UNIVERSITY OF CHICAGO
Booth School of Business

Bus 35120 – Portfolio Management Prof. Lubos Pastor

Assignment #8

Due: May 19 by 8:15am

Be as clear and brief as possible. The data for Part B of the assignment can be downloaded from Canvas, along with two sample programs that can help you complete Part B.

A. CASE STUDY: "Pension policy at the Boots company PLC." Read the case and answer the following questions.

1. Should Boots shift all of its pension assets into bonds? State some arguments in favor and against this proposal, and then take a stand.
2. What is the likely effect of such a shift on the company's stock price?
3. If Boots goes ahead with the proposal, should the trustees publicly announce their intentions?

Be prepared to discuss the case in class.

B. DATA ANALYSIS. The purpose of this assignment is to analyze two key issues encountered in the active mutual fund industry: performance evaluation and the relation between fund performance and fund flows. You will also apply one of the most commonly used econometric tools in empirical asset pricing, the Fama-MacBeth approach.

In part B1, you will evaluate the performance of a mutual fund that invests in two assets: the market portfolio and the T-bill. The fund's monthly holdings are in *fund_holding.txt*. The first column is the date (YYYYMM) and the second column is the weight on the market at the beginning of the given month (the weight on the T-bill is one minus the weight on the market). Monthly returns on the market and the T-bill can be obtained from the file *ff_factors_192607_201612.txt*.

In part B2, you will study the returns and net flows of all global equity mutual funds.[1] The data are available in *rets_hwk7.mat* and *flows_hwk7.mat*. Both files are Matlab readable, but they are not text files. To read them in Matlab, type *load rets_hwk7.mat* and *load flows_hwk7.mat* and two matrix variables, *rets* and *flows*, will be created. The first column is the fund identifier (which you don't really need), the first row identifies the year, and the rest of the entries are annual fund returns (in *rets*) and annual net fund flows (in *flows*). Missing data are denoted by -99.

[1] Net flow, the difference between a fund's cash inflow and outflow, is expressed as the growth rate of the fund's assets under management. If the initial size of the fund is \$2 and the net flow is 0.03, the fund's size changes to $2 \times (1 + 0.03) = 2.06$.

1. **Performance Evaluation and Market Timing.**
   Consider the fund whose market weights are contained in *fund_holding.txt*.
   (a) Unconditional estimates
      i. Estimate the fund's unconditional alpha and beta.
      ii. Does the fund manager appear to be skilled?
   (b) Conditional estimates
      i. How would you estimate this fund's conditional beta at time t?
      ii. How would you estimate this fund's conditional alpha at time t?
   (c) Does the fund manager have the ability to time the market, based on
      i. the Treynor-Mazuy approach?
      ii. the Henriksson-Merton approach?
      iii. the Grinblatt-Titman approach?[2]
   (d) What if anything have you learnt from this exercise?

2. **Estimating the Performance-Flow Relation.** Consider all equity mutual funds between 1992 and 2002, with data in *rets_hwk7.mat* and *flows_hwk7.mat*.
   (a) Examine the relation between fund returns in 2001 and fund flows in 2002.
      i. Sort funds into 10 decile portfolios according to their returns in 2001. For each decile, compute the average 2001 return, as well as the average 2002 net flow into the funds in that decile. Plot the average net flow across the ten deciles. Do you observe a convex pattern?
      ii. To look for convexity more formally, regress the average decile flows on the average decile returns and their squares:

$$F_{i,t} = a + bR_{i,t-1} + cR_{i,t-1}^2 + e_{i,t}, \quad i = 1, \ldots, 10, \quad t = 2002. \tag{1}$$

      Do your results support a convex relation between flows and returns?
      iii. In the figure from part (i), plot the fitted flow values using a dotted line:

$$\widehat{F}_{i,t} = \hat{a} + \hat{b}R_{i,t-1} + \hat{c}R_{i,t-1}^2. \tag{2}$$

      iv. Is there any problem with the standard errors in regression (1)?
   (b) Examine the performance-flow relation in the whole sample. For each year t between 1992 and 2001, sort funds into decile portfolios according to their returns in year t, compute the deciles' average returns in year t as well as their average net flows in year $t+1$, and run regression (1). This process produces a time series of regression estimates, with three estimates ($\hat{a}_t$, $\hat{b}_t$, and $\hat{c}_t$) for each of the 10 years.
      i. Summarize the evidence using the Fama-MacBeth approach. The Fama-MacBeth estimate of a given coefficient is the average of the coefficient's estimates across all 10 years (e.g., $\hat{a} = \frac{1}{10}\sum_{t=1}^{10}\hat{a}_t$), and the standard error

[2]Hint: Use $k = 1$ month and $N = 1$ asset (the market). To approximate the t-statistic on the GT measure, use the series of GT_t for $t = 1, 2, ..., T$ to estimate the standard error of GT.

is the standard deviation of those estimates divided by the square root of 10. What are the Fama-MacBeth estimates of a, b, and c? Is the performance-flow relation significantly positive? Is the convexity pattern statistically significant?

ii. Plot the average performance-flow relation in this sample. To do that, average the average decile flows across the 10 years, and plot these average average flows across the 10 deciles. Do you see a convex pattern?

(c) Consider two investments, A and B, both of which last one year. A is safe; it will bring 1% annual return for sure. B is risky, it will bring either -25% with probability 0.6 or +25% with probability 0.4.

i. Which project, A or B, would you choose if investing your own money?

ii. Now suppose you manage a $100 million mutual fund and you care only about your expected compensation, which is 1% of assets under management at the end of the year. Your fund allows inflows and outflows only at the end of the year. At the beginning of the year, you are deciding between A and B. Which of the two investments will you choose? [3]

iii. Is your choice between A and B the same in parts (i) and (ii)? Explain.

(d) What if anything have you learnt from this exercise?

C. EXAM-LIKE QUESTIONS.

1. The legendary Peter Lynch managed Fidelity Magellan, the biggest actively managed fund, from May 1977 until May 1990. Under his leadership, Magellan achieved an impressive CAPM alpha of 0.89% per month, with a t-stat of 5.69.

(a) What is the probability of achieving such a large (or larger) alpha purely by luck? Express this probability as "one over x." [4]

(b) What is the probability that at least one of 10,000 managers following unrelated techniques will achieve such a large alpha by luck?

(c) How does the answer change for 20,000 instead of 10,000 managers?

(d) What do you conclude about Peter Lynch's performance? Was it due to luck?

[3] Hint: Your expected compensation at the year-end depends on your assets under management at the year-end, which in turn depend on your return during the year as well as on the net flow into your fund at the year-end. This net flow will take place after the return on A or B is realized but before your compensation is determined. To compute the expected net flow as a function of your return, use the Fama-MacBeth estimates of a, b, and c from above and equation (2). Assume that A or B is your only investment during the year.

[4] Hint: The Matlab command *tcdf* can help you evaluate the probability of achieving a t-statistic lower than a given value. The alpha estimate is based on $T = 12 \times 13 = 156$ months of data, and it follows a t distribution with $T - 2$ degrees of freedom (two degrees of freedom are 'lost' in estimating the intercept and slope in the market model regression).

2. Consider a mutual fund F, whose market beta is 2.1 and whose monthly returns in excess of the risk-free rate (r^e_F) have a sample average of 1.8% and standard deviation of 10%. Monthly excess market returns (r^e_M) have a sample average of 0.8% and standard deviation of 4%. Some regression evidence: $r^e_{F,t} = -0.0037 + 1.8r^e_{M,t} + 0.4(r^e_{M,t})^2 + \epsilon_t$. All numbers are monthly, based on data covering the past 60 months. The fund's returns are before fees.
   (a) Assume that beta is the only measure of risk that investors care about. What is the maximum annual fee (in percent of assets under management) that fund F can afford to charge to attract customers?
   (b) Does the fund appear to have market timing ability? Why?
   (c) Is the fund's average excess return (of 1.8% per month) significantly different from zero at the usual 5% confidence level?
   (d) What is the correlation between r^e_F and r^e_M?
   (e) Suppose you care only about the mean and variance of returns, and you have to invest your money either in fund F or in the market M, but not both. A one-month T-bill is also available for investment, long or short. Which one do you choose, F or M?
   (f) Now suppose you currently hold M, but you want to shift some of your money into fund F. If the amount you shift is optimal in the sense that it gives you a portfolio with the highest possible Sharpe ratio, what is this highest possible (monthly) Sharpe ratio? Is the improvement in the Sharpe ratio large?
3. You would like to invest in a mutual fund with a tradition of investing in large-cap value stocks. Quick research turns up dozens of funds with "large-cap value" in their name, but you don't know how long these funds have been pursuing this strategy. Describe how you can learn more about the extent to which the fund has been following a large-cap value strategy, assuming that you have access to the historical returns on the fund as well as on the Fama-French factors.
4. "If a money manager is truly skilled, then we must observe persistence in the manager's risk-adjusted net returns." Briefly comment.
5. "Net flows into a mutual fund are more closely related to the fund's past performance than to the fund's future performance." True or false? Explain.
6. (not graded) Read the following excerpt from an article that came out in Street Authority Market Advisor. Do you agree with the way the article characterizes Peter Lynch?

   The Value Road To Wealth, by Paul Tracy, April 21, 2005

   Have you ever sat back and tried to compile a list of the most successful investors of all time? If you're like most investors, then during that process you probably considered such names as Warren Buffett, Benjamin Graham, Peter Lynch or John Neff. While all of these great investors certainly had distinct approaches to the market, they had one thing in common: They are all considered – to one degree or another – to be value investors. While momentum investors come and go and this year's hot mutual fund manager fades into next year's chump, value investors like Buffett and Lynch have shown incredible staying power over the course of their careers.