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ACTIVE PORTFOLIO MANAGEMENT, IMPLIED EXPECTED RETURNS, AND ANALYST OPTIMISM

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Abstract. This paper investigates whether implied expected returns based on the approach of CLAUS/THOMAS (2001) can be implemented in active portfolio management. This approach uses analysts' forecasts to derive return expectations by equating the present value of expected cash-flows to the current market price. It is found that active investment strategies which maximize implied expected returns significantly outperform a passive index investment. A significant part of this outperformance can be explained by the difference between the implied expected return and the return expectation justified by the CAPM. The empirical results suggest that a substantial part of this difference can be attributed to an optimism bias in analysts' forecasts.

1. Introduction

Portfolio management is concerned with providing returns and managing risks in order to achieve investors' objectives. In practice, the notion of investors' objectives is made operational through a benchmark, which is typically an index (e.g., DJ Stoxx 50 Total Return Index) or a mix of indices. Two different approaches to portfolio management can be observed. Passive portfolio management aims to replicate the performance of a benchmark by neutrally weighting asset classes and securities in each asset class. Active portfolio management, in contrast, attempts to implement investment strategies to achieve superior returns by overweighting (underweighting) assets that are expected to outperform (underperform) the relevant index. Therefore, the key to active portfolio management is to have good return forecasts (GRINOLD/KAHN, 1999).

A common method for estimating expected returns is to take the average of realized returns. This procedure would be appropriate if past returns were representative of future returns. However, several concerns can be raised against this. First, BROWN/GOETZMANN/ROSS (1995) note that a survivorship bias can significantly influence the historical return. Second, ELTON (1999) demonstrates that unexpected news (e.g., a merger announcement) may bias the historical estimator as information surprises are unlikely to cancel out over a sample period. Third, FAMA/FRENCH (1988) argue that time-varying discount rates affect realized returns.

When discount rates (i.e., expected returns) are falling, realized returns will, ceteris paribus, be unexpectedly high (e.g., COCHRANE (2001)). Looking at the last decade, we see that one of the main drivers of the stock market has been a decrease in discount rates (e.g., SIEGEL (1999);

SHILLER (2000); ARNOTT/BERNSTEIN (2002); FAMA/FRENCH (2002)).

Expected returns can also be estimated based on stock characteristics such as price ratios (e.g., the book-to-market ratio of FAMA/FRENCH (1992, 1996, 1998) or the cash-flow-to-price ratio of LAKONISHOK/SHLEIFER/VISHNY (1994)) and the company's market value (e.g., the size effect of BANZ (1981)). These characteristics can be applied in portfolio optimization if they are transformed into expected returns. This has been done, for instance, by the three factor model of FAMA/FRENCH (1996).

In the current paper, an alternative method for estimating expected returns is applied, which is based on earnings forecasts estimated by financial analysts (e.g., CLAUS/THOMAS (2001), GEBHARDT/LEE/SWAMINATHAN (2001), HARRIS/MARSTON (2001), EASTON/TAYLOR/SHROFF/SOUGIANNIS (2002), SCHRÖDER (2004)). Expected returns are calculated as follows: The present value of expected earnings is related to the current market price by a residual income model. The model is then solved for the discount rate. This discount rate is an estimate of the expected return and—as it is implied by the current market price and expected earnings—it is termed ''implied expected return''. The method of implied expected returns is utilized in an active stock selection strategy that aims to outperform a benchmark index.

Three main issues are addressed in this paper. First, it is investigated whether the active stock selection strategy, based on implied expected returns, leads to realized excess returns in comparison with a passive index investment. Second, causes for the success of the investment strategy are analyzed. Third, it is estimated how a possible bias in analysts' earnings expectations impacts implied expected returns. The remainder of the paper is organized as follows: In Section 2, the methodology for estimating implied expected returns is described and active portfolio strategies are developed. Section 3 empirically estimates the implied expected returns of a sample of large cap stocks in Europe and presents performance results of active portfolio strategies. The question of why the proposed strategies outperform the benchmark and the role of a possible analyst bias are also addressed in this section. Section 4 concludes the paper.

2. Implied Expected Returns and Portfolio Optimization

2.2 Implied Expected Returns

CLAUS/THOMAS (2001) and GEBHARDT/LEE/SWAMINATHAN (2001) propose a method for estimating implied expected returns which involves solving a residual income model for the discount rate that equates the present value of expected earnings to the current market price. According to the residual income model, the current stock price equals the sum of the current book value and discounted expected abnormal earnings:

$$P_t = B_t + \frac{(roe_{t+1} - k_t)\cdot B_t}{1 + k_t} + \frac{(roe_{t+2} - k_t)\cdot B_{t+1}}{(1 + k_t)^2} + \frac{(roe_{t+3} - k_t)\cdot B_{t+2}}{(1 + k_t)^3} + \ldots \quad (1)$$

where

P_t = price at t

B_t = book value at t

$(roe_{t+\tau} - k_t)\cdot B_{t+\tau-1}$ = expected abnormal earnings in year $t + \tau$

$roe_{t+\tau}$ = expected return on equity in year $t + \tau$ (proxied by analysts' forecasts)

k_t = discount rate (cost of capital) at t.

If expected returns were constant in future periods, the discount rate k_t would equal the expected return. However, returns on stocks usually vary stochastically (SAMUELSON (1965)). Thus,

k_t is only an approximation of the expected return, conditional on information available at time t. Assuming clean surplus, [1] book values evolve over time according to: $B_t = B_{t-1} \cdot (1 + roe_t) - D_t$, where D_t is the expected dividend in year t. Equation (1) requires abnormal earnings estimates for an infinite time horizon. In practice, earnings expectations (approximated by estimates provided by financial analysts) are available for a limited time horizon only. Therefore, (1) is simplified by a three-stage model, as illustrated in Figure 1.

In stage 1 (fiscal year +1 to fiscal year +5), the return on equity is derived from analyst forecasts. Stage 1 is limited to 5 years since the I/B/E/S database, which is used in the subsequent section, does not provide forecasts beyond fiscal year +5. The length of stage 2 is also five years (fiscal year +6 to fiscal year +10). In this stage, it is assumed that the return on equity converges linearly from roe_{t+5} to a long-term return on equity roe_L. The long-term return on equity is estimated as the unconditional mean return on equity of European companies, which is approximately 10%. In stage three (beyond fiscal year +10), it is assumed that each company earns the long-term return on equity. The long-term growth rate of the book value is approximated by the unconditional mean of the nominal GDP growth rate, which is estimated at 6%. These assumptions can be justified by the results of PENMAN (1991). He reports that returns on equity are mean-reverting over a period of between nine and twelve years. Our method differs from the approach of CLAUS/ THOMAS (2001), who do not model the second stage (convergence period). However, varying the length of the three periods does not significantly change the results in the subsequent section.

The simplified residual income model relates the current price to the book value and to the present value of the three stages (S_1, S_2, S_3):

$$P_t = B_t + S_1 + S_2 + S_3$$

where

$$S_1 \equiv \sum_{\tau=1}^{5} \frac{(roe_{t+\tau} - k_t) \cdot B_{t+\tau-1}}{(1+k_t)^{\tau}} \qquad (2)$$

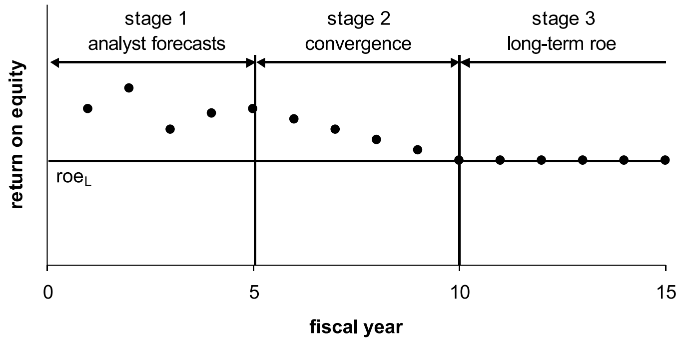
$$S_2 \equiv$$

$$\sum_{\tau=6}^{10} \frac{\left(roe_{t+5} + \frac{\tau-5}{5} \cdot (roe_L - roe_{t+5}) - k_t\right) \cdot B_{t+\tau-1}}{(1+k_t)^{\tau}}$$

$$S_3 \equiv \sum_{\tau=11}^{\infty} \frac{(roe_L - k_t) \cdot B_{t+\tau-1}}{(1+k_t)^{\tau}}$$

roe_L = expected long-term returns on equity.

Figure 1: Three-Stage Residual Income Model



In previous literature, the approach of implied expected returns has been applied as a descriptive tool. CLAUS/THOMAS (2001) estimate the equity risk premium and GEBHARDT/LEE/SWAMINATHAN (2001) the company's cost of capital. However, the method has not been used for selecting stocks in portfolio management. This gap is filled here by investigating two active stock selection strategies which are based on implied expected returns. The first strategy is concerned with the difference between the implied expected returns of the portfolio strategy and the implied expected returns of the benchmark. This difference is referred to as ''total expected excess returns'' and is maximized subject to a constraint on the tracking error (section 2.2). The second approach adjusts implied expected returns by equilibrium expected returns (e.g., GRINOLD/KAHN (1999)), which are calculated by the capital asset pricing model (CAPM) of SHARPE (1964) and LINTNER (1965). Although the CAPM is not the only equilibrium model that forecasts the expected return, it is one of the most widely used.[2] If one assumes the CAPM to be the true equilibrium model, deviations between implied and CAPM expected returns can be interpreted as mispricings. However, one has to be careful with the term ''mispricing'' because if the CAPM holds, no mispricing exists, since the capital market is in equilibrium. Therefore, I do not speak of ''mispricings'' but instead of ''exceptional expected excess returns'', following GRINOLD/KAHN (1999). The investment strategy that maximizes exceptional expected excess returns is developed in Section 2.3.

2.2 Portfolio Optimization with a Tracking Error Constraint

The first investment strategy maximizes the expected return of an active portfolio P in excess of a benchmark portfolio M, given a constraint on the tracking error. Optimal portfolio weights are obtained by solving the following optimization problem:

$$\max_{x_{iP,t}} \alpha_{P,t}^{(total)} = E_t(r_{P,t}) - E_t(r_{M,t}) = \sum_{i=1}^{N} (x_{iP,t} - x_{iM,t}) \cdot E_t(r_{i,t}) \tag{3}$$

s.t.

(i) $\sum_{i=1}^{N} x_{iP,t} = 1$

(ii) $x_{iP,t} \geq 0$

(iii) $\sum_{j=1}^{N}\sum_{i=1}^{N} (x_{iP,t} - x_{iM,t}) \cdot Cov_t(i,j) \cdot (x_{jP,t} - x_{jM,t}) \leq TE_{max}^2$

where

$\alpha_{P,t}^{(total)}$ = (total) expected excess returns of active portfolio P from t to t+1

$E_t(r_{P,t})$ = expected one-period returns of active portfolio P from t to t+1

$E_t(r_{i,t})$ = expected one-period returns of stock i from t to t+1, estimated by $k_{i,t}$

$x_{iP,t}$ = weight of stock i in active portfolio P

$x_{iM,t}$ = weight of stock i in benchmark portfolio M

N = number of stocks in benchmark portfolio M

$Cov_t(i,j)$ = covariance between returns of stock i and j.

Active portfolios are fully invested (restriction (i)) and short sales are excluded (restriction (ii)). Restriction (iii) limits the tracking error, which is the standard deviation of the return difference between the active portfolio and the benchmark portfolio. This constraint is common in practical asset management. The optimization problem can be justified if the manager is risk averse and if he is compensated according to the realized excess returns (e.g., REICHLING (1997)).

2.3 Portfolio Optimization with a CAPM Risk Constraint

Optimization (3) takes account of the risk resulting from the tracking error, but neglects the systematic risk which is measured by the CAPM-β. Therefore, portfolios optimized by (3) can have a higher systematic risk than the benchmark portfolio. As a higher β is compensated by a higher expected return, part of the portfolio's total expected excess return can be the result of a higher systematic risk. GRINOLD/KAHN (1999) consider systematic risk by adjusting the total expected excess return with their CAPM expected return. They refer to the difference as "exceptional expected excess return":

$$\alpha_{P,t}^{(exceptional)} = E_t(r_{P,t}) - \underbrace{(r_{f,t} + \beta_{P,t} \cdot \pi_t)}_{\text{CAPM expected returns}}, \qquad (4)$$

where

$\alpha_t^{(exceptional)}$ = (exceptional) expected excess return
$r_{f,t}$ = risk-free rate of return for period t to t+1
β_t = CAPM beta factor conditional on information available at time t
π_t = market risk premium for period t to t+1.

Systematic risk is considered by an additional constraint on the β-factor in optimization (3):

$$\max_{x_{iP,t}} \alpha_{P,t}^{(exceptional)} = \sum_{i=1}^{N} (x_{iP,t} - x_{iM,t}) \cdot E_t(r_{i,t}) \qquad (5)$$

s.t.

$$\text{(i)} \quad \sum_{i=1}^{N} x_{iP,t} = 1$$

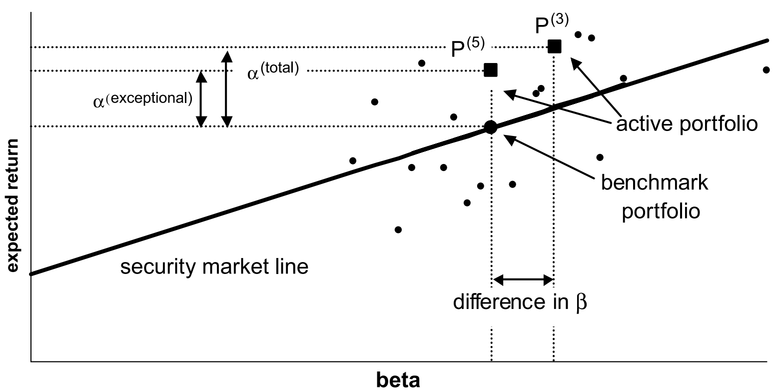
$$\text{(ii)} \quad x_{iP,t} \geq 0$$

$$\text{(iii)} \quad \sum_{j=1}^{N} \sum_{i=1}^{N} (x_{iP,t} - x_{iM,t}) \cdot Cov_t(i,j) \cdot (x_{jP,t} - x_{jM,t}) \leq TE_{max}^2$$

$$\text{(iv)} \quad \beta_{P,t} = \beta_{M,t}.$$

The difference between optimization problems (3) and (5) is illustrated in Figure 2. The solid line represents the CAPM equilibrium rate of return, which is known as the security market line (SML). In equilibrium, the benchmark portfolio (represented by a large dot) is on the SML. If single stocks (represented by small dots) deviate from the SML, the portfolio strategy is able to select a portfolio $P^{(5)}$ corresponding to optimization (5)

Figure 2: Expected Returns of Optimized Portfolio



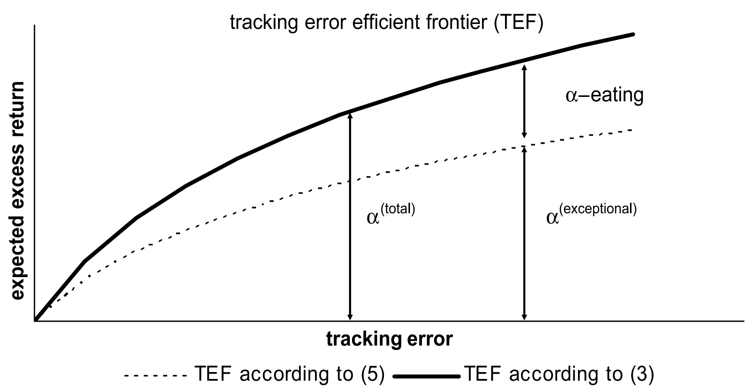
that promises exceptional expected excess returns $\alpha^{(exceptional)}$. Neglecting the β-restriction leads to optimization (3), and portfolio $P^{(3)}$ is obtained. This has a total expected excess return of $\alpha^{(total)}$, larger than $\alpha^{(exceptional)}$. However, the higher expected excess return of portfolio $P^{(3)}$ is the result of a higher β-factor. It should be noted that both portfolios, $P^{(3)}$ and $P^{(5)}$, have the same tracking error. By varying TE_{max}, different expected excess returns ($\alpha^{(total)}$ and $\alpha^{(exceptional)}$) can be achieved. A higher TE_{max} results in larger expected excess returns of the active portfolio P, whereas a lower TE_{max} leads to smaller expected excess returns. Varying TE_{max} from 0% to larger values, optimizations (3) and (5) give the tracking error efficient frontiers (TEF) displayed in Figure 3. The TEF is the locus of all portfolios that have the largest expected excess returns for a given constraint. The relationship between the expected excess returns and the tracking error is not linear because of the exclusion of short sales (e.g., GRINOLD/KAHN (1999)).

On account of the additional constraint on the β-factor, the TEF resulting from (5) is, in general, below the TEF from (3). The difference between the total expected excess returns and the exceptional expected excess returns, $\alpha^{(total)} - \alpha^{(exceptional)}$, can be termed "$\alpha$-eating". α-eating denotes the difference in return expectations due to the constraint on the β-factor. Therefore, α-eating compensates investors for bearing a higher systematic risk (β-risk). If, for example, expected returns of all stocks were equal to their CAPM expected returns ($\alpha^{(exceptional)} = 0$), the TEF corresponding to (5) would be flat, and positive total expected excess returns would simply be the result of a higher β-factor. See, for example, SCHLENGER (1998) for more on α-eating.

2.4 Convergence to CAPM Equilibrium

Optimal portfolios from (5) will have higher implied expected returns than CAPM expected returns. It is worth investigating whether implied expected returns converge to their CAPM expected returns and, therefore, decrease over time. Decreasing expected returns should have a positive effect on the realized returns of the investment strategy. A decrease in the discount rate of the residual income model (1) (i.e., implied expected returns), ceteris paribus, leads to an increase in price, and therefore, realized returns will be higher than implied expected returns. This effect is also known as the discount rate effect (FAMA/FRENCH (1988)). The convergence of implied expected returns to their CAPM equilib-

Figure 3: Tracking Error Efficient Frontier



rium rate is considered as follows. Starting with the definition of the realized return,[3]

$$r_t = \frac{P_{t+1} - P_t}{P_t}, \tag{6}$$

the observable market price P_t is replaced by a CAPM equilibrium price $P_t^{(CAPM)}$ and a CAPM deviation $DEV_t^{(CAPM)}$:

$$P_t = P_t^{(CAPM)} + DEV_t^{(CAPM)}. \tag{7}$$

Then, the realized return equals

$$r_t = \frac{P_{t+1}^{(CAPM)} + DEV_{t+1}^{(CAPM)} - P_t^{(CAPM)} - DEV_t^{(CAPM)}}{P_t}. \tag{8}$$

Defining $r_t^{(CAPM)} \equiv (P_{t+1}^{(CAPM)} - P_t^{(CAPM)})/P_t^{(CAPM)}$ as the return in CAPM equilibrium and $r_t^{(DEV)} \equiv (DEV_{t+1}^{(CAPM)} - DEV_t^{(CAPM)})/DEV_t^{(CAPM)}$ as the change in CAPM deviations, (8) can be written as [4]

$$\begin{aligned} r_t^{(CAPM,DEV)} &= r_t^{(CAPM)} \cdot (1 - NDEV_t) \\ &\quad + r_t^{(DEV)} \cdot NDEV_t, \end{aligned} \tag{9}$$

where $NDEV_t = DEV_t^{(CAPM)}/P_t$ is the normalized CAPM deviation. Then, the realized return is a weighted sum of the CAPM equilibrium return and the change in CAPM deviation. The normalized CAPM deviation can be approximated in terms of implied expected returns and CAPM expected returns as [5]

$$\begin{aligned} NDEV_t &= \frac{k_t^{(CAPM)} - k_t}{k_t^{(CAPM)} - g} \\ &= \frac{-\alpha_t^{(exceptional)}}{k_t^{(CAPM)} - g}, \end{aligned} \tag{10}$$

where g is the growth rate in book value. If the CAPM expected return $k_t^{(CAPM)}$ equals the implied expected return k_t, the normalized CAPM deviation is zero. In this case, the realized return r_t equals the realized return in CAPM equilibrium. If, however, $NDEV_t$ differs from zero, the realized return r_t can be higher or lower than in CAPM equilibrium. It will be higher when (i) the implied expected return is higher than the CAPM expected return (i.e., $NDEV_t < 0$) and (ii) the change in the CAPM deviation is negative (i.e., $r_t^{(DEV)} < 0$). One condition for CAPM deviations becoming smaller is a decrease in implied expected returns from t to t + 1 (i.e., implied expected returns converge to CAPM expected returns).[6]

2.5 Analyst Optimism

There is considerable evidence that analyst estimates are overly optimistic (e.g., CLEMENT (1999), EASTERWOOD/NUTT (1999), JACOB/LYS/NEALE (1999), MICHAELY/WOMACK (1999), HONG/KUBIK (2003), BECKERS/STELIAROS/THOMSON (2004), WALLMEIER (2004)). This optimism bias can be explained by conflicts of interest. Analysts have an incentive not to publish unfavorable earnings forecasts in order to support their relations with the company concerned and thus to attract additional revenues for their employer (i.e., the brokerage company). If earnings forecasts are optimistic, implied expected returns are also an optimistic estimator for return expectations. According to (2), inflated earnings (i.e., inflated returns on equities) result, ceteris paribus, in a higher discount rate. Then, part of the discount rate might be attributed to analyst optimism, while the remaining part could be assigned to the stock price:

$$k_t = k_t^{(PRICE)} + k_t^{(OPTIMISM)}, \tag{11}$$

where

$k_t^{(PRICE)}$ = implied expected returns at t due to stock price
$k_t^{(OPTIMISM)}$ = implied expected returns at t due to analyst optimism.

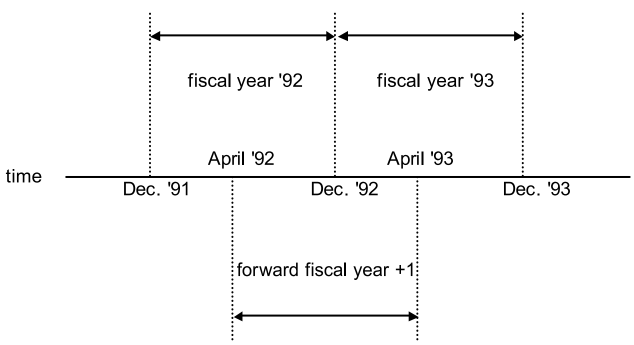
When optimizing a portfolio, an investor may like to reduce the impact of analyst optimism on implied expected returns. Unfortunately, the extent of analyst optimism is not known when portfolios are optimized. Therefore, the optimism bias will be empirically estimated in Section 3.

3. Empirical Results

3.1 Data and Sample Description

In this section, optimization problems (3) and (5) are solved empirically on the basis of an index of large cap stocks. The sample consists of all stocks that were constituents of the DJ Stoxx 50 index at the end of 2000. The DJ Stoxx 50 index is thus considered to be the benchmark index. Data on prices, return indices and book values are supplied by Datastream. Expected earnings are provided by I/B/E/S. The sample period covers monthly data from December 1989 up to December 2000. End-of-month data is used. All prices are converted into Euro. The sample had a combined market value of approximately € 4000 bn on December 31, 2000. This represented more than 50% of the total stock market capitalization in Europe. Limiting the empirical analysis to blue chip stocks has several distinct advantages. First, most institutional investors are evaluated and compensated according to benchmarks which include the investigated stocks. Second, transaction volumes in large cap stocks are high, therefore the implementation of the active portfolio strategy should have no major impact on prices. Third, bid-ask spreads of large cap stocks are usually low suggesting low transaction costs. Therefore, the results of the following portfolio strategies should be of interest to many investors.

Figure 4: Timing Conventions



Implied expected returns are calculated each month by solving (2) for k_t. However, book values and earnings estimates refer to fiscal years, most of which end on December 31 (but can deviate). The problem of different time intervals (i.e., monthly return estimation and yearly fundamental data) is addressed as follows: Instead of fiscal years' accounting data, forward book values and earnings estimates are calculated on a rolling basis as illustrated in Figure 4. If the fiscal year ends in December '91, forward earnings in April '92 are calculated as follows:

$$\text{forward earnings estimate in April '92} = \frac{8}{12} \cdot \text{earnings estimate for the fiscal year } 1992 + \frac{4}{12} \cdot \text{earnings estimate for the fiscal year, } 1993$$

Book values are computed in the same way.

β-factors are calculated by regressions using realized returns over the previous two years. The market risk premium is approximated by the difference between the implied expected return of the DJ Stoxx 50 index (i.e., the benchmark) and the yield of 10-year German government bonds, which proxies the risk-free rate of return.

3.2 Results of Portfolio Strategies

An active portfolio is optimized according to (3) or (5) at the end of each month. This portfolio realizes a return of $r_{t,P}$ in the subsequent month, while the benchmark index DJ Stoxx 50 yields a return of $r_{t,M}$. The difference between the two returns,

$$\Delta r_t = r_{P,t} - r_{M,t}, \tag{12}$$

is referred to as the excess return of the active portfolio. As active portfolios are rebalanced monthly over a period of 11 years (= 132 months), the average monthly excess return is

$$\overline{\Delta r_t} = \frac{1}{132} \sum_{t=\mathrm{Dec.89}}^{\mathrm{Nov.00}} \Delta r_t. \tag{13}$$

If $\overline{\Delta r_t}$ is significantly greater than zero, the active portfolio strategy is able to achieve higher returns than the benchmark portfolio. Applying optimization (5), the excess returns are adjusted for CAPM risk. Without knowing the portfolio manager's objective (i.e., the utility function), the optimal trade-off between the expected excess returns and the active risk cannot be determined. Therefore, the restriction on the tracking error is varied from 1% to 12%. Results are displayed in Table 1.

Panel A of Table 1 displays average return differences between portfolios optimized according to (3) and the benchmark index. Panel B shows corresponding results for portfolios optimized according to (5). In general, active portfolios achieve positive excess returns for all levels of tracking error restrictions. These results indicate that implied expected returns can be successfully exploited by an active investment strategy. The observed excess returns are both economically and statistically significant. For example, an active portfolio according to (5) with a maximum tracking error of 6% yields monthly excess returns of 0.59% on average. This corresponds to yearly excess returns of 8.70% (the average monthly return of the benchmark index is $\overline{r_{M,t}}$ = 1.59% in the sample period). All t-values for a tracking error restriction greater than 3% exceed two. It is worth noting that all information used for implied expected return calculations is available at the time of optimization. Therefore, the excess returns are the result of publicly available information. The effects of α-eating can also be seen. For example, by restricting the tracking error to 8%, a portfolio optimized according to (3) realizes average (total) excess returns of 0.88% per month, while a portfolio optimized according to (5) achieves average (exceptional) excess returns of 0.74% per month. Therefore, α-eating leads to a difference in average excess returns of 0.14% per month.

Table 1: Results of the Average Monthly Returns of the Active Portfolio in Excess of the Market Index

TE_{max}	$\overline{\Delta r_t}$	*t-value*	TE_{max}	$\overline{\Delta r_t}$	*t-value*	TE_{max}	$\overline{\Delta r_t}$	*t-value*
Panel A: Optimization (3)								
1%	0.11%	0.88	5%	0.56%	2.66	9%	0.98%	3.49
2%	0.33%	2.06	6%	0.65%	2.86	10%	1.00%	3.52
3%	0.45%	2.43	7%	0.80%	3.31	11%	1.09%	3.37
4%	0.51%	2.67	8%	0.88%	3.40	12%	1.16%	3.48
Panel B: Optimization (5)								
1%	0.09%	0.74	5%	0.50%	2.62	9%	0.81%	2.94
2%	0.18%	1.26	6%	0.59%	2.70	10%	0.83%	2.80
3%	0.25%	2.17	7%	0.66%	2.77	11%	0.89%	2.79
4%	0.38%	2.62	8%	0.74%	2.89	12%	0.94%	2.78

Note:
Period: 12/1989–12/2000

3.3 CAPM Convergence and Analyst Optimism

Table 2 compares monthly realized excess returns with average expected exceptional excess returns. The average expected excess return of the investment strategy that optimizes portfolios according to (5) is calculated by

$$\overline{\alpha_t^{(exceptional)}} = \frac{1}{132} \sum_{t=Dec.89}^{Nov.00} \left(k_{P,t}^{(m)} - k_{M,t}^{(m)} \right) \qquad (14)$$

where $k_{\cdot,t}^{(m)} = (1 + k_{\cdot,t})^{1/12} - 1$ are the respective expected returns corresponding to monthly intervals.

Average realized excess returns $\overline{\Delta r_t}$ should approximately equal average expected exceptional excess returns $\overline{\alpha_t^{(exceptional)}}$ if implied expected returns remain constant over time. If expected exceptional excess returns decrease over time, $\overline{\Delta r_t}$ should, ceteris paribus, be larger than $\overline{\alpha_t^{(exceptional)}}$. Table 2 shows that $\overline{\Delta r_t}$ is approximately three times the size of $\overline{\alpha_t^{(exceptional)}}$ (for tracking error restrictions above 4%). This is possibly the result of the discount rate effect, which occurs as implied expected returns of the optimized portfolio become smaller over time. As will be shown shortly, implied expected returns converge to their CAPM expected returns.

Realized returns are now investigated according to (9). Therefore, the normalized CAPM deviation $NDEV_t$ and the change in CAPM deviation $r_t^{(DEV)}$ have to be calculated. The calculation of $r_t^{(DEV)}$ requires an estimate of the change in implied expected returns from t to t + 1.[6] For this estimate, the implied expected returns of the active portfolio are calculated one month after the optimization date (keeping the portfolio weights constant). Averaging over all observations yields

$$\overline{k_{P,t+1}} = \frac{1}{132} \sum_{t=Dec.89}^{Nov.00} \left(\sum_{i=1}^{N} x_{iP,t} \cdot k_{i,t+1} \right), \qquad (15)$$

where

$\overline{k_{P,t+1}}$ = average implied expected returns of active portfolio P at t + 1 with optimal weights as in t

$k_{i,t+1}$ = implied expected returns of stock i at t + 1

$x_{iP,t}$ = weight of stocks i in portfolio P at t + 1 (same weight as in t).

For a tracking error restriction of 6%, for example, the average of P's implied expected returns on optimization date is $\overline{k_{P,t}} \approx 0.97\%$ (column 2, Table 3). After one month, the average of implied expected returns has fallen to $\overline{k_{P,t+1}} \approx 0.96\%$.[7] Therefore, implied expected returns of P converge (slowly) to the CAPM expected returns which are assumed to equal the average of implied expected returns of the benchmark portfolio, $\overline{k_{M,t}} = k_t^{(CAPM)} \approx 0.78\%$ (column 3, Table 3). With these

Table 2: Average Monthly Realized Excess Returns and Average Monthly Expected Exceptional Excess Returns

TE_{max}	$\overline{\Delta r_t}$	$\overline{\alpha_t^{(exceptional)}}$	TE_{max}	$\overline{\Delta r_t}$	$\overline{\alpha_t^{(exceptional)}}$	TE_{max}	$\overline{\Delta r_t}$	$\overline{\alpha_t^{(exceptional)}}$
1%	0.09%	0.06%	5%	0.50%	0.17%	9%	0.81%	0.25%
2%	0.18%	0.10%	6%	0.59%	0.19%	10%	0.83%	0.27%
3%	0.25%	0.12%	7%	0.66%	0.22%	11%	0.89%	0.28%
4%	0.38%	0.15%	8%	0.74%	0.23%	12%	0.94%	0.29%

Note:
Period: 12/1989–12/2000

figures, the change in CAPM deviation over one month (column 4, Table 3) equals

$$r_t^{(DEV)} \approx (1+0.49\%) \cdot \frac{[0.78\% - 0.96\%]\cdot[0.97\% - 0.49\%]}{[0.78\% - 0.97\%]\cdot[0.96\% - 0.49\%]} - 1 \approx -2.64\%$$

where 0.49% is the monthly growth rate in book value. The normalized CAPM deviation (column 5, Table 3) has a value of

$$NDEV_t \approx \frac{0.78\% - 0.97\%}{0.78\% - 0.49\%} \approx -63.83\%.$$

According to (9), one would expect the optimized portfolio P to realize returns of

$$r_{P,t}^{(CAPM,DEV)} \approx 0.78\%\cdot(1+63.83\%) + (-2.63\%)\cdot(-63.83\%) \approx 2.97\%$$

per month. Comparing $r_{P,t}^{(CAPM,\ DEV)} = 2.97\%$ (column 6, Table 3) with the observed realized returns $\overline{r_{P,t}} = 2.19\%$ (column 7, Table 3), one notes a difference. This difference can be explained by analyst optimism in earnings estimates. Optimistic earnings estimate would result in an optimism bias in the implied expected returns, which also influences the calculation of $NDEV_t$ and $r_t^{(DEV)}$. If $r_{P,t}^{(CAPM,\ DEV)}$ in (9) is equated with the observed realized returns $\overline{r_{P,t}}$, and the resulting equation is solved for k_t, then this k_t should be free from optimism bias and could therefore be replaced by $k_t^{(PRICE)}$. This procedure relies on the assumption that an optimism bias and changes in the optimism bias do not drive realized returns. Then, the difference between implied expected returns derived from (2) and $k_t^{(PRICE)}$ gives an estimate of the average optimism bias $k_t^{(OPTIMISM)}$. Unfortunately, (9) cannot be explicitly solved for k_t. Therefore, one has to rely on numerical solution methods. For a tracking error restriction of 6%, $k_t^{(PRICE)}$ equals 0.89% (column 8, Table 3) and $k_t^{(OPTIMISM)}$ equals 0.08% (last column, Table 3). An optimal portfolio with a tracking error restriction of 6% has on average exceptional expected excess returns of 0.19% per month. 0.08% of these 0.19% can be attributed to an optimism bias. This bias should allow investors with better (e.g., unbiased) earnings estimates to improve the results of their

Table 3: Optimism Bias in Implied Expected Returns

TE_{max} (1)	$\overline{k_{P,t}}$ (2)=(8)+(9)	$\overline{k_t^{(CAPM)}}$ (3)	$r_t^{(DEV)}$ (4)	$NDEV_t$ (5)	$r_{P,t}^{(CAPM,\ DEV)}$ (6)	$\overline{r_{P,t}}$ (7)	$k_t^{(DEV)}$ (8)	$k_t^{(OPTIMISM)}$ (9)
1%	0.85%	0.78%	−3.73%	−20.16%	1.69%	1.68%	0.85%	0.00%
2%	0.88%	0.78%	−3.32%	−33.59%	2.16%	1.77%	0.85%	0.03%
3%	0.90%	0.78%	−3.15%	−40.31%	2.37%	1.84%	0.86%	0.04%
4%	0.93%	0.78%	−2.91%	−50.39%	2.65%	1.98%	0.87%	0.06%
5%	0.95%	0.78%	−2.77%	−57.11%	2.81%	2.10%	0.88%	0.07%
6%	0.97%	0.78%	−2.64%	−63.83%	2.97%	2.19%	0.89%	0.08%
7%	1.01%	0.78%	−2.47%	−73.91%	3.19%	2.26%	0.90%	0.11%
8%	1.02%	0.78%	−2.41%	−77.27%	3.25%	2.34%	0.91%	0.11%
9%	1.03%	0.78%	−2.31%	−83.99%	3.38%	2.41%	0.91%	0.12%
10%	1.05%	0.78%	−2.21%	−90.70%	3.50%	2.43%	0.92%	0.13%
11%	1.06%	0.78%	−2.17%	−94.06%	3.56%	2.49%	0.92%	0.14%
12%	1.08%	0.78%	−2.12%	−97.42%	3.62%	2.54%	0.93%	0.15%

Note:
Period: 12/1989–12/2000

investment strategies. Results for tracking error restriction other than 6% are obtained in the same way and are reported in Table 3.

4. Conclusion

This paper has investigated active portfolio management strategies that are based on implied expected returns. The implied expected return is the discount rate that equates the current market price to the present value of expected earnings by a residual income model. Two investment strategies have been analyzed. The first strategy maximizes the difference between implied expected returns of the portfolio strategy and the benchmark portfolio, given a constraint on the tracking error. The second strategy additionally constrains the CAPM-β of the portfolio strategy to the CAPM-β of the benchmark.

Using the Dow Jones Stoxx 50 index as a benchmark index, both portfolio strategies are able to significantly outperform the benchmark. For example, in the period from 12/1989 to 12/2000, a tracking error restriction of 6% leads to an outperformance of 0.65% per month. With an additional restriction on the portfolio-β, an outperformance of 0.59% per month is achieved. Thus, using implied expected returns as return expectations, investors were able to outperform the Dow Jones Stoxx 50 Total Return Index by more than 8% per year.

It has been shown that the realized outperformance is three times as large as the difference in implied expected returns, which proxies the expected outperformance should discount rates remain constant. Therefore, two thirds of the realized outperformance can be attributed to changes in implied expected returns. It is found that implied expected returns converge to their CAPM equilibrium level. However, the convergence of market prices to their equilibrium prices seems to be slow. After one month, the CAPM deviation in price has been reduced by between 2% and 4%. These empirical observations support the following conclusion. Although, in the short-term, market prices seem to be in disequilibrium, in the long-term, they converge to their equilibrium values. Considering a potential analyst optimism in forecasted earnings may impact the estimation of implied expected returns. The resulting optimism bias in implied expected returns is approximately 50% of the observed CAPM deviation. One can conclude that the removal of the analyst bias could potentially improve return estimates and, finally, portfolio results. Investigation of this particular issue is left to future research.

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ENDNOTES

[1] Assuming clean surplus, the residual income model equals the dividend discount model.

[2] Although the CAPM is widely used as an equilibrium model, its track record in explaining the cross-section of realized returns is quite poor. See, for example, FAMA/FRENCH (1992).

[3] If dividends are paid in $t + 1$, they are, for notational simplicity, included in the price P_{t+1}.

[4] The realized return can be split into a part justified by the CAPM and a part resulting from CAPM deviations:

$$
\begin{aligned}
r_t &= \frac{P_{t+1}^{(CAPM)} + DEV_{t+1}^{(CAPM)} - P_t^{(CAPM)} - DEV_t^{(CAPM)}}{P_t} \\
&= \frac{P_{t+1}^{(CAPM)} - P_t^{(CAPM)}}{P_t} + \frac{DEV_{t+1}^{(CAPM)} - DEV_t^{(CAPM)}}{P_t} \\
&= \frac{P_{t+1}^{(CAPM)} - P_t^{(CAPM)}}{P_t} \cdot \frac{P_t^{(CAPM)}}{P_t^{(CAPM)}} \\
&\quad + \frac{DEV_{t+1}^{(CAPM)} - DEV_t^{(CAPM)}}{P_t} \cdot \frac{DEV_t^{(CAPM)}}{DEV_t^{(CAPM)}} \\
&= \frac{P_{t+1}^{(CAPM)} - P_t^{(CAPM)}}{P_t^{(CAPM)}} \cdot \frac{P_t - DEV_t^{(CAPM)}}{P_t} \\
&\quad + \frac{DEV_{t+1}^{(CAPM)} - DEV_t^{(CAPM)}}{DEV_t^{(CAPM)}} \cdot \frac{DEV_t^{(CAPM)}}{P_t} \\
&= r_t^{(CAPM)} \cdot (1 - NDEV_t) + r_t^{(DEV)} \cdot NDEV_t
\end{aligned}
$$

This is equation (9).

[5] Before modifying the normalized CAPM deviation $NDEV_t$, the price of a stock according to (1) will be simplified. Therefore, a constant roe ($roe_t = roe_{t+1} = roe_{t+2} = \ldots$) and a constant growth rate in the book value ($B_t = B_{t-1}(1+g)$) is assumed:

$$
\begin{aligned}
P_t &= B_t + \frac{(roe - k_t) \cdot B_t}{(1+k_t)} + \frac{(roe - k_t) \cdot B_{t+1}}{(1+k_t)^2} \\
&\quad + \frac{(roe - k_t) \cdot B_{t+2}}{(1+k_t)^3} + \ldots = B_t + \frac{(roe - k_t) \cdot B_t}{(1+k_t)} \\
&\quad + \frac{(roe - k_t) \cdot B_t \cdot (1+g)}{(1+k_t)^2} + \frac{(roe - k_t) \cdot B_t \cdot (1+g)^2}{(1+k_t)^3} + \ldots \\
&= B_t + B_t \cdot (roe - k_t) \cdot \sum_{\tau=1}^{\infty} \frac{(1+g)^{\tau-1}}{(1+k_t)^{\tau}} = B_t \cdot \frac{roe - g}{k_t - g}. \qquad (A1)
\end{aligned}
$$

Replacing real price P_t with equilibrium price $P_t^{(CAPM)}$, and k_t with CAPM expected return $k_t^{(CAPM)}$ yields:

$$
P_t^{(CAPM)} = B_t \cdot \frac{roe - g}{k_t^{(CAPM)} - g} \qquad (A2)
$$

Substituting (A1) for P_t, and (A2) for $P_t^{(CAPM)}$ in $NDEV_t$ yields

$$
\begin{aligned}
NDEV_t &= \frac{DEV_t^{(DEV)}}{P_t} \\
&= \frac{P_t - P_t^{(CAPM)}}{P_t} \\
&= \frac{B_t \cdot \frac{roe - g}{k_t - g} - B_t \cdot \frac{roe - g}{k_t^{(CAPM)} - g}}{B_t \cdot \frac{roe - g}{k_t - g}} \\
&= 1 - \frac{k_t - g}{k_t^{(CAPM)} - g} \\
&= \frac{k_t^{(CAPM)} - k_t}{k_t^{(CAPM)} - g} \\
&= \frac{-\alpha_t}{k_t^{(CAPM)} - g}
\end{aligned}
$$

This is equation (10).

[6] To investigate the condition when $r_t^{(DEV)}$ is smaller than zero, the change in CAPM deviation has to be modified as follows:

$$
\begin{aligned}
r_t^{(DEV)} &= \frac{DEV_{t+1}^{(CAPM)} - DEV_t^{(CAPM)}}{DEV_t^{(CAPM)}} \\
&= \frac{P_{t+1} - P_{t+1}^{(CAPM)}}{P_t - P_t^{(CAPM)}} - 1 \\
&= \frac{\frac{roe - g}{k_{t+1} - g} \cdot B_t \cdot (1+g) - \frac{roe - g}{k_{t+1}^{(CAPM)} - g} \cdot B_t \cdot (1+g)}{\frac{roe - g}{k_t - g} \cdot B_t - \frac{roe - g}{k_t^{(CAPM)} - g} \cdot B_t} - 1 \\
&= (1+g) \cdot \frac{\frac{1}{k_{t+1} - g} - \frac{1}{k_{t+1}^{(CAPM)} - g}}{\frac{1}{k_t - g} - \frac{1}{k_t^{(CAPM)} - g}} - 1
\end{aligned}
$$

Assuming that the CAPM expected return does not change over time (i.e., $k_t^{(CAPM)} = k_{t+1}^{(CAPM)}$) yields:

$$r_t^{(DEV)} = (1+g)\cdot \frac{\dfrac{1}{k_{t+1}-g} - \dfrac{1}{k_t^{(CAPM)}-g}}{\dfrac{1}{k_t-g} - \dfrac{1}{k_t^{(CAPM)}-g}} - 1$$

$$= (1+g)\cdot \frac{\left[k_t^{(CAPM)} - k_{t+1}\right]\cdot[k_t - g]}{\left[k_t^{(CAPM)} - k_t\right]\cdot[k_{t+1} - g]} - 1.$$

For positive k_t, only if $k_{t+1} < k_t$ holds, $r_t^{(DEV)}$ can be negative.

[7] After one year, the average implied expected return has fallen to $\overline{k_{P,t+12}} \approx 0.92\%$. This approximately equals 70% of the portfolios CAPM deviation on the optimization date. Therefore, the CAPM deviation is reduced by 30% within twelve months.

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