

Liquidity and the Business Cycle

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Main question in paper

- ▶ why do we observe time variation in **equity market liquidity**?

Main results

- ① liquidity vary with the real economy at business cycle frequencies (Norway/US, 1980-2007)
- ② flight to liquidity/quality within equities
- ③ liquidity is a **leading indicator** of real activity
- ④ liquidity vary with changes in investors' portfolio composition

Interpretation:

Δ expectations \Rightarrow **portfolio shifts/participation** \Rightarrow **liquidity**

Common variation in liquidity

- ▶ **across stocks** [e.g. Chordia et.al (00), Hasbrouck/Seppi (01), Huberman/Halka (01)]
- ▶ **across different markets** [Brockman/Chung/Pérignon (06)]
- ▶ **across different liquidity measures** [Korazyk/Sadka (07), Chollete et.al (07, 08)]

Asset pricing implications:

- ▶ **commonality** → systematic risk factor
- ▶ **empirical support for a liquidity risk premium**
[e.g. Pastor/Stambaugh (03), Acharya/Pedersen (05)...]

Why do we observe common variation in market liquidity?

Theoretical models with endogenous market liquidity

- ▶ Saar (06)
 - ▶ uncertainty about investors preferences and endowments
 - ▶ link time variation in liquidity to equity risk premium
- ▶ Eisfeldt (04)
 - ▶ market liquidity determined as a function of productivity
 - ▶ risky assets more attractive when productivity is high

Empirical studies

- ▶ Fujimoto (03), Goyenko/Ukhov (04)
 - ▶ monetary shocks (federal funds rate, NBRX) forecast equity market liquidity
 - ▶ no effect from shocks in activity variables

..do aggregate liquidity contain information about future macro?

- ▶ rational expectations view \Rightarrow current prices are set on the basis of forecasts of relevant real variables
 - ▶ Fama (90), Schwert (90): current stock returns lead production growth
 - ▶ Vassalou (03): Fama/French factors related to future GDP growth
 - ▶ Baudry/Portier(06): permanent changes in productivity preceded by stock market booms
- ▶ if changes in expectations generate portfolio shifts
 - \Rightarrow changes in participation affect market liquidity
 - \Rightarrow participation \uparrow increases competition

Is time variation in liquidity linked to economic conditions?

- ▶ two markets: Norway and the US, 1980-2007
- ▶ examine link between various liquidity variables and macro variables (GDP growth, unemployment, consumption, etc.)

Do market liquidity reflect information about future macro?

- ▶ examine the causality between liquidity and macro in a unrestricted VAR framework

Are changes in liquidity related to portfolio shifts/participation?

- ▶ monthly equity holdings of all Norwegian investors in all securities listed at the Oslo Stock Exchange (1993-2007)

The Norwegian equity data

- ▶ daily data, all listed securities at the Oslo Stock Exchange over the period 1980-2007 (OBI)
- ▶ close prices/returns, trading volume, **bid/ask prices**
- ▶ 100 listed companies in 1980, 260 listed companies in 2007

The US equity data

- ▶ daily data, all listed securities in the US (NYSE, AMEX, NASDAQ) 1980-2007 (CRSP)
- ▶ close prices/returns, trading volume
- ▶ 2400 listed companies in 1980, 5900 listed companies in 2007

Transaction cost measures

- ▶ Relative spread: $RS = \frac{P_{ask} - P_{bid}}{(P_{ask} + P_{bid})/2}$
- ▶ Lesmond/Ogden/Trzcinka (1999) measure (LOT)
 - ▶ implicit cost required for a firm's price to *not* move when the market moves

Price impact

- ▶ Amihud (2002) illiquidity ratio: $ILR = |r| / VOLUME$

Market-wide liquidity:

- ▶ calculate each measures for each stock
- ▶ **marketwide liquidity** → equally weighted cross sectional average

Table: **Correlations between liquidity measures**

Norway (1980-2007)

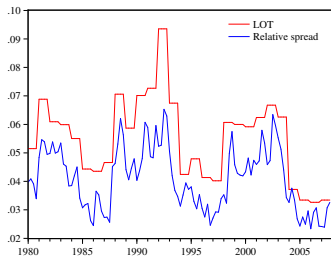
	RS	LOT
LOT	0.70	
ILR	0.41	0.35

US (1980-2007)

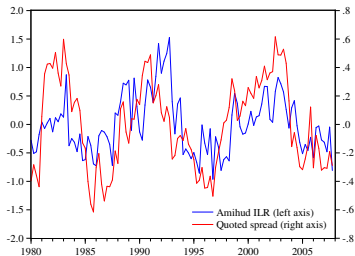
	RS*	LOT
LOT	0.77	
ILR	0.36	0.08

* Relative spread for the US from 1990 to 2007

Relative spread, LOT and Amihud Illiquidity ratio (ILR)



(a) Relative spread, LOT



(b) Quoted Spread, Amihud ILR

Norway - Output gap, unemployment and liquidity

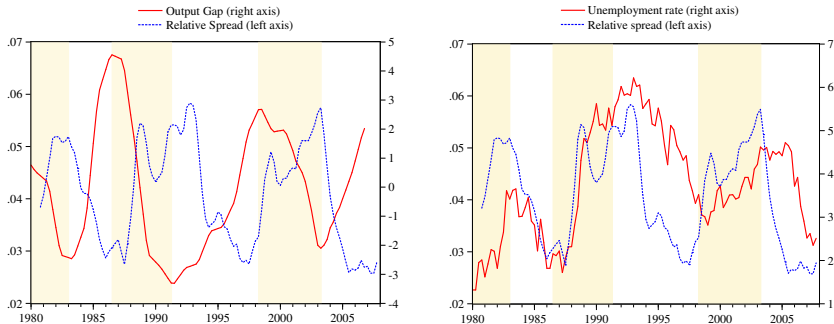


Figure: Output gap, unemployment rate and relative spread (1980-2007)

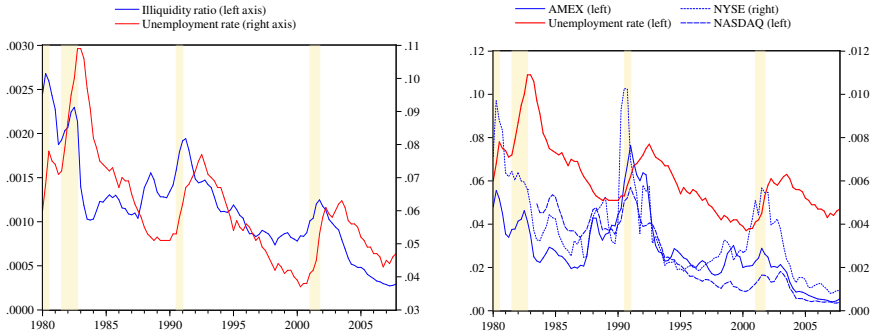
Table: **Average liquidity and economic activity**

	dOG<0	dOG>0	Diff.	p-value (Diff=0)
Quoted spread (NOK)	3.72	2.19	1.53	<0.01
Relative spread (%)	4.6 %	3.5 %	1.1 %	<0.01
LOT (%)	6.1 %	4.9 %	1.2 %	<0.01
ILR	1.03	0.65	0.38	<0.01

- ▶ significantly higher spread costs and price impact (ILR) during economic slowdowns

Similar relationship in the US

Figure: Unemployment rate, NBER recessions and illiquidity (1980-2007)



Examine more closely the relationship between market liquidity and macro

- ▶ unrestricted bivariate VARs, optimal lag length (SIC)
- ▶ Granger causality tests between macro variables and measures of market liquidity
- ▶ liquidity proxy for Norway: Relative bid/ask spread (RS)
- ▶ liquidity proxy for US: Illiquidity ratio (ILR)

Relation between liquidity and macro variables

(a) Unemployment and spread

	dUE _t	RS _t
Constant	-0.577** [-4.33]	0.006** [2.59]
dUE _{t-1}	-0.170 [-1.80]	-0.001 [-0.55]
RS _{t-1}	14.380** [4.55]	0.846** [14.93]
R ²	0.16	0.70
<i>Granger causality tests:</i>		

	Chi-sq	p-value
H0: dUE → RS	0.31	0.58
H0: RS → dUE	20.79**	0.00

(b) GDP growth and spread

	dGDP _t	RS _t
Constant	0.023** [5.67]	0.007** [2.94]
dGDP _{t-1}	-0.410** [-4.57]	-0.037 [-0.68]
RS _{t-1}	-0.373** [-3.99]	0.825** [14.71]
R ²	0.21	0.70
<i>Granger causality tests:</i>		

	Chi-sq.	p-value
H0: dGDP → RS	0.46	0.49
H0: RS → dGDP	15.99**	0.00

Table: Consumption growth and liquidity (relative spread)

	dCONS _t	RS _t
Const.	0.026** [5.45]	0.006** [2.30]
dCONS _{t-1}	-0.247** [-2.64]	0.041 [0.84]
RS _{t-1}	-0.433** [-3.97]	0.851** [15.13]
R ²	0.15	0.70
<i>Granger causality tests:</i>		
	Chi-sq	p-value
H0: dCONS → RS	0.71	0.40
H0: RS → dCONS	15.73**	0.00

US results - Liquidity and Unemployment rate

Table: **US unemployment rate (UE) and Illiquidity ratio (ILR)**

	All firms		NYSE firms		NASDAQ firms		AMEX firms	
	dUE _t	ILR _t	dUE _t	ILR _t	dUE _t	ILR _t	dUE _t	ILR _t
Const.	0.00 [-0.49]	0.00 [-0.58]	0.00 [-0.53]	0.00 [-0.80]	0.00 [-1.59]	0.00 [0.74]	0.00 [-0.57]	0.00 [-0.57]
dUE _{t-1}	0.33 [4.14]	0.00 [0.46]	0.29 [3.92]	0.00 [0.46]	0.41 [4.52]	0.01 [1.70]	0.28 [3.58]	0.00 [0.34]
ILR _{t-1}	5.96 [5.57]	0.62 [8.03]	30.61 [7.36]	0.51 [6.33]	2.77 [3.24]	0.68 [9.22]	3.08 [6.63]	0.58 [6.92]
R ²	0.47	0.46	0.55	0.35	0.34	0.55	0.52	0.40

Causality tests:

H0:	χ^2		χ^2		χ^2		χ^2	
	p-val		p-val		p-val		p-val	
dUE \rightarrow ILR	0.21	0.64	0.22	0.64	2.88	0.09	0.12	0.73
ILR \rightarrow dUE	31.07	0.00	54.27	0.00	10.49	0.00	43.89	0.00

US results - Liquidity and GDP growth

Table: **US GDP growth and illiquidity (ILR)**

	All firms		NYSE firms		NASDAQ firms		AMEX firms	
	dGDP _t	ILR _t	dGDP _t	ILR _t	dGDP _t	ILR _t	dGDP _t	ILR _t
Const.	0.01 [6.96]	0.00 [0.28]	0.01 [7.16]	0.00 [0.14]	0.01 [5.87]	0.00 [0.48]	0.01 [7.19]	0.00 [0.39]
dGDP _{t-1}	0.30 [3.29]	0.00 [-0.59]	0.30 [3.44]	0.00 [-0.55]	0.40 [4.20]	0.00 [-0.39]	0.28 [3.12]	0.00 [-0.70]
ILR _{t-1}	-7.94 [-2.81]	0.62 [8.64]	-38.37 [-3.34]	0.51 [6.96]	-4.44 [-2.25]	0.71 [9.55]	-4.05 [-3.25]	0.57 [7.47]
R ²	0.22	0.46	0.24	0.35	0.27	0.54	0.24	0.40

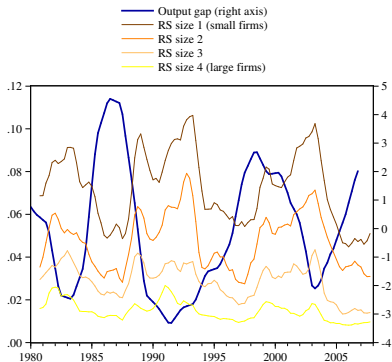
Causality tests:

H0:	χ^2	p-val	χ^2	p-val	χ^2	p-val	χ^2	p-val
dGDP \rightarrow ILR	0.34	0.56	0.30	0.59	0.15	0.70	0.49	0.48
ILR \rightarrow dGDP	7.92	0.00	11.12	0.00	5.07	0.02	10.54	0.00

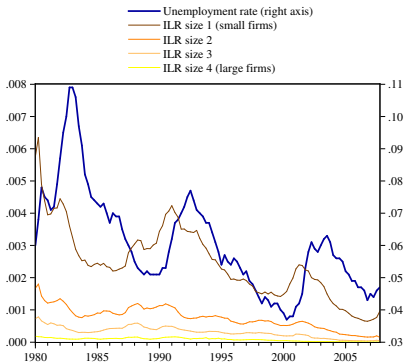
Does liquidity variation differ across firm characteristics?

- ▶ small firms are more risky than large firms
 - ▶ size risk premium (default risk, liquidity risk)
 - ▶ small firms generally less liquid
 - ▶ ...become relatively more illiquid during downturns
- ▶ “Flight to quality/liquidity” during economic downturns?
- ▶ group firms into four market capitalization (MCAP) groups

Liquidity and the Business Cycle - Firm size



(a) Norway: Output gap, relative spread



(b) US: Unemployment, ILR

“Flight to quality”

- ▶ small firms experience a greater drop in liquidity than large firms during economic downturns
 - ▶ “flight to quality/liquidity” effect
 - ▶ investors shift their portfolios into safer securities (large firms) when expecting lower growth

Liquidity of small firms more sensitive to expectations about economic conditions?

Unemployment and liquidity of small and large firms

Table: **Norway**

Granger causality tests:

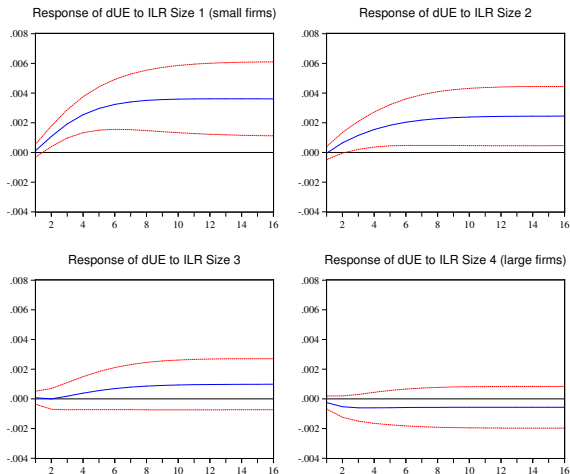
	Chi-sq	p-value
H0: $dUE \rightarrow RS^{small}$	0.004	0.948
H0: $dUE \rightarrow RS^{large}$	0.201	0.654
H0: $RS^{small} \rightarrow dUE$	9.283**	0.000
H0: $RS^{large} \rightarrow dUE$	0.526	0.469

Table: **US (all stocks)**

Granger causality tests:

	Chi-sq	p-value
H0: $dUE \rightarrow ILR^{small}$	2.54	0.11
H0: $dUE \rightarrow ILR^{large}$	1.84	0.18
H0: $ILR^{small} \rightarrow dUE$	26.35**	0.000
H0: $ILR^{large} \rightarrow dUE$	0.23	0.63

Impulse responses for ILR for firm sizes (US)



(Response to Cholesky One S.D. Innovations \pm 2 S.E.)

Is liquidity variation related to investor participation?

Monthly ownership data (VPS) for all owners in all listed companies (1989-2007)

- ▶ share holdings of all investors
- ▶ investor types (individuals, companies, foreigners/domestic, state, financials, non-financials)

Construct a simple participation measure

- ▶ $N(\text{investors that enter}) - N(\text{investors that leave})$
- ▶ correlation between liquidity and participation
- ▶ for all firms, across firm sizes

Table: **Correlation between liquidity and change in participation**

Quarterly	All firms	Firm size quartiles			
		Q1 (small)	Q2	Q3	Q4 (large)
All owners	-0.07	-0.35**	-0.10	-0.20	-0.11
Personal	-0.02	-0.33**	-0.09	-0.18	-0.08
Foreign	-0.18	-0.30**	-0.16	-0.25*	-0.23*
Financial	-0.06	-0.11	0.01	-0.09	-0.08
Nonfinancial	-0.16	-0.35**	-0.11	-0.21*	-0.20*
State	-0.06	-0.20	0.19	-0.10	-0.06

- ▶ high spreads (low liquidity) \Leftrightarrow lower participation
- ▶ stronger correlation for smallest firms

Summary of main results

Strong relation between equity market-liquidity and economic activity

- ▶ market liquidity contain **real time information** about future macro (both for Norway and US)
- ▶ liquidity of small firms contains most information about future macro
- ▶ "flight to quality" effect (out of small firms) during economic slowdowns

Link liquidity variation to investor participation using Norwegian equity ownership data

- ▶ correlation between participation and liquidity strongest for small firms