is the expectations of future residual income at the valuation date (defined as the difference between observed earnings and a cost of capital charge on the book value of the previous period) and ρ_e is the cost of equity capital.

However, it was Ohlson's (1995) and Feltham and Ohlson's (1995) applications of RIV that had the largest impact on the renaissance of fundamental valuation in academia, with Ohlson's (1995) application perhaps being the most important (hereafter referred to as the "Ohlson model"). In addition to the two assumptions, the Ohlson model includes a third assumption concerning the time-series behaviour of abnormal (residual) earnings. Ohlson (1995) and Feltham and Ohlson (1995) present this as the linear information model of the Ohlson model, where abnormal earnings develop linearly plus a correction for information other than accounting data and dividends. In this sense, the Ohlson model differs from the RIV model. Subsequent research and empirical studies of the Ohlson model often omit the third assumption as it is impractical to estimate (e.g.

Frankel and Lee, 1998; Francis, Olsson and Oswald, 2000), as does this study. Thus, the model tested was in fact RIV rather than the Ohlson model.

2.1.3 Theories on AEG

Ohlson (2000; 2005) identifies several problems related to Ohlson model and RIV. First, on a per share basis the clean surplus relation will not hold if there are expected changes in the number of shares outstanding. Second, the clean surplus relation is violated in instances where capital contributions are not accounted for in market value terms. Lastly, an all equity approach does not work if the firm plans to bring in new shareholders who derive a net benefit from their contributions. The result was a proposed shift away from book value and residual earnings towards expected earnings per share. This view is further developed by Ohlson and Juettner-Nauroth (2005) through the development of the abnormal earnings growth (AEG) model (also known as the "OJ model").

While RIV requires a quantification of abnormal earnings per se, the AEG model evaluates the growth of abnormal earnings. The approach is similar to the one used to derive RIV, in that one anchors on capitalised earnings per share for the next period t=1 and adds the present value of capitalised abnormal earnings growth. The capitalised increase in earnings per share is defined as the earnings for the period plus the dividend for the last period reinvested, less the earnings for the last period growing at the required rate of return, or

$$z_t = \frac{1}{\rho_e}[EPS_{t+1} + \rho_e DPS_t - (1+\rho_e)EPS_t] \tag{4}$$

where EPS_t is expected earnings per share at time t and DPS_t is the expected dividend per share at time t. This expression can be substituted into the RIV, which gives the AEG application, or the non-parsimonious AEG model (Jennergren and Skogsvik, 2007), defined as

$$V_0 = \frac{EPS_1}{\rho_e} + \sum_{t=1}^{\infty} \frac{1}{(1+\rho_e)^t} z_t \tag{5}$$

In the non-parsimonious AEG model, intrinsic value may be decomposed into two terms; first, the expected earnings per share for period t capitalised with the cost of equity capital. The second term captures the extra value from abnormal earnings growth for future years.

2.1.4 Empirics on valuation models

With the emergence of the RIV model through the contributions of Ohlson (1995) and Feltham and Ohlson (1995), the testing and comparison of RIV and related models became a central topic in valuation research. As an example, Ohlson (2005) addresses the critique directed at the eponymous model presented in 1995. RIV's most deficient aspect, Ohlson (2005) argues, is the importance it assigns to book values. As RIV could equivalently be relabelled as abnormal book value growth, the fact that earnings enter the model via the dubious surplus relation makes RIV neither "conceptually appealing" nor very practical. Instead, Ohlson (2005) advocates the benefits of AEG over RIV. This view is supported by Penman (2005), who points out that while AEG is more speculative, it enjoys the benefit of not being dependent on the questionable assumption of a clean surplus relation. However, when tested empirically, Penman (2005) finds that RIV yields a median V/P of 1.0 compared to an AEG ditto of 2.02. Indeed, RIV has been shown to explain stock prices better than other models (Bernard, 1995; Brief, 2007; Francis, Olsson and Oswald, 2000; Penman, 2005).

Brief (2007) elaborates on the results of Penman (2005) and concludes that RIV is advantageous to AEG as RIV is less complex mechanically and easier to interpret, as well as more accurate and less variable, with a standard deviation for AEG four times as large as for RIV. Bernard (1995) compares the RIV model to the DDM, regressing the components of the models on the variations in the stock price, and finds that RIV explains 68% of the changes in stock prices whereas DDM only explains 28%. Francis, Olsson and Oswald (2000) compare DDM, RIV and the discounted cash flow (DCF) model, also finding that RIV performs significantly better than the other two models, which is attributed to the fact that RIV is "anchored" on book value: it has both stock and flow components, whereas DDM and DCF only have flow components. While the concept of book values has its inherent flaws, arising from e.g. conservative accounting, it can be observed today, whereas flow components are dependent on uncertain future cash flows (Penman, 2005).

Dechow, Hutton and Sloan (1999) not only compute the V/P for versions of RIV but also test which version is better at predicting future stock returns by forming decile portfolios based on V/P. They find that the versions that are the best at predicting current stock prices are the worst at predicting stock returns. In fact, it is when analysts' forecasts are included in the models that the best predictions of current stock prices are obtained, but also when the worst predictions of future returns are obtained. One possible explanation for this that Dechow, Hutton and Sloan (1999) offer is that investors might naively price in analysts' forecasts into stock prices and that these forecasts can be incorrect, resulting in mispriced stocks. The existence of mispricing is contradictory to the efficient market hypothesis and would mean that empirical evaluation of valuation models using V/P is not optimal. Instead, it could be that a valuation model is better at predicting the fundamental value, but worse at predicting the current stock price if prices deviate from the fundamental value.

The different valuation models have also been compared in their ability to determine the expected return (discount rate) given price and expected payoffs. Gode and Mohanram (2003) compare AEG and RIV and find that the expected return from RIV is more correlated with future returns and risk proxies than the expected return of AEG. However, Easton and Monahan (2005) compare the expected returns from four versions of the OJ (AEG) model and two versions of the RIV model, as well as the expected return from a P/E model, and find that future returns cannot be explained by expected returns and that the simpler model (P/E) performs no worse than the other models.

In order for the empirical comparison of valuation models to be worthwhile, one has to ignore that when using consistent assumptions and input, all valuation models should

Table 1: Empirical comparison of valuation models

Author(s)	**Valuation models compared**	**Input to the models**	**Main findings**
Bernard (1995)	Dividend discount model (DDM) Residual income valuation model (RIV)	Analysts' forecasts	RIV is better than DDM at explaining stock prices
Penman and Sougiannis (1998)	Discounted cash flow model (DCF) Dividend discount model (DDM) Residual income valuation model (RIV)	Realised input (subsequent)	RIV models give lower valuation errors than the other models
Dechow, Hutton and Sloan (1999)	Different versions of the residual income valuation model (RIV)	Analysts' forecasts Past input (applies multiple)	All versions of RIV undervalue stocks; The versions that are the best at predicting prices are the worst at predicting future returns
Francis, Olsson and Oswald (2000)	Discounted cash flow model (DCF) Residual income valuation model (RIV)	Analysts' forecasts	RIV is significantly better than the other models at explaining stock prices
Penman (2005)	Residual income valuation model (RIV) Abnormal earnings growth model (AEG)	Analysts' forecasts	RIV is better than AEG at explaining stock prices (V/P of 1.0 for RIV and 2.02 for AEG)

yield equivalent valuations. Penman and Sougiannis (1998) test this assumption through a comparison of DDM, RIV, DCF and a capitalised earnings model and find that all models give the same value if the forecast period is extended into perpetuity, but that with the introduction of truncation, the models yield differing terminal values. Specifically, they find that RIV and the capitalised earnings model perform better than DDM and DCF, regardless of the inclusion of the terminal value, highlighting the ability of accounting-based models and accruals to "bring the future forward". Lundholm and O'Keefe (2001a) argue that this logic is flawed, and that any differences can be derived from inconsistencies in the valuation. Such inconsistencies include e.g. flaws in the determination of terminal value, inconsistent discount rates when valuing equity indirectly and directly, and that the clean surplus relation does not necessarily hold. This view is contended by Penman (2001), who argues that the empirical testing of valuation models is worthwhile in a setting of finite, truncated horizons, where it is preferred to forecast accrual accounting rather than cash flow accounting. The rationale is that in order to capture the effect of cash investments, one has to forecast impractically far into the future until the investment pays off. If one does not, cash investments are seen as value destroying; this problem is mitigated through the use of accrual accounting. Lundholm and O'Keefe (2001b) respond that even with a finite horizon, all models should yield the same value if consistently applied. This is further discussed by Penman (2005 p. 367), who concludes that "it is of course imperative that a valuation model be consistent with valuation theory, but it is not sufficient [...] valuation models are utilitarian – they serve to guide practice [...]". With a practical outlook, theory that stipulates coherence has little practical guidance if actual analyst forecasts are inconsistent with theory.

The previous literature empirically testing the different valuation methods has predominantly focused on the V/P ratio and how well the models explain stock prices at the valuation dates. Therefore, that research is dependent on the market being efficient, since otherwise it could be the market prices that are incorrect and not the fundamental values determined by the valuation model. The findings of Dechow, Hutton and Sloan (1999) – that the versions of RIV that are the best at explaining stock prices are the worst at explaining future returns and vice versa – warrant criticism of the efficient market hypothesis and the use of V/P to empirically evaluate valuation models. Emerging from the ambiguity related to the capital market efficiency, a research field that has stirred a debate is the research on *value versus growth.*

2.2 Value versus growth

2.2.1 The value premium

Inspired by value investors claiming that investments in stocks with low price-to-earnings (P/E) ratio yield superior returns, Basu (1977) tests whether investing in "cheap" stocks, as determined by the P/E ratio, generates greater returns than investing in "expensive" stocks, also determined by the P/E ratio, in the U.S. market. Basu not only finds that low P/E portfolios (also called value stocks) yield greater absolute returns than high P/E portfolios (also called growth stocks) but also that the risk adjusted returns are greater for low P/E portfolios than for high P/E portfolios. The returns that value stocks earn over growth stocks will henceforth be referred to as the "value premium" (Addae-Dapaah *et al.*, 2013). The value premium did not receive much attention until Fama and French (1992), the proponents of the efficient market hypothesis, researched it. Like Basu (1977), Fama and French find that value stocks earn greater returns than growth stocks and that this cannot be explained by common risk measures such as beta. Arguing for an efficient market, Fama and French (1992) assert that the ratios used for identifying value and growth stocks (P/E, price-to-book (P/B), dividend yield etc.) are risk proxies for risks that have previously not been identified.

The value premium has since been confirmed in other geographical markets than the U.S. Capaul, Rowley and Sharpe (1993) examine the value premium in six countries and find a value premium in all countries. Fama and French (1998; 2012) find a value premium in every country that they examine, both in emerging and major markets. The research on the value premium has also been extended beyond the stock market into other asset classes. Asness, Moskowitz and Pedersen (2013) find a value premium in currencies, commodities, government bonds and indices; Addae-Dapaah *et al.* (2013) find a value premium in real estate.

The value premium is not limited to investing using ratios such as P/E and P/B; a value premium has also been identified from investing based on past stock returns. Based on research in psychology showing that people tend to overreact, De Bondt and Thaler (1985) hypothesize that people overreact to financial information, thus causing popular stocks to be overvalued and unpopular stocks to be undervalued. Further hypothesizing that this overreaction will eventually be reversed, De Bondt and Thaler form portfolios based on past stock return, finding that stocks that performed poorly in the past earn higher returns going forward than stocks that performed well in the past. Furthermore, De Bondt and Thaler (1985) find that this effect is particularly pronounced during January, which Haugen (2009) argues is due to institutional investors being very active during January, which corrects mispricing. However, Jegadeesh and Titman (1993) find that in the short term, 3-12 months, the past winners outperform the past losers, but that in the long term, two years, the past losers outperform the past winners. This indicates that there is momentum, a continuation of stock price development, over the short term and price reversals in the long term. Haugen (2009) argues that as a result of the continuation of the momentum, institutional investors, who are evaluated over short time periods, are reluctant to exploit the value premium.

2.2.2 Value investing using fundamental valuation

Even though value investing using ratios such as P/E and P/B has been able to generate abnormal returns, the ratios themselves are not necessarily the product of either risk or mispricing. A low ratio does not necessarily mean that a stock is undervalued: it could simply have lower growth prospects or greater risk. Likewise, a low ratio does not mean that a stock is riskier: it could simply be that the growth prospects are lower. A fundamental valuation, on the other hand, incorporates both risk and future growth in determining the fundamental value.

Frankel and Lee (1998) value companies using RIV and consensus analysts' forecasts, put the fundamental value in relation to the price, i.e. V/P, and examine if V/P can be used to determine abnormal returns. Frankel and Lee (1998) find that V/P is a good predictor of future stock returns and that investing using V/P generates abnormal returns even after adjusting for the three-factor model of Fama and French (1993). Ali, Hwang and Trombley (2003) examine if the value premium from the V/P strategy of Frankel and Lee can be explained by risk or mispricing. They test several risk measures beyond the three-factor model, but find that those risk measures cannot explain the value premium. They find that the value premium is partially concentrated around earnings announcements, indicating erroneous expectations, i.e. mispricing. Johnson and Xie (2004) test whether the returns to a V/P strategy can be explained by price convergence, i.e. that the price converges to the value. This is done by studying the stocks in the most extreme quintiles based on the V/P ratio at the valuation date and after the holding period. Those stocks that have changed quintiles are then examined to see if the change in quintiles is caused by price convergence or value convergence, i.e. that the value converges to the price. They find evidence that the returns to the V/P strategy is caused by price convergence, i.e. that the stocks were incorrectly priced and that the prices converged towards the fundamental values.

As described in section 2.1.4, Dechow, Hutton and Sloan (1999) test the V/P strategy using different versions of RIV, forecasting both using past financial statements and analysts' forecasts. They find that the versions that best explain the stock price, i.e. a V/P as close to 1 as possible, are the worst at predicting future returns, and that those versions are the models where they used analysts' forecasts. The findings can be interpreted as investors putting too much emphasis on analysts' forecasts and too little focus on historical book values and earnings.

The RIV model has also been used in other ways than determining V/P to generate trading strategies. Skogsvik and Skogsvik (2010) use the RIV model to determine what the market's expectations of future return on equity (ROE) are, and determine how the ROE is likely to change using a univariate model utilising past ROE during the time period 1983-2003. They then take positions when the market's expectations differ from the ROE changes predicted by the univariate model. They generate significant abnormal returns, as measured by Jensen's alpha, to the long portfolios but not to the short; this is attributed to a positive bias where the market reacts more positively to positive earnings surprises than negatively to negative earnings surprises. However, no indications of mispricing are found in the last third of the time period. Based on this, Skogsvik and Skogsvik (2010) draw the conclusion that the market appears to have become more efficient over time.

2.2.3 Explanations for the value premium

The existence of a value premium is not contended; however, the explanation for the value premium is. Adherents to the efficient market theory attribute the excess return of value stocks to risk, the so-called risk-based explanation. Others believe that the value premium is not caused by risk, but evidences market mispricing, i.e. that the value premium is caused by the securities being mispriced, the so-called mispricing explanation.

The risk-based explanation is founded on modern portfolio theory (see e.g. Markowitz,

1952) and the efficient market hypothesis (see e.g. Fama, 1970) and is most heavily argued for by Fama and French (1993, 1996). Fama and French (1993) motivate the inclusion of P/B as a risk factor in their three-factor model by arguing that stocks with low P/B (value stocks) have lower profitability (earnings on assets) for at least five years prior to portfolio formation and five years after portfolio formation, whereas stocks with high P/B (growth stocks) have consistently high profitability. They argue that this is evidence of P/B being a risk factor. Accordingly, P/B, along with beta and market capitalisation, are risk factors in their three-factor model (Fama and French, 1993). Fama and French (1996) find that the value premium almost disappears when the portfolios are adjusted using the three-factor model, and therefore argue that value stocks are riskier. Other risk-based explanations for the value premium include time-varying risk, i.e. that the risk changes over time in a way that is consistent with the higher returns to value stocks (Ball and Kothari, 1989; Chan 1988).

The mispricing explanation offers several explanations for why stocks could be mispriced and therefore also for why a value premium can exist. When examining the value premium, Lakonishok, Shleifer and Vishny (1994) find that the value premium cannot be explained by the standard measures of risk such as beta and standard deviation. Some potential explanations for the value premium that they discuss and examine include: 1) investors extrapolating earnings growth too far into the future, 2) investors assuming trends in stock prices, 3) investors overreacting to good and bad news, and 4) investors equating a "good" company with a good investment. They find evidence that the growth rates do not differ much over a five-year period between value and growth stocks, indicating that investors that buy growth stocks overpay. When examining riskiness, Lakonishok, Shleifer and Vishny (1994) study beta, standard deviation and how often value portfolios yield lower returns than growth portfolios. They argue that the evidence does not support the notion that value stocks are riskier than growth stocks.

La Porta *et al.* (1997) examine if the value premium is caused by erroneous expectations by focusing on the three days following quarterly earnings announcements. They find that value stocks have positive earnings surprises and that growth stocks have negative earnings surprises and that these earnings surprises explain a great portion of the value premium. However, Frankel and Lee (1998) use analysts' forecasts and generate abnormal returns to their V/P strategy that cannot be explained by risk, indicating that investors have the ability to make correct predictions of future profitability and identify mispricing. The findings of Barniv et al. (2010) might be able to shed some light upon this: they find that analysts' forecasts can be used to determine fundamental values that are positively related to future returns, but that the fundamental values are negatively correlated to buy and sell recommendations (whereby the recommendations are negatively correlated with future returns). In other words, analysts make recommendations that are contrary to the recommendations that should be issued if they valued the stocks using their own forecasts. Since analysts' recommendations therefore yield lower returns than if recommendations based on fundamental value had been used, one can conclude that analysts either do not utilise their own forecasts (at least not correctly), or make recommendations that they know are suboptimal for their clients, most likely because they are incentivised for other actions than giving correct recommendations.

Similarly, fund managers might also act in self-interest. According to Haugen (2009), in-

Table 2: Value versus growth and explanations for the value premium

Authors	**Explanation for value premium**	**Ratios (factors)**	**Findings and argumentation**
Fama and French (1992)	Risk-based	P/E, P/B, size, etc.	P/B and size are good predictors of future returns; Argue that P/B and size are risk factors
Lakonishok, Shleifer and Vishny (1994)	Mispricing	P/E, P/B, past growth rates, etc.	Value stocks outperform growth stocks; Argue that value stocks are not riskier than growth stocks
Frankel and Lee (1998)	Mispricing	V/P	Value stocks outperform growth stocks even after adjusting for risk factors such as beta, P/B and size

stitutional investors invest in overvalued stocks because they are "good" companies and therefore their clients are comfortable owning them, and do not invest in undervalued stocks because they are "bad" companies and therefore their clients would not be comfortable owning them, even though the institutional investors know that the returns will be lower as a result. As Haugen (2009, p. 93) puts it:

> "*The reason [professional money] managers underperform [the market] is not because they are facing an efficient market. Managers underperform because they have an agency problem with their clients, and, as a result, they are victims of market inefficiency!*"

Haugen (2009, p. 94) also highlights the severe penalties managers may face if they underperform the market, such as losing their jobs and even the threat of lawsuits and jail, and that managers may be seen as having taken excess risk if they outperform the market too much:

> "*The pension officers then quickly appraise their position: They can lose, but they cannot win. [...] How can they keep from getting fired? [...] By looking as much like the "other guys" as they can.*"

By "looking as much like the 'other guys' as they can", Haugen means that institutional investors do not want to deviate too much from the index they are evaluated against, and therefore invest in growth stocks, since indices such as S&P 500 tend to consist mainly of growth stocks.

2.3 Time-series properties of accounting profitability and growth

One explanation for the value premium that the mispricing explanation offers is that investors make erroneous estimates of future profitability and growth, which causes stocks to be mispriced, hence creating a possibility to earn excess returns (Lakonishok, Shleifer and Vishny, 1994). One such erroneous expectation is the extrapolation of past growth and profitability too far into the future. Little (1962) examines the growth rates of UK companies in an attempt to determine how earnings and dividends develop. He finds that earnings growth tends to continue for one year, but with reversals of earnings growth starting already in year two. High growth companies only experience higher growth than low growth companies for two years, and Little (1962) concludes that one should not use past earnings growth in predicting future earnings growth. Chan, Karceski and Lakonishok (2003) also examine the predictability of growth rates and find that there is no persistence in long-term earnings growth, except what one would expect by chance. Furthermore, Chan, Karceski and Lakonishok (2003) find that valuation ratios, such as P/E and P/B, are not good at discriminating between companies with high and low future growth, which they argue supports the theory of investors having erroneous expectations, since companies trading at high multiples are not experiencing future growth rates high enough to warrant the high multiples, thus explaining the value premium.

Research into accounting profitability shows that there is a pattern of mean reversion in return on equity (ROE) as well. In researching the time-series properties of accounting income, Brooks and Buckmaster (1976) find that for their sample as a whole, the earnings for year t can often be predicted using earnings year t–1, but that earnings greater or lower than the norm tend to mean revert towards the norm. Freeman, Ohlson and Penman (1982) also find mean reversion when researching ROE, as do Penman (1991), Fairfield, Sweeney and Yohn (1996). Fama and French (2000) find that the mean reversion of ROE occurs faster the further away the observed ROE is from the mean in either direction. In fact, Skogsvik (2008) tests different prediction models in an attempt to predict future ROE and finds that a univariate (single variable) model utilising past return on equity predicts future ROE better than more advanced models. However, Fama and French (1995) find that the P/B ratio is predictive of future profitability for five years, indicating that investors are to some extent able to predict future profitability. The mean reversion of profitability can be explained by theory of competitive forces, where profitable industries and niches experience new actors entering the market and investments by existing competitors, driving profitability down, and unprofitable industries and niches experience increases in profitability from companies in that industry or niche going bankrupt or otherwise leaving the industry (Porter, 1980).

Even if the competitive forces drive profitability towards cost of capital as the company goes towards a zero net present value (NPV) setting, i.e. investments only earn the cost of capital, ROE is still expected to differ from the cost of equity when biased accounting is present (Runsten, 1998). This is because biased accounting, such as conservative accounting, causes book values to differ from fair values, whereby the accounting profitability, such as ROE, differs from the cost of capital. Runsten (1998) estimates a measure of permanent measurement bias caused by conservative accounting for different industries in Sweden. These permanent measurement biases can be used to give an approximation of the fair value in a zero NPV setting, whereby it can also be used to determine the ROE in a zero NPV setting.

2.4 Contribution

Unless one forecasts into infinity, or at least into a steady state setting, different fundamental valuation models will yield different estimates of the fundamental value. Different fundamental valuation models have therefore been empirically tested and compared to each other to see if any model is superior to the other models. The research indicates that the RIV model is better than other valuation models at explaining the stock prices at the valuation dates, however, such a finding is not necessarily evidence of superiority of RIV over the other models. Such a conclusion would be based on the assumption of market efficiency, when in fact the evidence from the research on the different valuation models suggests that the market is not efficient. Therefore, the question still remains which model is the best at predicting the fundamental value of stocks.

Instead of comparing valuation models through the accuracy of V/P, thereby relying on market efficiency in the semi-strong form, we propose a novel approach. By examining the models' abilities to predict future returns, we open up for the possibility that the market is not efficient in the semi-strong form. The rationale underlying the method is that if prices occasionally deviate from fundamental values, the model that is able to predict the largest future returns is superior at predicting fundamental values. The ability of a valuation model to predict future returns is not necessarily evidence of mispricing, as the ability to predict future abnormal returns could be interpreted as the ability to identify risk. As abnormal returns to a V/P strategy are reconcilable with both explanations for the occurrence of the value premium, this thesis is not dependent on the assumption of mispricing. Regardless of the explanation chosen, our hypothesis is that the most overvalued stocks generate negative risk-adjusted returns and that the most undervalued stocks generate positive risk-adjusted returns. Due to the lack of a level comparison of the models, we are unable to formulate a hypothesis on the superiority of any valuation model compared to the others.

3 Method

This thesis aims to contribute to the literature on valuation theory by examining if any model is better at predicting the fundamental value, as opposed to examining the ability of predicting the stock price which has been previously tested. The valuation models tested are DDM, two different specifications of RIV, and AEG. These models are chosen because they value equity directly and because they enable a comparison between using cash flow-based valuation (DDM) and accrual-based valuation (RIV and AEG). In order for the models to give different estimates of fundamental value despite having consistent assumptions and equal input, as to enable an empirical comparison, the input to the models (such as ROE, payout share, etc.) is forecasted over a 12-year period, where a steady state is assumed from the 12^{th} year onwards. However, all valuations are done using only the input from the first 10 years, a time period which should suffice to enable the use of Gordon growth, as indicated by research on the mean reversion of profitability (see e.g. Fairfield, Sweeney and Yohn, 1996; Freeman, Ohlson and Penman, 1982; Penman, 1991). Furthermore, a "full-fledged" valuation, where all valuation models yield equal estimates of fundamental value, is also performed using the entire 12-year forecast, so that it can be determined whether valuation accuracy is improved when the forecast period is extended.

After the valuations, the stocks are ranked according to their V/P ratio and then sorted into quintiles, with each quintile representing an equally weighted portfolio, as is done by Frankel and Lee (1998). The portfolios are held for 36 months, with proceeds from stocks delisted before that being invested in the index. The returns are regressed against proxies for risk factors, using both overlapping and non-overlapping data.

As there is a substantial amount of uncertainty involved in equity valuation, particularly what the future ROE and cost of equity will be, complementing tests that incorporate the risk of bankruptcy into the cost of equity and that forecast ROE differently are performed. In addition to the basic test, we perform three additional tests: Test 2 which incorporates bankruptcy risk into cost of equity; Test 3 which employs a different forecast of ROE; and Test 4 which combines Test 2 and Test 3.

3.1 Model specifications

The model specifications on which we base our model specific fundamental values are the following:

DDM:

$$V_0 = \sum_{t=1}^{T} \frac{DPS_t}{(1+\rho_e)^t} + \frac{\frac{DPS_{T+1}}{\rho_e - g_{ss}}}{(1+\rho_e)^T} \tag{6}$$

RIV q:

$$V_0 = BVPS_0 + \sum_{t=1}^{T} \frac{(ROE_t - \rho_e)BVPS_{t-1}}{(1+\rho_e)^t} + \frac{q_T BVPS_T}{(1+\rho_e)^T} \tag{7}$$

RIV GG:

$$V_0 = BVPS_0 + \sum_{t=1}^{T} \frac{(ROE_t - \rho_e)BVPS_{t-1}}{(1+\rho_e)^t} + \frac{\frac{(ROE_{T+1} - \rho_e)BVPS_T}{\rho_e - g_{ss}}}{(1+\rho_e)^T} \tag{8}$$

AEG:

$$V_0 = \frac{EPS_1}{\rho_e} + \sum_{t=1}^{T-1} \frac{1}{(1+\rho_e)^t} z_t + \frac{\frac{z_T}{\rho_e - g_{ss}}}{(1+\rho_e)^{T-1}} \tag{9}$$

$$z_t = \frac{1}{\rho_e}[EPS_{t+1} + \rho_e DPS_t - (1+\rho_e)EPS_t] \tag{10}$$

where:

V_0	= intrinsic value of equity at the valuation date t=0
DPS_t	= dividend per share at time t
EPS_t	= earnings per share at time t
$BVPS_t$	= book value per share at time t
ROE_t	= return on owners' equity (defined as net income for period t in relation to book value in the beginning of period t)
q_T	= permanent measurement bias from conservative accounting
z_t	= abnormal earnings growth in period t
g_{ss}	= terminal growth rate in steady state
ρ_e	= cost of equity capital
T	= year 9

Furthermore, a "full-fledged" valuation is performed, utilising the entire 12-year forecast. The choice of valuation model is indifferent, as all valuation models above will yield equivalent fundamental values using such input.

Using the model specifications above, the intrinsic value is calculated for each firm as of a common valuation date t, assumed to be May 1st. In order for DDM to be theoretically equivalent to RIV and AEG, yearly payoffs must coincide with the dividend payout date. As a result, dividends are assumed to be paid on the same date as the valuation date for each forecasted year, with the first dividend being paid at t=1. Consequently, the intrinsic value calculated is ex-dividend. In order for intrinsic values to be comparable with observed prices, prices must also be ex-dividend. Thus, prices are adjusted in instances where ex-dividend dates occur after the valuation date.

Terminal values are calculated using the Gordon growth formula (Gordon and Shapiro, 1956; Gordon, 1959), and also with the q value for an alternative RIV model. For DDM, Gordon growth is applied to the dividend in year 10, equation 6. For RIV, one terminal value is calculated by multiplying the q value with the opening balance of equity year 10 (henceforth referred to as "RIV q"), equation 7, and another terminal value applying Gordon growth to the residual income in year 10 (henceforth referred to as "RIV GG"), equation 8. For the terminal value in AEG, Gordon growth is applied to the abnormal earnings growth year 9, equation 9.

The application of Gordon growth modelling for terminal values two years before the competitive equilibrium implicitly assumes that ROE remains abnormal indefinitely after year 10. Consequently, all models except the "full-fledged" valuation and RIV q will never reach a "true" competitive equilibrium.

3.2 Model input

The input to the valuation models has its basis in historical information, where ratios for the last historical year are transferred to the first year of the forecast with a martingale approach. The forecast is done over a time period of 12 years, which is the explicit forecast period. After the 12th year, the ratios remain constant and the input grows at a steady state growth rate. However, since the purpose is to test different valuation models, four of the models will only use input from the first 10 years, as to test which is the best predictor of fundamental value when forecasts are not made into infinity.

3.2.1 Permanent measurement bias (q value)

With conservative accounting, the book value of equity will not equal market value of equity even in a competitive equilibrium where only zero NPV projects can be undertaken. The reason is that some assets in the balance sheet are understated due to e.g. expensing of R&D and depreciation and amortization occurring faster than the economic usage of the assets. Runsten (1998) estimates permanent measurement biases ("PMB", or q values) in the book value of different industries, caused by conservative accounting. Even though business goodwill can be expected to disappear over time due to competitive forces, the measurement bias caused by conservative accounting can be expected to remain indefinitely. The permanent measurement bias therefore plays a role in determining the capital value of an asset in steady state and competitive equilibrium, and can be used to estimate the accounting profitability in steady state and competitive equilibrium.

The industry classifications and related permanent measurement biases of Runsten (1998) are used to determine the permanent measurement biases for the stocks in our sample. However, some modifications and amendments are deemed necessary. Firstly, we use a new q value of 0.7, estimated by Bergquist and Kjerstadius (2014), for the industry *Software & Electronics*, an industry which has grown substantially in size since Runsten's (1998) study. Even though the usage of q values estimated in 2014 on data in e.g. 2002 introduces issues of foreknowledge, q values should merely be regarded an estimate of the permanent measurement bias; it is assumed that similar values would be obtained should a similar study be performed in 2002. The same assumption applies to q values estimated by Runsten (1998). Secondly, since fair value accounting for certain assets, such as biological assets, became the norm with EC regulation which rendered IFRS accounting mandatory in the consolidated financial statements for listed companies in 2005, q values could be erroneous predictors of accounting measurement bias for industries specially affected by the fair value accounting. Since financial services and real estate companies are excluded (see section 4), the industry in our sample that is mainly affected is pulp and paper, as companies in that industry, depending on business model, tend to record substantial biological assets in their balance sheets. After reviewing the balance sheets of those companies, it was determined that during the period only Holmen had biological assets substantial enough to constitute a significant part and cause divergence from the q value. Therefore, a new permanent measurement bias was estimated for Holmen by aggregating the accounting measurement bias related to inventory, machinery and equipment, land and buildings and deferred taxes (see appendix D). The new permanent measurement bias for Holmen was determined to be 0.27 and is applied from 2005 and onwards (before 2005 the former measurement bias of 0.67 is used).

In a competitive equilibrium, the market value equals book value plus the PMB from conservative accounting. Then, the PMB is equal to the terminal value in RIV (Skogsvik, 2002), whereby it can be expressed as the residual income capitalised using Gordon growth:

$$q_T = \frac{ROEss - \rho_e}{\rho_e - g_{ss}} \tag{11}$$

where:

q_T = permanent measurement bias caused by conservative accounting
ROE_{ss} = return on owners' equity in steady state
ρ_e = cost of equity capital
g_{ss} = growth rate in steady state

3.2.2 Return on equity and earnings per share

With a vast body of research indicating that return on equity (ROE) tends to mean revert (see e.g. Brooks and Buckmaster, 1976; Fairfield, Sweeney and Yohn, 1996; Freeman, Ohlson and Penman, 1982), the return on equity is forecasted to revert towards the ROE in steady state, ROE_{ss}, over the explicit forecasting period. This is accomplished through linear interpolation, where the return on equity in between the first and the last year of the forecast changes linearly, as represented mathematically by

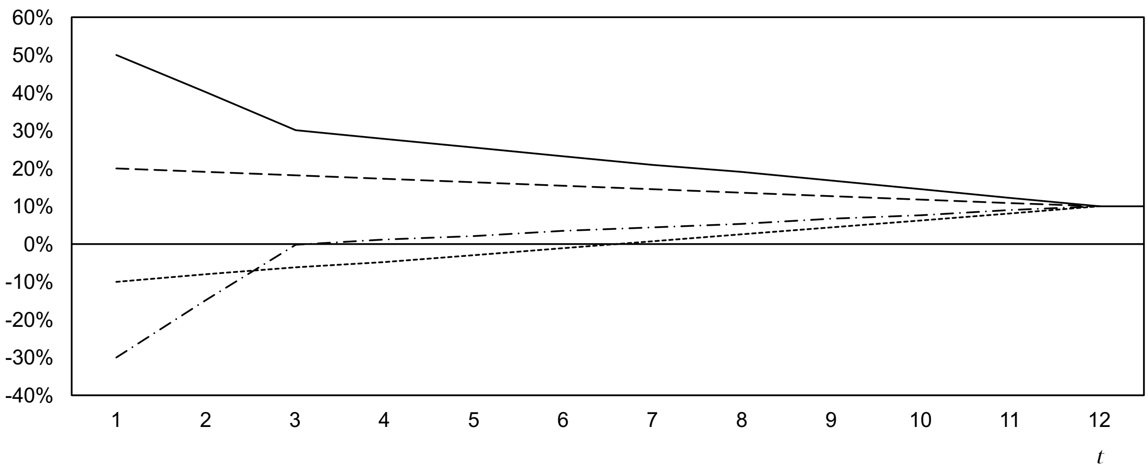
$$ROE_t = ROE_{t=1} + (ROE_{ss} - ROE_{t=1})\frac{t-1}{11} \quad (12)$$

where:

ROE_t = return on owners' equity at point in time t
ROE_{ss} = return on owners' equity in steady state (year 12 onwards)

In line with the findings of Brooks and Buckmaster (1976), that earnings for year t can be predicted using earnings year t–1, the martingale approach implies that ROE for the first year of the forecast, i.e. $ROE_{t=1}$, is set equal to ROE of the last historical year. However, since some companies demonstrate extreme levels of ROE due to e.g. an unusually low opening balance of equity or large transitory income, a linear change until year 12 is often not realistic. Therefore, ROE is limited to the range between +100% and –50% for the first year of the forecast to normalize for extreme and unsustainable ROE. Furthermore, previous research has shown that the further the observed ROE is from the mean, the faster the mean reversion occurs (Fama and French, 2000; Penman, 1991). Because of this, ROE is interpolated faster for companies with a ROE below –20% and greater than 40% so that a ROE of 0% is reached in t=3 for firms with ROE below –20% and half between observed ROE and steady state ROE for firms with ROE in excess of 40%.

Figure 1: Illustration of different ROE estimates with equivalent steady state ROE



The ROE in year 12 is the ROE that will continue perpetually, i.e. it is the ROE in steady state. Since competitive forces should eliminate abnormal profitability over time, it is assumed that in the steady state there are only zero NPV projects, i.e. firms can only invest at the required return and do not earn above or below it. However, due to conservative accounting, the book value of equity will not equal the market value of equity even in the steady state, whereby ROE in steady state will be greater than the cost of equity. Since all business goodwill will be gone in a zero NPV environment, only the permanent measurement bias from conservative accounting will remain. The ROE in steady state is therefore estimated using the relationship between ROE, cost of equity, growth and permanent measurement bias, which can be derived from Equation 11 as:

$$ROE_{ss} = \rho_e + q_T(\rho_e - g_{ss}) \tag{13}$$

where:

ROE_{ss} = return on owners' equity in steady state
ρ_e = cost of equity capital
q_T = permanent measurement bias caused by conservative accounting
g_{ss} = growth rate in steady state

The earnings per share for year t are determined by multiplying ROE_t with $BVPS_{t-1}$.

3.2.3 Dividends

Dividends are forecasted by multiplying an estimated payout share with the opening balance of book value of equity. The payout share is defined as the dividend for any year divided by the opening balance of book value of owners' equity. Since book value is less volatile than earnings, payout share will be less volatile than payout ratio, which is the dividend for any year divided by the earnings for that year.

In line with the martingale approach, the payout share for the first year is estimated using the payout share for the last historical year. However, if ROE the first year is negative, the payout share is set to zero. If ROE the first year is positive, the payout share is set to the minimum of the historical ROE and payout share, so that the dividend does not exceed the net income. For steady state, the payout share is determined in a way that is consistent with steady state growth. Since the clean surplus relation is assumed to hold, the payout share in steady state is dependent on ROE and growth in equity in steady state, as shown below:

$$PS_{ss} = ROE_{ss} - g_{ss} \tag{14}$$

where:

PS_{ss} = payout share in steady state
ROE_{ss} = return on owners' equity in steady state
g_{ss} = growth rate in steady state

The payout share in between the first year and the last year of the forecast period is forecasted by linear interpolation as shown below:

$$PS_t = PS_{t=1} + (PS_{ss} - PS_{t=1})\frac{t-1}{11} \tag{15}$$

where:

PS_t = payout share at point in time t
PS_{ss} = payout share in steady state
t = any given point in time

Also in future years, it is not realistic to assume that companies that make losses will pay dividends, or that companies will pay dividends in excess of their net income. Therefore, the payout share is set to zero if the ROE is negative, and in case the ROE is positive, the payout share is set to the minimum of ROE and payout share, so that dividends do not exceed net income.

3.2.4 Growth

Since the clean surplus relation is assumed to hold, the growth in book value during the explicit forecast period (excluding the first year in steady state) will be determined using the ROE and payout share, as shown below:

$$g_t = ROE_t - PS_t \tag{16}$$

where:

g_t = growth in equity at point in time t
ROE_t = return on owners' equity at point in time t
PS_t = payout share at point in time t

Previous studies (e.g. Francis, Olsson and Oswald, 2000) set the perpetual growth rate to 4%. However, we find such an assumption to be problematic due to the perpetual nature of the steady state; if nominal world GDP growth in fact is only 2%, one makes the implicit assumption that the sample set of firms will outgrow the rest of the world and eventually become the whole world. Instead, we argue that a perpetual growth rate of 2% better reflects a steady state as it is in line with expected long term GDP growth.

3.2.5 Cost of equity

The cost of equity is estimated using the capital asset pricing model (CAPM) of Lintner (1965) and Sharpe (1964):

$$\rho_e = r_f + \beta(r_M - r_f) \tag{17}$$

where:

ρ_e = cost of equity capital
r_f = risk-free rate
β = beta, i.e. non-diversifiable or systematic risk
r_M = return to the market portfolio

In other words, the cost of equity for any company is the risk-free rate plus a risk premium for the risk that cannot be diversified away. The risk-free rate is proxied with a 10-year Swedish government bond, and the market risk premium is heuristically set to 6%, same as Francis, Olsson and Oswald (2000) use. The beta for each company, i.e. the non-diversifiable or systematic risk, is estimated by regressing the stock returns against the market index with weekly returns for the two years prior to the valuation date and adjusting it with the method popularized by the likes of Bloomberg:

$$\beta' = \frac{2}{3} * \beta + \frac{1}{3} * 1 \tag{18}$$

The rationale underlying such an adjustment is the assumption that over time betas move towards 1 (see e.g. Damodaran, 1999), so when assuming a cost of equity that is to last into perpetuity, the beta should be normalized.

3.3 Portfolio formation and evaluation

To test the ability of the valuation models to predict future abnormal returns, the stocks are sorted into equally weighted quintiles based on the V/P, as made by Frankel and Lee (1998). These quintiles represent buy-and-hold portfolios that are evaluated over 36 months, since the value effect (outperformance of value stocks over growth stocks) is often documented to occur in the second and third year (Johnson and Xie, 2004). New portfolios are formed each year from 2002 until 2013, inducing overlapping data, whereby average returns are used for evaluations. When stocks are delisted from OMX Stockholm before the end of the holding period, the shares are sold and reinvested in the index that proxies for the market. Our hypothesis is that the most overvalued stocks will generate negative risk-adjusted returns and that the most undervalued stocks will generate positive risk-adjusted returns, as the prices converge towards the fundamental values. Furthermore, hedge portfolios are also constructed where long positions are taken in the most undervalued portfolios and short positions taken in the most overvalued portfolios. The valuation model that most accurately predicts over- and undervaluation, as determined by future abnormal returns, is the superior model.

Returns are calculated on a monthly basis, where the return is the price appreciation plus dividends reinvested. The portfolios' returns must be risk-adjusted to be commensurable, otherwise higher (or lower) return could be the result of higher (or lower) risk. The risk-adjusted measures utilized in this thesis include Jensen's alpha and the three-factor model, explained below.

3.3.1 Jensen's alpha

Jensen's alpha is the excess return over the expected return, where the expected return is given by the CAPM (Jensen, 1968). Jensen's alpha is the intercept in a regression as below:

$$\bar{r}_{p,t} = \alpha + \beta_p (r_{M,t} - r_{f,t}) + \varepsilon \tag{19}$$

where:

$\bar{r}_{p,t}$ = excess return to portfolio p for month t, averaged
β_p = beta of portfolio p
$r_{M,t}$ = return to the market portfolio for month t
$r_{f,t}$ = risk-free rate for month t

3.3.2 Three-factor model

There is an ongoing discussion on whether the risk factors of the multiple factor models are risk factors or mispricing factors (MacKinlay, 1995). For example, given the negative correlation between profitability and risk of bankruptcy (Skogsvik, 1987), it is difficult to argue that profitability, which is a risk factor in the five-factor model (Fama and French, 2015), should be a risk factor. Profitability should only be a risk factor if investors are unable to predict mean reversion, which they should be able to in an efficient market. Thus, it cannot be a risk factor in an efficient market. Furthermore, Fama and French (1993) argue that B/P is a risk factor because B/P is negatively correlated with profitability, which is contradictory to profitability being a risk factor. Therefore, the three-factor model of Fama and French (1993) is used instead of the five-factor model of Fama and French (2015). Regardless of whether the risk factors of the three-factor model represent risk or mispricing, the three-factor model has become the gold standard for risk adjustment in the contemporary finance literature.

The three-factor model adjusts for the return to portfolios formed on the basis of the three factors, which are the market risk premium, the premium of high B/P (inverse of P/B) over low B/P, and the premium of small capitalization stocks over large capitalization stocks. The excess return under the three-factor model is the alpha from a regression as represented by

$$\bar{r}_{p,t} = \alpha + \beta_1(r_{M,t} - r_{f,t}) + \beta_2 HML_t + \beta_3 SMB_t + \varepsilon \tag{20}$$

where:

$\bar{r}_{p,t}$ = excess return to portfolio p for month t, averaged
$r_{M,t} - r_{f,t}$ = market risk premium for month t
β_1 = beta to the market risk premium
β_2 = beta to the return of high B/P stocks less low B/P stocks
β_3 = beta to the return of small minus large stocks
HML_t = return to high B/P stocks less low B/P stocks in month t
SMB_t = return to small cap. stocks less large cap. stocks in month t

For the B/P effect, stocks are divided into three portfolios based on the B/P ratio (highest 30%, middle 40% and lowest 30%). For the size effect, stocks are divided into two portfolios based on the market capitalization, where the cut off point is the median of OMX Stockholm, so that half of the companies are sorted into the big portfolio and half into the small portfolio. The splits in portfolios are then combined, yielding six value-weighted portfolios. These portfolios are rebalanced yearly. The return attributed to the small effect, SMB, is calculated as the average return to the three small portfolios less the average return to the three large portfolios. The return attributed to the B/P effect, HML, is calculated as the average return to the two high B/P portfolios less the average return to the two low B/P portfolios.

3.4 Additional tests

Any valuation is dependent on the forecasted input such as ROE and cost of equity. Even though all valuation models use the same input and therefore should be under equal constraint of the ability to forecast, additional tests are performed where the cost of equity is adjusted for the risk of bankruptcy and the ROE is forecasted with different assumptions to make sure that the results obtained are not the result of improper forecasting.

3.4.1 Adjusting for risk of bankruptcy

CAPM (or any other method of determining cost of equity using past stock returns) ignores the fact that the company could be exposed to risk of bankruptcy (p_{fail}) not captured by the beta. Consequently, additional tests are performed where the risk of bankruptcy is determined and incorporated into the cost of equity. Since the sample consists of Swedish companies, the bankruptcy prediction model of Skogsvik (1987), which was estimated on Swedish companies, is used. The probability of failure for the next year is estimated by

$$V = -1.5 - 4.3 * R_1 + 22.6 * R_2 + 1.6 * R_3 - 4.5 * R_4 + 0.2 * R_5 - 0.1 * R_6 \tag{21}$$

where:

R_1 = return on average assets for year t
R_2 = interest expense in relation to average liabilities for year t
R_3 = average inventory in relation to sales for year t
R_4 = equity-to-assets ratio at the end of year t
R_5 = relative change in owners' equity during year t
R_6 = change in R_2 scaled by the standard deviation of R_2

V is an index of failure assumed to be normally distributed, which is used to find an explicit value of p_{fail}. The higher the value of V, the higher the estimated risk of bankruptcy. Because of the fact that the proportion of failing firms in Skogsvik's (1987) sample is disproportionate to the proportion of failing firms in the population, the estimated p_{fail} must be adjusted for this bias using Equation D1 (see appendix). Owing to the desire not to introduce survivorship bias, R_6 is assumed to be 0.

With the heuristic assumption that p_{fail} is constant, it may be incorporated into the cost of equity using (Skogsvik, 2006)

$$\rho_e^* = \frac{\rho_e + p_{fail}}{1 - p_{fail}} \tag{22}$$

where ρ_e^* is the adjusted cost of equity used in the valuation.

3.4.2 Forecasting ROE with different assumptions

Although the prediction and time-series properties of profitability is outside of the scope of this thesis, additional tests are nevertheless performed where ROE is forecasted differently to sensitise the impact of the input to the models. In Test 3 and 4, ROE is limited to +50% and –50% for the first year, and is interpolated in an additional year so that in t=4 a ROE of 0% is reached for firms with ROE below –20% and half between observed ROE and steady state ROE for firms with ROE in excess of 40%. The lower range for the ROE is motivated by a slower first period interpolation so that abnormally high ROE is not forecasted to remain abnormally high for too long.

4 Data

Data is collected from the databases DataStream (stock returns, share prices, book values per share and market index) and Serrano (accounting data for determining ROE, payout share and risk of bankruptcy), and, when data is missing, manually from annual reports. Proxies for risk-free rate are obtained from Sveriges Riksbank. Data is collected from 2000 to 2016, as to allow two years of data prior to the first portfolio formation in 2002 to determine betas, and three years of data for stock returns after the last portfolio formation in 2013. Only companies listed on OMX Stockholm are included since Runsten's (1998) q value is estimated on Swedish companies. Furthermore, the company must have its legal domicile in Sweden, both due to that non-Swedish domiciled companies are not included in the Serrano database and the estimation of q values. Since the valuation models are generally not suited for valuing financial companies (including e.g. banks, real estate companies, investment companies and other companies with the main purpose of holding shares in other companies and collecting dividends), such companies are often omitted (see e.g. Frankel and Lee, 1998), as in this study. One reason is fair value accounting for e.g. financial assets, whereby the q values are difficult to estimate, and one would have to trust the valuations done by the company itself; valuing companies based on their valuations is dubious. Moreover, since all companies are to be valued at the same date, only companies with fiscal year end in December are included so that there is no foreknowledge and to limit the gap between when the information is reported and positions are taken. Furthermore, companies with negative book value in either opening or closing balance of the last historical year are excluded, since ROE calculated on negative equity is not informative and negative equity cannot be used to forecast future net income and growth in equity.

Since the betas for the valuations are estimated using weekly returns for a two year period, the companies must have been listed at least two years prior to each valuation date. When companies are delisted from OMX Stockholm (by e.g. a move to another list or a public takeover), the shares are sold and reinvested in the index constituting the market proxy. While many firms prevail for several years on smaller lists, firms outside of OMX Stockholm have special characteristics that overall constitute unsuitable conditions both in theory and in practice, such as lack of liquidity, difficulties in forecasting and insufficient accounting data. In the event of bankruptcy, shares are deemed to have no value and the share price is effectively zero.

While the study only includes Swedish stocks, the use of a Swedish index, e.g. OMXS30, as a market proxy would neglect the possibility of an asset manager to invest across global capital markets without incurring any significant transaction costs. For this reason, the MSCI World index is designated the appropriate index that reflects the relevant opportunity cost for an investor with global capabilities. This is also theoretically founded, since the undiversifiable risk is the correlation with the capital market, which is better proxied by a world index than a Swedish index.

4.1 Descriptive statistics

Table 3: Sample statistics of key variables

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Number of firms	168	182	180	178	172	160	160	161	161	157	156	161
Value-weighted V/P	0,56	0,69	0,59	0,88	0,80	0,61	0,73	1,08	0,64	0,72	0,84	0,72
Median ROE	1,4%	(0,8%)	2,2%	11,4%	14,6%	16,1%	17,5%	12,9%	6,9%	11,0%	13,2%	9,2%
Median p(fail)	0,07%	0,04%	0,03%	0,01%	0,01%	0,01%	0,01%	0,02%	0,01%	0,01%	0,00%	0,01%
Median P/B	1,61	1,21	2,20	2,31	3,17	3,17	1,53	1,47	2,01	2,36	1,91	2,08
Median PS	0,0%	0,0%	0,0%	1,8%	3,9%	5,1%	5,6%	1,6%	2,4%	3,8%	4,4%	3,6%

Table 3 reports a summary of the sample throughout the study. The number of firms included each year is constrained by aforementioned criteria, and exhibit an overall declining trend during the period. The value-weighted V/P (calculated by the full-fledged model and weighted by market capitalisation) of the sample fluctuates between 0.56 and 1.08, with the lowest ratios during bull periods and the highest ratio observed during the financial crisis of 2009. The same pattern can be observed for the median P/B ratio. Median ROE is initially (2002-2004) very low, with a large number of growth companies surviving the dot-com bubble, which is also reflected in a relatively high median p_{fail} and low median payout share (PS). From 2005 onwards, median profitability increases significantly, with a constantly low median p_{fail}. Overall, it is possible to distinguish two separate periods, 2002-2004 and 2005-2013, with clear differences with regards to profitability, bankruptcy risk and valuations.

5 Results

5.1 Basic test

The results from the basic test are presented in Table 4. Our primary results from the basic test suggest that all long portfolios generate significant (using a 95% confidence level) positive abnormal returns, both CAPM adjusted (Jensen's alpha) and three-factor adjusted, regardless of valuation model employed. Among the long portfolios, RIV GG exhibits the largest abnormal returns, with Jensen's alpha and three-factor adjusted returns of 11.9% and 10.8% respectively, whereas AEG performs the worst with Jensen's alpha and three-factor adjusted returns of 8.1% and 6.8%, respectively.

All short portfolios generate positive abnormal returns; however, none are significant with 95% confidence level. A striking finding is that, at 7.1% per annum, the returns to AEG are much greater than for the other valuation models, and is even greater than for the long portfolio. While the difference between the other valuation models is marginal, DDM exhibits the lowest returns to the short portfolio at 2.0%.

The returns to the hedge portfolios are calculated on a monthly basis, as supposed to on a full-period basis, which causes the returns to differ from the returns to the long portfolio less the returns to the short portfolio due to the compounding effect. No hedge portfolio yields significant abnormal returns with a 95% confidence level (although RIV GG has a p-value of 0.054 for three-factor adjusted returns), but the returns to the hedge portfolios are positive for all valuation models except for AEG. Of the hedge portfolios, RIV GG performs the best, whereas AEG performs the worst.

Furthermore, it is worth noting that betas and standard deviations are lower for the long portfolios than for the corresponding short portfolios. In other words, the long portfolios have lower diversifiable and nondiversifiable risk than the short portfolios, even though the long portfolios generate greater raw returns (except for AEG). This is in line with previous research (e.g. Fama and French, 1992; Haugen, 2009; Lakonishok, Shleifer and Vishny, 1994).

Figure 2 depicts the cumulative raw returns to portfolios 1-5 of the "full-fledged" valuation. The figure can be read as the payoffs to an investor with an initial investment of 100 currency units in 2002. From the figure, it is evident that the order is not only declining according to V/P, where the most undervalued portfolio yields the highest cumulative raw returns, but that the distance between the extreme portfolios and middle portfolios is very pronounced. While this result is amplified by the compounding effect, it is evident throughout the whole period. The corresponding figures for the other valuation models are found in Figures C4-C7 in appendix.

5.2 Additional tests

The results from the introduction of bankruptcy risk to the basic test are found in Table B1. Neither the returns to the long portfolios nor the short portfolios deviate notably

Table 4: Basic test

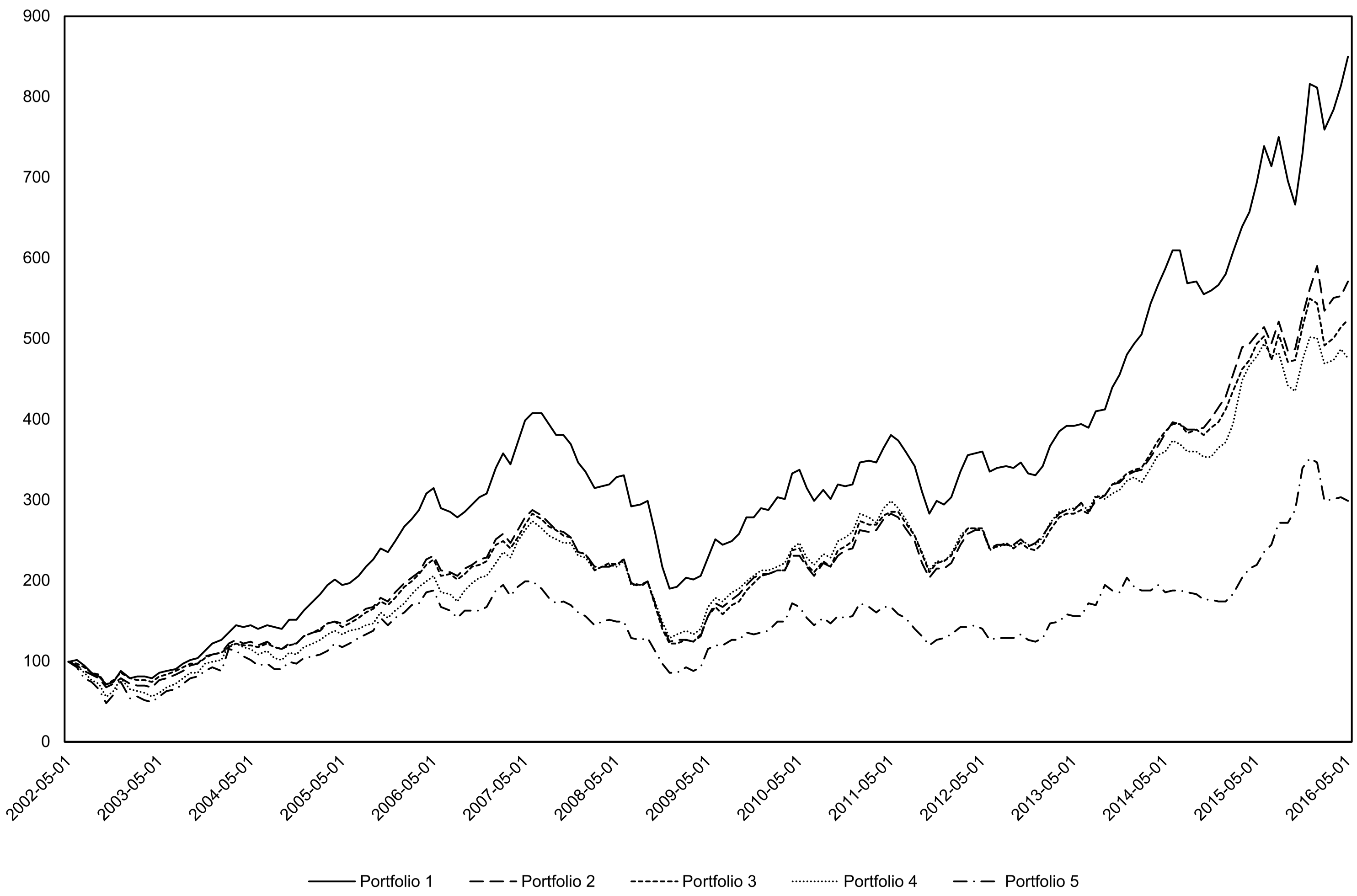
Hedge portfolios	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0.3%	0.3%	0.3%	0.4%	-0.1%
Raw return (yearly)	4.2%	4.3%	4.0%	5.1%	-1.6%
Jensen's alpha (monthly)	0,5%	0,5%	0,5%	0,6%	-0,1%
Jensen's alpha (yearly)	6,6%	6,5%	6,3%	7,2%	-0,6%
Beta	-0,12	-0,12	-0,11	-0,11	-0,05
p-value – Jensen's alpha	0,1691	0,1650	0,1872	0,1186	0,8526
p-value – beta	0,1402	0,1288	0,1527	0,1603	0,3474
Fama and French alpha (monthly)	0,6%	0,6%	0,6%	0,7%	0,0%
Fama and French alpha (yearly)	7,5%	7,6%	7,3%	8,4%	-0,3%
Fama and French MP beta	-0,19	-0,20	-0,19	-0,19	-0,08
Fama and French size beta	-0,37	-0,42	-0,38	-0,42	-0,08
Fama and French B/P beta	0,32	0,31	0,33	0,28	0,34
p-value – Fama and French alpha	0,0927	0,0805	0,1030	0,0537	0,9135
p-value – Fama and French MP beta	0,0103	0,0058	0,0109	0,0085	0,1222
p-value – Fama and French size beta	0,0001	0,0000	0,0001	0,0000	0,2205
p-value – Fama and French B/P beta	0,0014	0,0019	0,0013	0,0038	0,0000
Standard deviation (monthly)	0,0497	0,0491	0,0497	0,0482	0,0351

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,3%	1,3%	1,3%	1,3%	1,0%
Raw return (yearly)	16,5%	16,3%	16,5%	17,3%	13,3%
Jensen's alpha (monthly)	0,9%	0,9%	0,9%	0,9%	0,7%
Jensen's alpha (yearly)	11,2%	10,9%	11,1%	11,9%	8,1%
Beta	0,77	0,77	0,77	0,75	0,79
p-value – Jensen's alpha	0,0033	0,0032	0,0030	0,0015	0,0383
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,8%	0,8%	0,8%	0,9%	0,5%
Fama and French alpha (yearly)	10,0%	9,8%	10,0%	10,8%	6,8%
Fama and French MP beta	0,84	0,84	0,84	0,83	0,88
Fama and French size beta	0,45	0,40	0,44	0,42	0,54
Fama and French B/P beta	-0,07	-0,07	-0,06	-0,10	0,02
p-value – Fama and French alpha	0,0031	0,0033	0,0029	0,0014	0,0427
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,3610	0,3094	0,3794	0,1742	0,8254
Standard deviation (monthly)	0,0535	0,0529	0,0532	0,0527	0,0557

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,7%	0,6%	0,7%	0,7%	1,1%
Raw return (yearly)	8,1%	7,9%	8,3%	8,1%	13,5%
Jensen's alpha (monthly)	0,4%	0,3%	0,4%	0,4%	0,7%
Jensen's alpha (yearly)	4,3%	4,1%	4,6%	4,4%	8,8%
Beta	0,88	0,89	0,88	0,86	0,84
p-value – Jensen's alpha	0,4836	0,5082	0,4624	0,4750	0,0814
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,2%	0,2%	0,2%	0,2%	0,6%
Fama and French alpha (yearly)	2,3%	2,0%	2,5%	2,3%	7,1%
Fama and French MP beta	1,04	1,05	1,04	1,02	0,96
Fama and French size beta	0,82	0,82	0,82	0,83	0,62
Fama and French B/P beta	-0,39	-0,38	-0,39	-0,38	-0,32
p-value – Fama and French alpha	0,6622	0,6972	0,6330	0,6560	0,0976
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0013	0,0017	0,0014	0,0013	0,0009
Standard deviation (monthly)	0,0780	0,0781	0,0779	0,0766	0,0659

Figure 2: **Basic Test: Raw Returns, Full-Fledged Model**

Cumulative raw returns to the full-fledged model, where portfolio 1 represents the most undervalued quintile and portfolio 5 represents the most overvalued quintile. Returns are indexed starting in 2002.



compared to the basic test. The results confirm the findings from the basic test, with RIV GG yielding the highest abnormal returns and AEG the lowest.

When interpolating ROE over an additional year (Test 3, Table B2), the relative ranking of the valuation models does not change notably. Among the long portfolios, the full-fledged model, RIV GG, RIV q and AEG are marginally improved, whereas DDM exhibits lower returns compared to the basic test. As in the basic test, the abnormal returns to all long portfolios are significant. For the short portfolios, the change in three-factor adjusted returns is even more marginal. Furthermore, the returns to the short portfolios are not significant. However, Test 3 yields higher abnormal returns to all hedge portfolios except the full-fledged model. Still, for most models these returns are not significant, except for RIV GG, which exhibits significant positive abnormal returns to the hedge portfolio when interpolating ROE over 4 years.

When combining bankruptcy risk with four year interpolation (Test 4, Table B3), this result no longer holds as the returns to the RIV GG hedge portfolio becomes non-significant. Another important finding from Test 4 is that the raw returns to the AEG hedge portfolio are no longer negative and that the three-factor adjusted returns are improved considerably; however, the abnormal returns are not significant.

Overall, it can be noted that all long portfolios yield significant abnormal returns, both CAPM adjusted and three-factor adjusted, regardless of valuation model employed, ROE forecast and inclusion of bankruptcy risk. Likewise, all short portfolios yield nonsignificant positive abnormal returns, using both adjustments and regardless of aforementioned factors. In general, hedge portfolios do not generate significant abnormal returns, except RIV GG in Test 3 (only three-factor, not Jensen's alpha). Furthermore, AEG is the model that most consistently yields inferior returns; its hedge portfolio has negative raw and (non-significant) risk-adjusted returns for three out of four of the tests, due to the short portfolio outperforming the long portfolio. On the contrary, RIV GG performs the best; the hedge portfolio and the long portfolio outperform all other models in all tests except Test 4; the short portfolio underperforms (has higher returns) in all tests except Test 3. As RIV GG performs the best, there is no or even negative value added by using the input from the full 12-year period in the full-fledged model. The difference between RIV GG, RIV q and DDM is not so pronounced as the difference between those models and AEG.

To ensure that the results are robust over the whole time period, the time period has been divided into two time periods, 2002-2009 and 2009-2016, which are represented in Tables B4 and B5. In the first half of the sample period, 2002-2009, there are some deviations compared to the whole period. For one thing, the full-fledged model, DDM and AEG no longer have significant Jensen's alphas to the long portfolios with a 95% confidence level. Also, RIV GG no longer performs the best, although it performs quite close to the other models. However, the main difference is how well AEG performs compared to the whole period. In the period 2002-2009, AEG's short portfolio produces Jensen's alpha and three-factor adjusted returns that are close to that of the other valuation models.

In the second half of the sample period, 2009-2016, the results are similar to the whole period. All long portfolios generate significant risk-adjusted returns except AEG and all short portfolios generate nonsignificant risk-adjusted returns except AEG, which generates significant positive risk-adjusted returns. As in the whole period, RIV GG performs the best and AEG the worst.

Tests are also performed where the observations are not overlapping. Since the holding period is 36 months, this is achieved by looking at three time series separately: the first starting in 2002, with portfolio rebalancing every three years, i.e. 2005, 2008 and 2011; the second starting in 2003 with portfolio rebalancing every three years; the third starting in 2004 with portfolio rebalancing every three years. The results, which can be found in Tables B6, B7 and B8, are similar to the basic test: all long portfolios (except AEG in the time series starting 2002 and 2004) still generate significant abnormal returns and the short portfolios still generate non-significant abnormal returns (except AEG in the time series starting 2003 and in 2004 for Jensen's alpha). RIV GG still performs the best, except in the time series starting 2003, and AEG still performs the worst.

6 Discussion

6.1 Evaluation of models

In order for the empirical comparison of valuation models to be valid, the models must yield different estimates of the fundamental value. This is not the case if assumptions are consistent and forecasts are made into infinity, or at least until a steady state. In practice, a truncation point may (arbitrarily or not) be introduced before a "true" steady state is reached. With a practical outlook, which is the concern of this study, the critique by Lundholm and O'Keefe (2001a; 2001b) directed at Penman (2001) is nullified. If there is a discrepancy in the use of the steady state between theory and practice, the empirical comparison of valuation models is nevertheless worthwhile.

Even though the difference between RIV GG and the other valuation models is not as pronounced as between AEG and the other valuation models, RIV GG still emerges victorious. Previous research also finds that RIV is better than DDM (Penman and Sougiannis, 1998) and AEG (Penman, 2005), but in those studies the focus was on predicting current stock prices. Penman and Sougiannis (1998) argue that RIV outperforms DDM because DDM relies on cash flows, which are speculative, whereas RIV "anchors" on book value and adds the present value of future residual earnings. Consequently, in RIV the terminal value does not have as large an impact as in DDM. We agree, and also argue that this explains why RIV GG outperforms DDM. However, we believe that there are other explanations behind the superiority of RIV GG over full-fledged valuations, RIV q and AEG.

Since terminal values are determined before the firms are forecasted to enter a true competitive equilibrium, one would expect a full-fledged valuation to outperform the other valuation models. However, we find that RIV GG performs even better than the full-fledged valuation which uses an additional two years of input. The most likely explanation for this concerns the assumptions of competitive equilibrium. When Gordon growth is applied to the residual income in year 10, the ROE beyond year 10 is implicitly assumed to remain constant. Since the competitive equilibrium is reached in year 12, this means that no company is assumed to completely reach a competitive equilibrium. In other words, profitable companies will be assumed to have positive NPV projects forever, and unprofitable companies will be assumed to have negative NPV projects forever (note that the ROE can still exceed cost of equity for unprofitable firms due to the permanent measurement bias). If the market holds the belief that the competitive equilibrium will not be reached, i.e. that some firms will be able to maintain competitive advantages indefinitely, the value 36 months after the valuation date should be more in line with RIV GG than the full-fledged valuation.

The same reasoning can explain why RIV GG outperforms RIV q. Unlike RIV GG, RIV q assumes a competitive equilibrium, although two years prior to the terminal year in the full-fledged valuation. If the market believes that a competitive equilibrium will not take place, applying Gordon growth is more adequate than determining a terminal value using the permanent measurement bias which assumes a competitive equilibrium.

Even with the inclusion of bankruptcy risk, RIV GG outperforms the other models. As seen in Tables B1 and B3, abnormal returns are marginally improved or unchanged, except for AEG in combination with a lower ROE cap. The size of the improvement (or absence of improvement) is likely to be explained by the low risk of bankruptcy for the sample companies in this period (see Table 3). Therefore, the small improvement does not indicate that estimating bankruptcy risk is not worthwhile; it merely reflects the low bankruptcy risk in the sample. If there is a bankruptcy risk not captured by beta, which is often the case, then discounting the future payoffs using an adjusted cost of equity is more theoretically correct and is likely to lead to a better estimate of fundamental value, as shown by the abnormal returns in this study.

The reason RIV GG is superior to AEG could also be that RIV "anchors" on book value, whereas AEG "anchors" on expected future earnings, which are uncertain. However, a more plausible explanation concerns AEG's dependency on applying Gordon growth and then capitalising the terminal value along with earnings and abnormal earnings growth. The inability of AEG to predict the fundamental value is conspicuous and requires an analysis in itself. Indeed, bar AEG, the valuation models yield very similar returns. One explanation for this lies in how the models are utilised. In order for an empirical comparison of the valuation models to make sense, they have to give different estimates of fundamental value. If one has the same assumptions in all models, all models will yield the same estimate of fundamental value if forecasts are extended into infinity. When the terminal value is determined in year 10, firms are forecasted to be considerably close to a competitive equilibrium since only two years out of twelve remain. Therefore, the different valuation models will yield terminal values that are very close to the terminal values of a full-fledged version of those valuation models. The exception is AEG, which raises the question where the underperformance stems from.

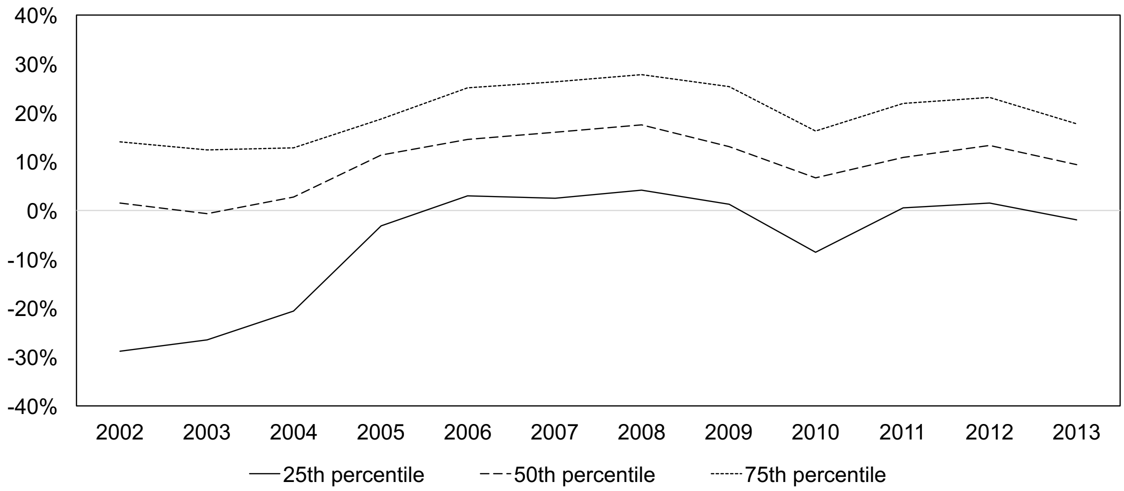
6.2 The AEG paradox

The inferior performance of AEG vis-à-vis the other valuation models is mostly attributed to the short portfolios in the period 2007 and onwards. The discrepancy can most likely be derived to a fundamental difference in the mechanics of AEG compared with other models. With AEG, earnings and future abnormal earnings growth are capitalised. Furthermore, to determine the terminal value, Gordon growth is applied to the abnormal earnings growth in year 9. This use of Gordon growth and capitalisation means that any unsustainable abnormal earnings growth will be exaggerated. The abnormal earnings growth is primarily based on the difference between net income between two years and is therefore affected to a large extent by the mean reversion of ROE. Greater mean reversion of ROE results in more extreme values of abnormal earnings growth, both positive and negative.

Due to mean reversion, companies experiencing high profitability as of the valuation date are forecasted to have negative abnormal earnings growth in year 10, since the ROE is mean reverting to a lower ROE in year 12. When Gordon growth is applied to this negative abnormal earnings growth, which is then capitalised, profitable companies are deemed to have low values and thus appear overvalued. The higher the profitability of the firm, the lower the value and V/P; herein lies the AEG paradox. Thus, AEG incorrectly indicates that some profitable companies should be shorted, when in fact they are not as overvalued as indicated by AEG.

The reason that the short portfolios of AEG perform badly from 2007 and onwards is most likely due to the observed median ROE being greater in the period 2005-2013 (see Figure 3 and Table 3). Note however that the extreme observations that have the largest impact are neither reflected by the median, nor the 25th or 75th percentile. The higher ROE means greater mean reversion, thus more extreme negative abnormal earnings growth and lower values to the companies. Thus, in this period AEG is more inclined to give sell signals to companies with high profitability that should not be shorted.

Figure 3: Return on equity in sample during test period



As seen in Section 5, the introduction of a lower ROE cap and the incorporation of bankruptcy risk in the valuations improve AEG significantly. The lower ROE cap means that the mean reversion each year will be lower, especially for firms with ROE in excess of 50%. Thus, the abnormal earnings growth each year will be less extreme, which reduces the error from applying Gordon growth and capitalising the abnormal earnings growth before a competitive equilibrium.

The incorporation of bankruptcy risk into the cost of equity has two effects that could help explain the improvement in AEG. Firstly, the increased cost of equity from bankruptcy risk (see equation 22) decreases the effect of applying Gordon growth and capitalising, thus reducing the error from determining a terminal value before the competitive equilibrium. Secondly, the increased cost of equity increases the ROE in the competitive equilibrium (see equation 13), whereby the mean reversion in ROE decreases. The decreased mean reversion leads to less extreme abnormal earnings growth. However, AEG is not as improved from only incorporating bankruptcy risk (Test 2, Table B1), indicating that the ROE cap and bankruptcy risk should be used in combination when valuations are performed with AEG.

6.3 The short portfolio enigma

The short portfolios present quite an enigma: if the valuation models are able to correctly predict future positive abnormal returns to the long portfolios, why are they unable to do so for the short portfolios? The short portfolios generate non-significant positive abnormal returns when they should generate negative abnormal returns, assuming that the models can predict future abnormal returns. A possible explanation could be found in the choice of market index. Over the period 2002-2016, the Swedish economy performed well, whereas many other economies were more heavily affected by the financial crisis and the Eurozone crisis. There is a rationale, however, for the choice of MSCI World Index as the market index: it represents the investment opportunities available to an investor not obliged to have all of his or her capital in Swedish assets and it is a better approximation of the capital market spanning all assets over the whole world. However, if the Swedish economy performs better than the market index, then the Swedish companies could have performed better than warranted by their correlation with the market, whereby the short portfolios only generate non-significant abnormal returns and not negative abnormal returns.

Skogsvik and Skogsvik (2010) argue that the absence of abnormal returns to the short portfolio stems from a positive bias in the market towards ROE surprises, where stock prices are more inclined to increase from positive ROE surprises than to decline from negative ones. We offer another, and perhaps more plausible, explanation, concerning the possibility to take short positions. Only a few stocks in the sample are actually shortable during the sample period, constituting an imperfection in the Swedish capital market: mispricing cannot be fully exploited because there are no means of exploiting overpricing for some stocks. In such an imperfect market, the forces that could drive away mispricing are not present to the same extent, whereby mispricing could remain for overvalued stocks.

A final explanation could be that the market is efficient, whereby the short portfolios do not generate significant abnormal returns simply because no stocks ever generate abnormal returns after adjusting for risk. Even though we do not reject the possibility of some risk yet to be identified, this explanation is difficult to reconcile with the fact that all long portfolios generate significant positive abnormal returns.

6.4 On market efficiency

With the exception of AEG, all long portfolios yield greater raw and risk-adjusted returns than the short portfolios. This holds in all tests, regardless of how ROE is forecasted, whether bankruptcy risk is incorporated, using overlapping and non-overlapping data, and different time periods. In other words, a value premium is observed. Since risk-adjusted returns are also greater for long portfolios than for short portfolios, the value premium cannot be explained by risk factors such as correlation with the market index, B/P or size. Furthermore, the betas (Lintner, 1965; Sharpe, 1964) and standard deviations are lower for the long portfolios compared to the short portfolios. This indicates that the undervalued stocks, the long portfolios, are less risky than the overvalued stocks, the short portfolios. Although this finding is contradictory to the efficient market hypothesis, it is nevertheless in line with previous research on value versus growth, which find that normal risk measures and observable risk cannot explain the value premium (Fama and French, 1992; Haugen, 2009; Lakonishok, Shleifer and Vishny, 1994).

The risk-based school of thought would argue that this value premium is caused by greater risk of the long portfolio. Since the three-factor model, the beta and the standard deviation cannot explain the excess returns, the risk would have to be related to a risk factor that has not yet been identified according to this explanation. However, the risk should still be observable in some way, even though the risk factor has not been identified. Otherwise, if the risk never materialises, there cannot be any risk. Similar to Lakonishok, Shleifer and Vishny (1994), it is tested if the long portfolio underperforms the short portfolio more often than not. If the value premium comes from only a few exceptional periods and the long portfolio often underperforms the short portfolio, then the long portfolio could be argued to be more risky. To test for this, the full-fledged valuation is used (because it is more theoretically correct than the other versions) and the raw returns of the long portfolios are compared to the raw returns of the short portfolios. With 36-month holding periods, the long portfolios exhibit raw returns in excess of those of the short portfolios for 11 out of 12 holding periods, or 92% of the times. Clearly, the risk does not materialise during this period of 14 years that includes two periods of bearishness (2007 and 2011 crises).

Furthermore, the abnormal returns are so substantial that they are unlikely to be explained by any unidentified risk factors. The long portfolio of RIV GG generates excess returns of 10.8% annually over 14 years after adjusting for the three-factor model. Since the three risk factors are known to be those that best explain future returns (Fama and French, 1992), it is difficult to imagine that any new risk factors would be identified that explain the 10.8% excess returns per year. Moreover, the inability to identify or observe the risk driving the excess returns poses a problem to the efficient market hypothesis, which states that all assets are correctly valued given their riskiness. If the risk cannot be identified or observed, then how can assets be correctly valued given their true risk?

On the contrary, the mispricing school of thought would argue that the excess returns of undervalued stocks compared to overvalued stocks are caused by mispricing. Since the excess returns cannot be explained by any observable risk factors, the mispricing explanation has a head start compared to the risk-based explanation. But if mispricing is the correct explanation, the puzzling question is what causes the mispricing. One explanation that Haugen (2009) offers is that the value premium tends to emerge after long time periods, e.g. 3 years which is used in this study, and that over short time periods, e.g. 1 year, growth stocks could earn greater returns than value stocks. Fund managers are often evaluated over short time periods, whereby they could be disincentivized to exploit the value premium if it requires that they buy stocks that do no not move in tandem with the market index, thereby favoring myopic behaviour. Haugen (2009) argues that, given the vast amounts of actively managed assets, if fund managers would exploit the value premium, the value premium would disappear. This theory is easily testable in our study by changing the holding period to 12 months and testing whether the value premium remains. As is evident from Table B9, the long portfolios have greater returns than the short portfolios (excluding AEG). Thus, the V/P strategy is able to pick winners and losers even over 12-month holding periods, whereby the preference for short term performance of fund managers is not the most likely cause of mispricing. One noteworthy finding from the 12-month holding periods is that the short portfolios yield lower returns, implying that the price adjustment occurs faster for overvalued stocks, whereby it appears better to take a short position over 12 months as opposed to 36 months.

If short-termism is not causing mispricing, then perhaps mispricing is caused by investors making incorrect forecasts of future profitability and growth, as argued by e.g. Lakonishok, Shleifer and Vishny (1994). However, since analysts' forecasts have been proven to be useful for V/P strategies (Frankel and Lee, 1998), investors should be able to predict future profitability, or use forecasts from analysts able to do so, to identify mispricing. Still, the findings of La Porta *et al.* (1997) that the value premium tends to be concentrated around quarterly earnings announcements indicate that investors might not be able to identify mispricing to the full extent. Since institutional investors tend to be very active during January (Haugen, 2009), the returns during January compared to the other months can say something about investor preference and market efficiency. In an efficient market, the returns during January should not be different from the other months unless January is riskier than the other months of the year or new information is released during January. Table 5 portrays the average returns during January compared to the average monthly returns of the rest of the year for portfolio 1 (long portfolio) to 5 (short portfolio). All models exhibit the same relationship except AEG, most likely due to AEG being unable to correctly value stocks, so the analysis is done on the models excluding AEG. All portfolios have greater average returns in January than during the rest of the year, which could be due to new information. However, the findings are not consistent with what one would expect in an efficient market. Portfolio 5 (short portfolio) generates the lowest returns during the 36-month holding periods and any new information reported during January should reveal this to the market. However, portfolio 5 yields the greatest return of all portfolios in January. During the rest of the year, portfolio 5 yields the lowest average returns. Since portfolio 5 has the lowest returns during the 36-month periods, it should bear the lowest risk according to the efficient market. This is awkward to reconcile with the fact that portfolio 5 has the greatest return of all portfolios in January, and that the average return in January is 11 times as great as in the other months.

The behavioral/mispricing interpretation of the "January effect" observed would be as follows: institutional investors are particularly active during January, which drives up stock prices. The greater returns to portfolio 5 in January compared to the other portfo-

Table 5: **"The January Effect"**

The table shows the average monthly returns to January and the "remainder" of the year (February-December). Returns for the remainder of the year is the average of the geometric average for the 11 months excluding January for the period 2002-2016.

	Full-fledged		**DDM**		**RIV *q***		**RIV GG**		**AEG**	
Portfolio	**January**	**Remainder**	**January**	**Remainder**	**January**	**Remainder**	**January**	**Remainder**	**January**	**Remainder**
Portfolio 1	3,5%	1,1%	3,2%	1,1%	3,4%	1,1%	3,2%	1,2%	3,9%	0,8%
Portfolio 2	1,6%	1,0%	1,5%	1,1%	1,6%	1,0%	1,4%	1,1%	2,3%	0,8%
Portfolio 3	1,3%	1,0%	1,4%	1,0%	1,5%	1,0%	1,4%	1,0%	3,0%	1,0%
Portfolio 4	2,6%	0,8%	2,8%	0,8%	2,6%	0,8%	2,9%	0,7%	2,0%	0,7%
Portfolio 5	4,4%	0,4%	4,6%	0,4%	4,4%	0,4%	4,7%	0,4%	2,3%	1,0%

lios is explained by institutional investors having a preference for the overvalued stocks, even though they yield lower returns during the rest of the year and have greater beta and standard deviation. It is this preference which has caused the stocks to be overvalued in the first place, which explains the lower returns to this portfolio over 36-month holding periods. The fact that portfolio 1 (long portfolio) yields the second highest returns of all portfolios in January can be explained by investors identifying mispricing, which supports the findings of Frankel and Lee (1998) that analysts' forecasts can be used to detect mispricing. However, portfolio 1 has greater returns than the other portfolios during the rest of the year, which indicates that the mispricing is not fully corrected in January, which could explain the subsequent quarterly earnings surprises found by La Porta *et al.* (1997).

Our observations on the "January effect" reconcile the seemingly contradictory findings of Frankel and Lee (1998) and La Porta *et al.* (1997), by indicating that investors are able to identify mispricing to some extent, but not fully since they are nevertheless taken aback by earnings announcements. Another possibility is that investors can forecast correctly and identify mispricing to the full extent, but choose not to exploit the mispricing, due to e.g. agency problems or irrational behavior (naively thinking that "good" companies always are good investments and/or buying stocks that are currently in favour). Barniv et al. (2010) find that analysts' forecasts can be used to determine fundamental values that are positively correlated with future returns, but that the same analysts give recommendations that are negatively correlated with future returns. Haugen (2009) argues that there is an agency problem in asset management and that institutional investors choose not to exploit mispricing since that would make their deviations (both positive and negative) from the index they are evaluated against greater, whereby they would be at the risk of severe penalties. However, determining whether analysts and investors act like they do because they consider the undervalued stocks to be riskier, and vice versa, or because they are acting in their own self-interest, are irrational, or simply are unskilled is not easily testable and would merit a study in its own right.

Since standard risk measures cannot explain the value premium observed in this study, and since the returns during January evidence behavior inconsistent with an efficient market, mispricing is the most likely cause of the value premium observed. It is possible that this is regional, i.e. that Sweden could be a less efficient market than the U.S. where most of the research concerning the value premium has been conducted. An alternative view would be that the V/P ratio is a risk factor and that RIV GG is not superior at predicting future abnormal returns, but rather at identifying this risk factor.

It should be noted that existence of mispricing in the market would not disqualify the use of fundamental valuation; investors can still be rational and consider earnings and other value drivers when making their investments. As La Porta *et al.* (1997) demonstrate, earnings announcements have a great impact on stock returns and explain a big portion of the value premium. The existence of mispricing would only mean that investors are not able to fully price in the available information into stock prices all the time, not that they do not care about the information. In fact, the existence of mispricing would only increase the need for fundamental valuation, since one cannot rely on the price being the true value and therefore has to value assets before buying them.

6.5 Implementability and persistence

In the light of previous research, the results from this study are remarkable, both with regard to the performance of the valuation models and the magnitude of abnormal returns. The pervasive question is whether this investment strategy really is implementable in practice. As has been mentioned above, only companies with fiscal year end in December are included and valuations and portfolio formations are done in May so that there should be no foreknowledge. Furthermore, the greatest and most significant abnormal returns come from the long portfolios. Had the abnormal returns been derived from the short portfolios, practical limitations would arise as very few stocks in the sample are shortable in practice. However, since the short portfolios do not have significant abnormal returns, it would not be desirable to take short positions. Moreover, the portfolios are held for 36 months, whereby the absence of transaction costs should not be able to explain the excess returns of 10.8% per year (for RIV GG). These factors prove the investment strategy to be implementable in practice.

Another warranted question is whether the results observed in this study will remain in the future or not. Since the abnormal returns to the long portfolios are significant, one can expect them to prevail as long as the future is similar to the period studied. However, it is important to consider why the observed results are the way they are. The inferior performance of AEG is driven by its dependency on applying Gordon growth and capitalising, which causes unsustainable earnings to be exaggerated and affect the value, so AEG is likely to be inferior going forward as well. The superiority of RIV over DDM is likely caused by RIV "anchoring" on book value, whereby RIV should outperform DDM going forward as well. And, if companies are not expected to reach a competitive equilibrium, one could expect the outperformance of RIV GG vis-à-vis RIV q and full-fledged valuations to prevail.

Even though the evidence in this study leans towards mispricing, the origins of the value premium remain shrouded in mystery, which is why it is difficult to predict if the value premium will endure. If the value premium is caused by risk, and undervalued stocks are riskier than overvalued stocks, then the value premium will continue to exist. However, if mispricing is causing the value premium, then it will depend on what is causing the mispricing. If mispricing is caused by unskilled investors being unable to correctly value stocks, then this study could bring an end to mispricing and the value premium by showing that one should use RIV GG and forecast input with mean reversion. If, on the other hand, mispricing is not caused by the inability to correctly value stocks but by an agency problem or irrational behavior, then the value premium will likely persist.

7 Conclusion

Owing to the ongoing debate regarding market efficiency, a novel approach for comparing fundamental valuation models is needed that is not dependent on the efficient market hypothesis. This thesis provides a novel approach by comparing different fundamental valuation models' – AEG, DDM and RIV – abilities to predict future abnormal returns. The focus on future abnormal returns circumvents the dependency on an efficient market, since future returns can be driven both by risk and mispricing. Therefore, this study is not dependent upon an assumption of mispricing either, since an alternative view would be that the models' abilities to identify risk, and not mispricing, is tested.

Of the valuation models tested, the abnormal earnings growth (AEG) model performs the worst, with the portfolio predicted to earn the lowest future returns earning the highest. This is explained by AEG's dependency on changes in earnings, which could be transitory, and applications of Gordon growth and capitalisation. In combination, these causes AEG to give irrational and inaccurate estimates of fundamental values for stocks expected to experience a high rate of mean reversion in profitability (as measured by return on equity). Incoherent with valuation logic, high profitability results in low fundamental values, giving rise to the "AEG paradox". The other models produce homogeneous results, indicating that the choice between the dividend discount model (DDM) and the residual income valuation (RIV) model is not as critical as the choice between AEG and the other models.

RIV with a terminal value derived from an application of Gordon growth (RIV GG) performs the best, even better than a full-fledged valuation that utilises a longer explicit forecast horizon. Like Penman and Sougiannis (1998), we argue that RIV's superiority over DDM originates from RIV "anchoring" on book value. However, RIV GG's superiority over a full-fledged valuation is attributable to its assumption that a true competitive equilibrium is never reached (since Gordon growth is applied before competitive equilibrium). This finding raises some questions regarding competitive equilibriums: do companies never truly enter a competitive equilibrium, or are they simply never anticipated by the market to enter a competitive equilibrium?

The incorporation of bankruptcy risk into the cost of equity only yields small improvements, except in combination with lower ROE cap for AEG (where it yields significant improvements) due to slower mean reversion and less impact from capitalisation, but this is to be expected given the low risk of bankruptcy in the sample. In case one is valuing a company or a set of companies where the risk of bankruptcy is expected to be negligible, then the results indicate that risk of bankruptcy can be neglected. However, if one is valuing companies with non-negligible risk of bankruptcy, then the risk should be incorporated into the discount rate.

Similar to Frankel and Lee (1998), a value premium to the V/P strategy is found, i.e. the long portfolios earn greater returns than the short portfolios. This value premium remains even after adjusting for CAPM and the three-factor model, whereby the market risk, B/P and size effect cannot explain the higher returns. Furthermore, beta, standard deviation and the probability of underperformance (as measured by the number of times the portfolio earns lower returns) are lower for the long portfolios compared to the short portfolios. In addition, the short portfolios earn greater returns during January than the other portfolios, returns that are higher than during the other months of the year, despite having the lowest return of all portfolios over 36 month holding periods. Such findings are inconsistent with an efficient market. Even though the evidence lends support to the mispricing explanation, the risk-based explanation cannot be completely rejected. Either the valuation models are able to identify unobservable risk, with V/P being a risk factor for unobservable risk, or the valuation models are good at determining the fundamental value, whereby the abnormal returns are caused by mispricing. Nevertheless, we argue that the results support the mispricing explanation. Regardless of the reason behind the abnormal returns, one can conclude that the valuation models, except AEG, are effective in the prediction of future returns.

As any valuation is dependent upon the value drivers, the optimal way of forecasting profitability and growth for individual companies would be beneficial for valuation theory. Therefore, future research could examine if there are any ways to improve the forecast. In addition, since the forecast is based on the assumption of a competitive equilibrium occurring after 12 years, future research could examine if that is a realistic assumption. Also, it could be beneficial to test if the results hold in other geographical areas than Sweden. Since the explanation for the value premium remains unresolved, it would also be worthwhile for future research to test if the predictions of the mispricing explanation holds, i.e. if institutional investors are incentivised to act in a way that is not in line with the principal's interests or if institutional investors make their investments based on irrational behaviour such as equating a good company with a good investment without considering the fundamental value. However, an even more desirable finding would be the finding of the unobservable risk, if any, which is claimed to cause the value premium according to the risk-based explanation.

References

Addae-Dapaah, K., Webb, J.R., Kim Hin Ho, D. and Hiang Liow, K. (2013). Value versus Growth International Real Estate Investment. *Real Estate Economics*, 41(1), pp. 65-101

Ali, A., Hwang, L.S. and Trombly, M.A. (2003). Residual-Income-Based Valuation Predicts Future Stock Returns: Evidence on Mispricing vs. Risk Explanations. *The Accounting Review*, 78(2), pp. 337-396

Asness, C.S., Moskowitz, T.J. and Pedersen, L.H. (2013). Value and Momentum Everywhere. *The Journal of Finance*, 68(3), pp. 929-985

Ball, R. and Kothari, S.P. (1989). Nonstationary Expected Returns: Implications for Tests of Market Efficiency and Serial Correlation in Returns. *Journal of Financial Economics*, 25(1), pp. 51-74

Barniv, R., Hope, O.K., Myring, M. and Thomas, W.B. (2010). International Evidence on Analyst Stock Recommendations, Valuations, and Returns. *Contemporary Accounting Research*, 27(4), pp. 1131-1167

Basu, S. (1977). Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis. *The Journal of Finance*, 32(3), pp. 663-682

Bergquist, J. and Kjerstadius, N. (2014). *Variations in the Permanent Measurement Bias.* MSc Thesis, Stockholm School of Economics, Stockholm, Sweden

Bernard, V.L. (1995). The Feltham-Ohlson Framework: Implications for Empiricists. *Contemporary Accounting Research*, 11(2), pp. 733-747

Brief, R.P. (2007). Accounting Valuation Models: A Short Primer. *ABACUS*, 43(4), pp. 429-437

Brooks, L.D. and Buckmaster, D.A. (1976). Further Evidence of the Time Series Properties of Accounting Income. *The Journal of Finance*, 31(5), pp. 1359-1373

Capaul, C., Rowley, I. and Sharpe, W.F. (1993). International Value and Growth Stock Returns. *Financial Analysts Journal*, 49(1), pp. 27-36

Chan, K.C. (1988). On the Contrarian Investment Strategy. *Journal of Business*, 61(2), pp. 147-163

Chan, L.K.C., Karceski, J. and Lakonishok, J. (2003). The Level and Persistence of Growth Rates. *The Journal of Finance*, 58(2), pp. 643-684

Damodaran, A. (1999). *Estimating Risk Parameters.* Working paper, New York University Stern School of Business, available at http://hdl.handle.net/2451/26906, downloaded 2017-04-07

De Bondt, W.F.M. and Thaler, R. (1985). Does the Stock Market Overreact? *The Journal of Finance*, 40(3), pp. 793-805

Dechow, P.M., Hutton, A.P. and Sloan, R.G. (1999). An Empirical Assessment of the Residual Income Valuation Model. *Journal of Accounting and Economics*, 26(1-3) pp. 1-34

Easton, P.D. and Monahan, S.J. (2005). An Evaluation of Accounting-Based Measures of Expected Returns. *The Accounting Review*, 80(2), pp. 501-538

Edwards. E.O. and Bell, P.W. (1961). *The Theory and Measurement of Business Income.* University of California Press, Oakland, United States

Fairfield, P.M., Sweeney, R.J. and Yohn, T.L. (1996). Accounting Classification and the Predictive Content of Earnings. *The Accounting Review*, 71(3), pp. 337-355

Fama, E.F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), pp. 383-417

Fama, E.F. and French, K.R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, 47(2), pp. 427-465

Fama, E.F. and French, K.R. (1993). Common Risk Factors in the Returns on Stocks and Bonds. *Journal of Financial Economics*, 33(1), pp. 3-56

Fama, E.F. and French, K.R. (1995). Size and Book-to-Market Factors in Earnings and Returns. *The Journal of Finance*, 50(1), pp. 131-155

Fama, E.F. and French, K.R. (1996). Multifactor Explanations of Asset Pricing Anomalies. *The Journal of Finance*, 51(1), pp. 55-84

Fama, E.F. and French, K.R. (1998). Value versus Growth: The International Evidence. *The Journal of Finance*, 53(6), pp. 1975-1999

Fama, E.F. and French, K.R. (2000). Forecasting Profitability and Earnings. *Journal of Business*, 73(2) pp. 161-176

Fama, E.F. and French, K.R. (2012). Size, Value and Momentum in International Stock Returns. *Journal of Financial Economics, 105(3)*, pp. 457-472

Fama, E.F. and French, K.R. (2015). A Five-Factor Asset Pricing Model. *Journal of Financial Economics*, 116(1), pp. 1-22

Feltham, G.A. and Ohlson, J.A. (1995). Valuation and Clean Surplus Accounting for Operating and Financial Activities. *Contemporary Accounting Research*, 11(2), pp. 689-731

Francis, J., Olsson P. and Oswald, D.R. (2000). Comparing the Accuracy and Explainability of Dividend, Free Cash Flow, and Abnormal Earnings Equity Value Estimates. *Journal of Accounting Research*, 38(1), pp. 45-70

Frankel, R. and Lee, C.M.C. (1998). Accounting Valuation, Market Expectation, and Cross-Sectional Stock Returns. *Journal of Accounting and Economics*, 25(3), pp. 283-319

Freeman, R.N., Ohlson, J.A. and Penman, S.H. (1982). Book Rate-of-Return and Prediction of Earnings Changes: An Empirical Investigation. *Journal of Accounting Research*, 20(2) part 2, pp. 639-653

Gode, D. and Mohanram, P. (2003). Inferring the Cost of Capital Using the Ohlson-Juettner Model. *Review of Accounting Studies*, 8(4), pp. 399-431

Gordon, M.J. (1959). Dividends, Earnings and Stock Prices. *The Review of Economics and Statistics*. 41(2) part 1, pp. 99-105

Gordon, M.J. and Shapiro, E. (1956). Capital Equipment Analysis: The Required Rate of Profit. *Management Science*, 3(1), pp. 102-110

Haugen, R.A. (2009). *The New Finance: Overreaction, Complexity, and Their Consequences*. 4^{th} ed. Prentice Hall, Upper Saddle River, New Jersey

Jegadeesh, N. and Titman, S. (1993). Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. *The Journal of Finance*, 48(1), pp. 65-91

Jennergren, P.L. and Skogsvik, K. (2007). *The Abnormal Earnings Growth Model: Applicability and Applications*. Working paper (September), Stockholm School of Economics, available at https://scholar.google.se/scholar?hl=en&q=jennergren+skogsvik 2007&btnG=&as_sdt=1%2C5&as_sdtp=&oq=jenn, downloaded 2017-01-24

Jensen, M.C. (1968). Problems in Selection of Security Portfolios: The Performance of Mutual Funds in the Period 1945-1964. *The Journal of Finance*, 23(2), pp. 389-416

Johnson, W.B. and Xie, S. (2004). *The Convergence of Stock Price to Fundamental Value*. Working paper (September), University of Iowa, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=590542, downloaded 2017-01-30

Lakonishok, J., Shleifer, A. and Vishny, R.W. (1994). Contrarian Investment, Extrapolation, and Risk. *The Journal of Finance*, 49(5), pp. 1541-1578

La Porta, R., Lakonishok, J., Shleifer, A. and Vishny, R.W. (1997). Good News for Value Stocks: Further Evidence on Market Efficiency. *The Journal of Finance*, 52(2), pp. 859-874

Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The Review of Economics and Statistics*, 47(1), pp. 13-37

Little, I.M.D. (1962). Higgledy Piggledy Growth. *Bulletin of the Oxford University Institute of Economics & Statistics*, 24(4), pp. 387-412

Lundholm, R. and O'Keefe, T. (2001a). Reconciling Value Estimates from the Discounted Cash Flow Model and the Residual Income Model. *Contemporary Accounting Research*, 18(2), pp. 311-335

Lundholm, R. and O'Keefe, T. (2001b). On Comparing Residual Income and Discounted Cash Flow Models of Equity Valuation: A Response to Penman 2001. *Contemporary Accounting Research*, 18(4), pp. 693-696

MacKinlay, A.C. (1995). Multifactor Models Do Not Explain Deviations from the CAPM. *Journal of Financial Economics*, 38(1), pp. 3-28

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, 7(1), pp. 77-91

Miller, M.H. and Modigliani, F. (1961). Dividend Policy, Growth, and the Valuation of Shares. *The Journal of Business*, 34(4), pp. 411-433

Ohlson, J.A. (1995). Earnings, Book Values and Dividends in Equity Valuation. *Contemporary Accounting Research*, 11(2), pp. 661-687

Ohlson, J.A. (2000). *Residual Income Valuation: The Problems*, Working paper (March), Stern School of Business, New York City, NY

Ohlson, J.A. (2005). On Accounting-Based Valuation Formulae. *Review of Accounting Studies*, 10(2-3), pp. 323-347

Ohlson, J.A. and Juettner-Nauroth, B.E. (2005). Expected EPS and EPS Growth as Determinants of Value. *Review of Accounting Studies*, 10(2-3), pp. 349-365

Peasnell, K.V. (1982). Some Formal Connections Between Economic Values and Yields and Accounting Numbers. *Journal of Business Finance & Accounting*, 9(3), pp. 361-381

Penman, S.H. (1991). An Evaluation of Accounting Rate-of-Return. *Journal of Accounting, Auditing & Finance*, 6(2), pp. 233-255

Penman, S.H. (1992). Return to Fundamentals. *Journal of Accounting, Auditing & Finance*, 7(4), pp. 465-482

Penman, S.H. (2001). On Comparing Cash Flow and Accrual Accounting Models for Use in Equity Valuation: A Response to Lundholm and O'Keefe. *Contemporary Accounting Research*, 18(4), pp. 681-692

Penman, S.H. (2005). Discussion of "On Accounting-Based Valuation formalue" and "Expected EPS and EPS Growth as Determinants of Value". *Review of Accounting Studies*, 10(2-3), pp. 367-378

Penman, S.H. and Sougiannis, T. (1998). A Comparison of Dividend, Cash Flow, and Earnings Approaches to Equity Valuation. *Contemporary Accounting Research*, 15(3), pp. 343-383

Porter, M. (1980). Industry Structure and Competitive Strategy: Keys to Profitability. *Financial Analysts Journal*, 36(4), pp. 30-41

Preinreich, G.A.D. (1938). Annual Survey of Economic Theory: The Theory of Depreciation. *Econometrica*, 6(3), pp. 219-241

Runsten, M. (1998). *The Association Between Accounting Information and Stock Prices.* PhD diss., Stockholm School of Economics, Stockholm, Sweden

Sharpe, W.F. (1964). Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. *The Journal of Finance*, 19(3), pp. 425-442

Skogsvik, K. (1987). *Prognos av finansiell kris med redovisningsmått.* PhD Diss., Stockholm School of Economics, Stockholm, Sweden

Skogsvik, K. (2002). *A Tutorial on Residual Income Valuation and Value Added Valuation.* Working paper (June), Stockholm School of Economics, Stockholm, Sweden

Skogsvik, K. (2006). *Probabilistic Business Failure Prediction in Discounted Cash Flow Bond and Equity Valuation.* Working paper (May), Stockholm School of Economics, Stockholm, Sweden

Skogsvik, S. (2008). Financial Statement Information, the Prediction of Book Return on Owners' Equity and Market Efficiency: The Swedish Case. *Journal of Business Finance & Accounting*, 35(7 & 8), pp. 795-817

Skogsvik, S. and Skogsvik, K. (2010). Accounting-Based Probabilistic Prediction of ROE, the Residual Income Valuation Model and the Assessment of Mispricing in the Swedish Stock Market. *ABACUS*, 46(4), pp. 387-418

Skogsvik, S. and Skogsvik, K. (2013). On the Choice Based Sample Bias in Probabilistic Bankruptcy Prediction. *Investment Management and Financial Innovations*, 10(1), pp. 29-37

Williams, J.B. (1938). *The Theory of Investment Value.* Harvard University Press, Cambridge, MA

A Companies included in sample

Table A1: Companies included in sample

Company	Years	PMB
AarhusKarlshamn	2009-2013	0,72
Academedia	2004-2013	0,62
Acando	2002-2013	0,59
ACAP Invest	2005-2013	0,47
A-Com	2008-2011	0,59
ACSC	2002-2007	0,47
Active Biotech	2002-2013	1,74
Addnode	2002-2013	0,59
Aerocrine	2010-2013	1,74
Alfa Laval	2005-2013	0,33
Allenex	2009-2013	1,74
Allgon	2002	0,70
AllTele	2012-2013	0,76
Anoto	2003-2013	0,70
Arise	2012-2013	0,76
Artimplant	2002-2013	1,74
Aspiro	2004-2013	0,70
ASSA ABLOY	2002-2013	0,33
Atlas Copco	2002-2013	0,33
AudioDev	2003-2009	0,70
Availo	2003-2013	0,70
Avega	2013	0,59
Axfood	2002-2013	0,47
Axis	2003-2013	0,70
Ballingslöv	2005-2008	0,72
BE Group	2009-2013	0,47
Beijer Alma	2002-2013	0,33
Beijer Electronics	2003-2013	0,70
Beijer Ref	2002-2013	0,47
Betsson	2003-2013	0,70
Biacore	2002-2006	1,74
Bilia	2002-2013	0,47
Billerud Korsnäs	2004-2013	0,31
BioGaia	2002-2013	1,74
BioInvent	2004-2013	1,74
Biolin Scientific	2002-2010	1,74
Biophausia	2002-2011	1,74
Biora	2002-2003	1,74
Biotage	2003-2013	1,74
Björn Borg	2010-2013	0,72
Boliden	2002-2013	0,31
Bong	2002-2013	0,31
Borås Wäfveri	2002-2010	0,31
Boss Media	2002-2007	0,70
Bredband2	2002	0,76
BRIO	2002-2009	0,72
Broström	2002-2008	0,65
BTS Group	2004-2013	0,59
Byggmax	2013	0,47
Capio	2003-2006	0,62
Cardo	2002-2010	0,33
CashGuard	2003-2008	0,76
CellaVision	2013	1,74
Cision	2002-2013	0,59
Cloetta	2013	0,72
Concordia Maritime	2002-2013	0,65
Connecta	2008-2013	0,59
Consilium	2005-2013	0,70
CTT Systems	2008-2013	0,33
Cybercom Group	2002-2013	0,59
DGC One	2011-2013	0,76
Dimension	2003	0,59
Doro	2002-2013	0,70
Duni	2010-2013	0,72
Duroc	2002-2013	0,33
Elanders	2002-2013	0,59
Electra Gruppen	2012-2013	0,47
Electrolux	2002-2013	0,72
ElektronikGruppen	2002-2011	0,70
Elos Medtech	2002-2013	1,74
Empire	2003	0,47
Enea	2002-2013	0,59
Eniro	2003-2013	0,70
Entraction	2003, 2006-2007	0,70
Ericsson	2002-2013	0,70
Esselte	2002	0,47
eWork Group	2012-2013	0,59
Fagerhult	2002-2013	0,31
Fazer Konfektyr	2002-2008	0,72
Feelgood Svenska	2003-2013	0,62
Fenix Outdoor	2002-2013	0,72
Fingerprint Cards	2002-2013	0,70
Finnveden	2002-2004	0,33
FlyMe Europ	2002	0,76
Formpipe Software	2012-2013	0,70
Frango	2002-2004	0,70
Gambro	2002-2006	1,74
Getine	2002-2013	1,74
Geveko	2002-2013	0,31
GHP Specialty Care	2011-2013	0,62
Glocalnet	2003-2005	0,76
Gorthon Lines	2002-2004	0,65
Gotland Rederi	2002	0,65
Graninge	2002-2003	0,76
Gunnebo	2002-2013	0,33
Gunnebo Industrier	2008	0,33
Haldex	2002-2013	0,33
Hemtex	2010-2013	0,72
Hexagon	2002-2013	0,70
Hexpol	2011-2013	0,44
Hifab Group	2003-2008	0,59
HiQ International	2002-2013	0,59
HL Display	2002-2010	0,31
HMS Networks	2010-2013	0,70
Höganäs	2002-2013	0,31
Holmen	2002-2013	0,27*
Human Care	2006-2008	0,31
Husqvarna	2009-2013	0,72
IAR Systems	2002-2013	0,70
IBS	2002-2009	0,59
ICA Gruppen	2008-2013	0,47
Image Systems	2002-2008, 2011-2013	0,70
IMS	2002	0,70
IFS	2002-2013	0,70
Indutrade	2008-2013	0,47
Intellecta	2007-2013	0,59
Intentia	2002-2006	0,70
ITAB	2011-2013	0,76
JC	2002-2006	0,47
Jeeves	2002-2012	0,70
JLT	2002	0,70
JM	2002-2013	0,38
Kabe	2002-2013	0,72
Karlshamns	2002-2005	0,72
Karo Pharma	2002-2013	1,74
KMY	2002-2007	0,33
Karolinska Dev.	2013	1,74
Klippan	2002-2005	0,31
Knowit	2002-2013	0,59
Labs2 Group	2002-2003	0,70

Company	Years	PMB
Lammhults Design Group	2002-2013	0,76
LB Icon	2002-2006	0,59
LBI International	2002-2010	0,59
LGP Allgon	2002-2004	0,70
Lindab	2009-2013	0,31
Loomis	2011-2013	0,76
Lundin Petroleum	2007-2013	0,31
Malmbergs Elektriska	2002-2013	0,47
Mandator	2002-2007	0,59
Meda	2002-2013	1,74
Medivir	2002-2013	1,74
Mekonomen	2003-2013	0,47
Midsona	2002-2013	0,72
Mind	2002	0,59
MTG	2002-2013	0,62
Model 1 Data	2002-2010	0,59
Mogul	2003	0,59
MSC Group	2002-2013	0,59
MultiQ International	2002-2013	0,70
Munters	2002-2010	0,31
Mycronic	2002-2013	0,31
Nan Resources	2002-2004	0,31
Närkes Elektriska	2002-2006	0,76
NCC	2002-2013	0,38
Nederman	2010-2013	0,31
Nefab	2002-2007	0,31
Neonet	2003-2010	0,59
Net Insight	2002-2013	0,70
NetEnt	2011-2013	0,70
New Wave Group	2002-2013	0,47
NIBE Industrier	2002-2013	0,31
Nilörngruppen	2002-2009	0,31
Niscayah Group	2009-2011	0,62
Nobia	2005-2013	0,72
Nocom	2003-2004	0,70
Nolato	2002-2013	0,33
Nordic Mines	2011-2013	0,31
NSP	2010-2013	0,76
NOTE	2007-2013	0,70
NovaCast Systems	2009-2010	0,70
Novotek	2002-2013	0,59
Odd Molly	2013	0,72
OEM International	2002-2013	0,47
Optimail	2002-2005	0,62
ORC Group	2003-2011	0,70
Orexo	2008-2013	1,74
Ortivus	2002-2013	0,70
PA Resources	2009-2013	0,31
PartnerTech	2002-2013	0,31
Peab	2002-2013	0,38
Perbio Science	2002-2003	1,74
Pergo	2004-2006	0,31
Poolia	2002-2013	0,59
Precise Biometrics	2003-2013	0,70
Prevas	2002-2013	0,59
Pricer	2002-2013	0,70
Proact IT Group	2002-2013	0,59
Probi	2007-2013	1,74
Proffice	2002-2013	0,59
ProfilGruppen	2002-2013	0,31
Pronyx	2002	0,59
Protect Data	2002-2006	0,59
Qliro	2013	0,47
Q-Med	2002-2010	1,74
RaySearch Laboratories	2004-2013	1,74

Company	Years	PMB
ReadSoft	2002-2013	0,70
Rejlers	2009-2013	0,59
Resco	2002-2005	0,59
Rezidor	2009-2013	0,76
Riddarhyttan Resources	2002-2005	0,31
RKS	2002-2003	0,59
Rörvik Timber	2002-2013	0,31
Rottneros	2002-2013	0,31
SAAB	2002-2013	0,33
Sandvik	2002-2013	0,33
Sapa	2002-2005	0,33
Sardus	2002-2006	0,47
SAS	2004-2012	0,76
SCA	2002-2012	0,72
Scan Mining	2002-2007	0,31
Scandiaconsult	2002-2003	0,59
Scania	2002-2013	0,33
Seco Tools	2002-2011	0,33
Securitas	2002-2013	0,62
Semcon	2002-2013	0,59
Senea	2002-2006	0,70
Sensys Gatso	2003-2013	0,70
Sigma	2004-2013	0,59
SinterCast	2002-2013	0,33
Skanska	2002-2013	0,38
SKF	2002-2013	0,33
Softronic	2002-2013	0,59
Song Networks	2002-2004	0,76
SSAB	2002-2013	0,33
Strålfors	2002-2006	0,59
Studsvik	2004-2013	0,76
Sweco	2002-2013	0,76
Svedbergs i Daltorp	2002-2013	0,31
Swedish Match	2002-2009	0,72
Swedish Orphan Biovitrum	2009-2013	1,74
Swedol	2011-2013	0,47
Svenska Orient Linien	2002-2003	0,65
Technology Nexus	2002-2009	0,70
Tele2	2002-2013	0,76
Teleca	2002-2008	0,59
Telelogic	2002-2007	0,70
Telia	2003-2013	0,76
Teligent	2002-2008	0,70
Ticket Travel Group	2002-2009	0,62
Tilgin	2009-2010	0,70
Tivox	2002-2003	0,33
TradeDoubler	2008-2013	0,59
Trelleborg	2002-2013	0,33
Trention	2002-2013	0,33
Tricorona	2002-2010	0,31
Trio	2002-2006	0,70
TurnIT	2002-2005	0,59
TV4	2002-2005	0,62
Uniflex	2009-2013	0,59
VBG Group	2002-2013	0,33
Venue Retail Group	2002	0,47
Viking Supply Ships	2002-2013	0,65
Vitrolife	2002-2013	1,74
VLT	2002-2006	0,62
WM-data	2002-2006	0,59
Volvo	2002-2013	0,33
XANO Industri	2002-2013	0,33
XPonCard Group	2002-2008	0,70
Zodiak Television	2002-2008	0,62
ÅF	2002-2013	0,59

*Prior to 2005, Runsten's (1998) PMB of 0.67 is used for Holmen.

B Results from adjusted model tests

Table B1: Test 2 – Bankruptcy risk

Hedge portfolios	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,3%	0,4%	0,4%	-0,2%
Raw return (yearly)	4,6%	3,8%	4,7%	4,9%	-1,9%
Jensen's alpha (monthly)	0,6%	0,5%	0,6%	0,6%	-0,1%
Jensen's alpha (yearly)	7,2%	6,4%	7,2%	7,4%	-0,8%
Beta	-0,13	-0,13	-0,13	-0,13	-0,05
p-value – Jensen's alpha	0,1524	0,2003	0,1492	0,1367	0,8261
p-value – Beta	0,1032	0,1077	0,1135	0,1207	0,4132
Fama and French alpha (monthly)	0,7%	0,6%	0,7%	0,7%	0,0%
Fama and French alpha (yearly)	8,3%	7,6%	8,3%	8,6%	-0,4%
Fama and French MP beta	-0,22	-0,23	-0,21	-0,22	-0,09
Fama and French size beta	-0,40	-0,46	-0,40	-0,46	-0,12
Fama and French B/P beta	0,30	0,29	0,31	0,24	0,32
p-value – Fama and French alpha	0,0828	0,1024	0,0799	0,0657	0,9019
p-value – Fama and French MP beta	0,0067	0,0042	0,0074	0,0058	0,1410
p-value – Fama and French size beta	0,0001	0,0000	0,0001	0,0000	0,0888
p-value – Fama and French B/P beta	0,0056	0,0056	0,0041	0,0193	0,0001
Standard deviation (monthly)	0,0524	0,0522	0,0522	0,0518	0,0377

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	1,3%	1,3%	1,3%	1,4%	1,1%
Raw return (yearly)	16,7%	16,4%	16,7%	17,5%	13,4%
Jensen's alpha (monthly)	0,9%	0,9%	0,9%	1,0%	0,7%
Jensen's alpha (yearly)	11,3%	10,9%	11,3%	12,1%	8,2%
Beta	0,75	0,76	0,75	0,74	0,78
p-value – Jensen's alpha	0,0023	0,0022	0,0020	0,0009	0,0309
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,8%	0,8%	0,8%	0,9%	0,6%
Fama and French alpha (yearly)	10,2%	9,9%	10,2%	11,0%	6,9%
Fama and French MP beta	0,83	0,83	0,83	0,81	0,86
Fama and French size beta	0,44	0,39	0,43	0,40	0,52
Fama and French B/P beta	-0,08	-0,08	-0,07	-0,10	0,01
p-value – Fama and French alpha	0,0020	0,0022	0,0017	0,0008	0,0333
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,2853	0,2499	0,3052	0,1443	0,9337
Standard deviation (monthly)	0,0524	0,0517	0,0520	0,0515	0,0544

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	0,6%	0,6%	0,6%	0,6%	1,1%
Raw return (yearly)	7,5%	7,9%	7,5%	8,0%	13,7%
Jensen's alpha (monthly)	0,3%	0,3%	0,3%	0,4%	0,7%
Jensen's alpha (yearly)	3,8%	4,3%	3,8%	4,4%	9,0%
Beta	0,89	0,89	0,88	0,87	0,82
p-value – Jensen's alpha	0,5453	0,5055	0,5459	0,4918	0,0827
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,1%	0,2%	0,1%	0,2%	0,6%
Fama and French alpha (yearly)	1,8%	2,2%	1,8%	2,3%	7,3%
Fama and French MP beta	1,05	1,05	1,04	1,03	0,95
Fama and French size beta	0,84	0,85	0,83	0,85	0,65
Fama and French B/P beta	-0,37	-0,37	-0,38	-0,35	-0,31
p-value – Fama and French alpha	0,7418	0,6908	0,7416	0,6738	0,0996
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0029	0,0031	0,0025	0,0050	0,0019
Standard deviation (monthly)	0,0796	0,0800	0,0792	0,0790	0,0668

Table B2: Test 3 – No bankruptcy risk, 4-year interpolation

Hedge portfolios	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,3%	0,4%	0,4%	-0,1%
Raw return (yearly)	4,3%	3,9%	4,5%	5,3%	-1,1%
Jensen's alpha (monthly)	0,5%	0,5%	0,5%	0,6%	0,0%
Jensen's alpha (yearly)	6,6%	6,2%	6,7%	7,3%	0,0%
Beta	-0,11	-0,11	-0,10	-0,10	-0,06
p-value – Jensen's alpha	0,1655	0,1881	0,1498	0,1020	0,9911
p-value – Beta	0,1472	0,1551	0,1719	0,1778	0,3030
Fama and French alpha (monthly)	0,6%	0,6%	0,6%	0,7%	0,0%
Fama and French alpha (yearly)	7,7%	7,3%	7,7%	8,4%	0,3%
Fama and French MP beta	-0,20	-0,20	-0,19	-0,18	-0,10
Fama and French size beta	-0,40	-0,43	-0,39	-0,41	-0,12
Fama and French B/P beta	0,32	0,31	0,33	0,27	0,34
p-value – Fama and French alpha	0,0853	0,0910	0,0738	0,0438	0,9166
p-value – Fama and French MP beta	0,0089	0,0066	0,0105	0,0096	0,0797
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0746
p-value – Fama and French B/P beta	0,0016	0,0014	0,0007	0,0034	0,0000
Standard deviation (monthly)	0,0496	0,0488	0,0483	0,0464	0,0357

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,3%	1,3%	1,3%	1,3%	1,1%
Raw return (yearly)	16,9%	16,4%	16,8%	17,4%	13,8%
Jensen's alpha (monthly)	0,9%	0,9%	0,9%	0,9%	0,7%
Jensen's alpha (yearly)	11,4%	11,0%	11,4%	12,0%	8,5%
Beta	0,76	0,77	0,77	0,76	0,79
p-value – Jensen's alpha	0,0020	0,0028	0,0020	0,0013	0,0260
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,8%	0,8%	0,8%	0,9%	0,6%
Fama and French alpha (yearly)	10,3%	9,9%	10,3%	10,9%	7,3%
Fama and French MP beta	0,84	0,84	0,84	0,83	0,87
Fama and French size beta	0,43	0,39	0,42	0,41	0,51
Fama and French B/P beta	-0,06	-0,07	-0,06	-0,09	0,02
p-value – Fama and French alpha	0,0019	0,0029	0,0019	0,0012	0,0282
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,3709	0,3555	0,4354	0,2040	0,7441
Standard deviation (monthly)	0,0528	0,0526	0,0527	0,0527	0,0549

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,7%	0,7%	0,7%	0,7%	1,0%
Raw return (yearly)	8,4%	8,4%	8,4%	8,3%	13,4%
Jensen's alpha (monthly)	0,4%	0,4%	0,4%	0,4%	0,7%
Jensen's alpha (yearly)	4,6%	4,5%	4,4%	4,4%	8,6%
Beta	0,88	0,88	0,87	0,86	0,84
p-value – Jensen's alpha	0,4541	0,4542	0,4575	0,4556	0,0894
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,2%	0,2%	0,2%	0,2%	0,6%
Fama and French alpha (yearly)	2,5%	2,5%	2,4%	2,3%	6,9%
Fama and French MP beta	1,04	1,03	1,03	1,01	0,97
Fama and French size beta	0,82	0,83	0,81	0,82	0,63
Fama and French B/P beta	-0,38	-0,38	-0,39	-0,37	-0,31
p-value – Fama and French alpha	0,6249	0,6267	0,6298	0,6315	0,1088
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0014	0,0013	0,0009	0,0013	0,0013
Standard deviation (monthly)	0,0771	0,0768	0,0757	0,0746	0,0663

Table B3: Test 4 – Bankruptcy risk, 4-year interpolation

Hedge portfolios	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,3%	0,4%	0,4%	0,3%
Raw return (yearly)	4,5%	3,9%	5,1%	4,9%	3,1%
Jensen's alpha (monthly)	0,6%	0,5%	0,6%	0,6%	0,3%
Jensen's alpha (yearly)	6,8%	6,2%	7,2%	7,2%	4,2%
Beta	-0,10	-0,11	-0,10	-0,11	-0,02
p-value – Jensen's alpha	0,1671	0,2028	0,1230	0,1358	0,2712
p-value – Beta	0,2283	0,1612	0,1835	0,1672	0,7908
Fama and French alpha (monthly)	0,6%	0,6%	0,7%	0,7%	0,4%
Fama and French alpha (yearly)	7,9%	7,4%	8,3%	8,3%	4,6%
Fama and French MP beta	-0,18	-0,20	-0,18	-0,20	-0,05
Fama and French size beta	-0,41	-0,45	-0,39	-0,44	-0,14
Fama and French B/P beta	0,29	0,29	0,29	0,24	0,15
p-value – Fama and French alpha	0,0900	0,1045	0,0607	0,0649	0,2263
p-value – Fama and French MP beta	0,0207	0,0083	0,0136	0,0098	0,4526
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0733
p-value – Fama and French B/P beta	0,0052	0,0051	0,0031	0,0183	0,0932
Standard deviation (monthly)	0,0513	0,0512	0,0488	0,0499	0,0404

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	1,3%	1,3%	1,3%	1,4%	1,1%
Raw return (yearly)	16,8%	16,4%	16,8%	17,5%	14,0%
Jensen's alpha (monthly)	0,9%	0,9%	0,9%	1,0%	0,7%
Jensen's alpha (yearly)	11,4%	10,9%	11,3%	12,0%	8,7%
Beta	0,76	0,75	0,76	0,75	0,78
p-value – Jensen's alpha	0,0017	0,0021	0,0016	0,0009	0,0219
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,8%	0,8%	0,8%	0,9%	0,6%
Fama and French alpha (yearly)	10,3%	10,0%	10,2%	11,0%	7,4%
Fama and French MP beta	0,83	0,82	0,83	0,82	0,87
Fama and French size beta	0,41	0,38	0,41	0,39	0,51
Fama and French B/P beta	-0,06	-0,07	-0,06	-0,09	0,00
p-value – Fama and French alpha	0,0016	0,0021	0,0014	0,0008	0,0229
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,3807	0,3503	0,4193	0,1907	0,9854
Standard deviation (monthly)	0,0520	0,0515	0,0516	0,0513	0,0545

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	0,6%	0,7%	0,6%	0,7%	0,7%
Raw return (yearly)	8,1%	8,3%	7,7%	8,4%	8,6%
Jensen's alpha (monthly)	0,4%	0,4%	0,3%	0,4%	0,4%
Jensen's alpha (yearly)	4,3%	4,5%	3,8%	4,6%	4,3%
Beta	0,85	0,87	0,86	0,85	0,80
p-value – Jensen's alpha	0,4835	0,4695	0,5264	0,4517	0,4077
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,2%	0,2%	0,1%	0,2%	0,2%
Fama and French alpha (yearly)	2,3%	2,4%	1,8%	2,5%	2,7%
Fama and French MP beta	1,01	1,03	1,01	1,01	0,92
Fama and French size beta	0,82	0,83	0,80	0,83	0,66
Fama and French B/P beta	-0,35	-0,35	-0,35	-0,33	-0,14
p-value – Fama and French alpha	0,6626	0,6446	0,7207	0,6228	0,5540
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0032	0,0033	0,0028	0,0051	0,1677
Standard deviation (monthly)	0,0767	0,0773	0,0756	0,0761	0,0670

Table B4: Test 5 – Basic test, 2002-2009

Hedge portfolios	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,5%	0,4%	0,4%	0,5%
Raw return (yearly)	5,1%	6,2%	5,2%	4,9%	6,6%
Jensen's alpha (monthly)	0,6%	0,6%	0,6%	0,5%	0,6%
Jensen's alpha (yearly)	7,0%	8,0%	7,1%	6,6%	7,4%
Beta	-0,26	-0,23	-0,26	-0,22	-0,14
p-value – Jensen's alpha	0,3314	0,2704	0,3262	0,3424	0,1339
p-value – Beta	0,0196	0,0403	0,0222	0,0362	0,0719
Fama and French alpha (monthly)	0,6%	0,7%	0,6%	0,6%	0,6%
Fama and French alpha (yearly)	7,7%	8,8%	7,8%	7,4%	7,0%
Fama and French MP beta	-0,37	-0,35	-0,37	-0,34	-0,18
Fama and French size beta	-0,50	-0,54	-0,51	-0,52	-0,21
Fama and French B/P beta	0,15	0,16	0,16	0,13	0,17
p-value – Fama and French alpha	0,2511	0,1869	0,2454	0,2422	0,1476
p-value – Fama and French MP beta	0,0006	0,0011	0,0007	0,0010	0,0164
p-value – Fama and French size beta	0,0001	0,0000	0,0001	0,0000	0,0197
p-value – Fama and French B/P beta	0,2845	0,2555	0,2655	0,3179	0,0952
Standard deviation (monthly)	0,0542	0,0545	0,0546	0,0520	0,0368

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,0%	1,0%	1,0%	1,0%	1,0%
Raw return (yearly)	12,5%	13,3%	12,6%	12,8%	12,7%
Jensen's alpha (monthly)	0,9%	1,0%	0,9%	0,9%	1,0%
Jensen's alpha (yearly)	11,7%	12,4%	11,7%	11,9%	12,1%
Beta	0,78	0,80	0,78	0,79	0,81
p-value – Jensen's alpha	0,0580	0,0382	0,0536	0,0481	0,0636
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,9%	1,0%	0,9%	0,9%	0,9%
Fama and French alpha (yearly)	11,4%	12,2%	11,4%	11,8%	11,1%
Fama and French MP beta	0,89	0,90	0,88	0,89	0,94
Fama and French size beta	0,50	0,45	0,49	0,48	0,60
Fama and French B/P beta	-0,21	-0,20	-0,20	-0,23	-0,17
p-value – Fama and French alpha	0,0342	0,0222	0,0321	0,0257	0,0404
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0559	0,0650	0,0641	0,0373	0,1289
Standard deviation (monthly)	0,0600	0,0600	0,0595	0,0597	0,0630

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,2%	0,1%	0,2%	0,2%	0,3%
Raw return (yearly)	2,0%	1,6%	1,8%	2,9%	3,4%
Jensen's alpha (monthly)	0,4%	0,3%	0,3%	0,4%	0,4%
Jensen's alpha (yearly)	4,4%	4,1%	4,3%	5,1%	4,3%
Beta	1,04	1,03	1,04	1,01	0,95
p-value – Jensen's alpha	0,6696	0,6938	0,6795	0,6140	0,6054
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,3%	0,3%	0,3%	0,3%	0,3%
Fama and French alpha (yearly)	3,5%	3,1%	3,3%	4,1%	3,9%
Fama and French MP beta	1,26	1,25	1,25	1,23	1,12
Fama and French size beta	1,00	1,00	1,00	0,99	0,81
Fama and French B/P beta	-0,36	-0,36	-0,36	-0,36	-0,34
p-value – Fama and French alpha	0,6833	0,7126	0,6969	0,6113	0,5728
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0499	0,0502	0,0525	0,0408	0,0236
Standard deviation (monthly)	0,0943	0,0940	0,0943	0,0914	0,0800

Table B5: Test 6 – Basic test, 2009-2016

Hedge portfolios	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,3%	0,2%	0,2%	0,4%	-0,8%
Raw return (yearly)	3,4%	2,4%	2,8%	5,3%	-9,3%
Jensen's alpha (monthly)	0,3%	0,2%	0,2%	0,5%	-0,9%
Jensen's alpha (yearly)	3,5%	2,9%	2,8%	5,8%	-9,8%
Beta	0,09	0,05	0,10	0,06	0,10
p-value – Jensen's alpha	0,5702	0,6208	0,6436	0,3473	0,0188
p-value – Beta	0,4199	0,6559	0,3872	0,6091	0,1993
Fama and French alpha (monthly)	0,7%	0,6%	0,6%	0,8%	-0,5%
Fama and French alpha (yearly)	8,1%	7,1%	7,3%	10,0%	-6,1%
Fama and French MP beta	0,00	-0,04	0,01	-0,03	0,05
Fama and French size beta	-0,14	-0,21	-0,15	-0,24	0,14
Fama and French B/P beta	0,55	0,49	0,54	0,48	0,51
p-value – Fama and French alpha	0,1701	0,2124	0,2093	0,0942	0,0930
p-value – Fama and French MP beta	0,9815	0,6997	0,9345	0,7564	0,4886
p-value – Fama and French size beta	0,3172	0,1280	0,2883	0,0829	0,1256
p-value – Fama and French B/P beta	0,0002	0,0004	0,0002	0,0009	0,0000
Standard deviation (monthly)	0,0450	0,0433	0,0446	0,0445	0,0321

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,6%	1,5%	1,6%	1,7%	1,1%
Raw return (yearly)	20,6%	19,4%	20,5%	21,9%	13,9%
Jensen's alpha (monthly)	0,9%	0,8%	0,9%	1,0%	0,4%
Jensen's alpha (yearly)	10,8%	9,9%	10,7%	12,4%	4,4%
Beta	0,75	0,73	0,75	0,71	0,77
p-value – Jensen's alpha	0,0190	0,0265	0,0194	0,0067	0,3285
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,9%	0,8%	0,9%	1,0%	0,5%
Fama and French alpha (yearly)	11,6%	10,5%	11,5%	12,9%	6,1%
Fama and French MP beta	0,78	0,75	0,78	0,74	0,79
Fama and French size beta	0,39	0,35	0,38	0,35	0,48
Fama and French B/P beta	0,12	0,09	0,12	0,07	0,24
p-value – Fama and French alpha	0,0078	0,0149	0,0084	0,0037	0,1295
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0002	0,0006	0,0002	0,0008	0,0000
p-value – Fama and French B/P beta	0,2217	0,3596	0,2411	0,4587	0,0130
Standard deviation (monthly)	0,0463	0,0449	0,0462	0,0446	0,0476

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,1%	1,1%	1,2%	1,1%	1,9%
Raw return (yearly)	14,6%	14,5%	15,2%	13,6%	24,6%
Jensen's alpha (monthly)	0,6%	0,5%	0,6%	0,5%	1,2%
Jensen's alpha (yearly)	7,1%	6,8%	7,7%	6,3%	15,7%
Beta	0,66	0,68	0,66	0,66	0,67
p-value – Jensen's alpha	0,3063	0,3277	0,2643	0,3726	0,0037
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,3%	0,3%	0,3%	0,2%	1,0%
Fama and French alpha (yearly)	3,3%	3,1%	3,9%	2,6%	13,0%
Fama and French MP beta	0,77	0,79	0,77	0,77	0,74
Fama and French size beta	0,53	0,56	0,53	0,59	0,34
Fama and French B/P beta	-0,42	-0,40	-0,42	-0,40	-0,27
p-value – Fama and French alpha	0,5988	0,6120	0,5289	0,6756	0,0094
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0006	0,0003	0,0005	0,0002	0,0038
p-value – Fama and French B/P beta	0,0055	0,0087	0,0055	0,0092	0,0187
Standard deviation (monthly)	0,0576	0,0581	0,0571	0,0584	0,0470

Table B6: Test 7 – Non-overlapping series, vintage 2002

Hedge portfolios	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,3%	0,3%	0,5%	0,0%
Raw return (yearly)	4,4%	4,1%	4,1%	5,6%	0,6%
Jensen's alpha (monthly)	0,6%	0,5%	0,6%	0,7%	0,1%
Jensen's alpha (yearly)	7,3%	6,8%	6,9%	8,2%	1,5%
Beta	-0,13	-0,12	-0,12	-0,10	-0,01
p-value – Jensen's alpha	0,2049	0,2317	0,2251	0,1464	0,6917
p-value – Beta	0,1495	0,1930	0,1702	0,2662	0,8125
Fama and French alpha (monthly)	0,5%	0,5%	0,5%	0,6%	0,1%
Fama and French alpha (yearly)	6,8%	6,4%	6,5%	7,9%	0,8%
Fama and French MP beta	-0,20	-0,20	-0,19	-0,17	-0,04
Fama and French size beta	-0,31	-0,41	-0,32	-0,35	-0,08
Fama and French B/P beta	0,29	0,29	0,29	0,28	0,33
p-value – Fama and French alpha	0,2179	0,2324	0,2395	0,1489	0,8203
p-value – Fama and French MP beta	0,0285	0,0230	0,0334	0,0513	0,4719
p-value – Fama and French size beta	0,0060	0,0003	0,0056	0,0017	0,2991
p-value – Fama and French B/P beta	0,0182	0,0162	0,0179	0,0225	0,0001
Standard deviation (monthly)	0,0550	0,0547	0,0552	0,0542	0,0376

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,2%	1,1%	1,2%	1,2%	1,0%
Raw return (yearly)	15,0%	13,7%	14,7%	15,6%	13,3%
Jensen's alpha (monthly)	0,7%	0,6%	0,7%	0,8%	0,6%
Jensen's alpha (yearly)	9,2%	7,8%	8,9%	9,7%	7,4%
Beta	0,75	0,77	0,76	0,76	0,81
p-value – Jensen's alpha	0,0319	0,0555	0,0375	0,0236	0,0946
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,7%	0,6%	0,7%	0,8%	0,6%
Fama and French alpha (yearly)	8,9%	7,5%	8,6%	9,4%	6,8%
Fama and French MP beta	0,84	0,83	0,84	0,84	0,89
Fama and French size beta	0,47	0,40	0,47	0,45	0,52
Fama and French B/P beta	-0,04	-0,02	-0,03	-0,05	0,07
p-value – Fama and French alpha	0,0204	0,0445	0,0249	0,0146	0,0785
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,6658	0,8068	0,6779	0,5572	0,4166
Standard deviation (monthly)	0,0557	0,0549	0,0559	0,0558	0,0591

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,5%	0,4%	0,5%	0,4%	0,9%
Raw return (yearly)	5,9%	5,0%	5,9%	5,4%	11,2%
Jensen's alpha (monthly)	0,1%	0,1%	0,1%	0,1%	0,5%
Jensen's alpha (yearly)	1,8%	0,9%	1,8%	1,3%	5,8%
Beta	0,88	0,88	0,88	0,86	0,82
p-value – Jensen's alpha	0,7967	0,8944	0,7967	0,8466	0,2749
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,2%	0,1%	0,2%	0,1%	0,5%
Fama and French alpha (yearly)	2,0%	1,0%	2,0%	1,5%	6,0%
Fama and French MP beta	1,03	1,03	1,03	1,01	0,94
Fama and French size beta	0,78	0,81	0,78	0,80	0,60
Fama and French B/P beta	-0,33	-0,31	-0,33	-0,33	-0,26
p-value – Fama and French alpha	0,7528	0,8684	0,7528	0,8085	0,2060
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0217	0,0298	0,0217	0,0195	0,0158
Standard deviation (monthly)	0,0822	0,0824	0,0822	0,0807	0,0663

Table B7: Test 8 – Non-overlapping series, vintage 2003

Hedge portfolios	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,3%	0,3%	0,3%	-0,1%
Raw return (yearly)	4,5%	4,3%	3,8%	3,8%	-1,2%
Jensen's alpha (monthly)	0,5%	0,5%	0,4%	0,4%	0,0%
Jensen's alpha (yearly)	5,8%	5,6%	5,0%	4,7%	-0,3%
Beta	0,05	0,03	0,06	0,07	-0,02
p-value – Jensen's alpha	0,2834	0,2836	0,3432	0,3525	0,9377
p-value – Beta	0,5561	0,7153	0,5194	0,4200	0,7400
Fama and French alpha (monthly)	0,5%	0,5%	0,5%	0,5%	0,0%
Fama and French alpha (yearly)	0,5%	0,5%	0,5%	0,5%	0,0%
Fama and French MP beta	-0,01	-0,04	-0,01	0,01	-0,01
Fama and French size beta	-0,29	-0,31	-0,30	-0,32	0,13
Fama and French B/P beta	0,16	0,15	0,17	0,08	0,15
p-value – Fama and French alpha	0,2147	0,2067	0,2592	0,2666	0,9099
p-value – Fama and French MP beta	0,9016	0,6800	0,9056	0,9422	0,8168
p-value – Fama and French size beta	0,0105	0,0036	0,0063	0,0021	0,0825
p-value – Fama and French B/P beta	0,1831	0,1943	0,1470	0,4623	0,0648
Standard deviation (monthly)	0,0521	0,0503	0,0510	0,0492	0,0349

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	1,6%	1,5%	1,6%	1,5%	1,3%
Raw return (yearly)	20,3%	20,2%	20,7%	20,3%	16,9%
Jensen's alpha (monthly)	1,0%	1,0%	1,0%	1,0%	0,8%
Jensen's alpha (yearly)	12,5%	12,4%	12,8%	12,6%	9,8%
Beta	0,77	0,77	0,77	0,74	0,72
p-value – Jensen's alpha	0,0044	0,0039	0,0028	0,0032	0,0355
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,9%	0,9%	0,9%	0,9%	0,7%
Fama and French alpha (yearly)	0,9%	0,9%	0,9%	0,9%	0,7%
Fama and French MP beta	0,86	0,85	0,85	0,83	0,83
Fama and French size beta	0,45	0,43	0,43	0,43	0,63
Fama and French B/P beta	-0,09	-0,08	-0,07	-0,12	-0,04
p-value – Fama and French alpha	0,0042	0,0038	0,0026	0,0030	0,0317
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,3299	0,3265	0,3815	0,1446	0,6259
Standard deviation (monthly)	0,0552	0,0546	0,0543	0,0534	0,0560

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV q**	**RIV GG**	**AEG**
Raw return (monthly)	1,0%	1,0%	1,1%	1,0%	1,4%
Raw return (yearly)	12,2%	12,5%	13,4%	13,3%	17,5%
Jensen's alpha (monthly)	0,5%	0,5%	0,6%	0,6%	0,8%
Jensen's alpha (yearly)	6,3%	6,5%	7,4%	7,5%	10,1%
Beta	0,72	0,74	0,72	0,67	0,74
p-value – Jensen's alpha	0,3122	0,2984	0,2319	0,2155	0,0234
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,4%	0,4%	0,4%	0,5%	0,7%
Fama and French alpha (yearly)	4,4%	4,6%	5,5%	5,6%	8,8%
Fama and French MP beta	0,87	0,89	0,86	0,82	0,84
Fama and French size beta	0,74	0,74	0,73	0,75	0,50
Fama and French B/P beta	-0,25	-0,24	-0,25	-0,21	-0,19
p-value – Fama and French alpha	0,4161	0,3970	0,3060	0,2807	0,0254
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0498	0,0571	0,0462	0,0826	0,0277
Standard deviation (monthly)	0,0694	0,0694	0,0684	0,0665	0,0550

Table B8: Test 9 – Non-overlapping series, vintage 2004

Hedge portfolios	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,5%	0,4%	0,5%	-0,3%
Raw return (yearly)	5,0%	6,1%	5,1%	6,8%	-3,3%
Jensen's alpha (monthly)	0,5%	0,6%	0,5%	0,7%	-0,2%
Jensen's alpha (yearly)	6,2%	7,2%	6,3%	8,1%	-2,8%
Beta	-0,06	-0,05	-0,06	-0,08	0,03
p-value – Jensen's alpha	0,0900	0,0490	0,0882	0,0315	0,4237
p-value – Beta	0,3081	0,3818	0,3371	0,1769	0,5934
Fama and French alpha (monthly)	0,6%	0,7%	0,6%	0,8%	-0,1%
Fama and French alpha (yearly)	7,9%	8,9%	8,0%	9,7%	-1,1%
Fama and French MP beta	-0,14	-0,14	-0,14	-0,17	-0,04
Fama and French size beta	-0,16	-0,21	-0,18	-0,24	-0,07
Fama and French B/P beta	0,41	0,38	0,41	0,34	0,50
p-value – Fama and French alpha	0,0192	0,0086	0,0189	0,0058	0,7217
p-value – Fama and French MP beta	0,0150	0,0168	0,0161	0,0043	0,4823
p-value – Fama and French size beta	0,0296	0,0047	0,0164	0,0015	0,3436
p-value – Fama and French B/P beta	0,0000	0,0000	0,0000	0,0000	0,0000
Standard deviation (monthly)	0,0352	0,0351	0,0356	0,0361	0,0346

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,2%	1,3%	1,2%	1,2%	0,9%
Raw return (yearly)	15,2%	16,1%	15,2%	16,1%	11,5%
Jensen's alpha (monthly)	0,8%	0,9%	0,8%	0,9%	0,5%
Jensen's alpha (yearly)	10,3%	11,1%	10,2%	11,0%	6,6%
Beta	0,64	0,65	0,64	0,64	0,70
p-value – Jensen's alpha	0,0083	0,0030	0,0078	0,0034	0,0945
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,7%	0,8%	0,7%	0,8%	0,5%
Fama and French alpha (yearly)	9,2%	9,9%	9,2%	9,8%	6,0%
Fama and French MP beta	0,75	0,75	0,74	0,74	0,79
Fama and French size beta	0,47	0,41	0,45	0,41	0,47
Fama and French B/P beta	-0,11	-0,13	-0,11	-0,17	0,03
p-value – Fama and French alpha	0,0072	0,0028	0,0070	0,0033	0,0908
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,1591	0,0785	0,1651	0,0329	0,7307
Standard deviation (monthly)	0,0484	0,0474	0,0480	0,0474	0,0513

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,7%	0,6%	0,6%	0,6%	1,1%
Raw return (yearly)	8,1%	7,8%	7,9%	6,9%	14,2%
Jensen's alpha (monthly)	0,3%	0,3%	0,3%	0,2%	0,8%
Jensen's alpha (yearly)	3,9%	3,6%	3,7%	2,7%	9,6%
Beta	0,70	0,70	0,70	0,73	0,67
p-value – Jensen's alpha	0,4466	0,4831	0,4742	0,6031	0,0451
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,1%	0,1%	0,1%	0,0%	0,6%
Fama and French alpha (yearly)	1,3%	1,0%	1,1%	0,1%	7,2%
Fama and French MP beta	0,88	0,88	0,88	0,91	0,83
Fama and French size beta	0,63	0,61	0,63	0,66	0,53
Fama and French B/P beta	-0,52	-0,52	-0,52	-0,51	-0,47
p-value – Fama and French alpha	0,7566	0,8093	0,7937	0,9798	0,0678
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0000	0,0000	0,0000	0,0000	0,0000
Standard deviation (monthly)	0,0608	0,0607	0,0610	0,0622	0,0560

Table B9: Test 10 – Basic test with 12-month holding periods

Hedge portfolios	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,5%	0,3%	0,6%	-0,1%
Raw return (yearly)	5,2%	6,8%	4,0%	6,9%	-1,6%
Jensen's alpha (monthly)	0,6%	0,7%	0,5%	0,8%	-0,1%
Jensen's alpha (yearly)	7,6%	9,1%	6,4%	9,4%	-0,8%
Beta	-0,13	-0,11	-0,12	-0,15	0,02
p-value – Jensen's alpha	0,1368	0,0755	0,2067	0,0613	0,8408
p-value – Beta	0,1086	0,1554	0,1232	0,0644	0,8041
Fama and French alpha (monthly)	0,6%	0,7%	0,5%	0,7%	-0,1%
Fama and French alpha (yearly)	7,3%	8,9%	6,1%	9,3%	-1,5%
Fama and French MP beta	-0,19	-0,19	-0,19	-0,21	0,00
Fama and French size beta	-0,30	-0,37	-0,30	-0,35	0,02
Fama and French B/P beta	0,22	0,20	0,24	0,14	0,32
p-value – Fama and French alpha	0,1379	0,0679	0,2139	0,0532	0,6824
p-value – Fama and French MP beta	0,0175	0,0183	0,0194	0,0067	0,9546
p-value – Fama and French size beta	0,0029	0,0002	0,0027	0,0004	0,8103
p-value – Fama and French B/P beta	0,0493	0,0606	0,0274	0,1783	0,0002
Standard deviation (monthly)	0,0491	0,0489	0,0492	0,0480	0,0384

Long portfolios (portfolio 1)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	1,1%	1,1%	1,0%	1,1%	0,8%
Raw return (yearly)	13,8%	14,4%	13,3%	14,3%	9,6%
Jensen's alpha (monthly)	0,6%	0,7%	0,6%	0,7%	0,3%
Jensen's alpha (yearly)	7,9%	8,4%	7,4%	8,5%	4,1%
Beta	0,77	0,79	0,78	0,74	0,81
p-value – Jensen's alpha	0,0648	0,0416	0,0789	0,0400	0,3849
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,6%	0,6%	0,6%	0,7%	0,3%
Fama and French alpha (yearly)	7,6%	8,0%	7,0%	8,3%	3,4%
Fama and French MP beta	0,87	0,87	0,87	0,83	0,92
Fama and French size beta	0,54	0,47	0,52	0,50	0,67
Fama and French B/P beta	-0,02	-0,02	-0,01	-0,07	0,06
p-value – Fama and French alpha	0,0412	0,0271	0,0549	0,0221	0,3716
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,7670	0,8178	0,9344	0,3525	0,4644
Standard deviation (monthly)	0,0567	0,0561	0,0567	0,0544	0,0612

Short portfolios (portfolio 5)	**Full-fledged**	**DDM**	**RIV *q***	**RIV GG**	**AEG**
Raw return (monthly)	0,4%	0,3%	0,4%	0,3%	0,8%
Raw return (yearly)	4,5%	3,5%	5,3%	3,4%	9,9%
Jensen's alpha (monthly)	0,0%	-0,1%	0,1%	-0,1%	0,4%
Jensen's alpha (yearly)	0,3%	-0,7%	1,0%	-0,8%	4,9%
Beta	0,90	0,91	0,91	0,88	0,79
p-value – Jensen's alpha	0,9642	0,9188	0,8879	0,9026	0,3755
p-value – Beta	0,0000	0,0000	0,0000	0,0000	0,0000
Fama and French alpha (monthly)	0,0%	-0,1%	0,1%	-0,1%	0,4%
Fama and French alpha (yearly)	0,2%	-0,8%	0,9%	-1,0%	5,0%
Fama and French MP beta	1,06	1,06	1,06	1,04	0,91
Fama and French size beta	0,84	0,84	0,83	0,84	0,65
Fama and French B/P beta	-0,24	-0,22	-0,25	-0,22	-0,26
p-value – Fama and French alpha	0,9706	0,8900	0,8798	0,8686	0,2996
p-value – Fama and French MP beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French size beta	0,0000	0,0000	0,0000	0,0000	0,0000
p-value – Fama and French B/P beta	0,0835	0,1120	0,0708	0,1105	0,0169
Standard deviation (monthly)	0,0821	0,0823	0,0817	0,0807	0,0667

C Cumulative raw returns to basic test portfolios

Figure C1: **Basic Test: Raw Returns to Long Portfolios**
Cumulative raw returns to the long portfolio (portfolio 1, the most undervalued quintile) of each valuation model. Returns are indexed starting in 2002.

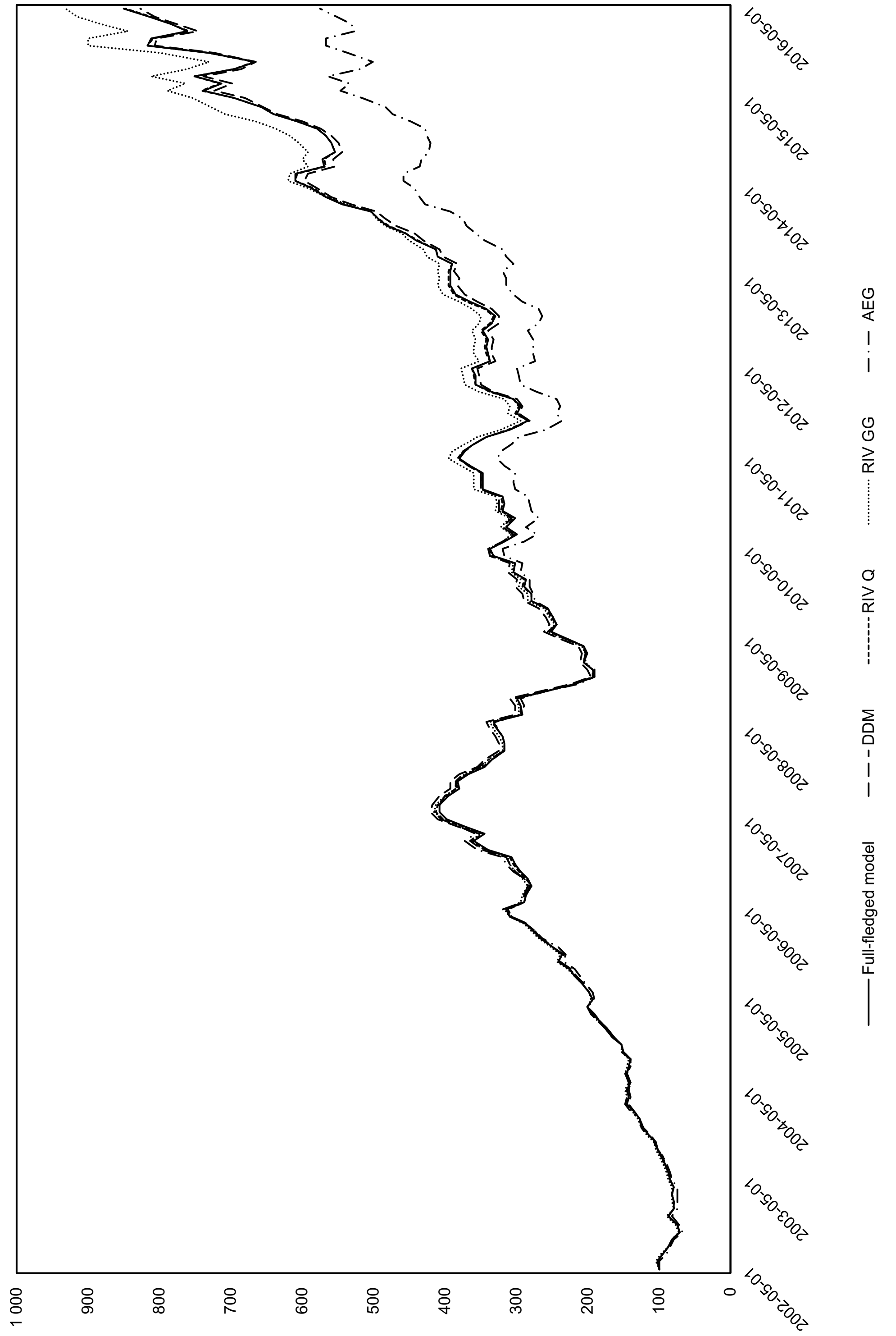


Figure C2: **Basic Test: Raw Returns to Short Portfolios**
Cumulative raw returns to the short portfolio (portfolio 5, the most overvalued quintile) of each valuation model. Returns are indexed starting in 2002.

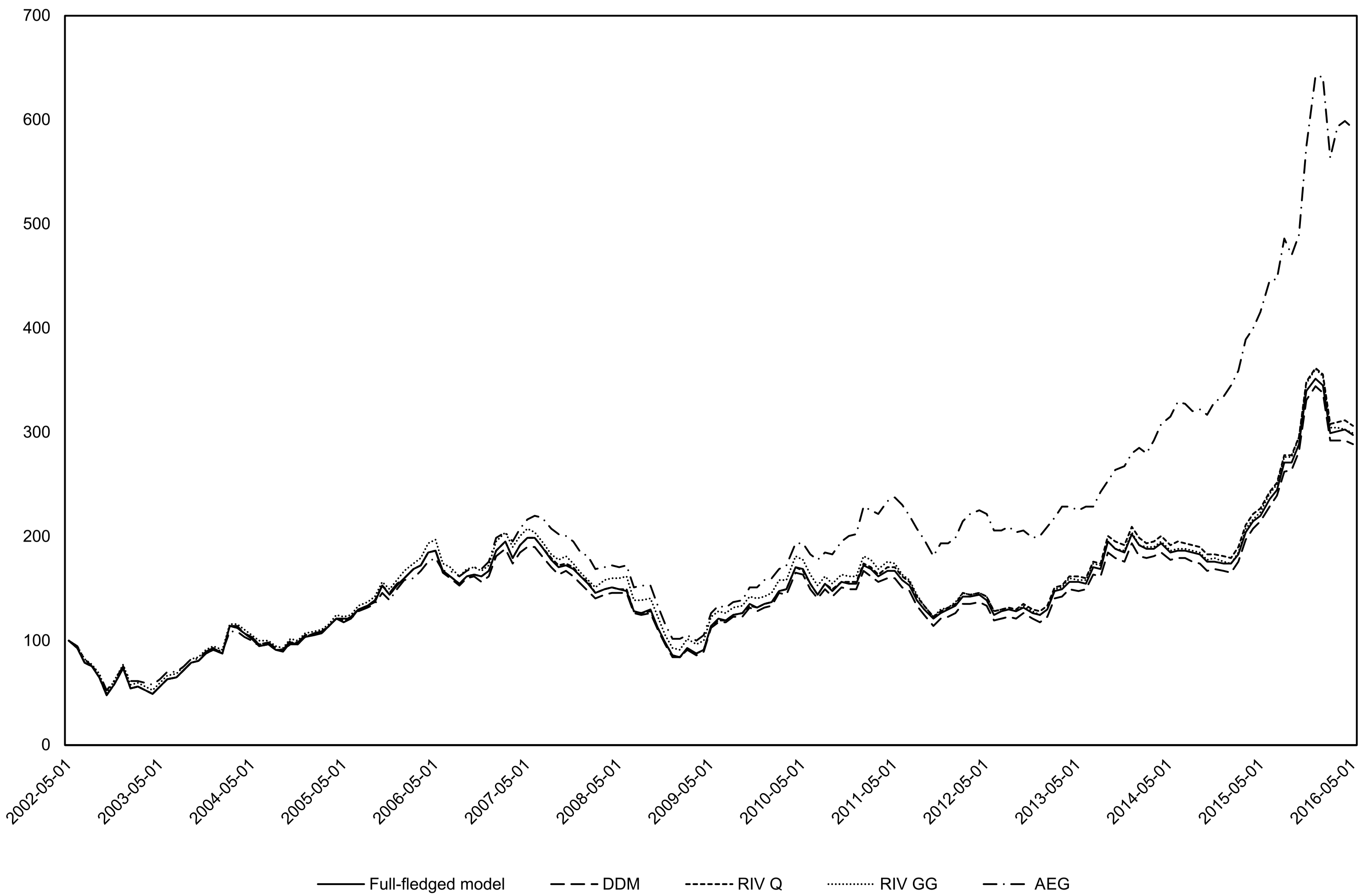


Figure C3: **Basic Test: Raw Returns to Hedge Portfolios**
Cumulative raw returns to the hedge portfolio (long minus short) of each valuation model. Returns are indexed starting in 2002.

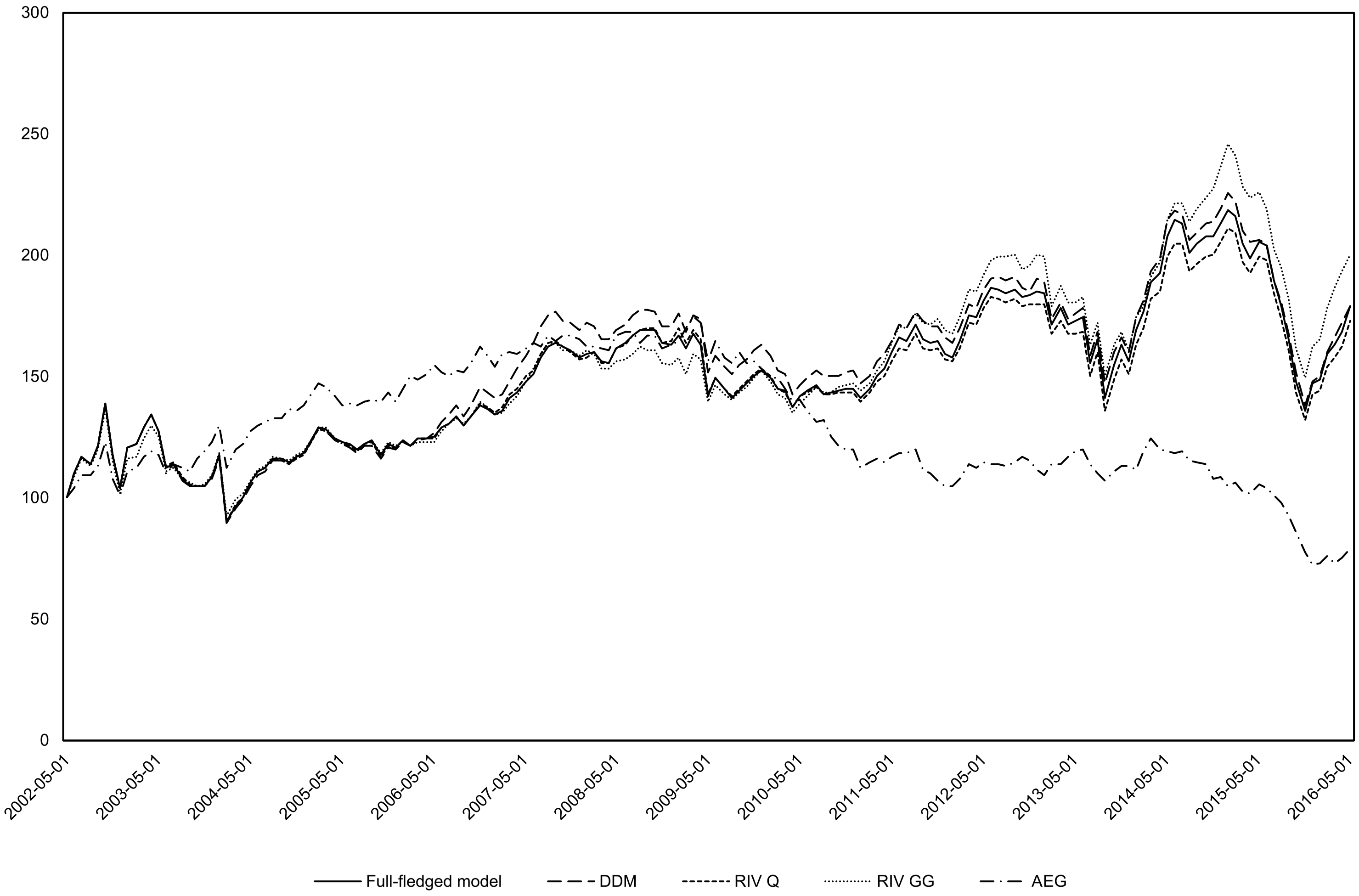


Figure C4: **Basic Test: Raw Returns, DDM**
Cumulative raw returns to the dividend discount model, where portfolio 1 represents the most undervalued quintile and portfolio 5 represents the most overvalued quintile. Returns are indexed starting in 2002.

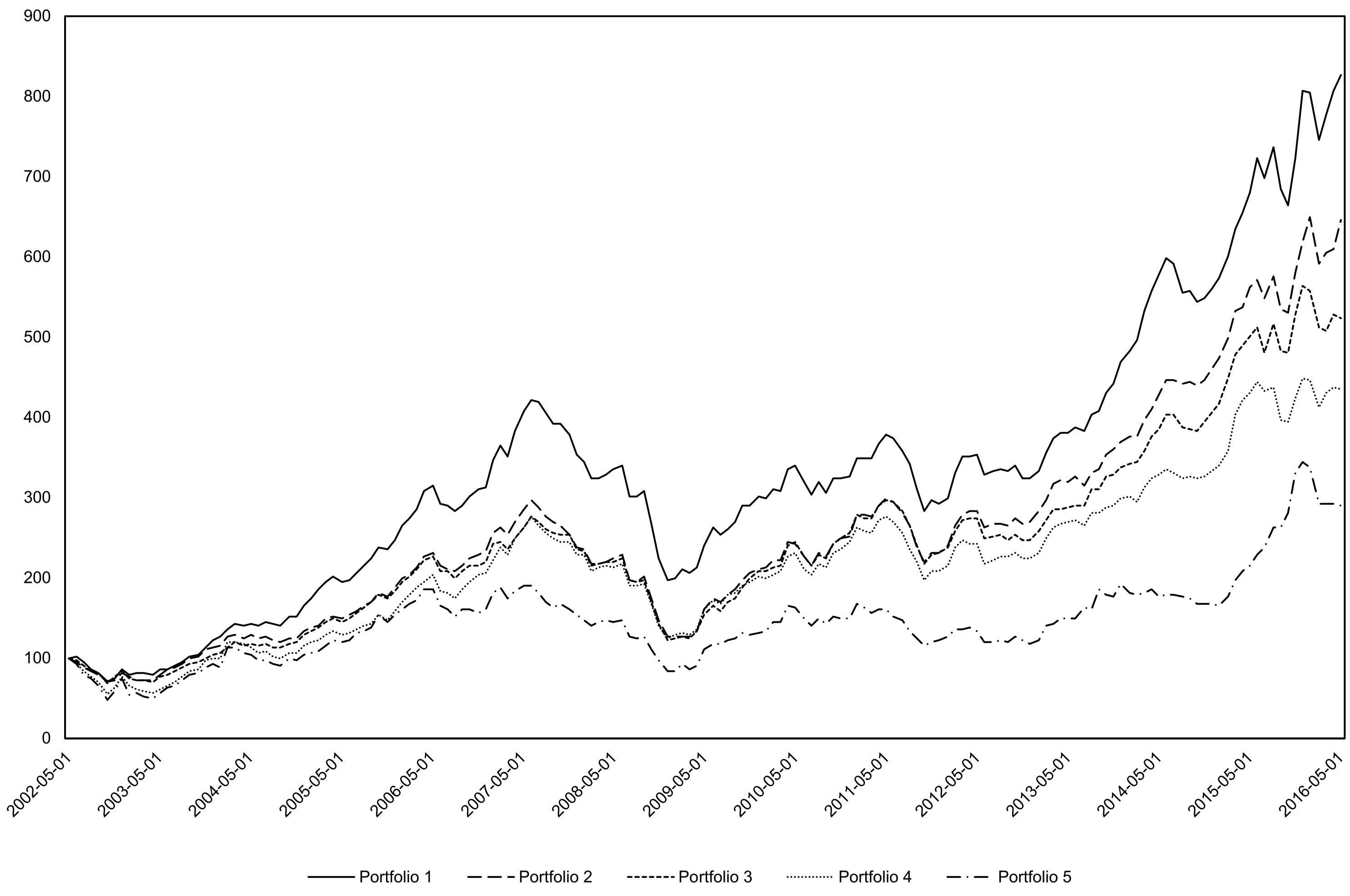


Figure C5: **Basic Test: Raw Returns, RIV *q***

Cumulative raw returns to the residual income valuation model using q values for terminal values, where portfolio 1 represents the most undervalued quintile and portfolio 5 represents the most overvalued quintile. Returns are indexed starting in 2002.

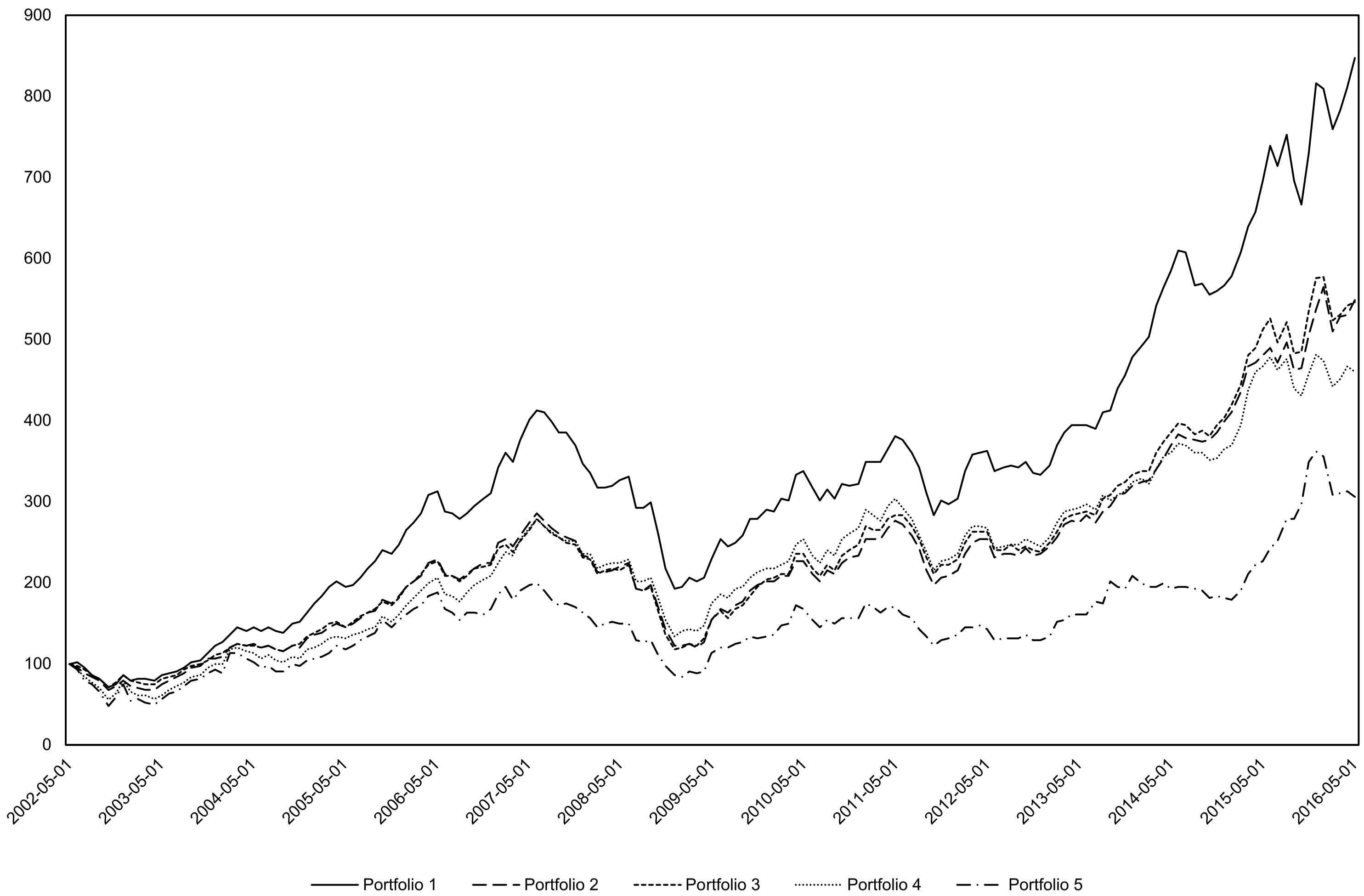


Figure C6: **Basic Test: Raw Returns, RIV GG**
Cumulative raw returns to the residual income valuation model using Gordon growth for terminal values, where portfolio 1 represents the most undervalued quintile and portfolio 5 represents the most overvalued quintile. Returns are indexed starting in 2002.

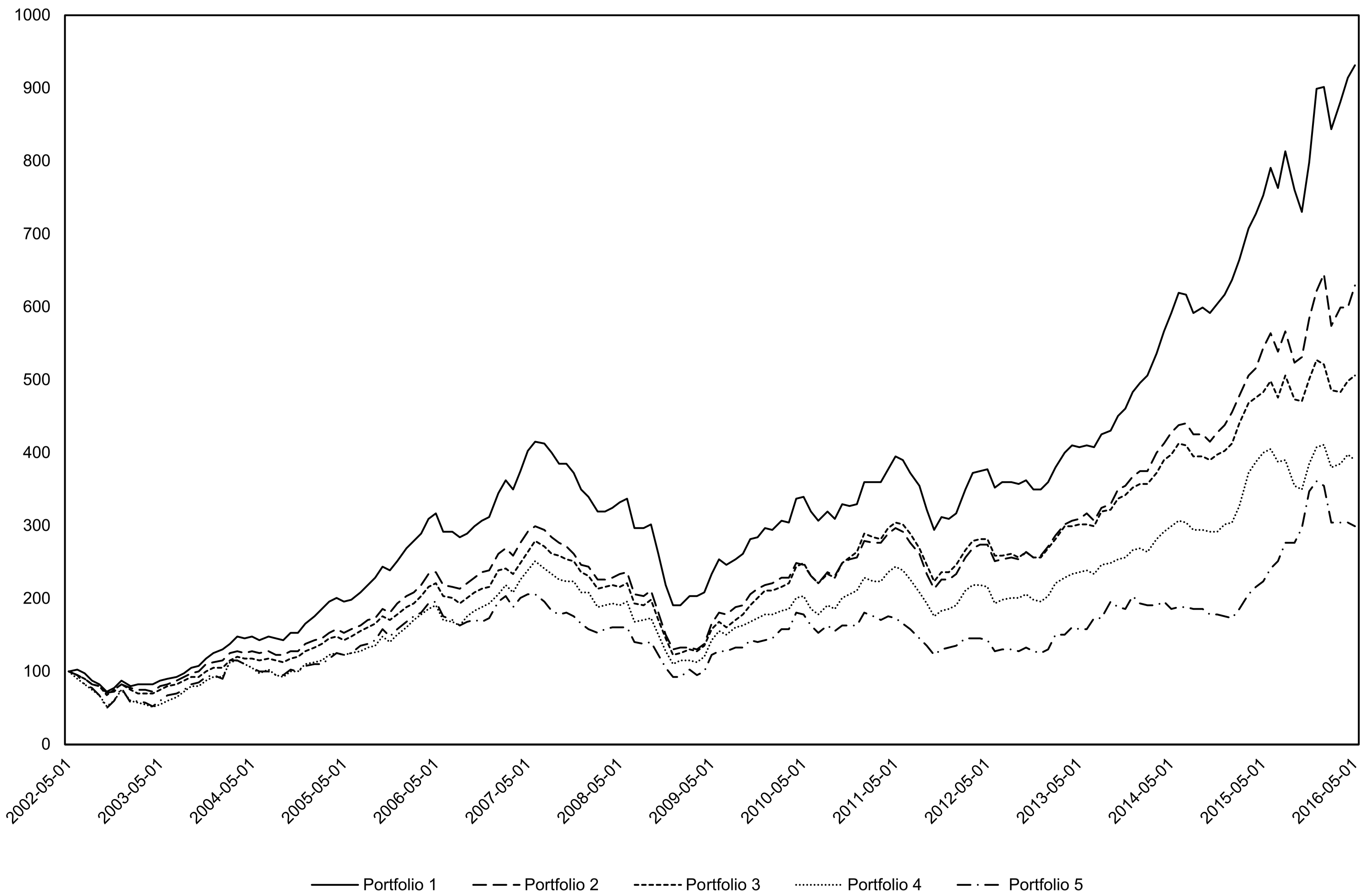
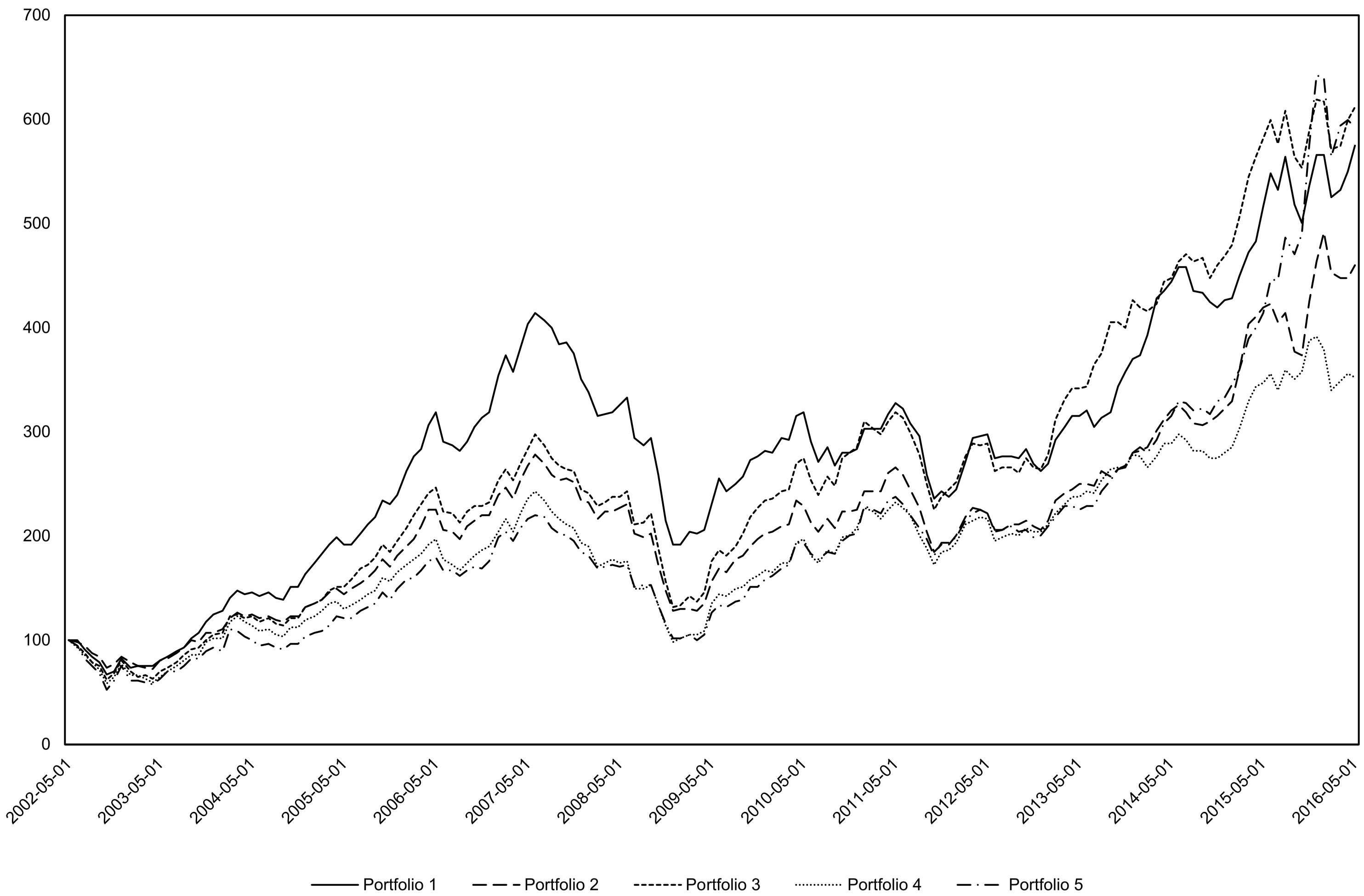


Figure C7: **Basic Test: Raw Returns, AEG**
Cumulative raw returns to the abnormal earnings growth model, where portfolio 1 represents the most undervalued quintile and portfolio 5 represents the most overvalued quintile. Returns are indexed starting in 2002.



D Additional calculations

Probability of failure adjustment formula (Skogsvik and Skogsvik, 2013)

$$p_{fail,POP} = p_{fail,ES} + \left[\frac{\pi(1-prop)}{prop(1-\pi) + p_{fail,ES}(\pi - prop)}\right] \tag{D1}$$

where:

π	= a priori probability of failure in the population of companies
$prop$	= proportion of failure companies in the estimation sample of companies t
$..._{POP}$	= value of variable in the population of companies
$..._{ES}$	= value of variable in the estimation sample of companies

Calculation of the permanent measurement bias (q value)

The permanent measurement bias (PMB) is the difference between book value and fair value of assets due to biased accounting practices such as conservative accounting (Runsten, 1998). The q value for Holmen between 2005 and 2013 is calculated by determining the PMB related to inventory, buildings & land and machinery & equipment, and deferred taxes and scaling those by the book value of equity.

The PMB related to inventory is calculated by counting up the inventory by the mark-up for finished goods.

$$Mark\text{-}up = \frac{Operating\ profit}{Cost\ of\ goods\ sold} \tag{D2}$$

$$PMB_{Inv} = Mark\text{-}up * Inventory \tag{D3}$$

The PMB related to land & buildings and machinery & equipment is calculated by applying current cost accounting. In order to do so, the investment and depreciation pattern is determined and the current value of those investments calculated by adjusting for the inflation.

$$PMB_{M\&E} = Current\ value_{M\&E} - Book\ value_{M\&E} \tag{D4}$$

The deferred tax in the balance sheet is adjusted for the time value, since it will not be reversed immediately but over time as the assets and liabilities it is related to are used up or sold. The discounting is done using the cost of debt. Furthermore, there is deferred tax related to the PMB which must also be adjusted for the time value.

$$PMB_{DT} = \sum_{t=1}^{\infty} \frac{DT\ reversals}{(1+\rho_D)^t} - Book\ value_{DT} \tag{D5}$$

The total PMB from the calculations above is then scaled by equity to determine the q value.

$$q = \frac{PMB_{Inv} + PMB_{M\&E} + PMB_{DT}}{Book\ value\ of\ equity} \tag{D6}$$