Empirical Asset Pricing: Problem Set 6

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0.0.1   a

The table below shows the time-series average return, t-statistic, annualized Sharpe ratio and standard deviation on this 1-month, 1-month industry momentum portfolio.

	Average return	t-statistic	Annualized Sharpe ratio	Standard deviation
1-month,1-month IND MOM	0.6936	4.1919	0.4411	5.4477

0.0.2   b

For the 1-month, 1-month strategy, we decompose its returns as follows:

$$Mom = \sigma_\mu^2 + \sigma_\beta^2 cov(\tilde{F}_t, \tilde{F}_{t-1}) + \frac{1}{N} \sum_{j=1}^{N} cov(\epsilon_{j,t}, \epsilon_{j,t-1})$$

Here, we used CAPM to get the μ, β and ϵ as follows:

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \epsilon_{it}$$

By comparing the number in the table below, we find out that the third term, $\frac{1}{N} \sum_{j=1}^{N} cov(\epsilon_{j,t}, \epsilon_{j,t-1})$, which is the serial covariation in firm-specific components, is the greatest contributor to momentum profits.

	σ_μ^2	$\sigma_\beta^2 cov(\tilde{F}_t, \tilde{F}_{t-1})$	$\frac{1}{N} \sum_{j=1}^{N} cov(\epsilon_{j,t}, \epsilon_{j,t-1})$
Mom	0.0122	0.1337	0.6351

0.0.3   c

The table below shows the time-series average return, t-statistic, annualized Sharpe ratio and standard deviation on this 12-month, 1-month industry momentum portfolio.

	Average return	t-statistic	Annualized Sharpe ratio	Standard deviation
12-month,1-month IND MOM	0.8583	4.5857	0.4849	6.1310

0.0.4   d

The table below shows the time-series average return, t-statistic, annualized Sharpe ratio and standard deviation on this 12-month, 1-month, skip 1 month industry momentum portfolio and differences between this strategy and the 12-month, 1-month, no skipping momentum strategy above. From the table, we can see this strategy achieves 0.0701 percent more average monthly returns, higher t-statistics, 0.0414 bigger annual Sharpe ratio and 0.0200 lower standard deviation. The difference shows the 12-month, 1-month, skip 1-month momentum strategy performs better than 12-month, 1-month, skip 1 month momentum strategy.

	Average return	t-statistic	Annualized Sharpe ratio	Standard deviation
12-1 month,skip 1 month IND MOM	0.9284	4.9765	0.5263	6.1110
12-1 month, no skip IND MOM	0.8583	4.5857	0.4849	6.1310
Difference	0.0701	0.3908	0.0414	-0.0200

0.0.5   e

The table below shows the alpha and betas of three momentum strategies using the following regression,

$$r_{MOM,t} = \alpha + \beta_{RMRF}(r_{mt} - r_{ft}) + \beta_{SMB}r_{SMB,t} + \beta_{HML}r_{HML,t} + \epsilon_t$$

From the table, we can see the α of three regressions are all quite big and apparently different from zero. The t-statistic of αs are larger than 1.96, so we can reject the null hypothesis that $\alpha = 0$ at 5% significance level. Thus, the Fama-French model can not price the momentum strategies.

	α	$t(\alpha)$	β_{RMRF}	β_{SMB}	β_{HML}
1-1 month IND MOM	0.6924	4.1527	-0.0634	-0.0514	0.1329
12-1 month,no skip,IND MOM	1.0449	5.6479	-0.1365	0.0509	-0.2796
12-1 month,skip 1 month,IND MOM	1.1076	6.0057	-0.1321	0.0845	-0.2866

0.0.6   f

The table below shows the alpha and betas of three momentum strategies using the following regression,

$$r_{MOM,t} = \alpha + \beta_{RMRF}(r_{mt} - r_{ft}) + \beta_{SMB}r_{SMB,t} + \beta_{HML}r_{HML,t} + \beta_{UMD}r_{UMD} + \epsilon_t$$

From the table, we can see that α for 1-month, 1-month momentum strategy is 0.5631 and t-statistics is 3.2937, which is still bigger than 1.96. So we can reject the null hypothesis that $\alpha = 0$ at 5% significance level and the four factor model stiil cannot explain the 1-month, 1-month strategy.

Also, we notice the α of other two regressions are small. The t-statistic of αs are smaller than 1.96, so we can not reject the null hypothesis that $\alpha = 0$ at 5% significance level. Thus, the four factor model can price the intermediate-term and long-term momentum strategies now. Thus, we learn that the momentum factor UMD can well explain the intermediate-term and long-term momentum strategies returns but it still cannot explain the short-term momentum strategy.

	α	$t(\alpha)$	β_{RMRF}	β_{SMB}	β_{HML}	β_{UMD}
1-1 month IND MOM	0.5631	3.2937	-0.0318	-0.0488	0.2003	0.1387
12-1 month,no skip,IND MOM	0.0785	0.5606	0.0747	0.0834	0.1859	0.9751
12-1 month,skip,IND MOM	0.1428	1.0248	0.0787	0.1169	0.1781	0.9734

According to the previous problem sets and this problem set, we conclude that cross section of returns can partly be explained by market, SMB, HML, UMD factors. Also, all the four factors