

Exercise Set 4

1. In contrast to the capital asset pricing model, arbitrage pricing theory:
   1. Requires that markets be in equilibrium
   2. Uses risk premiums based on micro variables.
   3. Specifies the number and identifies specific factors that determine expected returns.
   4. Does not require the restrictive assumptions concerning the market portfolio.
2. The general arbitrage pricing theory (APT) differs from the single-factor capital asset pricing model (CAPM) because the APT:
   1. Places more emphasis on market risk
   2. Recognizes multiple systematic risk factors
   3. Minimizes the importance of diversification
   4. Recognizes multiple unsystematic risk factors
3. According to the Arbitrage Pricing Theory:
   1. High-beta stocks are consistently overpriced.
   2. Low-beta stocks are consistently overpriced.
   3. Positive alpha investment opportunities will quickly disappear.
   4. Rational investors sometimes do not pursue arbitrage opportunities because they are too risky.
4. BigAuto exposure to the market is 1.2 and the exposures to the Fama-French factors, SMB and HML are

-0.6 and 0.4 respectively. The expected risk premium for the market if 8%, for the SMB factor is 1.5% and for the HML factor it is 2%. Assume a risk-free asset return equal to 0.5%. Compute the expected return of BigAuto Co. based on Fama-French factor model.

1. Suppose that two factor portfolios, portfolios 1 and 2, have expected returns 𝐸(𝑟1) = 15% and 𝐸(𝑟2) = 8%. Suppose further that the risk-free rate is 2%. Now consider a well-diversified portfolio, portfolio A, with beta on the first factor, 𝛽𝐴1 = 0.25 and beta on the second factor, 𝛽𝐴2 = 1.5. Calculate the portion of portfolio A’s risk premium that is compensation for its exposure to each factor, and the total expected return on the portfolio.
2. Consider the information in the previous question. Suppose now that the expected return of Portfolio A is 18% instead of the value you achieved in question 5. How would you take advantage of this arbitrage opportunity? What is your expected dollar profit on this trade?
3. Asset A is an efficient portfolio expected to generate a return of 10% and its returns have a standard deviation of 15%. Asset B is an efficient portfolio with a Beta of 2. The market portfolio is expected to generate a return of 12% and a standard deviation of 20%. The risk-free asset yields a return of 2%. Consider a portfolio that invests 50% in asset A and 50% in asset B.
   1. What is the expected return of the Portfolio
   2. What is the volatility of the Portfolio
4. Please consider the following information regarding Fama-French 3 factor model:

|  |  |  |
| --- | --- | --- |
|  | **Risk premium** | **Volatility** |
| **MRP** | 10,0% | 18,0% |
| **SMB** | 6,0% | 10,0% |
| **HML** | 2,0% | 5,0% |

|  |  |  |  |
| --- | --- | --- | --- |
| **Correlation** | **MRP** | **SMB** | **HML** |
| **MRP** | 1 | -0,2 | 0,7 |
| **SMB** | -0,2 | 1 | -0,3 |
| **HML** | 0,7 | -0,3 | 1 |

|  |  |  |
| --- | --- | --- |
| **Betas** | **Stock A** | **StockB** |
| **MRP** | 2.2 | 0.3 |
| **SMB** | -0.2 | 0.9 |
| **HML** | 0.5 | -0.1 |

Assuming an equal-weighted portfolio composed by Stock A and Stock B and knowing that the risk-free is 1.05%, compute:

* 1. The portfolio’s expected return
  2. The portfolio’s volatility, assuming an idiosyncratic component of 15% for stock A and 5% for stock B

1. Suppose that there are two independent economic factors, F1 and F2. The risk-free rate is 6%, and all stocks have independent firm-specific components with a standard deviation of 45%. The following are well-diversified portfolios:

|  |  |  |  |
| --- | --- | --- | --- |
| **Portfolio** | **Beta on F1** | **Beta on F2** | **Expected Return** |
| **A** | 1.7 | 2.2 | 33% |
| **B** | 2.7 | -0.22 | 30% |

What is the expected return–beta relationship in this economy?

1. Suppose you run a first-stage (time-series) CAPM regression for N stocks in a sample of historical

returns: 𝑟𝑖,𝑡 − 𝑟𝐹,𝑡 = 𝛼𝑖 + 𝛽𝑖,𝑀(𝑟𝑀,𝑡 − 𝑟𝐹,𝑡) + 𝜀𝑖,𝑡. With this regression you estimate market beta (𝛽𝑖,𝑀) and idiosyncratic variance (𝜎2 ) for each stock i=1,..,N, where 𝜎2 is the variance of the residuals from each

𝜀,𝑖 𝜀,𝑖

first-stage regression. What are the testable hypotheses in the following second-stage (cross-sectional) regression that serve to test whether the CAPM correctly describes cross-sectional variation in expected returns:

𝐸(𝑟𝑖,𝑡 − 𝑟𝐹,𝑡) = 𝜆0 + 𝜆1𝛽𝑖,𝑀 + 𝜆2𝜎2 + 𝑢𝑖?

𝜀,𝑖

a. 𝜆0= 0; 𝜆1= 𝐸(𝑟𝑀,𝑡 − 𝑟𝐹,𝑡); 𝜆2 = 0.

b. 𝜆0= 0; 𝜆1= 𝐸(𝑟𝑀,𝑡); 𝜆2= 0.

c. 𝜆0= 𝛼𝑖; 𝜆1= 𝐸(𝑟𝑀,𝑡 − 𝑟𝐹,𝑡); 𝜆2< 0.

d. 𝜆0= 0; 𝜆1= 𝐸(𝑟𝑀,𝑡); 𝜆2< 0.

1. Consider the following information:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Exp. Excess Ret.** | **Beta(MKT)=** | **Beta(F2)=** |
| **Portfolio A** | 11% | 1.2 | -0.2 |
| **Portfolio B** | 4% | -0.1 | 1.2 |
| **MKT=F1** | 10% | 1 | 0 |
| **F2** | 3% | 0 | 1 |

Does the two-factor APT model predict the returns of portfolios A and B correctly? If A and/or B are mispriced, carefully document which portfolio is underpriced and/or overpriced

1. Please consider the following information regarding Fama-French 3 factor model:

|  |  |  |
| --- | --- | --- |
|  | **Risk premium** | **Volatility** |
| **MRP** | 10.0% | 18.0% |
| **SMB** | 7.0% | 10.0% |
| **HML** | 4.0% | 8.0% |

|  |  |  |  |
| --- | --- | --- | --- |
| **Correlation** | **MRP** | **SMB** | **HML** |
| **MRP** | 1 | 0.1 | 0.3 |
| **SMB** | 0.1 | 1 | 0.4 |
| **HML** | 0.3 | 0.4 | 1 |

Assuming that a stock has a Beta of 0.5 for the MRP, of 0.4 for the SMB and of 0.3 for the HML factor and knowing that the risk-free is 3%, compute:

* 1. The stock’s expected return
  2. The stock’s volatility, assuming an idiosyncratic component of 9%

1. Consider the following data for a one-factor economy. All portfolios are well diversified.

|  |  |  |
| --- | --- | --- |
| **Portfolio** | **Expected return** | **Beta** |
| **A** | 12% | 1.8 |
| **F** | 6% | 0 |

Suppose that another portfolio, portfolio E, is well diversified with a beta of 0.6 and expected return of 9%. Would an arbitrage opportunity exist? If so, what would be the arbitrage strategy?

According to the theory of arbitrage:

a. High-beta stocks are consistently overpriced.

b. Low-beta stocks are consistently overpriced.

c. Positive alpha investment opportunities will quickly disappear.

d. Rational investors will pursue arbitrage consistent with their risk tolerance.