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Revisiting Pastor–Stambaugh liquidity factor

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HIGHLIGHTS

- The Pastor–Stambaugh liquidity-augmented four-factor asset pricing model is examined.
- A state-of-the-art two-pass cross-sectional regression methodology is employed.
- The liquidity factor is not priced in the U.S. equity market.

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ABSTRACT

The objective of this study is to examine the Pastor and Stambaugh (2003) liquidity-augmented four-factor asset pricing model to revisit whether the liquidity factor is indeed priced in the U.S. equity market, over the period from January 1966 through December 1999. The study applies the state-of-the-art two-pass cross-sectional regression methodology of Lewellen et al. (2010). I find the liquidity factor is not priced. The result is robust using an extended sample that ends in December 2016.

1. Introduction

Recently, Pastor and Stambaugh (2003, PS, henceforth) examines the Fama and French (1993) three-factor asset pricing model augmented with a liquidity factor, namely innovations in aggregate liquidity, in pricing the cross-sectional variation in the returns to decile portfolios sorted with respect to predicted liquidity betas, over the period from January 1966 through December 1999. The article applies the Hansen (1982) Generalized Method of Moments (GMM) methodology and finds the liquidity factor is priced in the U.S. equity market.

More recently, Goyenko et al. (2009) finds that the PS liquidity measure, namely Gamma, is unable to capture the time-series or cross-sectional NYSE/AMEX five-minute price impact, calculated from NYSE's Trade and Quote database.

The empirical finding in Goyenko et al. (2009) motivates this study to examine the PS liquidity-augmented four-factor asset pricing model to revisit whether the liquidity factor is indeed priced in the U.S. equity market, over the period from January 1966 through December 1999. The study applies the state-of-the-art two-pass cross-sectional regression methodology of Lewellen et al. (2010, LNS, henceforth) and finds the liquidity factor is not priced. The result is robust using an extended sample that ends in December 2016.

The study extends the literature on asset pricing by providing an updated general result of the PS liquidity premium theory that can be used as a reference point for academic researchers, portfolio managers, and individual investors.

The rest of the study is organized as follows: Section 2 contains the methodology. Section 3 describes the data and provides descriptive statistics. Section 4 provides the empirical results and analysis. Section 5 is the robustness. Finally, Section 6 concludes.

2. Methodology

The study applies the LNS two-pass cross-sectional regression methodology to examine the PS liquidity-augmented four-factor asset pricing model. Specifically, the model is required to explain the cross-sectional variation in the monthly value-weighted excess returns to the 25 portfolios sorted on size and book-to-market plus five portfolios sorted by industry.[1] I impose the theoretical

[1] Daniel and Titman (2012) find that industry sorted portfolios exhibit considerable variation in factor loadings relative to a number of macroeconomic factors, that is largely unrelated to book-to-market ratio.

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Table 1
Descriptive statistics for the test assets.

Panel A											
	Mean Excess Return (%)						Standard Deviation (%)				
	Low	2	3	4	High		Low	2	3	4	High
Small	0.25	0.73	0.75	0.96	1.04	Small	7.80	6.78	6.14	5.75	6.07
2	0.45	0.68	0.79	0.91	0.96	2	7.36	6.17	5.53	5.21	5.84
3	0.52	0.70	0.62	0.78	0.93	3	6.75	5.65	5.02	4.81	5.48
4	0.58	0.42	0.63	0.75	0.83	4	5.98	5.32	4.90	4.68	5.42
Big	0.52	0.52	0.46	0.56	0.72	Big	4.88	4.66	4.40	4.33	4.81

Panel B					
Portfolio	I1	I2	I3	I4	I5
Mean Excess Return (%)	0.56	0.45	0.67	0.67	0.57
Standard Deviation (%)	4.93	4.31	4.99	5.31	5.41

Panel A is for the monthly value-weighted excess returns to the 25 portfolios sorted on size and book-to-market with small to big size portfolios on the vertical side and low to high growth portfolios on the horizontal side. Panel B is for the monthly value-weighted excess returns to the five industry sorted portfolios. Industries are consumer (I1), Manufacturing (I2), HiTechnology (I3), Healthcare (I4), and others (I5). Statistics reported are the Mean and Standard Deviation.

restriction that the zero-beta rate is equal to the risk-free rate, and also use the Generalized Least Squares cross-sectional regression approach. In testing the null hypothesis that the factor risk-premia is equal to zero, I use Kan et al. (2013, KRS, henceforth) test to assess for possible misspecification.[2]

3. Data and descriptive statistics

The value-weighted returns to the 25 portfolios sorted on size and book-to-market, the return to the market factor as well as the size and value factors are all constructed according to the Fama and French (1993) methodology. The value-weighted returns to the five industry portfolios are constructed according to the Fama and French (1997) methodology. I use the one-month U.S. Treasury bill rate as a risk-free rate. Data are obtained from Kenneth R. French's website,[3] and cover all stocks traded on NYSE, AMEX, and NASDAQ that has a CRSP shares code 10 and 11.[4] The liquidity factor is the innovations in aggregate liquidity constructed according to the PS methodology.[5] Data is obtained from Robert F. Stambaugh website,[6] and cover all stocks traded on NYSE and AMEX that has a CRSP shares code 10 and 11. All data cover the period from January 1966 through December 1999.

Table 1 shows that the mean excess returns to the test assets varies between 0.25% and 1.04%, while the standard deviation varies between 4.31% and 7.80%.

Table 2 shows that the market factor has a mean of 0.025% per month with standard deviation of 4.569%. Both size and value factors have a mean of 0.166% and 0.337% with a standard deviation of 2.996% and 2.678%, respectively. The liquidity factor has a negative mean of −0.001% with the lowest standard deviation of 0.053%.

From Table 3, I notice that the correlation between the liquidity factor and each of the size and the value factors is very low; 0.22 and −0.12, respectively.

4. Empirical results and analysis

Table 4 shows that the liquidity factor beta is statistically significant for five out of the 30 portfolios, at 5% significance level. It also has a positive spread of 10.52 with a mean of 0.09 and standard deviation equal to 2.43.

Table 5 shows that the null hypothesis that the liquidity factor risk-premia is equal to zero is not rejected.[7]

The annual abnormal return for going long in the portfolio with high sensitivity to liquidity and short in the portfolio with low sensitivity is equal to 1.06% which is much smaller than the 9.63% reported in PS. Overall, the liquidity factor is not priced.

Table 2
Descriptive statistics for the factors.

Factors	*MKT*	*SMB*	*HML*	*PS*
Mean (%)	0.025	0.166	0.337	−0.001
Standard Deviation (%)	4.569	2.996	2.678	0.053

MKT is the market factor. *SMB* and *HML* are the size and the value factors, respectively. *PS* is the liquidity factor. Statistics reported are the Mean and Standard Deviation.

Table 3
The correlation coefficients among the factors.

	MKT	*SMB*	*HML*	*PS*
MKT	1.00			
SMB	0.31	1.00		
HML	−0.39	−0.15	1.00	
PS	0.35	0.22	−0.12	1.00

MKT is the market factor. *SMB* and *HML* are the size and the value factors, respectively. *PS* is the liquidity factor.

5. Robustness

Given the importance of liquidity risk, it is reasonable to provide a robustness test using an extended sample that includes more recent data. Hence, I consider a monthly sample that ends in December 2016. To briefly summarized, the main finding that the liquidity factor is not priced in the U.S. equity market is robust using an extended sample that ends in December 2016.[8]

6. Conclusion

PS's paper is very influential, but also very questionable. Their liquidity measure is weakly related to price impact (see Goyenko

[2] The test is given in Equation (IA.244) in the internet appendix for "Pricing model performance and the two-pass cross-sectional regression methodology" of KRS.

[3] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

[4] Dividends are included.

[5] See PS's Equations ((1)–(8)).

[6] http://finance.wharton.upenn.edu/~stambaug/.

[7] In the online appendix for "Misspecification-robust inference in linear asset-pricing models with irrelevant risk factors" of Gospodinov et al. (2014), in an unreported empirical example of Liu (2006) liquidity-augmented two-factor asset pricing model, using Gospodinov et al. (2014) test which assess for possible misspecification, simultaneously produce similar results for the PS liquidity factor.

[8] The results are available upon request.

Table 4
The liquidity factor betas.

Panel A											
	b_{PS}						t-stat				
	Low	2	3	4	High		Low	2	3	4	High
Small	−3.78*	−1.32	1.79	2.05*	1.09	Small	−2.02	−0.68	1.09	1.75	0.72
2	−2.36	0.76	1.64	1.39	−1.22	2	−1.26	0.56	1.10	1.00	−0.96
3	−3.78*	1.41	0.76	−0.31	0.46	3	−2.37	0.73	0.32	−0.26	0.30
4	−1.12	2.36	0.99	−2.64	−0.12	4	−0.61	1.28	0.53	−1.43	−0.06
Big	−0.64	5.10*	2.32	−2.83	−2.90	Big	−0.47	3.25	1.24	−1.57	−1.41
Panel B											
Portfolio		I1		I2		I3		I4		I5	
b_{PS}		3.46		2.39		−5.43*		0.67		2.57	
t-stat		1.43		1.39		−2.21		0.17		1.14	

The table reports the liquidity factor betas, b_{PS}, and their corresponding GMM t-statistics of Cochrane (2005), t-stat, obtained from the LNS first-pass time-series regressions. Panel A is for the monthly value-weighted excess returns to the 25 portfolios sorted on size and book-to-market with small to big size portfolios on the vertical side and low to high growth portfolios on the horizontal side. Panel B is for the monthly value-weighted excess returns to the five industry sorted portfolios. Industries are consumer (I1), Manufacturing (I2), HiTechnology (I3), Healthcare (I4), and others (I5).
* Represents the significance at 5% significant level.

Table 5
The liquidity factor risk-premia.

λ_{PS} (%)	0.008
t_{KRS}	0.80

The table reports the liquidity factor risk-premia, λ_{PS}, and its corresponding KRS t-ratio, t_{KRS}, obtained from the LNS second-pass cross-sectional regression methodology. I use one-lag Newey and West (1987) to correct for the effect of heteroskedasticity and autocorrelation in the residuals.

et al., 2009), though they find that the fluctuations in the average of this measure is priced in the U.S. equity market.

This study examines the PS liquidity-augmented four-factor asset pricing model to revisit whether the liquidity factor is indeed priced in the U.S. equity market, over the period from January 1966 through December 1999. The study applies the state-of-the-art two-pass cross-sectional regression methodology of LNS and finds the liquidity factor is not priced. The result is robust using an extended sample that ends in December 2016.

Recently, Ben-Rephael et al. (2015) finds that the premium associated with liquidity risk is significantly priced in NASDAQ stock exchange. It should be emphasized that in this study I do not separate the analysis among the U.S. stock exchanges. Whether the liquidity factor is indeed priced in NASDAQ stock exchange, using the methodology employed in this study, is subject for further empirical investigation.

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