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Portfolio Management - Applications

Value factor

Assignment 1 - Report

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1 How to understand our solutions

2 Declaring the intent to present

We can both present.

3 Main part

First, we had a look at the mean returns of every portfolio, just to get a feeling. We control for size since we want to separate the size effect from the value effect.

```
> retmonth
```

```
              BM1         BM2         BM3         BM4         BM5         BM6
 [1,] 0.003726194 0.007934612 0.011606429 0.013056512 0.011668266 0.013141135
 [2,] 0.006123075 0.010798003 0.011930848 0.011101575 0.012359842 0.010625113
 [3,] 0.007684590 0.010954166 0.012695888 0.010425236 0.011957620 0.014411009
 [4,] 0.008290896 0.009923821 0.010128542 0.011973823 0.011670713 0.012682828
 [5,] 0.008067915 0.010214522 0.011624398 0.015274093 0.011168300 0.013128818
 [6,] 0.007617846 0.010347893 0.011268548 0.010914292 0.010670843 0.011033812
 [7,] 0.011051183 0.009525090 0.010323199 0.010624545 0.009265266 0.011631070
 [8,] 0.010115966 0.009529570 0.010091769 0.009156158 0.012632655 0.009416638
 [9,] 0.008572480 0.009090793 0.009890379 0.010420640 0.011064272 0.010444571
[10,] 0.008548885 0.009332724 0.009429059 0.008773362 0.008253761 0.009718213
              BM7         BM8         BM9        BM10
 [1,] 0.014207581 0.014236730 0.01501988 0.015368245
 [2,] 0.014324789 0.013241070 0.01411459 0.015182306
 [3,] 0.012619166 0.012887452 0.01599890 0.013574781
 [4,] 0.013441747 0.012741481 0.01501107 0.009796306
 [5,] 0.012830307 0.013079722 0.01419639 0.013782390
 [6,] 0.013091994 0.011870357 0.01397257 0.015180975
 [7,] 0.012907278 0.011643553 0.01228528 0.012877908
 [8,] 0.012500452 0.011699169 0.01197736 0.011972300
 [9,] 0.011172766 0.009396839 0.01138007 0.012193818
[10,] 0.007213557 0.009101625 0.01065349 0.009231489
```

Overall one sees that the returns are increasing from low Book-to-market to high Book-to-Market ratio but with few exceptions. We take the mean of every column:

```
> b
```

```
 [1] 0.003726194 0.006123075 0.007684590 0.008290896 0.008067915 0.007617846
 [7] 0.011051183 0.010115966 0.008572480 0.008548885
```

We get that BM decile 7 and 8 have the highest average return. We show these 2 tables just to get an intuition. Now we want to look at the Fama Macbeth procedure to derive risk premia and show whether the value factor is indeed relevant or not.
We first ran the three time series regressions on the three different models. We get 5 betas for every portfolio. For the Fama-French Five-Factor Model, we get a mean of -0.0003 for the intercept (with t-statistic -0.1515, i.e. it can be considered insignificant), +0.2175 for the loading on HML with a t-statistic of 16.0735 and an R-squared of 0.8077473. The high loading of on HML, the high t-statistic and the high R-squared speak for the HML-factor. These results are consistent Asness, Frazzini, Israel and Moskowitz (2015). The fit is good.
When we estimated the model wihout the HML factor we get that R-squared is slightly reduced to 0.7846. The intercept is -0.0003 (with t-statistic -0.1445).
If we use the the HML-Dev version of the value factor which uses recent data instead of 6 month old data, we get a loading of 0.1470 for the HML-Dev factor with t-value of 15.8868, r-squared 0.8011 and intercept -0.0003 (with t-statistic 0.1648). Overall this specification seems slightly worse than the original fama-french. This is consistent with Asness and Frazzini (2013). Only with the addition of Momentum factor the HML-Dev adds more value than the standard HML. Now we look at the estimated risk premias from the cross-sectional regression. The variables with a "2" at the end are regressed without intercept.

```
> riskp
```

```
           Mkt-Rf          SMB          HML         RMW          CMA
[1,] -0.004459042 0.002694834 0.003061033 0.00207955 0.002933392
```

```
> riskp2
```

```
          Mkt-Rf          SMB          HML          RMW          CMA
[1,] 0.004602411 0.003238974 0.002986091 0.001719804 0.004229482
```

```
> riskpb
```

```
           Mkt-Rf          SMB       RMW          CMA
[1,] -0.004378727 0.002673267 0.0020003 0.002824709
```

```
> riskpb2
```

```
          Mkt-Rf         SMB          RMW          CMA
[1,] 0.004564218 0.00328881 0.002031023 0.002734408
```

```
> riskpc
```

```
          Mkt-Rf          SMB       HML-Dev          RMW          CMA
[1,] -0.002019212 0.002618859 0.0004982879 0.001526725 0.004505029
```

```
> riskpc2
```

```
          Mkt-Rf          SMB       HML-Dev          RMW          CMA
[1,] 0.004989825 0.002953317 -0.0003926406 0.001225172 0.005563863
```

The first thing that came to our mind was that when we saw the numbers was that the risk premium for market excess return is negative when we choose a model with intercept. Compared to the other risk premia it can be considered strongly negative. This phenomenon looks similar to the betting against beta strategy from Frazzini(2014). When you include the intercept (which are 2 bp for the model with HML-Dev and 3 bp for the other 2), then the risk premia are high especially for the Market factor and CMA. Once one excludes the HML factor, risk premia decrease for all factors. This highlights that the model from a) earns much better returns than the model from b) since we can harvest more risk premia in a). In the HML-Dev model CMA and Market factor risk premia are even bigger than in the standard model. The risk premium on the HML-Dev factor is small though or even negative. This can be improved by including Momentum. We also calculated standard deviations and confidence intervals for the risk premia. For the standard deviation the formula from the slides seem wrong as they result in very small standard deviations. We think the T^2 is wrong. We used the usual MLE estimator for the sd and used bootstrapping for the estimation. We get:

```
> bsda
```

```
[1] 0.011198329 0.004824601 0.004565842 0.005720886 0.005005029
```

```
> bsda2
```

```
[1] 0.006936691 0.004848444 0.004560107 0.005794627 0.005146316
```

```
> bsdab
```

```
[1] 0.011388911 0.004881037 0.005864758 0.004554609
```

```
> bsdab2
```

```
[1] 0.006936061 0.004851116 0.005854315 0.004538796
```

```
> bsdac
```

```
[1] 0.011657490 0.004820934 0.006995617 0.005722032 0.004553911
```

```
> bsdac2
```

```
[1] 0.006973788 0.004827712 0.006889091 0.005765961 0.004606265
```

Using an intercept leads to higher standard deviation. Across the board, standard deviations are quite similar. We now look at the Bootstrap confidence interval of the HML factors (the rest can be seen in the code).

```
> cia[[3]]

$lower
[1] 0.002232714

$higher
[1] 0.006122067

> cia2[[3]]

$lower
[1] 0.00211487

$higher
[1] 0.005972181

> cic[[3]]

$lower
[1] -0.001630571

$higher
[1] 0.002097162

> cic2[[3]]

$lower
[1] -0.001627431

$higher
[1] 0.001649374
```

We see that the Confidence Interval for the standard Fama-French 5-factor model is pretty large but the lower bound is around 0.002 which is still quite high. The upper bounds are high. The higher bound for the HML-Dev risk premium estimate is only slightly higher than the lower bound of the standard model. We think that this supports our hypothesis that without momentum the usual HML is better. Momentum is important for the HML-Dev model since the negative correlation between momentum and HML-Dev leads to diversification benefits.

When we do the regression of HML on the remaining 4 factors of the Fama French 5 factor model to see if value is redundant. We want to know whether HML can be explained by the other 4 factors and thus does not deliver additional information.

```
> Valuef <- lm(DT[,"HML"]~DT[,"Mkt.RF"]+DT[,"SMB"]+DT[,"RMW"]+DT[,"CMA"]) #timeser
> summary(Valuef)

Call:
lm(formula = DT[, "HML"] ~ DT[, "Mkt.RF"] + DT[, "SMB"] + DT[,
    "RMW"] + DT[, "CMA"])

Residuals:
      Min        1Q    Median        3Q       Max
-0.096967 -0.012334  0.000418  0.012521  0.087892

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)    -0.0000581  0.0008303  -0.070 0.944239
DT[, "Mkt.RF"]  0.0192465  0.0205162   0.938 0.348541
DT[, "SMB"]     0.0312208  0.0285004   1.095 0.273732
DT[, "RMW"]     0.1357879  0.0388669   3.494 0.000509 ***
DT[, "CMA"]     1.0079761  0.0431542  23.358  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0201 on 639 degrees of freedom
Multiple R-squared:  0.4973,        Adjusted R-squared:  0.4941
F-statistic:   158 on 4 and 639 DF,  p-value: < 2.2e-16
```

As we can see, the coefficient for the market factor and the SMB factor are 0, while RMW and CMA are highly significant with loadings 0.1358 and 1.0079 and t-statistics 3.494 and 23.358. These 2 factors are the extension of the fama-french 3 factor model. From the regression we can see that value factor does not add any additional value when RMW and CMA are included because it is in the span of the other 2 factors.

Overall, we believe the value factor is not redundant. Evidence from Asness and Frazzini (2013) show that this is especially true if momentum is included.

4 References

Asness C. and Frazzini A. 2013. The Devil in HML's Details. Asness C., Frazzini A., Israel R. Moskowitz T. 2015. Fact, Fiction, and Value Investing. Frazzini A. and Pedersen L. 2014. Betting against beta.