Problem Set

PROBLEM SET: Performance

Exercise 1.

As head of the portfolio management team for Doonurbest Capital Management, a subsidiary of Biggerbanks has hired Nosyboiz and Associates to evaluate the performance of your group. Nosyboiz is consulting firm formed by former Finance Professors who were denied tenure at major U.S. business schools. Their procedure in evaluating performance is to estimate average returns, βs, and the risk free rate with historical returns. They then rank all the portfolio managers they evaluate and group them into four quartiles. The ranking is based on the difference between the average return to the manager's portfolio and the return predicted by the CAPM for assets with that β. Unfortunately, your teams portfolio placed in the lowest quartile. The letter form Biggerbanks informing you of this has asked you to come to a meeting to discuss the matter. A representative of the consulting firm will also be present.

1. What arguments would you advance at the meeting to save your career?
2. If you were the representative of Nosybioz, how would you rebut these arguments?
3. As president of Biggerbanks, what do you think of the performance of Doonurbest?

Exercise 2.

RTMF [4]

You are asked to investigate the performance of Right Time Mutual Fund (RTMF) over some horizon. Assuming that the CAPM holds, you run the following regression:

$$R_p - R_0 = \alpha_p + \beta_p(R_m - R_0) - \gamma \min(0, R_m - R_0) + \varepsilon_p$$

You find that

$$\alpha_p = -0.005$$
$$\beta_p = 1.1$$
$$\gamma_p = 0.4$$

All coefficients are significantly different form zero.

1. Assuming that you have chosen a good proxy for the market portfolio, what do you conclude about the fund's stock selection and timing ability?
2. You are also told that RTMF frequently uses futures and options to insure against the market going down. Given this additional information how would your interpretation of a_P and y_p change (if at all)?

Exercise 3.

You are given the historical percentage excess returns (returns in excess of the risk free rate) for 2 portfolios, P, Q and a benchmark M.

time	$r_P - r_f$	$r_Q - r_f$	$r_M - r_f$	
1	3.58	2.81	2.2	0
2	-4.91	-1.15	-8.41	
3	6.51	2.53	3.27	
4	11.13	37.09	14.41	
5	8.78	12.88	7.71	
6	9.38	39.08	14.36	
7	-3.66	-8.84	-6.15	
8	5.56	0.83	2.74	
9	-7.72	0.85	-15.27	
10	7.76	12.09	6.49	
11	-4.01	-5.68	-3.13	
12	0.78	-1.77	1.41	

1. Determine whether there is evidence of timing ability for the two portfolios by calculating the Theynor-Mazy and Henriksson-Merton measures.

Exercise 4.

[3]
A stock has a beta of 0.9. A security analyst who specializes in studying this stock expects its return to be 13%. Suppose the risk free rate is 8% and the market risk premium is 6%.

1. Is the analyst pessimistic or optimistic about this stock relative to the markets expectation?

Exercise 5.

Performance Measures [5]
There are three classical measures of portfolio performance

- The Sharpe Ratio
- The Treynor Ratio
- Jensens alpha

Which of these is suited for a well-diversified investor? How about an undiversified investor?

Exercise 6.

Share Portfolio [3]
A friend of yours has inherited some money and wants to invest the amount in shares of two companies, BuyIT and SellIT. He gives you the following information about the stocks.

Company	Annual Expected Return	Annual Volatility
BuyIT	6%	20%
SellIT	12%	40%

In addition, he tells you that the correlation coefficient between the two companies is estimated to be 0. The annual risk-free interest rate is 5%.

The expected return on the market index is 10% per year, and the annual volatility is 20%. The β value of BuyIT is 0 and the β value of SellIT is 1.6.

1. What is Jensen's alpha for the two stocks?

2. Calculate the Sharpe Ratio for the following portfolios (given by portfolio weights of the two assets):

(a) Weights

$$w_{BuyIT} = 0.8$$
$$w_{SellIT} = 0.2$$

(b) Weights

$$w_{BuyIT} = 0.3636$$
$$w_{SellIT} = 0.6364$$

3. What is the Sharpe Ratio for the market?

Exercise 7.

Norwegian Portfolio [8]

In this exercise we consider an actual example of performance evaluation.

A standard benchmark for academic studies is the three-factor model of Fama and French (1995)

$$eR_{pt} = \alpha_p + \beta_p \text{RMRF}_t + s_p \text{SMB}_t + h_p \text{HML}_t + \varepsilon_{pt}$$

where eR_{pt} is the time-t excess return on a the managed portfolio (net return minus T-bill return); RMRF_t is the time-t excess return on a aggregate market proxy portfolio; and SMB_t and HML_t are time-t returns on zero-investment factor-mimicking portfolios for size and book-to-market (BTM) equity, respectively. Suppose such an analysis has been carried out for a specific portfolio of Norwegian stocks. The following tables shows the results from estimating the model, both with a single factor (the market RMRF) and the three factor model. In the tables we investigate two choices for the market portfolio. In (1) we use an equally weighted market index, in (2) a value weighted market index.

The portfolio is measured over the period 1995 to 2014, and is calculated with weekly return observations.

One-factor model

	Dependent variable:	
	eRp	
	(1) (EW)	(2) (VW)
Constant	-0.003^{***}	-0.001
	(0.001)	(0.001)
eRm	1.424^{***}	0.954^{***}
	(0.044)	(0.033)
Observations	994	994
Adjusted R^2	0.510	0.461
Note:	*p<0.1; **p<0.05; ***p<0.01	

Three Factor Model:

	Dependent variable:	
	eRp	
	(1) (EW)	(2) (VW)
Constant	-0.002^{**}	-0.003^{***}
	(0.001)	(0.001)
eRm	1.320^{***}	1.127^{***}
	(0.050)	(0.046)
SMB	-0.143^{***}	0.378^{***}
	(0.045)	(0.059)
HML	-0.131^{***}	-0.159^{***}
	(0.044)	(0.045)
Observations	994	994
Adjusted R^2	0.519	0.488
Note:	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$	

1. Comment on the performance of this portfolio.

Solutions

PROBLEM SET: Performance

Solution to Exercise 1.

1. The arguments you should advance are: i) Since the market portfolio can never be identified, all CAPM-based portfolio performance measures, and especially rankings are dependent in the proxy chosen for the market. ii) Since Nosyboiz have obviously found different Jensen-measures, they have obviously chosen a proxy that is mean-variance inefficient. But it is well known, that these measures are sensitive to the choice of the proxy. Ranking especially have been shown to 'switch' by small changes in the proxy. Hence, the Nosyboiz methodology and ranking are without any content.
2. It is true that the measures and ranking are sensitive to proxy choice. But it is also known that the (Jensen) measures do not change by much if we choose another inefficient proxy "close" to the original one. Even though rankings may be suspect, if our proxy as "broad" enough, a negative Jensen measure for Doonurbest (if true) is still a cause for concern.
3. Ignore the rankings, but look at the sign and the size of the Jensen measure as indicate of performance.

Solution to Exercise 2.

RTMF [4]

1. Selection and timing ability:

$$\alpha_p < 0 \quad \Rightarrow \quad \text{'poor' stock selection ability}$$
$$\gamma_p > 0 \quad \Rightarrow \quad \text{good timing ability}$$

2. This will go against interpreting positive γ_p as (a) sign|evidence of good timing ability: notice, that $\alpha_p < 0$ is consistent with absence of timing ability and use of options and futures to hedge downward risk.

Solution to Exercise 3.

1. We need to do some regressions here, I will be using Matlab to go through this.

   Read in the data

```
> erP = [ 3.58 -4.91 6.51 11.13 8.78 9.38 -3.66 5.56 -7.72 7.76 -4.01 0.78];
> erQ = [ 2.81 -1.15 2.53 37.09 12.88 39.08 -8.84 0.83 0.85 12.09 -5.68 -1.77 ];
> erM = [ 2.2 -8.41 3.27 14.41 7.71 14.36 -6.15 2.74 -15.27 6.49 -3.13 1.41];
```

   Will first estimate the Treynor-Marzuy regression

$$r_P - r_f = \alpha_P + b_P(r_m - r_f) + c_P(r_m - r_f)^2 + e_P$$

   Regressing the portfolio P on a constant, the excess market return and the excess market return squared:

```
> X=[ones(12,1) erM' (erM.*erM)']
>  bP = inv(X'*X)*X'*erP'
bP =
   1.7778189
   0.6982808
  -0.0020865
```

   gives the following estimates:

$$\alpha_P = 1.77,\ b_P = 0.698 \text{ and } c_P = -0.002$$

   Since the c_P is negative, and almost equal to zero, there is little evidence of timing ability for portfolio P.

   Doing the same procedure for portfolio Q:

```
bQ = inv(X'*X)*X'*erQ'
bQ =
  -2.30096
   1.29892
   0.10408
```

We find some more evidence of timing here

$$\alpha_Q = -2.30,\ b_Q = 1.29 \text{ and } c_Q = 0.104$$

Next want to use the Henrikson-Merton methods, instead of the quadratic term on excess market return, use a dummy for whether the exess market return is positive.

$$r_P - r_f = \alpha_P + b_P(r_m - r_f) + c_P 1_{r_m - r_f > 0} + e_P$$

```
> X=[ones(12,1), erM', erM'.*(erM>0)']
X =
    1.00000    2.20000    2.20000
    1.00000   -8.41000    0.00000
    1.00000    3.27000    3.27000
    1.00000   14.41000   14.41000
    1.00000    7.71000    7.71000
    1.00000   14.36000   14.36000
    1.00000   -6.15000    0.00000
    1.00000    2.74000    2.74000
    1.00000  -15.27000    0.00000
    1.00000    6.49000    6.49000
    1.00000   -3.13000    0.00000
    1.00000    1.41000    1.41000
```

Doing the regression for P and Q:

```
> bP=inv(X'*X)*X'*erP'
bP =
   1.783669
   0.719809
  -0.044759
> bQ=inv(X'*X)*X'*erQ'
bQ =
  -7.41661
  -0.49959
   3.60384
```

We find no evidence in favour of timing for P ($c_P = -0.044$), but we do for Q ($c_Q = 3.603$).

Solution to Exercise 4.

[3]

1. The market expects

$$\begin{aligned} E[r] &= r_f + (E[r_m] - r_f)\beta \\ &= 0.08 + 0.06 \cdot 0.9 \\ &= 13.4\% \end{aligned}$$

The analyst is pessimistic, since his expectation of 13% is lower than the 13.4% expected return for a stock with $\beta = 0.9$.

Solution to Exercise 5.

Performance Measures [5]

well-diversified investor: Treynor and Jensen

undiversified investor: Sharpe

Solution to Exercise 6.

Share Portfolio [3]

1. Alphas According to the CAPM:

$$E[r_{BuyIT}] = 0.05$$
$$E[r_{SellIT} = 0.13$$

Therefore, alpha estimates

$$\alpha_{BuyIT} = 0.01$$
$$\alpha_{SellIT} = -0.01$$

Sharpe calculation.
Portfolio (a)

$$E[r_a] = 0.06 \cdot 0.8 + 0.12 \cdot 0.2 = 0.072$$
$$\sigma^2(r_a) = 0.2^2 \cdot 0.8^2 + 0.4^2 \cdot 0.2^2 = 0.032$$
$$\sigma(r_a) = \sqrt{0.032} = 0.1789$$
$$S_a = \frac{0.072 - 0.05}{0.1789} = 0.1230$$

Similarly for portfolio (b)

$$S_b = \frac{0.0982 - 0.05}{0.2647} = 0.1830$$

and the market

$$S_m = \frac{0.10 - 0.05}{0.20} = 0.25$$

Solution to Exercise 7.

Norwegian Portfolio [8]

The interesting coefficients for performance is the alpha measure.

Here, if they are significant, the alphas are negative.