UNIVERSITY OF CHICAGO
Booth School of Business

Bus 35120 – Portfolio Management Prof. Lubos Pastor

Assignment #6

Due: May 5 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 a sample program that can help you complete Part B.

A. CASE STUDY: "S&P Indices and the Indexing Business in 2012." Read the case and answer the following questions. You can use any additional sources of information.

1. What do index providers do? How do they generate revenue?
2. What is the license fee that the largest ETF in the world pays to S&P? How does it compare to the license fees charged by MSCI?
3. How does S&P distinguish its indices from their competitors?
4. Who are the best known index providers? Which new provider arrived at the scene in late 2012, shortly after the case study was written?

B. DATA ANALYSIS.

This assignment explores the time variation in aggregate stock market liquidity and its implications for asset prices. You will need four data files. First, download the monthly series of innovations in aggregate liquidity in August 1962 through December 2015 from WRDS.[1] (Look under Fama-French & Liquidity Factors, Pastor-Stambaugh. Or go to http://faculty.chicagobooth.edu/lubos.pastor/research/liq_data_1962_2015.txt.) After formatting the file so that the first column contains the date and the second column contains the innovation series ("PS_innov"), save it as *liq.txt.* Second, download the monthly returns of portfolios sorted on historical liquidity betas from http://faculty.chicagobooth.edu/lubos.pastor/research/liq_vw_hist_deciles.txt. Portfolio 1 contains stocks with the lowest historical liquidity betas; portfolio 10 the highest ones. The last column is the return on a 10-1 long-short portfolio (long portfolio 10, short portfolio 1). These portfolios can be constructed in real time since historical betas at time t are computed by using only information prior to time t. These data cover the period January 1968 through December 2015. Third, the file *vix.txt* contains

[1] As of this writing, the liquidity data are available on WRDS only through December 2015. WRDS should post the update through December 2016 soon. At the time you work on this assignment, the 2016 liquidity data may or may not be posted on WRDS. Regardless, use only data through 2015.

the month-end values of the VIX index from its inception in January 1990 through December 2016. VIX measures the implied volatility in the equity index option market.[2] Finally, monthly returns on the aggregate stock market and the other two Fama-French factors are in *ff_factors_192607_201612.txt*, which you used in an earlier assignment.

1. What is the correlation between the innovations in liquidity and the VIX index? Use the longest time period over which both series are available.
   (a) How does the magnitude of this correlation compare to the correlation between liquidity and volatility reported in the original Pastor and Stambaugh (2003) study? Why is it somewhat different?
   (b) Provide an economic explanation for why this correlation is negative.
2. What is the correlation between the innovations in liquidity and stock market returns? Use the longest time period over which both series are available. Can you explain the sign of the correlation?
   (a) Calculate the same correlation in two distinct subsamples: downmarkets (months in which the excess stock market return is negative) and upmarkets (months in which it is nonnegative). Is there a difference? Why?
3. Is liquidity risk priced? Pastor and Stambaugh (2003) answered "yes" based on the sample period 1962–1999.[3] Update their analysis through the present (1962–2015). Do stocks with higher liquidity betas continue to have higher Fama-French alphas? Does the 10-1 portfolio have a significantly positive alpha?
   (a) Answer the same questions using the sample period January 2000–December 2015. This is a pure "out of sample" test of Pastor & Stambaugh (2003).
   (b) For both time periods (1962–2014 and 2000-2015), plot the Fama-French alphas across the 10 portfolios.
4. Do historical liquidity betas predict future liquidity betas? For both time periods (1962–2015 and 2000-2015), calculate the future ("post-ranking") liquidity betas of the 10 portfolios by regressing their returns on innovations in liquidity and the Fama-French factors. For both periods, plot those liquidity betas across the 10 portfolios. Do the betas exhibit an increasing pattern across the 10 portfolios? Does the 10-1 portfolio have a significantly positive liquidity beta?

C. EXAM-LIKE QUESTIONS.

The performance of funds that invest in illiquid assets (such as private equity, convertible bonds, etc.) can be distorted by the illiquidity of the funds' investments. Since illiquid assets do not trade every day, their value cannot be easily and promptly marked to market. Illiquid holdings are often carried on the books at historical or stale prices, distorting traditional performance measures. This distortion is illustrated in the first two exam-like questions below. The remaining exam-like questions are unrelated.

[2] The VIX data come from the CBOE website, http://www.cboe.com/micro/vix-options-and-futures.aspx.

[3] In addition to simple historical liquidity betas, which we examine here, Pastor and Stambaugh sorted stocks into portfolios based on "predicted" liquidity betas, which use more information. Their results based on predicted betas are stronger than those based on historical betas. In this assignment, we will only work with historical liquidity betas, for simplicity.

1. Stale Price Asset Management (SPAM) invests all of its capital in the stock market index whose average return is 1% per month. SPAM always marks to market one month late. For example, if the market goes up 5% in January, SPAM reports a 5% return in February.
   (a) To evaluate SPAM's performance, you run a standard market model regression. What estimates of alpha and beta do you expect to find?
   (b) What would SPAM's alpha and beta be if SPAM were to mark to market properly?
   (c) How can you adjust the standard performance evaluation regression to remove the stale price problem?
2. Consider a private equity (PE) fund holding a portfolio of illiquid assets. The portfolio's value is determined each month by an internal appraisal procedure that considers both recent comparable sales and past appraised values. As a result, the PE fund's returns tend to exhibit positive autocorrelation. Assume for simplicity that the fund's reported returns r_t^* follow an AR(1) process:

$$r_t^* = a + b r_{t-1}^* + \epsilon_t \ , \tag{1}$$

   where b is the autocorrelation coefficient, $0 < b < 1$, and ϵ_t is i.i.d. with mean zero. A natural way to "unsmooth" the PE fund's returns is by removing the serial correlation:

$$r_t = \frac{1}{1-b} r_t^* - \frac{b}{1-b} r_{t-1}^* \ , \tag{2}$$

   where r_t is the PE fund's true unobserved return.
   (a) Does the unsmoothing procedure in equation (2) produce a higher or lower expected return? Compare the expected values of r_t^* and r_t.
   (b) Does the unsmoothing procedure produce more or less volatile returns? Compare the variances of r_t^* and r_t.
   (c) What have you learned from this exercise about the reported Sharpe ratios of funds holding illiquid investments, such as PE funds?

3. True or false? "Low trading volume is the best sign that liquidity has dried up."
4. True or false? "More volatile stocks tend to have higher bid-ask spreads to compensate the demanders of liquidity for the higher risk involved in holding these stocks."
5. True or false? "Implementation shortfall tends to be larger for small-cap stock strategies than for large-cap stock strategies."