

Solution Sheet on Problem Set 3

**Asset Pricing Models & Portfolio Choice**

Deadline: 30.11.2021

**Solved by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| **Task** |  | **Points Earned** |
| 1. **Analyzing Beta Sorted Portfolios**   a)  Annualized portfolio statistics  (4 points) |  |  |
| b)  CAPM regression & report of statistics  (8 points) |  |  |
| c)  Plot and interpret returns and betas (8 points) | The security market line distinguishes between Portfolios above and under the line. Portfolios above the line are outperforming the market, whereas Portfolios under the line are underperforming the market. The market portfolio is equal to   = 1. For our dataset, we observe that the assets with a > 1 are underperforming, whereas the < 1 are outperforming the market. Recalling that a > 1 means that the stock’s price swings more wildly (i.e. is more volatile) than the overall market, we can conclude, that the higher do not perform strong enough, compared to the market (i.e. the returns are not high enough, given the higher volatility).  This is in line with our results in part a). Recall the formula for the Sharpe Ratio:  The analysis in part a) gave us a decreasing Sharpe Ratio from to . When we look into the parameters, which are defining the Sharpe Ratio, we see that the Returns are – more or less – increasing from to . However, the volatility (i.e. the Standard Deviation) is increasing much more, in relation to the increasing return. This leads to the decrease in the Sharpe Ratio, which is, eventually, why they are underperforming the market. |  |
| d)  Plot and interpret alphas and betas  (8 points) | We compare how volatile a stock’s price is in comparison to the overall stock market (, x-axis) versus the investment strategy’s ability to beat the market (, y-axis). Also called “excess return” or “abnormal rate of return”.  is created by active investing, where as can be earned through passive investing.  Our plot shows a decreasing relationship for and Meaning, 1 has a – relatively – high abnormal return, while having a low volatility (in comparison with the market).  Based on our dataset, the lower CAPM- have earned higher abnormal returns, while having lower volatility than the market. On the other side, the higher CAPM- have earned clearly lower abnormal returns, while having much higher volatility (again, in comparison with the market). |  |
| e) Plot and interpret R squared and betas  (8 points) | Lastly, we compare again our on the x-axis with the Estimated , the measure of how well observed outcomes are replicated by the model, on the y-axis.  Obviously, the higher our , the more accurate the linear relation in our CAPM-Regression. We observe an increase in up to 5 and then a (weaker compared to the increase) decreases in higher . Our dataset basically shows that for high/low Beta, the linear relation between returns and market returns is weaker, compared to medium-. Which means, that our model is less accurate, when we analyze high/low Portfolios. |  |
| f) Build beta-neutral portfolio and plot results vs. market  (6 points) |  |  |
| g) Performance comparison of beta-neutral portfolio to market  (6 points) |  |  |
| h) regressions on beta and Fama-French models  (14 points) |  |  |
| i) Performance analysis of rebalanced portfolio  (10 points) |  |  |
| 1. **Factor Rotation**   a)  Formulate and solve the optimization function  (8 points) |  |  |
| b) Calculate time-varying weights of optimal portfolio  (10 points) |  |  |
| c) Report performance measures and run Fama-French 5-factor regression  (10 points) |  |  |