

# Liquidity and the Business Cycle

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# Topic: Equity Liquidity and the Macroeconomy

## **This paper:**

Investigate links

- ▶ Equity Market Liquidity
- ▶ Macroeconomy — i.e. Business Cycle.

We

- ▶ Show: Strong empirical link between (aggregate) stock market liquidity and the business cycle.
- ▶ Speculate: Are expectations about business cycle (consumption, investment) leading to portfolio rebalancing of individual investors?
- ▶ Show: Portfolio rebalancing of equity portfolios consistent with such a story.

# Overview of presentation

- ▶ Equity market liquidity
  - ▶ What is it?
  - ▶ How to measure it?
- ▶ Why should liquidity
  - ▶ vary?
  - ▶ be related to the macroeconomy?
- ▶ What markets are we looking at?
- ▶ What is the relationship?
  - ▶ Multivariate VARs
- ▶ Possible mechanism:
  - ▶ Rebalancing of individual investor portfolios.
- ▶ Evidence on portfolio rebalancing.
- ▶ Conclusion

## Defining liquidity

Maureen O'Hara: *"..a liquid market is one in which buyers and sellers can trade into and out of positions quickly and without having large price effects."*

Harris [2002], four interrelated liquidity dimensions:

- ▶ **depth** - the volume that can be traded
- ▶ **width** - the difference between the fundamental price and the transaction price
- ▶ **immediacy** - the speed of trade execution
- ▶ **resiliency** - how fast does the price move back to equilibrium after a large liquidity trade

# Literature on liquidity

Starting point: Market Microstructure

- ▶ Implications of asymmetric information for price formation of single asset (stock)  
This literature - do not aggregate  
(Unless degree of asymmetric information varies)

Evolving microstructure literature:

- ▶ Broader implications – Asset pricing
- ▶ Common variation in (time series) of liquidity across
  - ▶ *stocks* [e.g. Chordia, Roll, and Subrahmanyam [2000], Hasbrouck and Seppi [2001], Huberman and Halka [2001]]
  - ▶ *markets* [e.g. Brockman, Chung and Pérignon (2006)]
  - ▶ *liquidity measures* [e.g. Korajczyk and Sadka [2007], Chollete, Naes, and Skjeltorp [2007, 2008]]

# Time series variation in aggregate liquidity

## *Asset pricing implications*

- ▶ commonality → systematic (non diversifiable) risk factor
- ▶ empirical support for a liquidity risk premium [e.g. Pastor and Stambaugh [2003], Acharya and Pedersen [2005]...]

But:

Why should we observe common variation in market liquidity?

## *Theoretical models with endogenous market liquidity*

- ▶ Eisfeldt [2004]
  - ▶ market liquidity determined as a function of productivity
  - ▶ risky assets more attractive when productivity is high
- ▶ Gallmeyer, Hollifield, and Seppi [2008]: Demand Discovery, Saar [2006]
  - ▶ uncertainty about investors preferences and portfolios
  - ▶ link time variation in liquidity to equity risk premium

# Relevant empirics

Typical empirical question:

- ▶ Do shocks to macroeconomic variables affect liquidity of financial markets?

US: Fujimoto [2003], Goyenko/Ukhov (2004)

Scandinavia: Söderberg [2008]

- ▶ monetary shocks (federal funds rate) forecast equity market liquidity
- ▶ no effect from shocks in real variables

In this paper:

- ▶ Ask the opposite question
  - Are there effects *from* liquidity *to* macroeconomic variables?

# Measuring liquidity

Liquidity – “Soft” concept

→ Many empirical measures, aspects of liquidity.

We use three such measures:

## 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
  - ▶ do not require ask/bid prices for estimation

## Price impact

- ▶ Amihud [2002] illiquidity ratio:  $ILR = |r| / VOLUME$ 
  - ▶ How much does one unit of trade move the price?

## Market-wide liquidity

→ cross sectional averages of these liquidity measures



## Norway 1980–2007

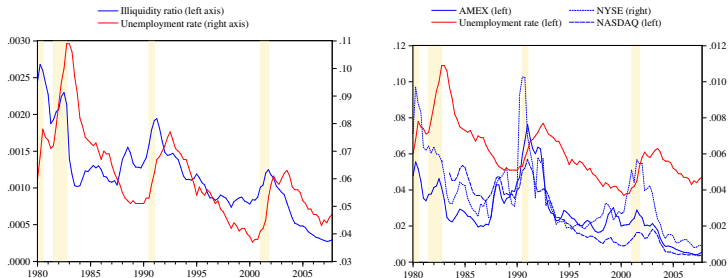
- ▶ daily data, all listed securities at the Oslo Stock Exchange over the period 1980-2007 (OBI)
- ▶ close prices/returns, trading volume, bid/ask prices
- ▶ 100 listed companies in 1980, 260 listed companies in 2007

## USA 1980–2007

- ▶ 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

# Indicative: Does liquidity and macro covary? – USA

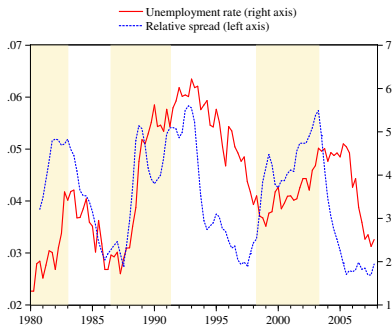
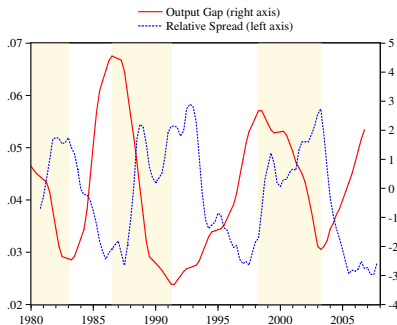
## US - Unemployment rate, NBER recessions and illiquidity



- ▶ Note: liquidity observed in real-time, macro variables with delay

# Indicative: Does liquidity and macro covary? – Norway

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



# Formal investigation – Vector Autoregressions

## Unrestricted bivariate VARs

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} c_y \\ c_x \end{bmatrix} + \begin{bmatrix} A_{1,1} & A_{1,2} \\ A_{2,1} & A_{2,2} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon_t^y \\ \epsilon_t^x \end{bmatrix}$$

- ▶ Macro variables ( $y$ ): GDP , unemployment, consumption
- ▶ liquidity proxy ( $x$ ) for Norway: Relative bid/ask spread (**RS**)
- ▶ liquidity proxy ( $x$ ) for US: Illiquidity ratio (**ILR**)
- ▶ perform Granger causality tests between  $x$  and  $y$

# Norway - Liquidity, unemployment and GDP growth

(a) Unemployment and spread

	dUE <sub>t</sub>	RS <sub>t</sub>
Constant	-0.577** [-4.33]	0.006** [2.59]
dUE <sub>t-1</sub>	-0.170 [-1.80]	-0.001 [-0.55]
RS <sub>t-1</sub>	14.380** [4.55]	0.846** [14.93]
R <sup>2</sup>	0.16	0.70

*Granger causality tests:*

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

(b) GDP growth and spread

	dGDP <sub>t</sub>	RS <sub>t</sub>
Constant	0.023** [5.67]	0.007** [2.94]
dGDP <sub>t-1</sub>	-0.410** [-4.57]	-0.037 [-0.68]
RS <sub>t-1</sub>	-0.373** [-3.99]	0.825** [14.71]
R <sup>2</sup>	0.21	0.70

*Granger causality tests:*

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

# US results - Liquidity and GDP growth

## US GDP growth and illiquidity (ILR)

	All US stocks		NYSE stocks		NASDAQ stocks		AMEX stocks	
	dGDP <sub>t</sub>	ILR <sub>t</sub>	dGDP <sub>t</sub>	ILR <sub>t</sub>	dGDP <sub>t</sub>	ILR <sub>t</sub>	dGDP <sub>t</sub>	ILR <sub>t</sub>
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 <sub>t-1</sub>	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 <sub>t-1</sub>	-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 <sup>2</sup>	0.22	0.46	0.24	0.35	0.27	0.54	0.24	0.40

### Causality tests:

H0:	$\chi^2$	p-val	$\chi^2$	p-val	$\chi^2$	p-val	$\chi^2$	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

# Possible causal mechanism

## Theory:

- ▶ Demand discovery [Gallmeyer et al., 2008]:  
Trading in equity markets (portfolio rebalancing) reflect changes in expectations of real economy  
(Consumption needs, liquidity necessary for hedging)

## Particularly:

“Flight to liquidity” in economic downturns

- Least liquid stocks most sensitive to changes in business cycle
- Investors portfolios rebalanced, move out of the least liquid stocks.

## Can we find evidence of such a “flight to liquidity”?

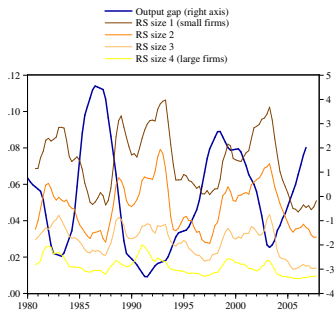
Show two empirical observations consistent with such a story.

1. Link between equity market liquidity and business cycle strongest for small firms (least liquid stocks).
2. Portfolio rebalancing in equity portfolios: Move away from small stocks.



# Small firms strongest link liquidity — business cycle...

## Norway: Output gap, relative spread



# Small firms strongest link liquidity — business cycle...

## VARs: Unemployment and liquidity of small and large firms

### Norway

#### Granger causality tests:

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	Chi-sq	p-value
H0: dUE $\rightarrow$ RS <sup>small</sup>	0.004	0.948
H0: dUE $\rightarrow$ RS <sup>large</sup>	0.201	0.654
H0: RS <sup>small</sup> $\rightarrow$ dUE	<b>9.283**</b>	<b>0.000</b>
H0: RS <sup>large</sup> $\rightarrow$ dUE	0.526	0.469

### US (all stocks)

#### Granger causality tests:

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	Chi-sq	p-value
H0: dUE $\rightarrow$ ILR <sup>small</sup>	1.80	0.18
H0: dUE $\rightarrow$ ILR <sup>large</sup>	0.61	0.43
H0: ILR <sup>small</sup> $\rightarrow$ dUE	<b>20.65**</b>	<b>0.00</b>
H0: ILR <sup>large</sup> $\rightarrow$ dUE	0.23	0.63

# Changes in investor portfolio compositions

Norway – Data from VPS – Portfolios of individual investors.

Ask: Is liquidity variation related to investor participation?

Monthly ownership data (VPS) for all owners in all listed companies (1993-2007)

- ▶ share holdings of all investors
- ▶ investor types (individuals, 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

## Changes in investor portfolio compositions ctd.

### Correlation between liquidity and change in participation

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

- ▶ equity market liquidity contains information about **current and future macro fundamentals**
- ▶ mainly reflected in the liquidity of small firms

## **Variation in market liquidity related to changes in equity portfolio composition**

- ▶ liquidity worsens simultaneously with investors moving out of small stocks

## Planned work..

### ⇒ **additional markets**

- ▶ currently started to look at Japan, Australia, UK, Sweden

### ⇒ **forecasting/“nowcasting”**

- ▶ which liquidity measure has the best/most robust forecasting performance
- ▶ common liquidity factor á la Chollete/Næs/Skjeltorp('07,'08)



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