

FE312: Homework 7

1 Testing a Liquidity Factor Model

In their 2003 Journal of Political Economy paper, Lubos Pastor and Robert Stambaugh advocate the need for a liquidity factor. Further, they claim that their liquidity factor can explain part of the momentum. In this homework we will investigate their claims and in the process learn a bit more how we can implement the APT in practice.

Open the dataset HW7_Data.xlsx. It contains the following: The Pastor-Stambaugh liquidity factor (ps_level), innovations in the liquidity factor (ps_innov), excess returns on the market portfolios (MKTRF), the risk-free rate (RF) and returns on 10 Portfolios sorted on past 1 year returns (the 10 Momentum portfolios). Let us test a version of the APT that has two factors: the market portfolio and the Pastor-Stambaugh liquidity factor. We will investigate whether the momentum effect can be attributed to differences in exposure to the liquidity factor between winners and losers.

1. Plot the level of the Pastor-Stambaugh liquidity factor. High values of this factor indicate liquid months, low levels identify illiquid months. Identify the two months when the liquidity factor had its lowest value. What happened on those dates?
2. Pastor and Stambaugh have kindly provided us with an innovation series (ps_level). How do you think this series is constructed and how does it differ from the level liquidity factor (ps_level)?
3. Construct $\tilde{f}_{m,t} = MKTRF_t - E[MKTRF_t]$, i.e. innovations in returns to the market portfolio. Use the historical average return for the market to estimate $E[MKTRF_t]$
4. For each momentum portfolio ($R_1 \dots R_{10}$) estimate the factor loadings on innovations to the market portfolio and the liquidity innovation series

$$R_{i,t} = a_i + b_{mkt,i}\tilde{f}_{m,t} + b_{liq,i}PS_INNOV_t + \epsilon_{it}$$

From this regression, we will use the market loadings $b_{mkt,i}$ and the liquidity factor loadings $b_{liq,i}$. You should have 10 of each.

5. Is there any difference in liquidity factor loadings across the momentum portfolios? Interpret the estimated loadings on the liquidity factor for the 10 momentum portfolios. When liquidity is high, which portfolio goes up by more, winners or losers? Is the difference statistically significant? (HINT: for answering the latter question, create an eleventh portfolio, Winners - Losers and estimate its market and liquidity factor betas).
6. Estimate the historical average return of each of the 10 momentum portfolios,

$$\hat{\mu}_i = \frac{1}{T} \sum_{t=1}^T R_{i,t}.$$

7. Now, it's time to estimate the model: Regress the estimates of average returns on the 10 momentum portfolios on their loadings on the market and the liquidity factor:

$$\hat{\mu}_i = \lambda_0 + \lambda_{mkt}b_{mkt,i} + \lambda_{liq}b_{liq,i} + u_i$$

This is a regression with only 10 datapoints, one for each momentum portfolio. Report the estimates for the λ 's, the associated t-statistics and the R^2 of this regression.

8. Interpret the estimated prices of risk λ_{mkt} and λ_{liq} . Does the sign make sense? Are they statistically different from zero? Also interpret the estimate of the risk-free rate, λ_0 . Given that we are dealing with monthly data, does the magnitude make sense?
9. Based on your findings what do you conclude? Do you think that liquidity risk is priced, at least using the cross-section of momentum portfolios? Does liquidity provide an adequate explanation for momentum? Plot the historical average return of these portfolios $\hat{\mu}_i$ versus the model-predicted return $\lambda_0 + \lambda_{mkt}b_{mkt,i} + \lambda_{liq}b_{liq,i}$.