

In this exercise, we apply the Fama-MacBeth methodology by using 360 monthly excess returns for market and 456 stocks. Fama and MacBeth (1973) suggest a three-steps approach to test the beta risk-return relationship. The first step is to separate the time series data by three periods and estimate the beta risk for each stock from the first period. In this step, we regress the excess return for each stock on market return from the first 120 months by the ordinary least squares (OLS):

$$R_{i,t} - r_t = \alpha_i + \beta_i(R_{m,t} - \gamma_t) + \varepsilon_{i,t} \quad \text{for } t=1, 2, \dots, 120 \text{ and } i=1, 2, \dots, 456$$

The coefficients  $\beta_i$  are the estimated beta risk for the stocks. Then we group the stocks into 10 portfolios by the beta ranking such that the first group has the smallest estimated beta risks and the tenth group has the largest estimated beta risks. In this exercise, the first six portfolios contain 46 stocks in each portfolio and the other four portfolios have 45 stocks in each one. In the second step, we estimate the average excess returns for each portfolio in the second sub-period. We then estimate the portfolio betas by regressing the average excess return for each portfolio on market return from month 121 to 240:

$$R_{p,t} - r_t = \alpha_p + \beta_p(R_{m,t} - \gamma_t) + \varepsilon_{p,t} \quad \text{for } t=121, 122, \dots, 240 \text{ and } p=1, 2, \dots, 10$$

Finally, we estimate cross-sectional OLS regression of average excess returns for the portfolios on the estimated portfolio betas from the previous step for each month of the final sub-period:

$$R_{p,t} - r_t = \gamma_{1,t} + \gamma_{2,t}(\hat{\beta}_p) + \varepsilon_{p,t} \quad \text{for } p=1, 2, \dots, 10 \text{ and } t=241, 242, \dots, 360$$

Table 1 presents the results of Fama-MacBeth three-step approach. The average of the estimated coefficients  $\gamma_{2,t}$  is 0.003 with large standard deviation. Given the t-value, we fail to reject the null hypothesis that the beta risk-return relationship is insignificant. The excess returns for the stocks have no significant dependence on their beta risks. To sum it up, the result conflicts with the Capital Asset Pricing Model (CAPM), which suggests that average returns on the stocks do not reflect the attempts of risk-averse investors to hold efficient portfolio. However, we should keep in mind that since we do not have the actual beta risk, error in the estimated beta risk could change our result.

Table1

<b>Coefficient (<math>\gamma_{2,t}</math>)</b>	
<b>Mean</b>	0.003
<b>St. d</b>	0.097
<b>T-value</b>	0.357
<b>P-value</b>	0.722
<b>Observations</b>	120