# Problem Set 7

*Instructions: Work in a group of 1-3 people. Each group hands in one typed copy of their answers. Be brief and to the point, but be sure to explain your logic. Do not print data, entire spreadsheets, or programs – instead, copy the relevant statistics to a table. All tables and charts should have legends and explanations. Answers (excluding tables and figures) should be typed and a maximum of 6 pages. Exceeding these limits will draw a penalty.*

In this problem set you will look at another potential source of risk / explanation of excess returns: Quality.

In order to proceed you need Microsoft Excel Problem\_Set7.xls in the folder. These files contain spreadsheets:

1) monthly returns of 49 value-weighted industry portfolios;

2) monthly returns of the Fama and French portfolios RMRF, SMB, HML, UMD, CMA, RMW, and rf;

3) monthly returns of a betting-against-beta factor BAB, quality minus junk factor QMJ

**Part I: Conceptual:**

1. What is quality? How is it defined? Do you think it should have an effect on asset expected returns? It this obvious, or is it surprising?
2. How is quality measured? Is there an obvious way in which it should be measured?
3. Compare and contrast the quality measurements used by
   1. Robert Novy-Marx (*The Other side of Value*)
   2. Frazzini and Pedersen (*Betting Against Beta*)
   3. Asness, Frazzini, Pedersen (*Quality Minus Junk*)
   4. Fama, French (*A five-factor asset pricing model*)

How do each measure the idea of “quality”? Which measure do you find more reasonable and which not? Why should any of these measures predict returns? Is your explanation consistent or inconsistent with an efficient market?

**Part II: For the 49 industry portfolio data:**

1. Using the market proxy and the risk-free rate, estimate the for each of the portfolios.
2. Calculate the expected return of each of the portfolios for the time period specified (that is, estimate the expected return).
3. Plot the data on an axis of *expected return* vs .
4. Is this the shape you would expect to see for this data, given theory (like the CAPM) is true?
5. Plot the security market line you would expect to see in theory (note: A line can be specified by two points, think of the two points on the SML that you know).
6. Plot a line of best fit through the data you plotted in c). How does this line compare with the theoretical line in e)? What might cause this, and what kind of implications does this have for asset pricing models?
7. What kind of real life constraints might lead to this effect?
8. How would you take advantage of the findings in the graph if you thought the CAPM was the right model?

**Part III: Using the BAB factor:**

1. Consider a factor model test (with cross sectional regression) of the form:

where BAB is a “betting-against-beta” portfolio constructed in the style of Fama/French, and the other factors are as created by Fama/French.

1. Run a cross-sectional regression test on the 49 portfolios using the above model. Do so in the style of Fama-MacBeth, where you:
   1. Estimate for each portfolio, where is a vector of the coefficients on all of the explanatory factors.
   2. 2nd pass: for each month run a regression of and to compute all of the in each given month.
   3. Now, take the time series you have for and compute t-stat, standard deviation, standard error, p value, etc. for each factor.
2. Report the p-value, t-stat, and estimate for the risk premia for each risk factor above.
3. Does exposure to the BAB factor here help explain any of the variation in expected returns? Does this make sense?
4. Is there anything about the test results that does not sit well with you? What about the r^2? The coefficient on the market beta?

**Part IV: Comparing Quality:**

1. Repeat part III but for the QMJ factor instead of BAB.
2. Repeat part III but for the RMW factor instead of BAB.
3. How do your results for the QMJ factor affect your beliefs about the BAB factor?
4. Which do you think is a better measure of quality? Why? Are they picking up the same effects?
5. Which do you think goes a longer way in explaining the cross section of expected returns?

**Part V: Concluding:**

1. Can you come up with one test that you would like to see performed that might shed some more light on this “quality” anomaly? Suggest any test and describe how you would go about performing it, but DO NOT do any analysis (unless, of course you really want to and then I’ll be impressed!).