

Problem Set 5

Instructions: Work in a group of 1-3 people. Each group hands in one electronic copy of their answers. Try to make your answers readable. 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. Answer text (excluding tables and figures) should be typed and maximum five pages long. Exceeding these limits will result in penalty points.

This problem set explores the value-growth effect on two dimensions: 1) how these returns vary over the business cycle and 2) whether characteristics or covariances better capture their returns. We will also look at the characteristics vs. covariance debate for another anomaly – momentum. Reading the Lakonishok, Shleifer, and Vishny (1994) and Daniel and Titman (1997) articles will be most useful.

In order to proceed you need Microsoft Excel and file “Problem_Set5.xls”. This file contains three spreadsheets:

- 1) The factor portfolios calculated by Fama and French, a dummy variable indicating recessionary periods as defined by the *National Bureau of Economic Research*. In addition, the file contains monthly T-bill returns. The factor portfolios include the RMRF portfolio (market minus T-bill rate), SMB portfolio (size factor), HML portfolio (book-to-market factor), and UMD portfolio (momentum factor).
- 2) The 25 size and BE/ME sorted portfolios of Fama and French. The value-weighted average returns, average size, and average BE/ME characteristic of each of these portfolios over time are provided.
- 3) The 25 size and Momentum (past 2-to-12 month return) sorted portfolios of Fama and French. The value-weighted average returns, average size, and average past return characteristic of each of these portfolios over time are provided.

Business cycle variation

- a) Compute the average return on RMRF, SMB, HML, and UMD during recessions only. This can be done by running a regression of the returns of each factor portfolio on an intercept and a recession dummy variable. What does this tell you? Do you believe SMB or HML is more related to risk or other sources based on these results?
- b) Repeat part a) only for the smallest growth, smallest value, and largest growth and largest value portfolios (e.g., the “four corners” of the 25 Fama-French portfolios), and for the smallest losers, smallest winners, and largest losers and winners. Make sure you use the excess returns of these portfolios by subtracting the risk-free rate. Do you notice any stronger cyclical relationships for these four portfolios?

Characteristics vs. Covariances**25 Size and BE/ME portfolios.**

c) Consider the following Fama-MacBeth cross-sectional regressions:

$$\begin{aligned}
 (1) \quad R_i &= \gamma_0 + \gamma_M \beta_{iM} + \gamma_{\text{size}} \ln(\text{size}) + \gamma_{B/M} \ln(\text{BE/ME}) + \eta_{i1}, \\
 (2) \quad R_i &= \gamma_0 + \gamma_M \beta_{iM} + \gamma_{\text{SMB}} \beta_{i\text{SMB}} + \gamma_{\text{HML}} \beta_{i\text{HML}} + \eta_{i2}, \\
 (3) \quad R_i &= \gamma_0 + \gamma_M \beta_{iM} + \gamma_{\text{size}} \ln(\text{size}) + \gamma_{B/M} \ln(\text{BE/ME}) + \gamma_{\text{SMB}} \beta_{i\text{SMB}} + \gamma_{\text{HML}} \beta_{i\text{HML}} + \eta_{i3},
 \end{aligned}$$

where γ_0 , γ_M , γ_{size} , $\gamma_{B/M}$, γ_{SMB} , and γ_{HML} are regression parameters. β_{iM} , $\beta_{i\text{SMB}}$, and $\beta_{i\text{HML}}$ are betas with respect to the Fama-French factors SMB and HML and size and BE/ME are the average size and book to market ratio characteristics of the portfolio.

Estimate equations (1), (2), and (3) using the full sample of data and the Fama-MacBeth procedure. The following is a brief outline of the procedure:

1. Estimate β_{iM} , $\beta_{i\text{SMB}}$, and $\beta_{i\text{HML}}$ for each portfolio by running a time-series regression for each of the 25 portfolios on the Fama-French factors RMRF, SMB, and HML. Assume that the betas do not change over time; hence, you can estimate the betas using full-period OLS regressions.
2. Each month estimate the regressions using the month-by-month cross-section of realized returns on the 25 portfolios on their estimated betas and characteristics according to equations (1), (2), and (3).
(*Hint: You have already estimated equation (1) in problem set 3! Hope you saved your program.*)
3. Compute the time series average of the estimates of γ_0 , γ_M , γ_{size} , $\gamma_{B/M}$, γ_{SMB} , and γ_{HML} . In addition, compute the standard error and t -stat of the time series averages in the style of Fama and MacBeth (1973).

- d) Based on your estimates of these parameters in equations (1), (2), and (3), do characteristics or covariances better capture the cross-sectional variation in average returns? What arguments can you make in favor of one side versus the other? What arguments can you make that suggest you can't tell which side is better able to capture returns?
- e) Repeat part c) using only data after January 1963. Does your answer change in terms of whether characteristics or covariances better capture the cross-section of returns? Do you now feel more or less strongly about your answer to this question in general?

25 Size and Momentum portfolios.

f) Consider the following Fama-MacBeth cross-sectional regressions:

$$\begin{aligned}
 (1) \quad R_i &= \gamma_0 + \gamma_M \beta_{iM} + \gamma_{\text{size}} \ln(\text{size}) + \gamma_{\text{ret212}} (\text{ret212}) + \eta_{i1}, \\
 (2) \quad R_i &= \gamma_0 + \gamma_M \beta_{iM} + \gamma_{\text{size}} \beta_{i\text{SMB}} + \gamma_{\text{UMD}} \beta_{i\text{UMD}} + \eta_{i2}, \\
 (3) \quad R_i &= \gamma_0 + \gamma_M \beta_{iM} + \gamma_{\text{size}} \ln(\text{size}) + \gamma_{\text{ret212}} (\text{ret212}) + \gamma_{\text{SMB}} \beta_{i\text{SMB}} + \gamma_{\text{UMD}} \beta_{i\text{UMD}} \\
 &\quad + \eta_{i3},
 \end{aligned}$$

where γ_0 , γ_M , γ_{size} , γ_{ret212} , γ_{SMB} , and γ_{UMD} are regression parameters. β_{iM} , $\beta_{i\text{SMB}}$, and $\beta_{i\text{UMD}}$ are betas with respect to the Fama-French factors SMB and UMD and size and ret212 are the average size and past 2-to-12-month return characteristics of the portfolio.

Estimate equations (1), (2), and (3) using the full sample of data and the Fama-MacBeth procedure. The following is a brief outline of the procedure:

1. Estimate β_{iM} , $\beta_{i\text{SMB}}$, and $\beta_{i\text{UMD}}$ for each portfolio by running a time-series regression for each of the 25 portfolios on the Fama-French factors RMRF, SMB, and UMD. Assume that the betas do not change over time; hence, you can estimate the betas using full-period OLS regressions.
 2. Each month estimate the regressions using the month-by-month cross-section of realized returns on the 25 portfolios on their estimated betas and characteristics according to equations (1), (2), and (3).
 3. Compute the time series average of the estimates of γ_0 , γ_M , γ_{size} , γ_{ret212} , γ_{SMB} , and γ_{UMD} . In addition, compute the standard error and t -stat of the time series averages in the style of Fama and MacBeth (1973).
- g) Based on your estimates of these parameters in equations (1), (2), and (3), do characteristics or covariances better capture the cross-sectional variation in average returns? What arguments can you make in favor of one side versus the other? What arguments can you make that suggest you can't tell which side is better able to capture returns?
- h) Repeat part f) using only data after January, 1963. Does your answer change in terms of whether characteristics or covariances better capture the cross-section of returns? Do you now feel more or less strongly about your answer to this question in general?