

# FIE401 - Second assignment

## Is momentum priced in the Norwegian stock market?

Group 08

2022-10-13

### **Abstract**

In this assignment, we analyze whether momentum is priced in the Norwegian stock market. We based our analysis on the Fama Mac Beth approach, using 10 portfolios sorted by size and book to market. From the first step, we found a positive relationship between exposure to the momentum factor and expected returns of the portfolios. After the second state it became clear that for portfolios sorted by size, there it a demand for a risk premium for exposure to momentum risk. For the portfolios ranked by book to market the significance was lower, and we could not conclude the risk premium to be different from zero, hence the risk premium could be zero for these portfolios. To answer the assignment question, we can assume that stocks or portfolios that are exposed to a momentum risk factor earn a higher expected return.

## Exploratory analysis

Figure 1 shows that factors are not significantly correlated, therefore we should be able to study the momentum factor loading effect on Size and Book-to-market portfolios.

Table 1 demonstrates that portfolio with small size firms have higher returns and standard deviations compared to big size, most likely because investors consider firms of the small size riskier. The trend can also be seen on Figure 2, as the returns of the small-size portfolio are more skewed to the right, compared to big size.

As Table 2 and Figure 3 demonstrate, Book-to-market portfolios do not have such a clear pattern, even though the book-to-market effect is well documented in finance. In general, high book-to-market stocks, also referred as value stocks, earn significant positive excess returns while low book-to-market stocks, also referred as growth stocks, earn significant negative excess returns. Potentially lack of effect can be explained by the sample period.

Figure 1: Factor correlation matrix

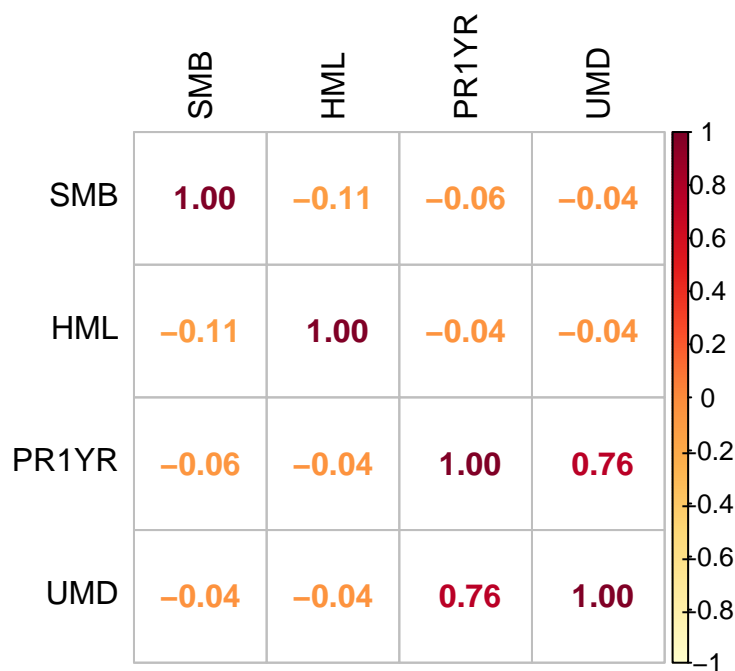


Table 1: Summary statistics size portfolios

Statistic	Min	Pctl(25)	Mean	Pctl(75)	Max	St. Dev.
Small.size.1	−0.267	−0.007	0.044	0.070	1.007	0.103
SIZE 2	−0.121	−0.011	0.037	0.067	0.371	0.076
SIZE 3	−0.263	−0.011	0.028	0.058	0.403	0.076
SIZE 4	−0.212	−0.012	0.026	0.057	0.332	0.072
SIZE 5	−0.170	−0.014	0.027	0.060	0.359	0.068
SIZE 6	−0.158	−0.009	0.030	0.064	0.797	0.077
SIZE 7	−0.234	−0.015	0.025	0.058	0.381	0.070
SIZE 8	−0.211	−0.016	0.023	0.062	0.554	0.070
SIZE 9	−0.250	−0.019	0.019	0.059	0.252	0.073
Large.size.10	−0.279	−0.020	0.015	0.054	0.219	0.064

Figure 2: Density plot returns of small and large size portfolios

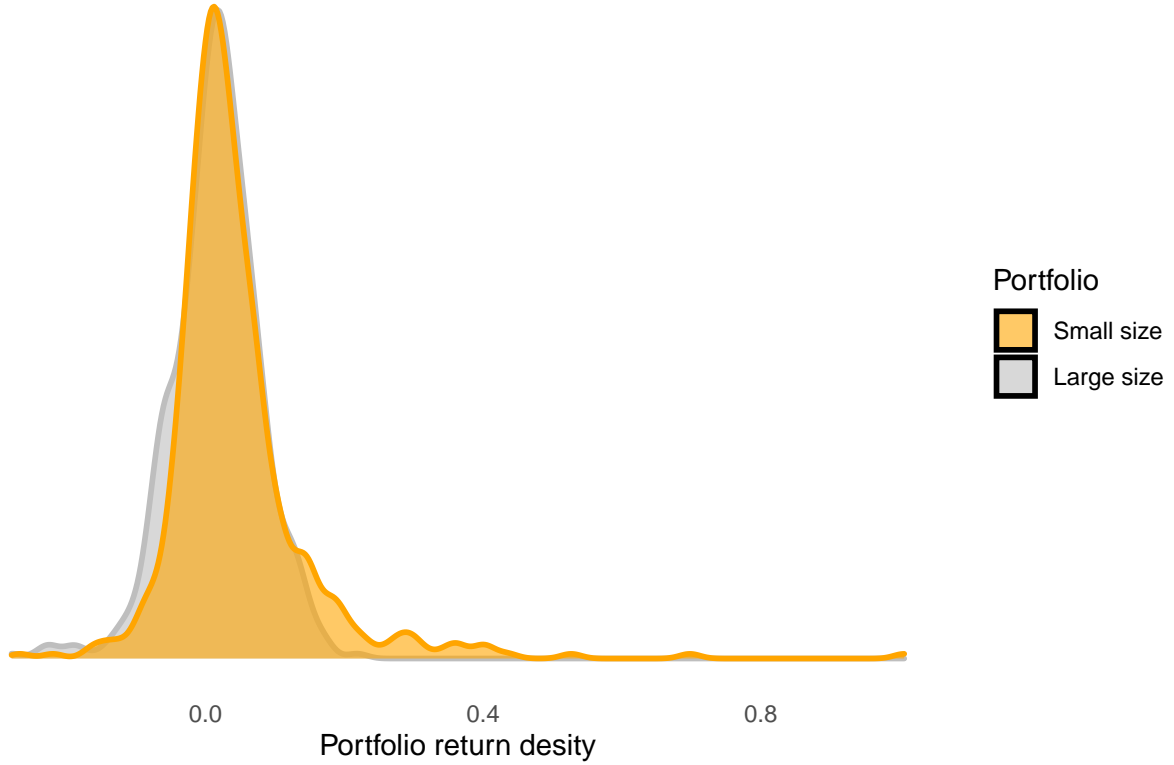


Table 2: Summary statistics book-to-market portfolios

Statistic	Min	Pctl(25)	Mean	Pctl(75)	Max	St. Dev.
Low.bm.1	-0.265	-0.023	0.021	0.063	0.666	0.082
BM 2	-0.331	-0.028	0.023	0.060	0.884	0.100
BM 3	-0.344	-0.025	0.015	0.056	0.311	0.076
BM 4	-0.269	-0.022	0.020	0.057	0.270	0.074
BM 5	-0.285	-0.027	0.018	0.063	0.302	0.079
BM 6	-0.316	-0.029	0.019	0.061	0.524	0.081
BM 7	-0.294	-0.025	0.022	0.069	0.312	0.081
BM 8	-0.285	-0.020	0.023	0.070	0.461	0.089
BM 9	-0.264	-0.018	0.027	0.064	0.852	0.093
High.bm.10	-0.254	-0.021	0.027	0.070	0.333	0.086

Figure 3: Density plot returns of low and high BM portfolios

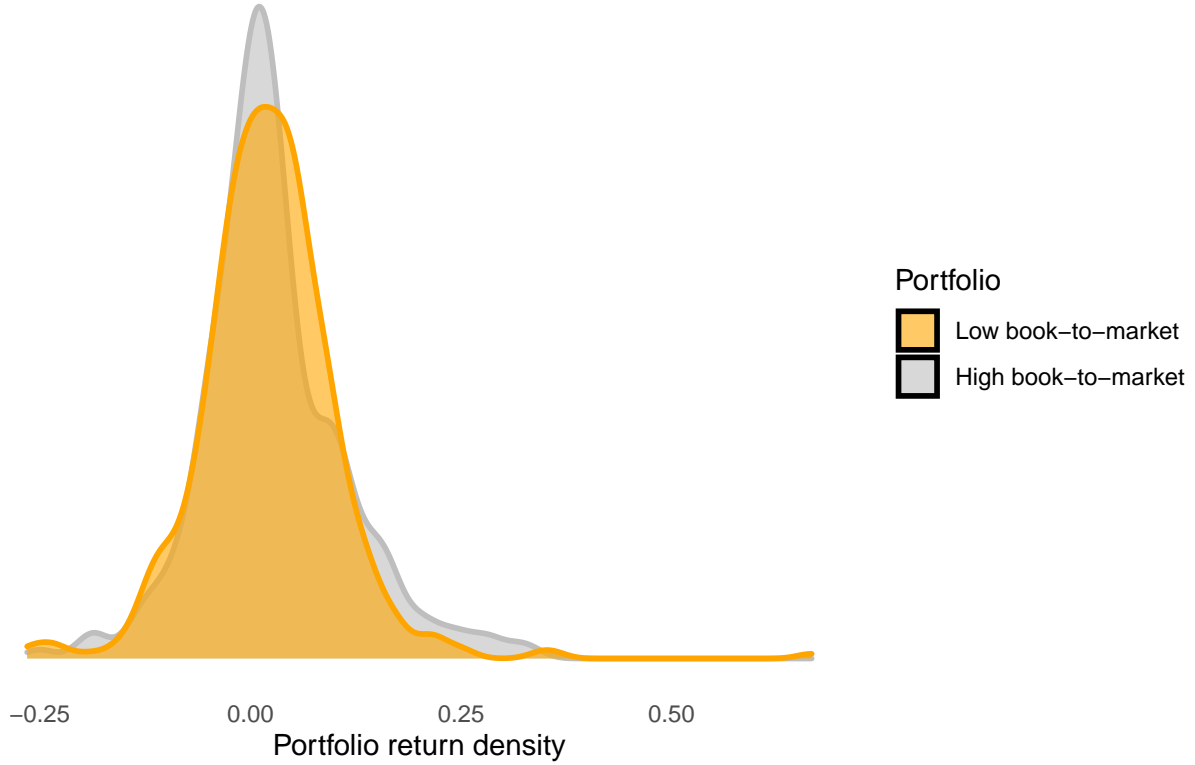


Table 3: Summary statistics momentum portfolio

Statistic	Min	Pctl(25)	Mean	Pctl(75)	Max	St. Dev.
SMB	-0.288	-0.018	0.012	0.038	0.289	0.049
HML	-0.281	-0.025	0.003	0.035	0.228	0.057
PR1YR	-0.184	-0.012	0.017	0.048	0.236	0.054
UMD	-0.277	-0.020	0.013	0.049	0.224	0.062

## Size portfolios and momentum

Figure 4: Size portfolio, momentum betas and returns

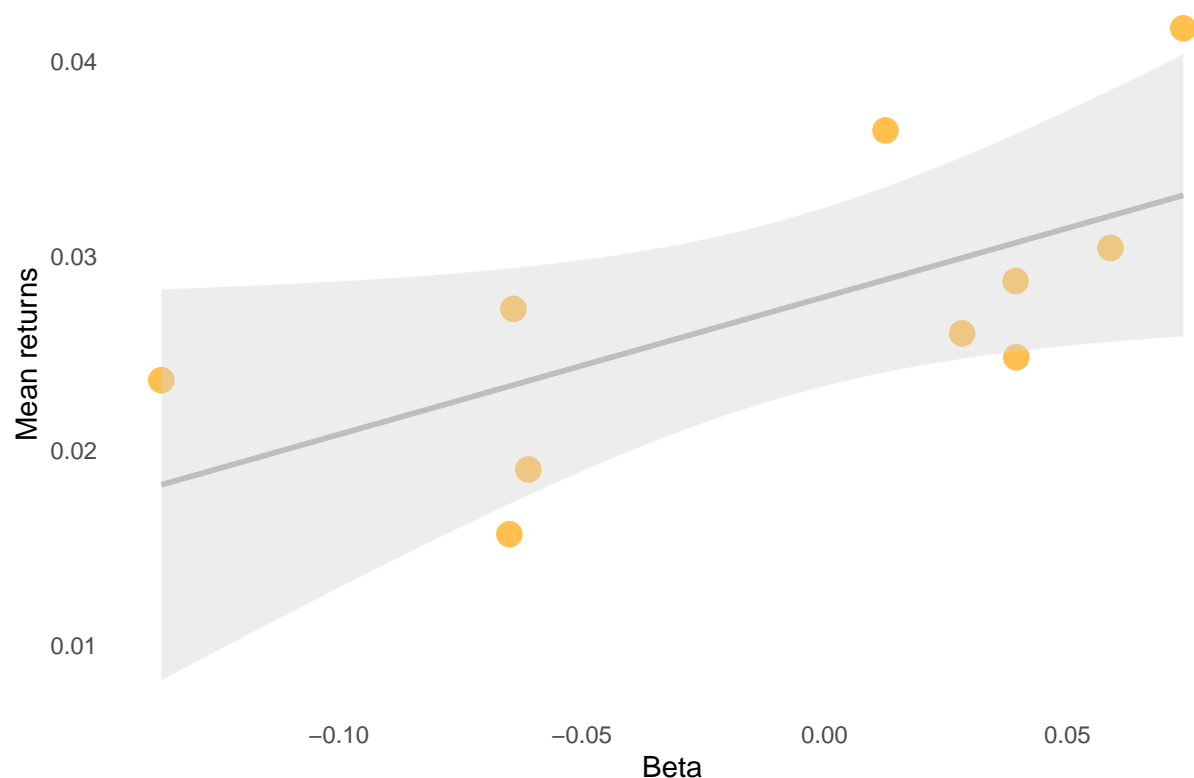


Table 4: Gamma significance test: Size

estimate	statistic	p.value	parameter	conf.low	conf.high	method	alternative
0.0707208	4.969478	5e-07	477	0.0472673	Inf	One Sample t-test	greater

Interpretation:

From the scatter plot we can observe a slight positive co-movement between the portfolios return and the momentum factor. This correlation implies that a higher exposure to momentum factor is associated with a higher compensation for exposure. According to economic theory this seems to indicate that momentum can be a risk factor and investors require a higher return for higher risk. However, the high error variance is a substantial concern in terms of predicting returns on basis of the beta in this linear regression.

The model gives us a t-value of 4,969 which is statistically significant at a 1% level. Which implies that we can reject the Null Hypothesis that the true mean is equal to 0. The mean of x in the One Sample t-test is 0,0707 (the estimated coefficient). An interpretation of this could be that for each unit of exposure to momentum factor, we demand a risk premium of 7,07%. However, the sample contains small variance in portfolio's exposure to momentum factor, therefore the results might be inconsistent.

## Book-to-market portfolios and momentum

Figure 5: BM portfolios, momentum betas and returns

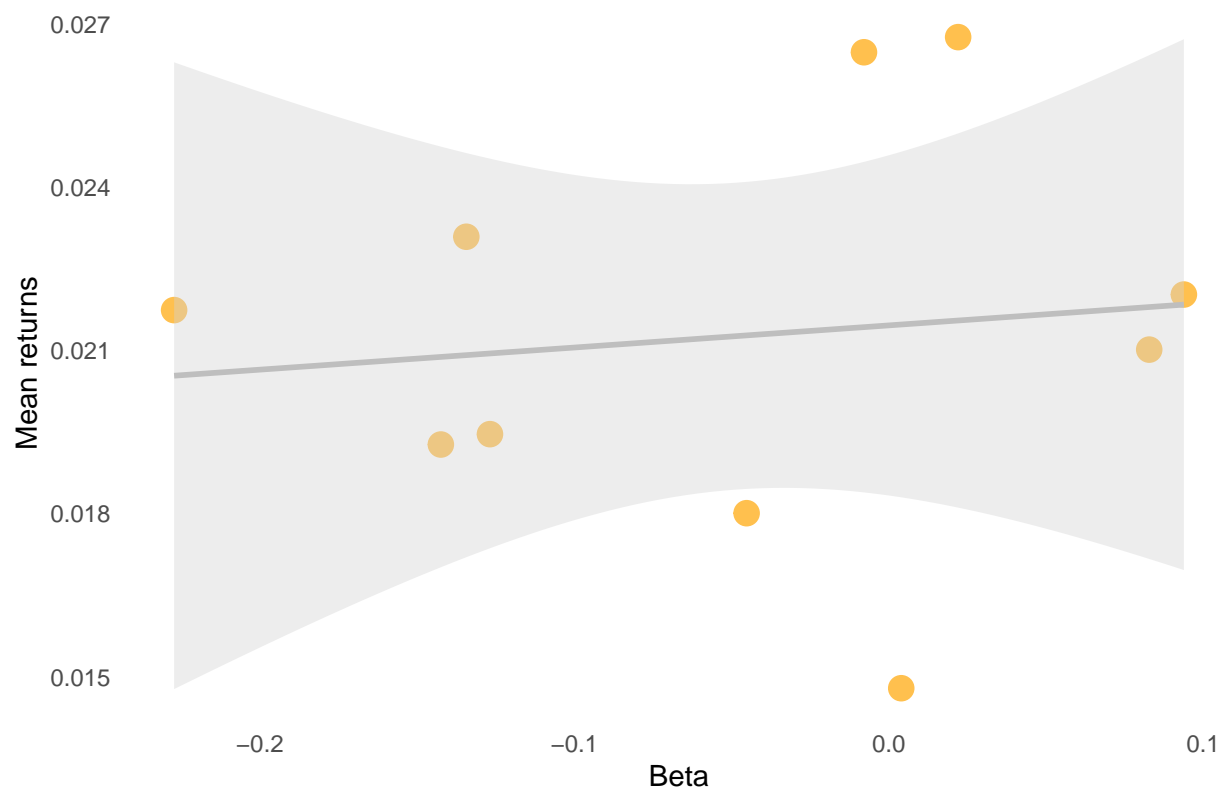


Table 5: Gamma significance test: Book-to-market

estimate	statistic	p.value	parameter	conf.low	conf.high	method	alternative
0.0040689	0.4275285	0.3345937	477	-0.0116161	Inf	One Sample t-test	greater

Interpretation:

The scatter plot does not demonstrate any clear indicators that the relationship between momentum exposure and returns is either positive or negative. In contrast to size portfolios we cannot observe any pattern that portfolios with higher/lower BM have higher/lower average returns. The mean gamma is 0,00406, which means that for every unit of exposure the average required return will increase by 0,04%. However the model has a t-value of 0.4275, and we can therefore conclude that the beta is not statistically different from zero.

## Conclusion

- Which bias might you be concerned about in this analysis, and how would it affect your results?

In this study we considered 478 slopes and then performed a t-test to check whether the mean is significantly different from 0. Several of the assumptions of the t-test could have been violated, the observations are not independent and potentially not normally distributed. Moreover, when performing second step of Fama

MacBeth, we are using only 10 observations (10 portfolios), which might lead to a very imprecise estimation of the beta.

- Why don't you find the same results for portfolios sorted on book-to-market as for size? Remember, both portfolios are constructed from the same set of stocks.

As shown in the Table 2, the mean returns of a Book-to-market portfolios are fairly consistent across portfolios (mean from 0.015 to 0.027), with a potentially U-shaped relationship, while Table 3 demonstrates that mean returns of Size portfolios have higher variance (from 0.016 to 0.042), this potentially allows to detect the relationship better. Moreover, the statistical significance of the regressions was not tested, therefore, Book-to-market portfolios might not have significant exposure to momentum, while Size portfolios do. It can occur with the same set of stocks when stocks that are positively exposed to momentum and stocks that are negatively exposed to momentum are combined in the same portfolio.