Quantitative Financial Economics

Matlab tutorials

Problem set on cross-sectional asset pricing

1. A wide range of stock characteristics have been shown to be related to average returns in the cross section of stocks. These characteristics include size, value, investment, profitability, momentum, reversal, among others. Characteristic-sorted portfolios generate a spread in average returns, but characteristics associated with large average returns are not necessarily associated with large market betas and the CAPM therefore fails to explain the cross section of average returns.

Fama and French (2015) suggest a five-factor model that adds investment and profitability factors to the Fama and French three-factor model, which consists of market, size, and value factors and until recently has been one of the main benchmark models for estimating expected returns in empirical asset pricing. Fama and French have in their recent research shown that their new five-factor model accounts for several anomalies.

The excel file "Cross_sectional_asset_pricing" contains data on the five factors in the Fama-French five-factor model as well as excess returns on three portfolio sets: i) 25 portfolios formed on profitability and investment, ii) 25 portfolios formed on size and long-term reversal, and iii) 25 portfolios formed on size and momentum. The sample covers the period from 1963:m7 to 2020:m8 and all data are obtained from Kenneth French's website.

a) Analyze how the CAPM, the Fama-French three-factor model and the Fama-French five-factor model perform in explaining expected returns on the 25 portfolios formed on profitability and investment:

- Compute the GRS statistic and the corresponding p-value for each of the three models.

- To judge the economic size of the alphas, compute the average absolute value of the alphas for each of the three models. In matlab you use can e.g. mean(abs(alphas)).

b) Redo the analysis from a) using the 25 portfolios formed on size and long-term reversal instead of the profitability and investment sorted portfolios.

c) Redo the analysis from a) using the 25 portfolios formed on size and momentum instead of the profitability and investment sorted portfolios.

2. Petkova (2006) analyzes an empirical implementation of Merton's intertemporal CAPM (ICAPM) and provides evidence that it has the ability to explain the size and value effects. Besides the market factor (M), the model includes as factors the innovations in the log dividend-price ratio (dp), the spread on the yield curve ($term$), the default spread (def), and the short t-bill rate (rf), where the innovations are derived from a VAR(1) model.

The purpose of this problem is to examine whether we can get similar results as Petkova (2006) using an updated sample period that covers the period 1963:m7 to 2019:m12. The excel file "Cross_sectional_asset_pricing" contains data on the five factors in Petkova's (2006) ICAPM specification as well as excess returns on the 25 portfolios formed on size and book-to-market.

a) Estimate the Petkova's (2006) model on the 25 size and value sorted portfolios using the Fama-MacBeth procedure, where you allow for a free intercept in the estimation. Compute the Fama-MacBeth t-statitics for the intercept and the five factors. Which factors are statistically significant and how do the results compare with those of Petkova (2006)?

b) Compute the cross-sectional R^2 and make a plot of mean excess returns against the model predicted mean excess returns. How does the model fit compare to the findings of Petkova (2006)?

c) Now impose the theoretical constraint that the intercept in the second-stage cross-sectional regressions is zero. Re-estimate the model and analyze how this constraint impacts the estimate on the market factor.

Reference list

Fama, E.F. and K.R. French (2015). A five-factor asset pricing model. *Journal of Financial Economics* 116, 1-22.

Petkova, R. (2006). Do the Fama-French factors proxy for innovations in predictive variables? *Journal of Finance* 61, 581-612.