

Economics 136: Financial Economics
Section Notes for Week 13

1 Asset Pricing Anomalies

There are four well-documented asset pricing anomalies. These effects are anomalous in that the CAPM prediction that a test of the time-series regression $R_{i,t} - R_{f,t} = a_i + \beta_i(R_{m,t} - R_{f,t}) + e_{i,t}$ will show $a_i = 0$ fails (because the estimated alpha is statistically significantly different than zero).

1.1 Value Effect

Value stocks (those with high book value-to-market value ratios) tend to have higher expected returns than the CAPM prediction, and growth stocks (those with low book-to market ratios) have lower expected returns than the CAPM prediction. In an empirical test of CAPM, a portfolio that buys value stocks and short sells growth stocks has $a > 0$ (this alpha is statistically significantly different than zero).

1.2 Size Effect

Small stocks (those with low market capitalization) tend to have higher expected returns than the CAPM prediction, and large stocks (those with high market capitalization) tend to have lower expected returns than the CAPM prediction. In an empirical test of CAPM, a portfolio that buys small stocks and short sells large stocks has $a > 0$.

1.3 Momentum Effect

Momentum stocks (those that have done well in the past year) have higher expected returns than the CAPM prediction, and recent loser stocks (those that have done poorly in the past year) have lower expected returns than the CAPM prediction. In an empirical test of CAPM, a portfolio that buys recent winner stocks and shorts recent loser stocks has $a > 0$.

1.4 Reversal Effect

Long-run loser stocks (those that have done poorly in the past 3 to 5 years) have higher expected returns than the CAPM prediction, and long-run winner stocks (those that have done well in the past 3 to 5 years) have lower expected returns than the CAPM prediction. In an empirical test of CAPM, a portfolio that buys long-run loser stocks and shorts long-run winner stocks has $a > 0$.

2 Fama-French Three-Factor Model

Fama and French expanded the prediction of CAPM to include the value effect and size effect as additional risk factors. The Fama-French Three-Factor model predicts:

$$E[R_i] - R_f = \beta_{i,M}(E[R_M] - R_f) + \beta_{i,HML}F_{HML} + \beta_{i,SMB}F_{SMB}$$

where

- $E[R_M]$ = expected return on the market portfolio
- $F_{HML} = (E[R_{value}] - E[R_{growth}])$
- $F_{SMB} = (E[R_{small}] - E[R_{big}])$.

3 Testing the Fama-French Model

The Fama-French model can be tested by running the time series regression:

$$\begin{aligned} R_{i,t} - R_{f,t} = & a_i + \beta_{i,M}(R_{M,t} - R_{f,t}) \\ & + \beta_{i,HML}(R_{value,t} - R_{growth,t}) \\ & + \beta_{i,SMB}(R_{small,t} - R_{big,t}) + e_{i,t} \end{aligned}$$

Note that R_{value} is the return of a portfolio of value stocks (and similarly for R_{growth} , R_{small} , and R_{big} .) Here a_i = the estimated expected excess return on asset i that is not due to its aggregate risk, which is captured by $\beta_{i,M}(E[R_M] - R_f) + \beta_{i,HML}(E[R_{value}] - E[R_{growth}]) + \beta_{i,SMB}(E[R_{small}] - E[R_{big}])$; in other words a_i = the estimated abnormal return on asset i .

Fama-French predicts that $a_i = 0$ for most stocks. This prediction holds true in empirical tests. The Fama-French model is the most successful and widely-used asset pricing model to date.

Note that $e_{i,t}$ represents idiosyncratic risk of investing in asset i . This idiosyncratic risk can be eliminated in a well-diversified portfolio. Aggregate risk cannot be diversified away.

4 Chen, Roll, and Ross Five-Factor Model

Chen, Roll, and Ross formulate a five-factor model which uses factors that describe macro-economic activity broadly:

$$R_{i,t} = a_i + \beta_{i,IP}F_{IP,t} + \beta_{i,EI}F_{EI,t} + \beta_{i,UI}F_{UI,t} + \beta_{i,CG}F_{CG,t} + \beta_{i,GB}F_{GB,t}$$

where

- F_{IP} = % change in industrial production
- F_{EI} = % change in expected inflation
- F_{UI} = % change in unanticipated inflation
- F_{CG} = excess return of long-term corporate bonds over long-term government bonds
- F_{GB} = excess return of long-term government bonds over T-bills

5 Examples

5.1 Problem 1

The value effect is an empirical regularity of stock returns that has attracted a great deal of attention both in academic circles and among practitioners.

a) What are value stocks and growth stocks? What is the value effect?

ans: Value stocks have high book-to-market ratios, and growth stocks have low book-to-market ratios. (Alternatively, value stocks can be defined as those that have low price-to-earnings ratios, and growth stocks can be defined as those with high price-to-earnings ratios.) The value effect is that in the past value stocks have had higher average returns than growth stocks.

b) Is the value effect consistent with CAPM? Why or why not?

ans: The value effect is inconsistent with CAPM because a portfolio of value stocks has a lower beta than a portfolio of growth stocks, yet value stocks have had higher average returns. CAPM predicts the opposite, namely that value stocks should have a lower return than growth stocks.

c) What other risk and return based model has been used to explain the value effect? What economic interpretation can you give for the risk source associated with value stocks in that model?

ans: The Fama-French Three-Factor Model has been used to explain the value effect as a risk-return trade-off. Their model includes the risk factor HML, which is the excess return on a portfolio of value stocks above that of a portfolio of growth stocks. Value stocks have positive betas on the risk factor HML, and growth stocks have negative betas on the risk factor HML. Thus, in their model has the interpretation that value stocks have higher returns than growth stocks because they are riskier. The economic source of HML risk that has been proposed is that the HML risk factor captures the risk of financial distress. The idea is that value companies have a high chance of going bankrupt during recessions, and thus value stocks are especially risky during bad economic times. There is not conclusive evidence that this idea is true.

5.2 Problem 2

An empirical regularity is that small firms earn an excess risk adjusted expected return:

$$E[R_{small}] - R_f = a_{small} + \beta_{small}(E[R_m] - R_f)$$

$a_{small} > 0$. Explain this finding in the context of the empirical performance of CAPM versus that of multifactor models.

ans: This finding is evidence that the CAPM does not hold for small firms because it predicts that excess risk adjusted expected return (alpha) for all stocks is zero. The prediction of

CAPM fails empirically. Multifactor models, such as the Fama-French three factor model, do not fail empirically because they incorporate this high expected return of small firms' stocks as a risk factor. In the Fama-French model this risk factor is called SMB, which is the excess return on a portfolio of small stocks above that of a portfolio of big stocks. Financial economists aren't certain what economic risk factor SMB is capturing.