Funding Liquidity and its Risk Premiums

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This draft has 72 pages. Here is what it does:

1. Use theory to motivate a new measure of funding liquidity in the cross-section of stocks.
2. Define and estimate an empirical counterpart.
3. It is a significant predictor of one-month market returns.
4. Robust to various controls, across sub-samples, out-of-sample, to alternative construction, and to small-sample bias.
5. Also a significant predictor of GDP growth up to 6-8 quarters ahead.
6. Visual comparisons with market sentiments (Baker and Wurgler, 2007), bond market funding liquidity (Fontaine and Garcia 2011), hedge funds (Ang, Gorovyy and van Inwegen, 2011), and liquidity mergers (Almeida, Campello and Hackbarth, 2011).

Preview

I have 24 slides. Here is the preview:

- The role of liquidation risk or intermediation constraints on equilibrium stock prices is an important and timely topic.
- This paper is rich in empirical details for the fearless reader.
- The predictability of the new measure seems robust.
- But the link with the theory is weak and the interpretation in terms of funding liquidity is unconvincing.
- Is this a risk factor or a puzzling state variable?

Model

One consumer endowed with y_1 and y_2 shares, with prices p (vector) and payoffs $v \sim N(\bar{v}, \Omega)$,

1. Risk-averse consumer :

$$\max_y \; E\left[-\exp(-\gamma W)\right]$$
$$s.t.\; W_c = p'1 + (v-p)'(y+1)$$

2. Risk-neutral speculator with margin constraint:

$$\max_x \; E\left[(v-p)'x\right]$$
$$s.t.\; |x_1|m_1 + |x_2|m_2 \leq W_0$$

3. Financier : margins m_1 and m_2 set to satisfy VAR constraint.

$$m_j = \Phi^{-1}(1-\pi)\sigma_j$$

Model

- A simplification of Brunnermeier and Pedersen (2009)? This is an economy with two agents with different risk aversion. No intermediation.
- What do they trade and why? One agent trades-off portfolio mean returns and variance. The other agent trades-off mean returns against relaxing the VAR constraint (diversification in the tail). What happens when correlation is zero?
- Do we have evidence of substantial margin heterogeneity in the cross-section of stocks? For retail investors? Institutional investors? Intermediaries?
- Copeland, Martin and Walker (2010) report substantial heterogeneity across fixed-income instrument but not for equities.

Model

- The Price Impact (PI) of exogenous liquidity demand, $y + \epsilon$,

$$\text{PI} = \frac{|p^* - p^*(\epsilon)|}{\bar{v}}$$

- PI varies with the wealth of the the intermediary,

$$\text{PI sensitivity} = corr(PI, W_0 + \eta)$$

- This has the feeling of comparative statics

$$\frac{\partial p^*}{\partial y} \text{ and } \frac{\partial^2 p^*}{\partial y \partial W_0}$$

  But these are not partial derivatives - not local effects.

- Are the equilibrium conditions satisfied for all shocks ϵ and η? Do we get no-trade equilibrium?

Model

- Define the gap between the PI sensitivities of high and low volatility stocks,

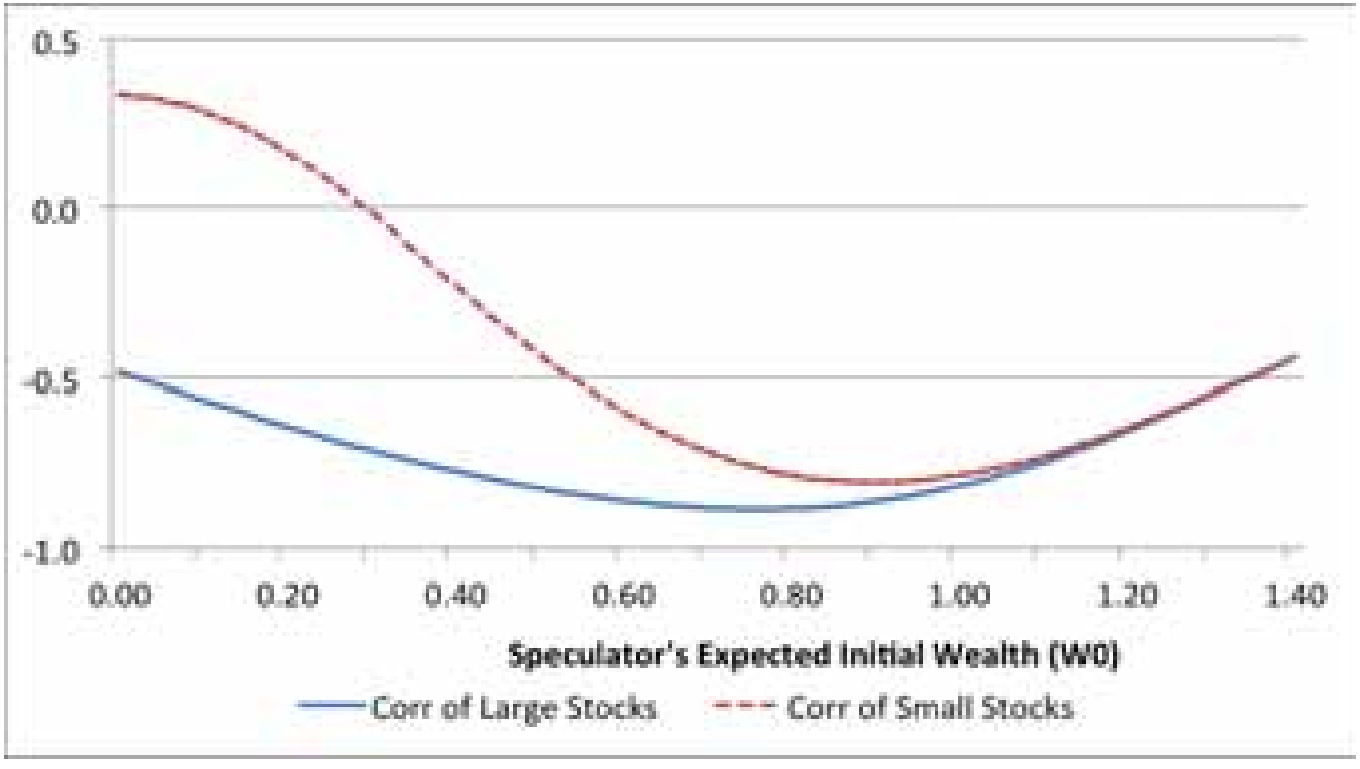
$$\text{Gap:} \quad \Delta(W_0) = corr(PI_{lowvol}, W_0 + \eta) - corr(PI_{highvol}, W_0 + \eta)$$

- The gap is larger the more constrained is the intermediary :

$$\Delta(W_{low}) > \Delta(W_{high})$$

- Idea : estimate the gap through time and use it as a measure of intermediary's constraint.

Prediction



The sensitivity is larger for the more volatile asset,

$$corr(PI_{highvol}, W_0 + \eta) > corr(PI_{lowvol}, W_0 + \eta)$$

Brunnermeier and Pedersen (2009)

Proposition 6(iv) : Flight to quality
The market liquidity differential between high- and low- volatility securities is bigger when speculator funding is tight, that is, $\sigma^l < \sigma^k$ *implies that* $|\Lambda^k|$ *increases more with a negative wealth shock to the speculator,* η*,*

$$\frac{\partial|\Lambda^l|}{\partial(-\eta)} \leq \frac{\partial|\Lambda^k|}{\partial(-\eta)},$$

and [some conditions],

$$Cov(|\Lambda^l|, \phi) \leq Cov(|\Lambda^k|, \phi).$$

$|\Lambda^i|$ is the liquidity premium for asset *i* and ϕ is the shadow price of the intermediary's constraint.

Acharya and Pedersen (2005)

Fixed investment horizon but time-varying costs of trading. Implies 3 conditional liquidity betas related to illiquidity.

3. $cov_t(r^M_{t+1}, c^i_{t+1})$
The third effect is due to covariation between a security's illiquidity and the market return.

The (unconditional) return premium due to $-cov(r^M_{t+1}, c^i_{t+1})$ *is* 0.82% *across illiquidity-sorted portfolios.*

Small stocks are riskier than large stocks,
$cov(r^M_{t+1}, c^{small}_{t+1}) < cov(r^M_{t+1}, c^{large}_{t+1})$.

Vayanos (2004)

Dynamic equilibrium model where fund managers are subject to liquidation risk when performance falls.

Conditional Two-factor CAPM

$$E_t[dR_{n,t}] = ACov_t(dR_{n,t}, dR_{m,t}) + AZ'(v_t)Cov_t(dR_{n,t}, dv_t) + \textit{illiqu. costs}$$

Volatility is a factor since it determines liquidation risk. Hence, the model can also be given an interpretation based on value-at-risk (VaR) constraints.

Exogenous supply shocks have a higher price impact during volatile times.

Disentangling Theories

The main theoretical prediction can arise from existing mechanisms,

1. Credit-constrained intermediary.
2. Liquidation risk in delegated management.
3. Time-varying transaction costs.
4. Others?

Empirics

Empirical strategy:

1. Form 5 portfolios sorted on size as proxy for stock total volatility.
2. Take Amihud (2002) price impact measure as liquidity proxy.
3. Take market returns as a proxy for varying intermediary wealth.
4. Compute 30-month rolling correlations $corr_t(liq_i, R_m)$ across size portfolios.
5. Use the gap as a measure of funding liquidity,

$$fliq = corr(illiq_{small}, R_m) - corr(illiq_{large}, R_m).$$

Empirics

Empirical strategy:

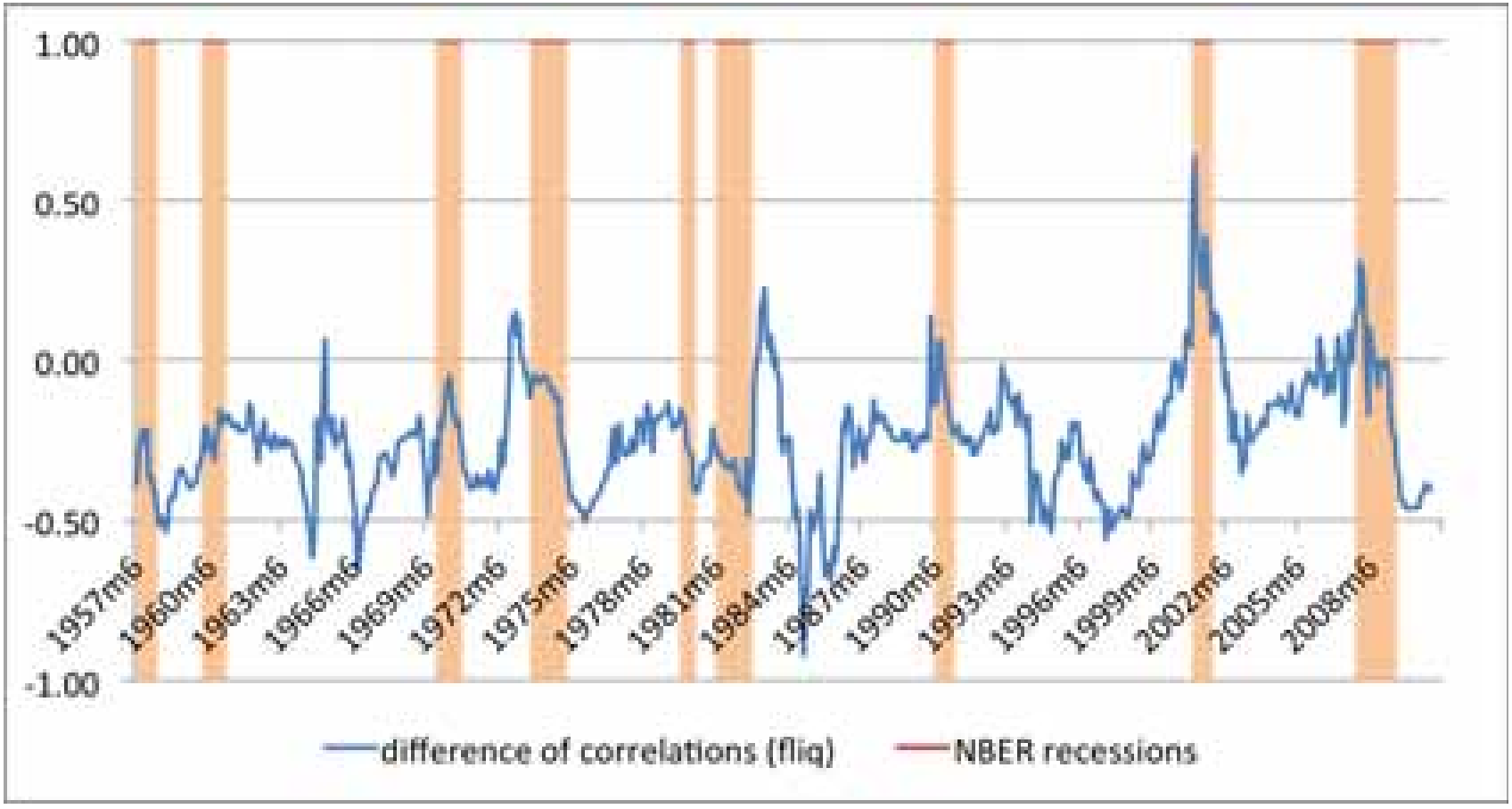
- Form 5 portfolios sorted on size as proxy for stock total volatility.
  $\rightarrow$ Why size if theory predicts sorting on volatility?
- Amihud proxy.
  $\rightarrow$ Why include NASDAQ stocks?
- Take market returns as a proxy for varying intermediary wealth.
  $\rightarrow$ Is this the right proxy? Hameed, Kang and Vishnawathan (JF2010) use returns on a broker-dealers index or returns on zero-cost liquidity-supply strategies?
  Adrian, $\rightarrow$ Etula and Muir (WP2010) use innovations to broker-dealer leverage.
- Compute 30-month rolling correlations $corr_t(liq_i, R_m)$ across size portfolios.
  $\rightarrow$ Rolling correlations mixes parameter instability. Why not compute correlation in subsets with high-low intermediary's wealth/high-low illiquidity measure.

GDP predictability

Panel B. Regression on *fliq* and Yield Curve Slope

fliq	-0.940***	-1.197***	-1.104***	-1.134***	-0.954***	-0.854**	-0.625*
	(-2.845)	(-3.712)	(-3.419)	(-3.516)	(-2.913)	(-2.566)	(-1.882)
slope	0.221***	0.297***	0.262***	0.270***	0.259***	0.173**	0.151*
	(2.833)	(3.912)	(3.439)	(3.527)	(3.320)	(2.168)	(1.886)
obs	234	233	232	231	230	229	228
R^2	0.069	0.118	0.098	0.102	0.082	0.049	0.032

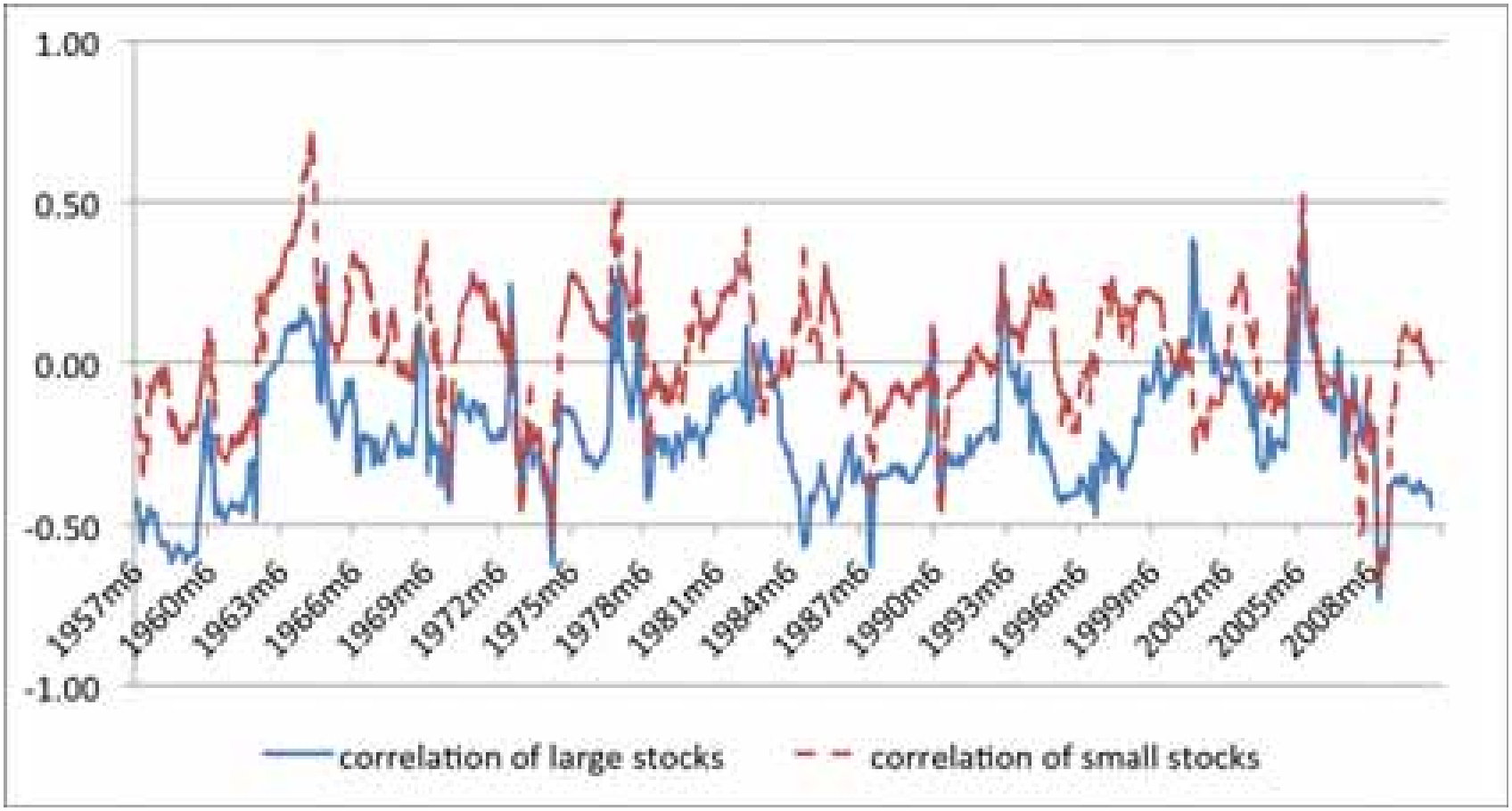
$$fliq = corr(PI_{large}, W_0 + \eta) - corr(PI_{small}, W_0 + \eta)$$



Spikes in recessions appear inconsistent with model's prediction.

"Recessions are in part triggered by excess liquidity" is conventional wisdom?

Individual correlation of large and small portfolios.



The source of spike is the portfolio of large stocks. This also appears inconsistent with the model's prediction.

Stock Market Liquidity and the Business Cycle

- Næs, Skjeltorp and Ødegaard (JF2011) - Market liquidity, especially liquidity of small stock portfolios predicts GDP growth (and other macro variables).
- Beber, Brandt and Kavajecz (RF2010) - Order flow portfolio based on cross-sector flows predicts macro indicators.
- Jensen and Moorman (JFE2010) - Aggregate market liquidity deteriorates before and increase after expansive monetary policy shifts. The return differential between illiquid and liquid stocks also fluctuates around policy shifts.

Can $fliq_t$ be a risk factor, or is it a conditioning variable?

Monthly market excess returns (Jan 1986 - Dec 2009)

$fliq_{t-1}$	-3.39			-3.26
	(2.66)			(2.51)
u_t^{fliq}	-21.6			-20.3
	(6.27)			(6.04)
$illiq_{t-1}$		-1.01		-0.60
		(0.64)		(0.37)
u_t^{illiq}		-8.66		-7.54
		(2.99)		(2.84)
FG_{t-1}			0.59	0.39
			(0.93)	(0.88)
u_t^{FG}			-5.47	-5.01
			(4.33)	(4.27)
PE_{t-1}	-0.29	-0.30	1.01	0.38
	(0.36)	(0.36)	(1.26)	(0.20)
$\bar{R}^2$	13.1%	2.8%	6.2%	20.0%

$illiq_{t-1}$ is the monthly Amihud measure for the aggregate market.
FG_{t-1} is the funding liquidity value from the bond market (Fontaine and Garcia, 2011)

Size Portfolios Returns

(Jan 1986 - Dec 2009)

$fliq_t$

	P_{small}	$P2$	$P3$	$P4$	P_{large}
u^{fliq}_{t+1}	3.57	-0.89	-0.73	0.02	0.30
	(1.15)	(0.31)	(0.29)	(0.01)	(0.24)
R^m_{t+1}	0.87	0.95	1.06	1.08	1.04
	(16.9)	(21.2)	(21.6)	(33.9)	(52.3)
R^2	52%	64%	74%	82%	91%

Funding Liquidity Value in Bond Market (Fontaine and Garcia)

	P_{small}	$P2$	$P3$	$P4$	P_{large}
u^{fg}_{t+1}	-2.46	-2.35	-1.01	-0.41	-0.43
	(2.24)	(2.45)	(1.18)	(0.61)	(1.23)
R^m_{t+1}	0.82	0.93	1.06	1.07	1.03
	(16.6)	(21.6)	(27.2)	(34.8)	(53.4)
R^2	53%	65%	74%	82%	92%

Volatility Portfolios

(Jan 1986 - Dec 2009)

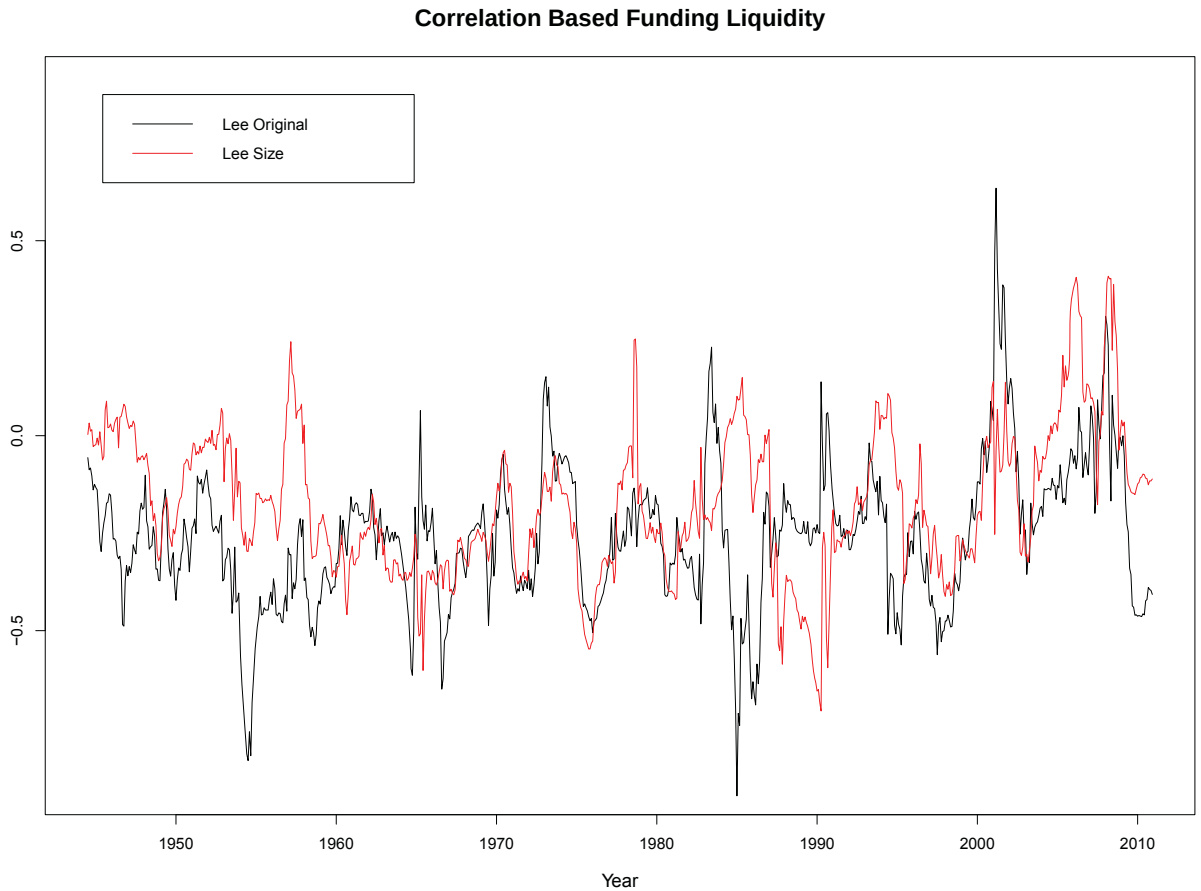
$fliq_t$

	P_{high}	$P2$	$P3$	$P4$	P_{low}
u^{fliq}_{t+1}	-3.12	-0.30	0.91	0.65	-0.46
	(0.82)	(0.12)	(0.47)	(0.37)	(0.30)
R^m_{t+1}	1.38	1.13	0.96	0.83	0.6
	(22.6)	(28.8)	(31.2)	(29.5)	(29.3)
R^2	68%	77%	79%	77%	69%

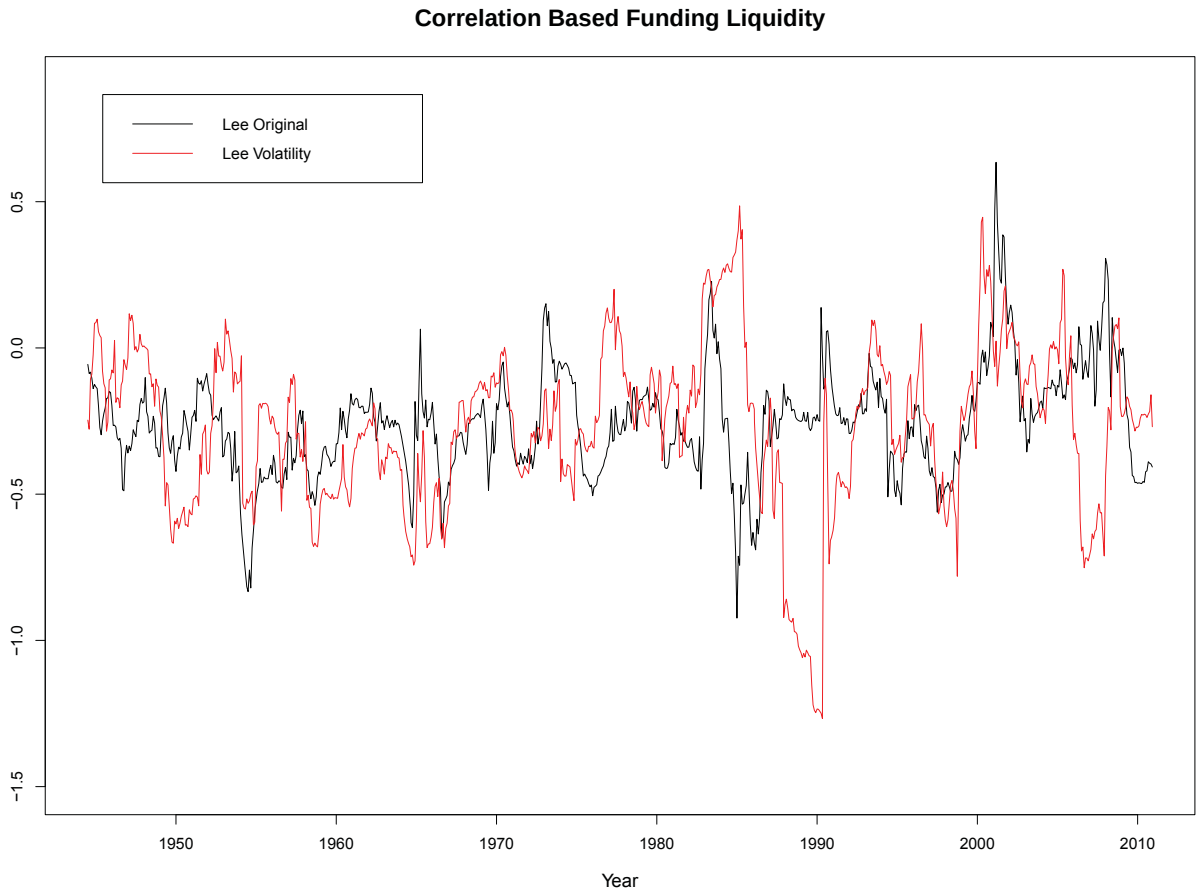
Funding Liquidity Value in Bond Market

	P_{high}	$P2$	$P3$	$P4$	P_{low}
u^{fg}_{t+1}	0.60	-0.49	-1.14	-1.42	-1.61
	(0.49)	(0.59)	(1.79)	(2.38)	(3.03)
R^m_{t+1}	1.40	1.12	0.94	0.81	0.58
	(23.7)	(29.6)	(31.7)	(30.0)	(24.3)
R^2	68%	76%	79%	70%	69%

Replication



Volatility Portfolios



Conclusion

- Robust predictability results - 72 pages of material - but the links and implications for theory need to be clarified.
- Is $fliq_t$ a risk factor or a state variable?
- Is this funding risk, or liquidation risk, or else?