Stock Market Liquidity and Bond Risk Premia

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Introduction

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Question: Does aggregate stock market liquidity help to predict future bond returns above and beyond the usual term structure and macro factors?

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Approach: We regress future excess bond returns on aggregate stock market liquidity.

Main finding: stock market liquidity significantly predicts excess bond returns

- controlling for both **yield curve** and **macro** information (forwards and Cochrane-Piazzesi factor for yield curve, Ludvigson-Ng factors for macro)
- small sample inference based on bootstrap
- out-of-sample forecasting tests
- yearly and monthly bond returns
- effect economically significant (45 bps on annual returns)

What do we know?

Excess bond returns related to yields

- *n*-year forward rate - one-year-yield (Fama and Bliss, 1987)
- treasury yield spreads (Campbell and Shiller, 1991)
- linear combination of 5 forward spreads (Cochrane and Piazessi, 2005)

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Excess bond returns related to macroeconomic information

- macro variables have information about future bond excess returns (Ludvigson and Ng, 2009; Cooper and Priestly, 2009)
- latent component negatively related to economic activity (Duffee, 2011a)

Why equity market liquidity? I

We examine different potential explanations.

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Bond liquidity:

- commonality in bond and stock liquidity (Chordia, Sarkar and Subrahmanyam, 2005)
- maybe stock liquidity is proxying for a bond liquidity premium
- we find no empirical support

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Market-wide private information:

- Albuquerque *et al.* (2008): market-wide private information can forecast industry stock returns and currency returns
- Amihud liquidity measure captures private information (Brennan *et al.*, 2011).
- we find no empirical support for our liquidity measure capturing private information

Why equity market liquidity? II

Flight to liquidity & Flight to safety

- investor flee to safer and more liquid assets during economic uncertainty
- theoretical work
  - uncertainty about investors preferences and time-varying risk aversion (Gallmeyer *et al.*, 2005 and Saar, 2006)
  - liquidity is a forward-looking measure for risk preferences
- empirical work
  - flight to liquidity tend to precede flight to safety (Connolly, Stiversa and Suna (2005), Underwood (2009) and Beber, Brandt and Kavajecz (2009))
  - leading information in stock market liquidity is consistent with flight to liquidity and flight to safety (Næs, Skjeltorp and Ødegaard, 2011)
- consistent with our empirical findings

Why equity market liquidity? III

Macro channel

- shock to market liquidity has impact on macroeconomy, cost of capital and investments
- theoretical work
  - models with funding and resaleability constraints: Kiyotaki and Moore (2008) and Brunnermeier and Pedersen (2009)
  - Eisfeldt (2005): model with endogenous liquidity linked to productivity
  - lower liquidity induces lower investments
- empirical work
  - market liquidity affects cost of capital (Skjeltorp and Ødegaard, 11; Lipson and Mortal, 09)
  - relation between cost of capital and risk premia through investment channel (Lettau and Ludvigson, 02)
  - consistent with theoretical above models: **Aggregate stock market liquidity** $\rightarrow$ **macro.** Stock market liquidity is a leading indicator for business cycle (Næs, Skjeltorp and Ødegaard, 2011)
- consistent with our empirical findings

Contribution

Bond modelling literature

- show that equity market liquidity contains info for bond excess returns
- join others in showing that info beyond bond yields is important
- examining alternative explanations, finding support for a flight-to-quality channel and a macro channel

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Link between bond and stock markets

- provide evidence that stock and bond mkts potentially driven by common liquidity factor
- inform theoretical work on the topic (Koijen et al., 06; Lettau and Wachter, 11)

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Macroeconomics

- provide empirical support for literature on macroeconononomics with financial frictions and market microstructure models with endogenous liquidity

Data

Fama-Bliss US Treasury Bonds

- Fama-Bliss yields, end-of-month, January 1964 - December 2008
- maturities: 1, 2, 3, 4, 5 years
- log one-year monthly excess returns rx_t - overlapping observations

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Fama Bond Portfolios

- Fama bond portfolio yields, end-of-month, January 1964 - December 2008
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Ludvigson-Ng macro factors

- 9 factors extracted from 132 monthly macro series

Measure of stock market liquidity

- Amihud (2002) illiquidity ratio $\frac{1}{N}\sum_{t=1}^{N}(\frac{|r_t|}{VOLUME_t})$
- monthly, CRSP common shares listed at NYSE , averaging over stocks
- detrending using log yearly change

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Two measures

- $D_{12}ILR$: average over all stocks
- $D_{12}ILRSMB$: average of small stocks minus average of big stocks

Excess bond returns

log excess return of n year bond: $rx_{t+1}^{(n)} = p_{t+1}^{(n-1)} - p_t^{(n)} - y_t^{(1)}$

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- Creating the CP factor

$$\overline{rx}_{t+1} = \gamma' \boldsymbol{X}_t^{CP} + \overline{\varepsilon}_{t+1}, \tag{1}$$

$$\boldsymbol{X}_t^{CP} = [1, y_t^{(1)}, f_t^{(2)}, \ldots, f_t^{(5)}]$$

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- Creating the LN factor

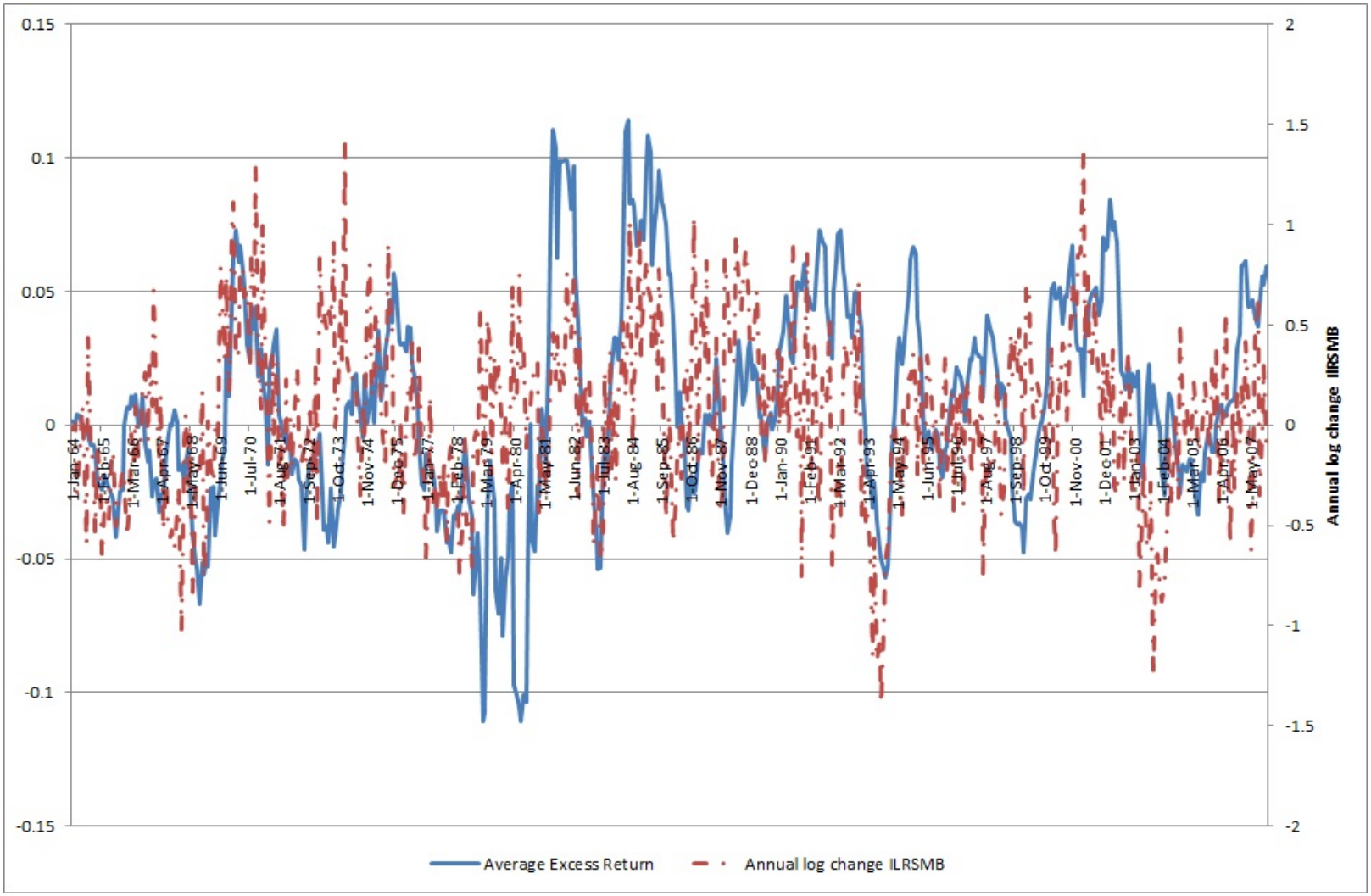
$$\overline{rx}_{t+1} = \delta' \boldsymbol{X}_t^{LN} + \overline{\varepsilon}_{t+1}, \tag{2}$$

$$\boldsymbol{X}_t^{LN} = [1, LNF_{1,t}, \ldots, LNF_{9,t}]$$

Econometric issues

- monthly observations of yearly returns $\rightarrow$ overlapping observations
- Newey-West MA(18) standard errors
- bootstrapped standard errors - small sample bias

Excess bond returns & Stock market liquidity



Correlation = 0.28

'Canonical Regression'

Table: $rx_{t+12} = \beta' \boldsymbol{X}_t + \varepsilon^{(n)}_{t+12}$

Variable	Coef.	Prob.	Coef.	Prob.
LNF_1	0.015	0.00		
LNF_2	0.002	0.12		
LNF_3	-0.001	0.12		
LNF_4	-0.004	0.03		
LNF_5	-0.002	0.06		
LNF_6	-0.005	0.01		
LNF_7	-0.005	0.00		
LNF_8	0.006	0.00		
LNF_9	-0.001	0.00		
F1	-1.400	0.00		
F2	0.604	0.08		
F3	2.106	0.00		
F4	0.521	0.06		
F5	-1.515	0.00		
CP			0.725	0.00
				(0.00)
LN			0.718	0.00
				(0.00)
Adj. R^2	0.41		0.40	

In-sample - Average equally weighted portfolio

Table: Yearly portfolio

Variable	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
CP					0.672	0.00	0.730	0.00
LN					0.713	0.00	0.708	0.00
$D_{12}ILRSMB$	0.025	0.00			0.019	0.00		
$D_{12}ILR$			0.010	0.06			0.009	0.02
Adj. R^2	0.07		0.02		0.44		0.41	

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Table: Monthly portfolio

	coeff	p-val	coeff	p-val	coeff	p-val	coeff	p-val
CPBP					0.519	0.06	0.530	0.18
LNBP					0.949	0.00	0.911	0.00
$D_{12}ILRSMB$	0.003	0.00				0.03		
$D_{12}ILR$			0.003	0.00			0.002	0.00
Adj. R^2	0.01		0.02		0.12		0.13	

In-sample regressions - Yearly portfolios

			2-year					3-year		
CP			0.315	0.318	0.286			0.610	0.615	0.560
			(0.00)	(0.00)	(0.00)			(0.00)	(0.00)	(0.00)
LN			0.359	0.353	0.357			0.639	0.630	0.635
			(0.00)	(0.00)	(0.00)			(0.00)	(0.00)	(0.00)
$D_{12}ILR$	0.006			0.005		0.010			0.009	
	(0.03)			(0.01)		(0.04)			(0.00)	
$D_{12}ILRSMB$		0.013			0.010		0.023			0.018
		(0.00)			(0.00)					(0.00)
Adj. R^2	0.03	0.09	0.38	0.41	0.44	0.02	0.09	0.39	0.47	0.44

			4-year					5-year		
CP			0.917	0.923	0.856			1.058	1.064	0.988
			(0.00)	(0.00)	(0.00)			(0.00)	(0.00)	(0.00)
LN			0.847	0.835	0.842			1.026	1.014	1.020
			(0.00)	(0.00)	(0.00)			(0.00)	(0.00)	(0.00)
$D_{12}ILR$	0.012			0.011		0.012			0.011	
	(0.06)			(0.02)		(0.10)			(0.05)	
$D_{12}ILRSMB$		0.030			0.022		0.034			0.024
		(0.00)			(0.00)		(0.00)			(0.00)
Adj. R^2	0.02	0.07	0.41	0.43	0.45	0.01	0.06	0.38	0.39	0.41

Out-of-sample forecasts - Yearly portfolios

- out-of-sample period December 1979 - December 2008
- moving estimation window of 15 years
- Giacomini-White (2006) (GW) test for equal predictive ability
- Clark-West (2007) (CW) test for equal predictive ability

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	average return		2y return		3y return		4y return		5y return	
	ILR	ILRSMB	ILR	ILRSMB	ILR	ILRSMB	ILR	ILRSMB	ILR	ILRSMB
Ratio	0.990	0.972	0.990	0.970	0.988	0.969	0.990	0.973	0.992	0.975
CW	1.342	2.100	1.283	2.378	1.443	2.313	1.365	2.062	1.247	1.880
p-value	0.09	0.02	0.10	0.01	0.08	0.01	0.09	0.02	0.11	0.03
GW	0.613	1.362	0.550	1.451	0.683	1.482	0.637	1.343	0.560	1.231
p-val	0.27	0.09	0.29	0.07	0.25	0.07	0.26	0.09	0.29	0.11

Out-of-sample forecasts - Monthly portfolios

	average return		$<$ 1y		1-2y		2-3y	
	ILR	ILRSMB	ILR	ILRSMB	ILR	ILRSMB	ILR	ILRSMB
Ratio	0.994	0.994	0.980	0.984	0.989	0.989	0.993	0.991
CW	1.999	1.874	2.445	2.367	2.143	2.281	2.053	2.089
p-value	0.02	0.03	0.01	0.01	0.02	0.01	0.02	0.02
GW	1.386	1.112	1.697	1.406	1.512	1.410	1.428	1.199
p-value	0.08	0.13	0.04	0.08	0.07	0.08	0.08	0.12

	3-4y		4-5y		5-10y	
	ILR	ILRSMB	ILR	ILRSMB	ILR	ILRSMB
Ratio	0.995	0.994	0.997	0.996	0.997	0.996
CW	1.903	1.846	1.809	1.646	1.726	1.496
p-value	0.03	0.03	0.04	0.05	0.04	0.07
GW	1.281	1.082	1.202	0.930	1.184	0.903
p-value	0.10	0.14	0.11	0.18	0.12	0.18

Empirical findings on explanations I

Bond liquidity:

- we include a bid-ask spread measure of bond liquidity in the predictive regressions.
- finding: bond liquidity is insignificant and does not affect predictive power of stock market liquidity.

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Market-wide private information:

- we include in our predictive regressions measures of market-wide private information proposed by Albuquerque *et al.* (2008)
- finding: market-wide private information significantly predict bond returns, but do not affect the predictive power of stock market liquidity.

Empirical findings on explanations II

Flight to liquidity & Flight to safety

- flight-to-quality $\rightarrow$ portfolio shift out of equity into Treasuries and money market funds
  - we look at net exchange flows inequity mutual funds and money market funds
  - finding: stock market illiquidity is strongly comoves with flows in money market funds and out of equity funds.
  - we also look at the holdings of balanced funds and find that stock market illiquidity comoves with a shift from equities into bonds
- VIX/VXO as a proxy of flight to quality (Bekaert *et al.*, 2010, Bailey and Stulz, 1989)
  - we regress VXO on lagged stock market liquidity
  - finding: liquidity significantly predicts future VXO
  - all in all our findings are consistent with a flight-to-quality story

Empirical findings on explanations III

Macro channel

- shock to market liquidity has impact on macroeconomy, cost of capital and investments
- we regress real private fixed investments on lagged liquidity (Skjeltorp and Ødegaard, 2011)
- finding: a decrease in liquidity significantly predicts a decrease in investments

Conclusion

- we find evidence that information in stock market liquidity contains predictive information for excess bond returns above and beyond information in the yield curve and macroeconomic variables
- findings consistent with flight-to-liquidity/flight-to-quality and macro story