Stock Market Liquidity and the Business Cycle

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Overview

- Using financial markets variables to forecast the real economy.
- What is equity market liquidity?
- Showing that equity market liquidity predicts the real economy.
- Decomposing equity market liquidity – which stocks?
- Why is liquidity important?
  - Investigate one explanation: Demand for saving
    – Data on equity holdings from Norway.

Forecasting real variables with financial variables

Intuition: Financial variables, such as stock prices, are forward looking, since they are present values of future cashflows, *conditioned on current information*.
Financial variables – candidate "leading indicators":

- Stock prices
- Term spread (Difference long term short term interest rates)
- Credit spread (Difference high risk - low risk debt rates)
- Stock volatility

However – empirical performance of financial variables not stellar.
Stock and Watson [2003] (Survey):

- *"some asset prices have substantial and statistically significant marginal predictive content for output growth at some times in some countries."*
- *"forecasts based on individual indicators are unstable."*

Our work

Will show that equity market *liquidity* is a superior forecasting variable.
What is *liquidity*?
For economists: The elasticity of stock prices with respect to quantity traded.
In finance: Various aspects of the process by which financial assets are traded:

- How *fast* can one trade?
- How *much* can one trade – how fast?
- Is there a *price impact*? – permanent/temporary?

Empirically measuring liquidity

Since liquidity is multidimensional, problematic to find *one* measure capturing all aspects of it.
Typical measures

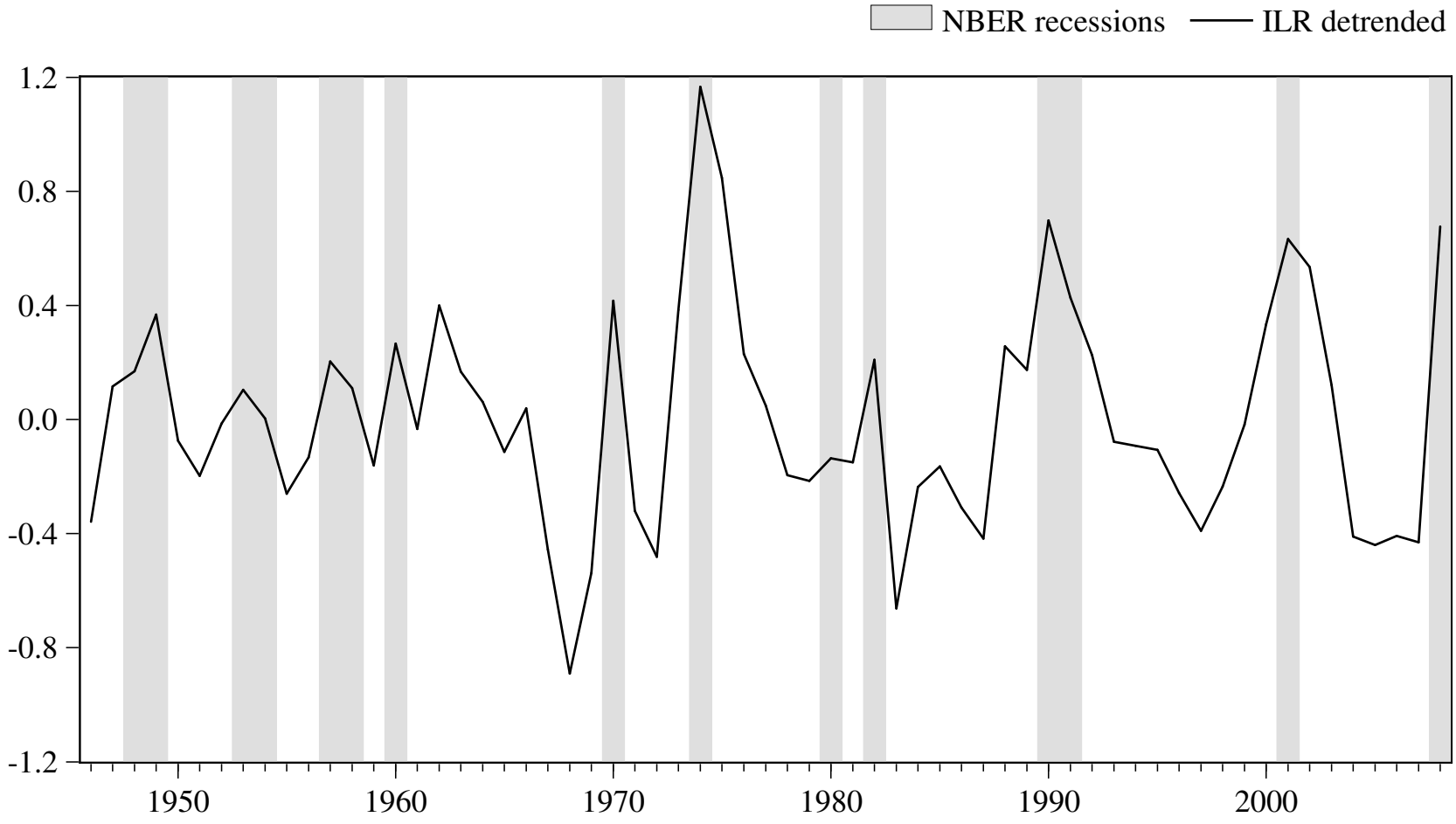
- Bid/ask spread – difference best buy – best sell price
- (Implicit) Trading costs – what fraction of the price is lost when trading?
- Elasticity measure – Stock price movement relative to volume transacted

Not so good measures of liquidity:

- Trading volume/Turnover – Can have good liquidity even if actual volume traded is low, and vice versa.
  (Limit Order book)

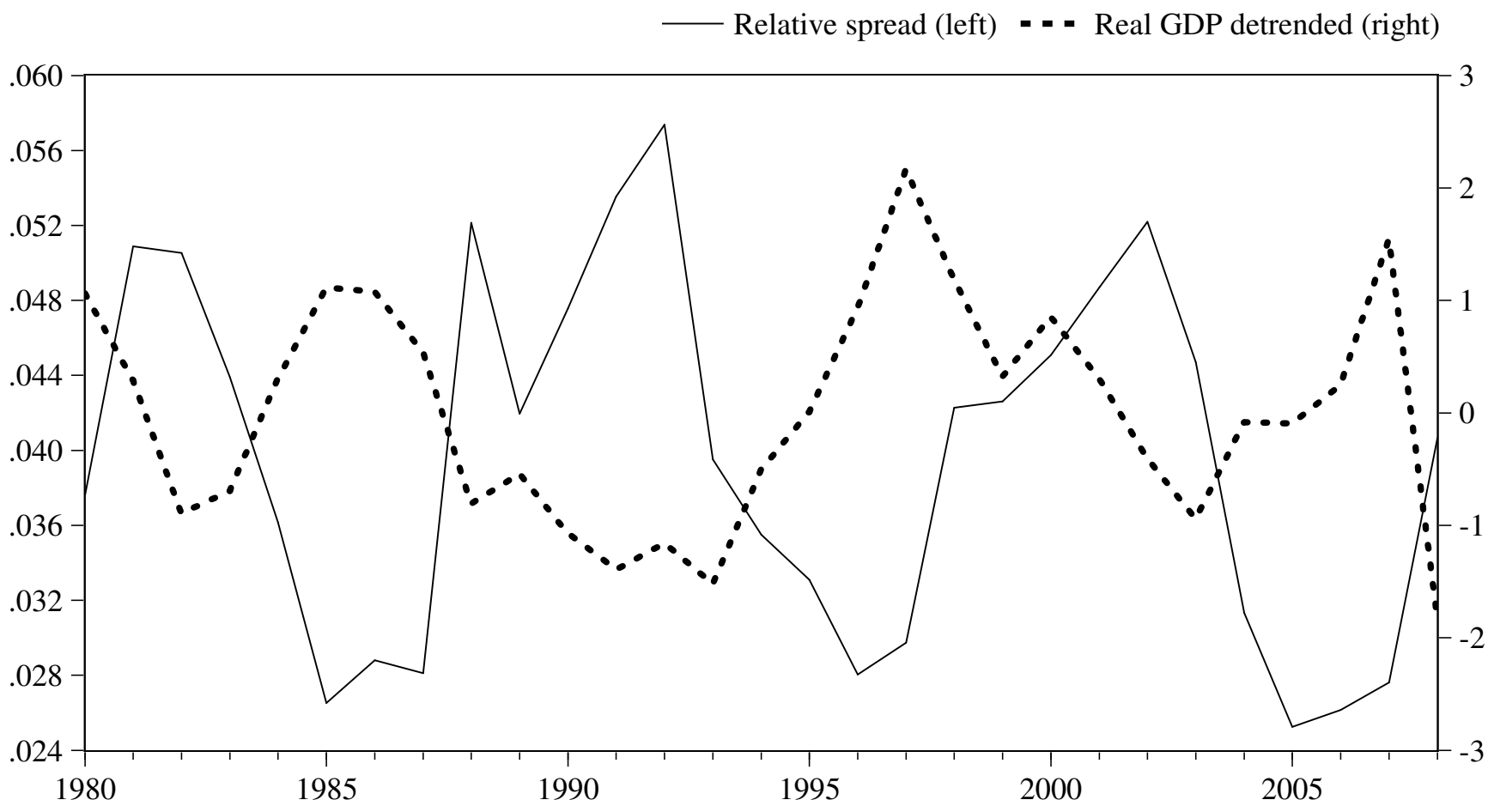
Aggregate measures: Calculate liquidity measures for all listed stocks, take averages.

US (1947–2008) Liquidity measure: ILR (detrended)



The liquidity measure is detrended with at Hodrick-Prescott filter

Norway (1980–2008) Liquidity(Spread) – Output Gap



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In sample predicting US real economy with liquidity

Models: predictive regressions

$$y_{t+1} = \alpha + \beta LIQ_t + \gamma' \mathbf{X}_t + u_{t+1} \tag{1}$$

- y_{t+1} is the growth in the macro variable over quarter t+1,
- LIQ_t is the market illiquidity measured for quarter t
- $\mathbf{X}_t$ is a set of control variables observed at t.

Results of in sample predictive regressions – all control variables

	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Cred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{Rm}$	$\bar{R}^2$
dGDPR	0.006	-0.008	0.203	0.000	-0.005	0.000	0.016	0.16
	(5.72)	(-3.90)	(3.57)	(0.92)	(-2.38)	(-0.02)	(2.01)	
dUE	0.006	0.021	0.307	-0.008	0.048	-0.033	-0.235	0.213
	(0.79)	(1.14)	(6.25)	(-2.64)	(3.56)	(-0.93)	(-4.58)	
dCONSR	0.005	-0.001	0.302	0.001	-0.001	0.002	0.026	0.171
	(4.76)	(-0.39)	(4.43)	(2.29)	(-1.04)	(0.34)	(3.38)	
dINV	0.003	-0.020	0.243	0.004	-0.019	0.007	0.048	0.238
	(1.16)	(-3.74)	(3.91)	(2.54)	(-3.95)	(0.55)	(2.14)	

Granger causality tests, US - liquidity - GDP

Which direction do links go?
Granger causality tests (in bivariate VAR)

	Whole sample	First half	Second half	20 year sub-periods				
	1947 2008	1947-1977	1978-2008	1950-1970	1960-1980	1970-1990	1980-2000	1990 2008
N (observations)	243	119	124	84	84	84	84	76
NBER recessions	11	6	5	5	4	4	2	3
(a) ILR measure								
H0: dGDPR↛ dILR								
χ^2	4.08	1.66	3.13	3.84	3.56	3.35	2.83	2.66
p-value	(0.13)	(0.44)	(0.21)	(0.15)	(0.17)	(0.19)	(0.24)	(0.26
H0: dILR↛ dGDPR								
χ^2	31.97**	19.01**	14.50**	16.42**	8.89**	11.70**	11.64**	11.85
p-value	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00

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Out of sample evidence, US

Timing of information:
Liquidity – realtime observations
Macro variables – published with a lag, revised.
We predict last vintage macroeconomic variables using variables observable at time when prediction is made.

Out of sample performance of illiquidity vs alternatives

Ask: Does adding ILR to a baseline model improve the out of sample performance?
Two test statistics:

1. Encompassing test (ENC-NEW) proposed by Clark and McCracken [2001].
   – asks whether the restricted model (the model that do not include ILR), encompasses the unrestricted model that includes ILR.
2. F-type test for equal MSE between two nested models proposed by McCracken [2007] termed MSE-F.

Nested model comparisons – Forecasting real GDP growth: Illiquidity (ILR) versus other financial variables

Unrestricted model	Restricted model	1 quarter-ahead forecasts			2 quarters-ahead forecasts		
		$\frac{MSE_u}{MSE_r}$	MSE-F	ENC-NEW	$\frac{MSE_u}{MSE_r}$	MSE-F	ENC-NEW
ILR, TERM	TERM	0.917	20.95**	41.96**	0.927	18.09**	31.49**
ILR, Rm	Rm	0.976	5.69**	14.39**	1.003	-0.59	12.33**
ILR, CRED	CRED	1.000	0.02	18.73**	0.964	8.53**	22.86**
ILR, Vola	Vola	0.889	28.76**	50.91**	0.895	26.88**	35.98**

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Conclusion of predictability estimates

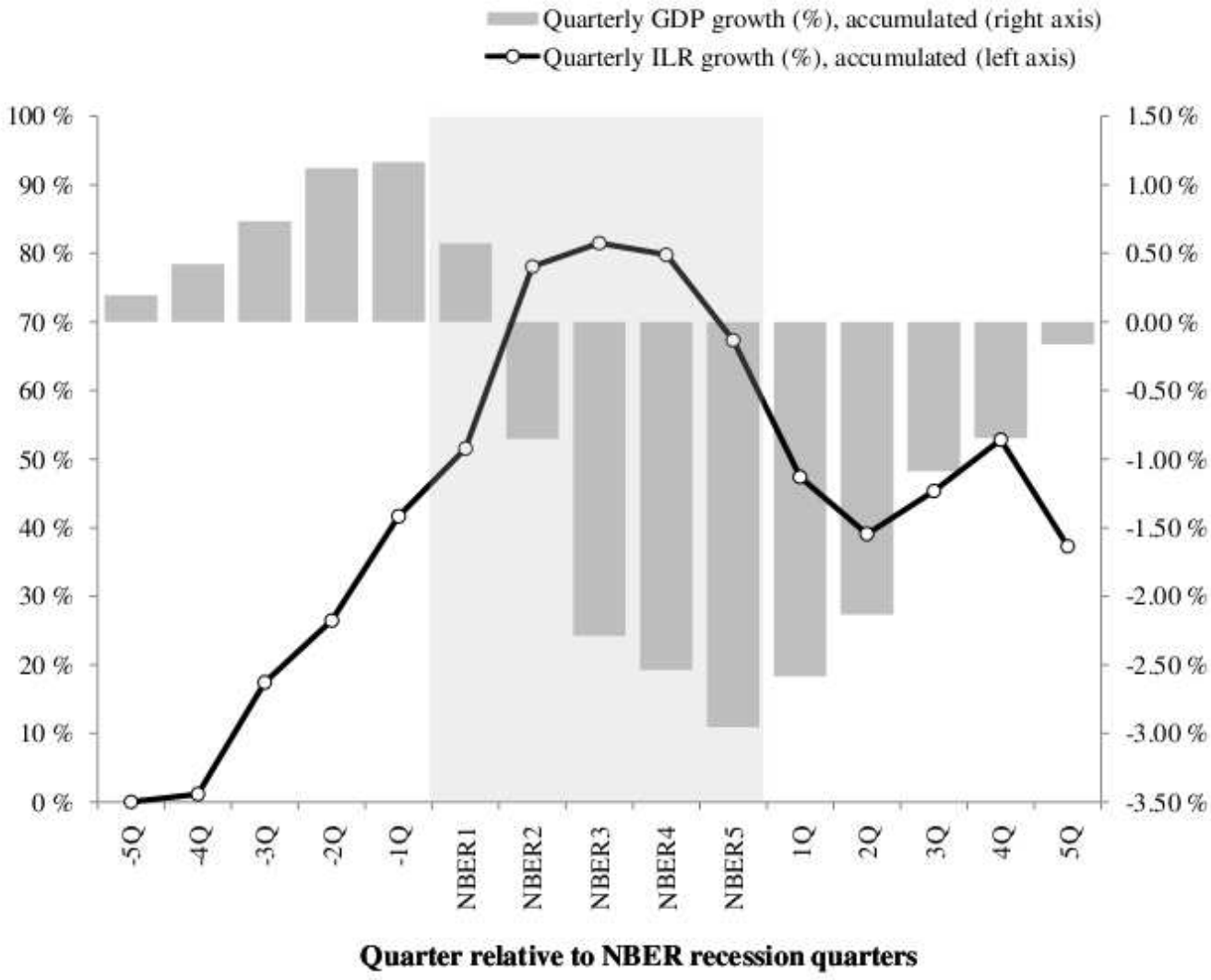
- There is information about future macro in liquidity
  - Robust to which liquidity measure
  - Both in sample and out of sample
  - Information in liquidity is not subsumed by other financial measures used in the literature.

Event studies

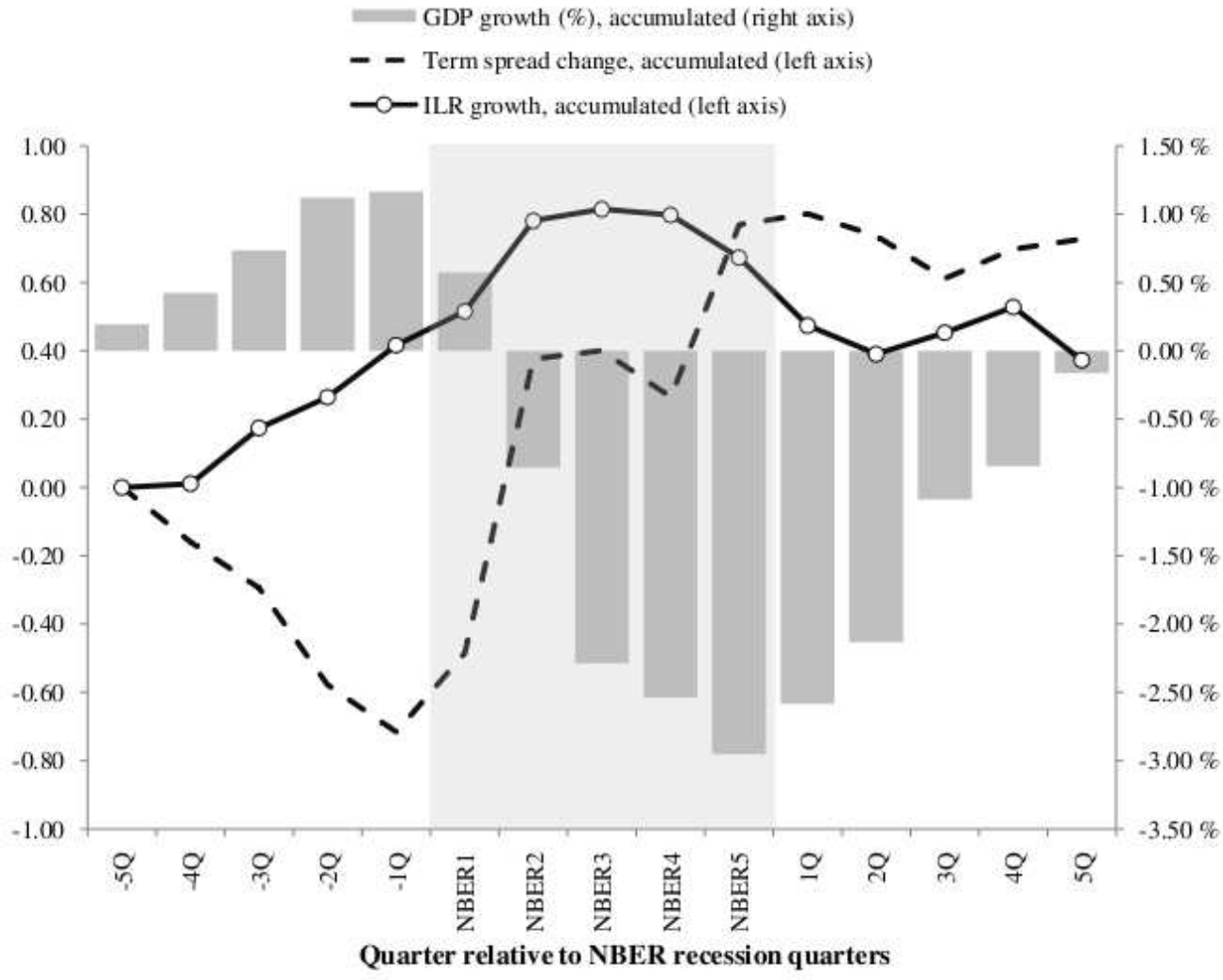
Ask: when are the forecasting variables reacting relative to the onset of recessions?
US 1947–2008: Use NBER recession starting points.
Plot averages of the forecasting variables starting five quarters before the onset of the recession.

Market illiquidity around NBER recessions

Full sample period: 1947-2008



Market illiquidity and other financial variables around NBER recessions – Term spread



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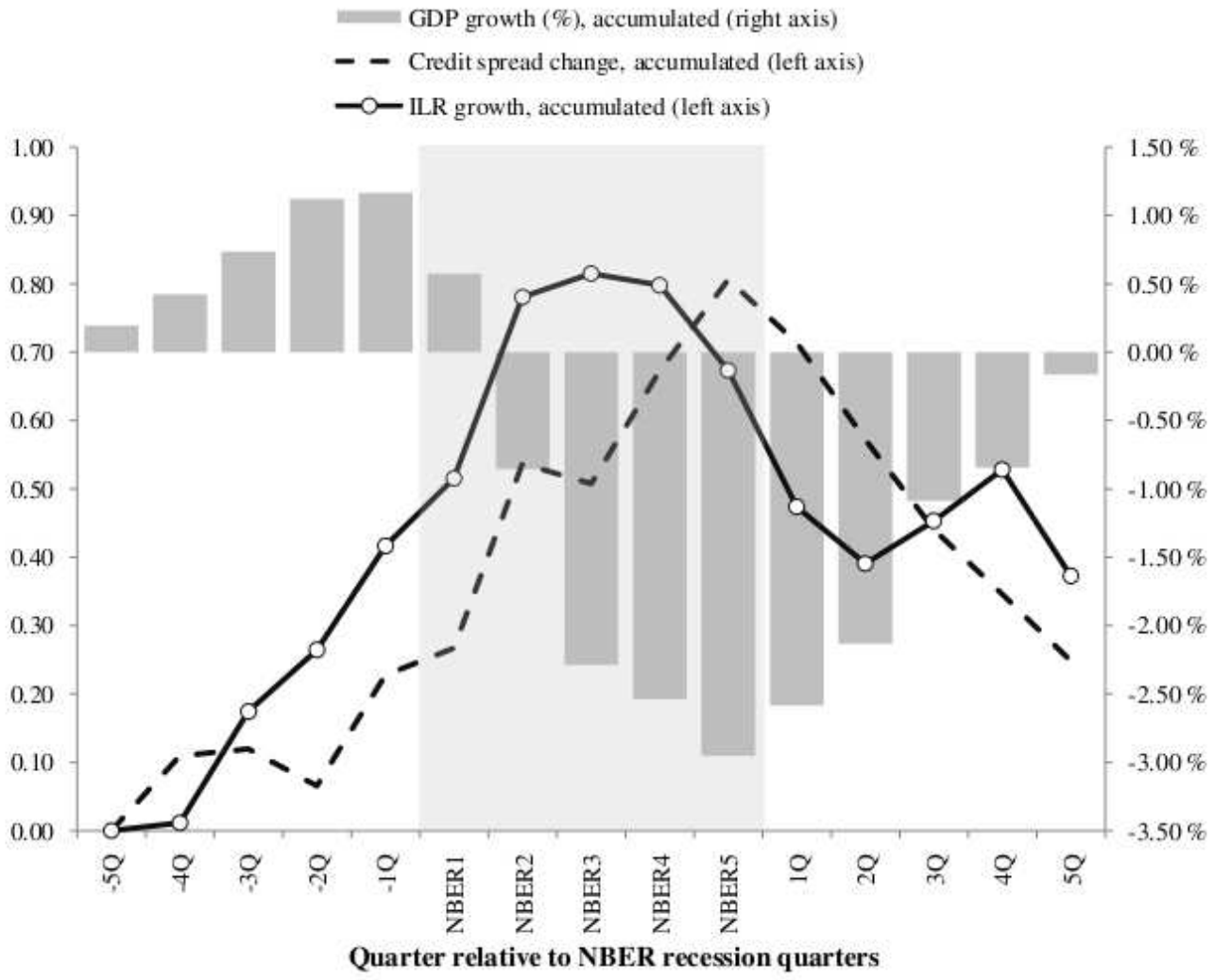
Market illiquidity and other financial variables around NBER recessions – Credit spread



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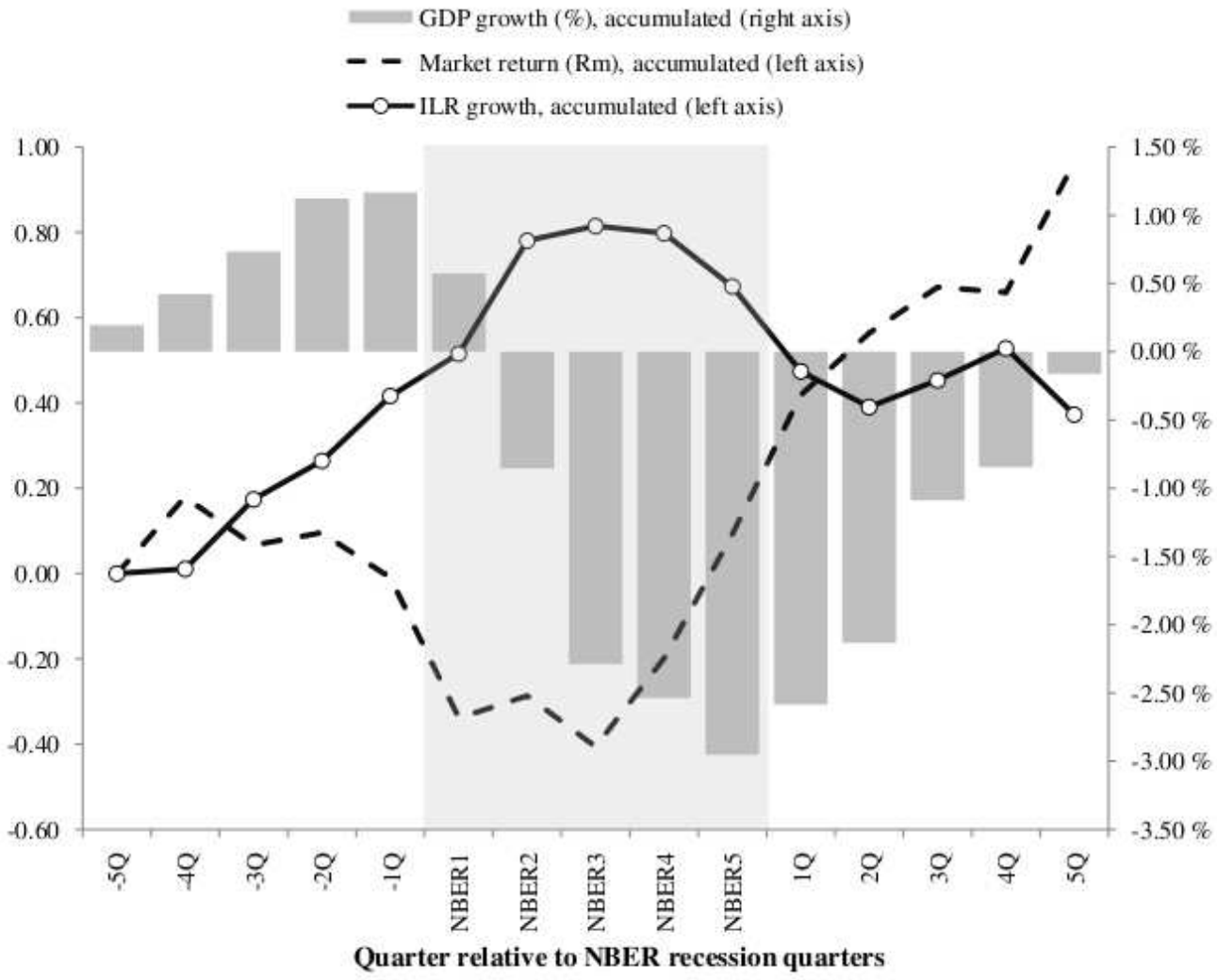
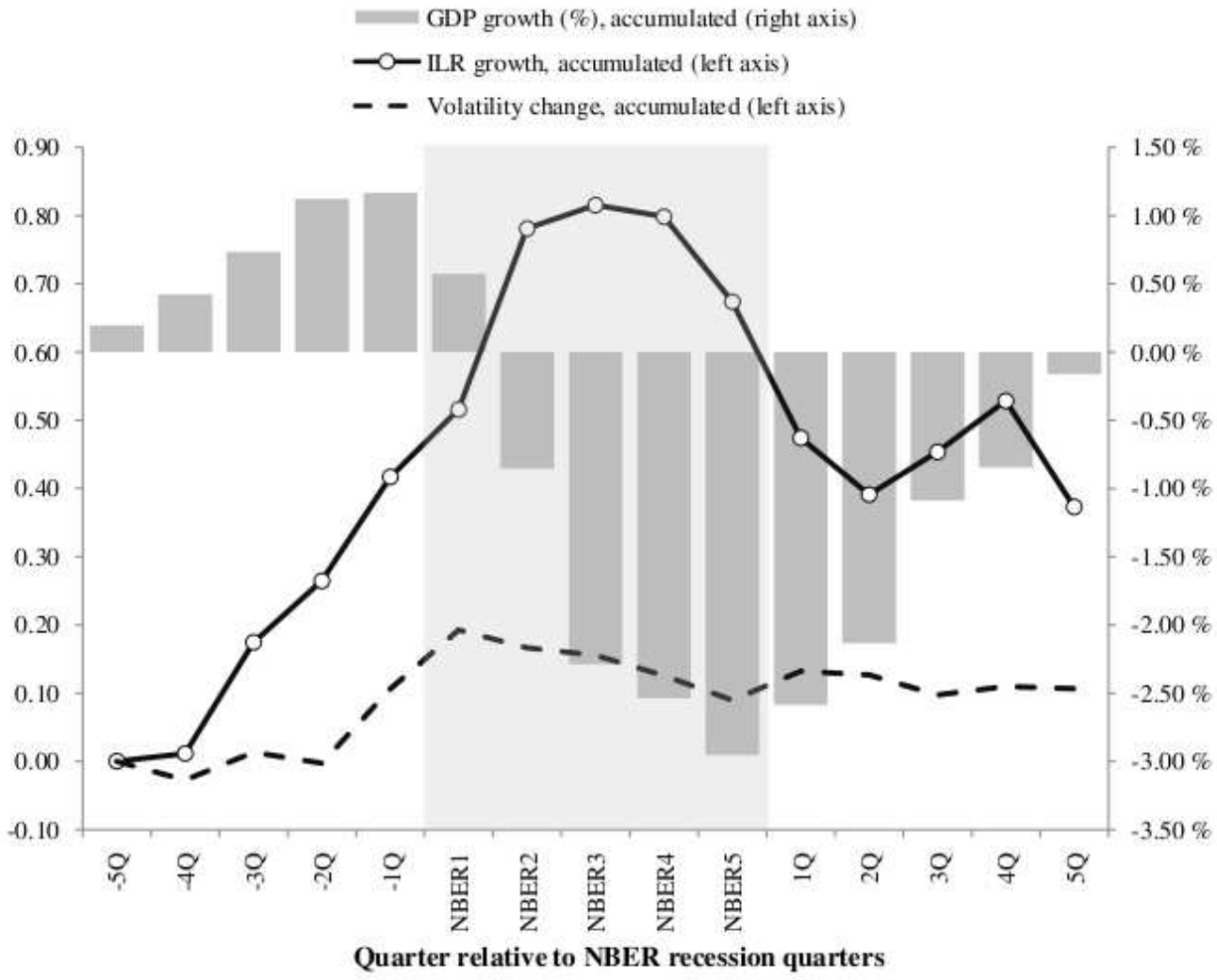
Market illiquidity and other financial variables around NBER recessions – Market return



Market illiquidity and other financial variables around NBER recessions – Volatility



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Decomposing information content

Stocks on the exchange – differently exposed to the business cycle?
Small firms, less diversified, less diversified ownership, etc.
May do worse in downturns.
Are there differences in information content depending on firm size?
Implement: Group firms into four size portfolios, look at average liquidity of small firms (S) and large firms (L).

Comparing large and small stocks – in sample predictive regressions

	$\hat{\alpha}$	$\hat{\beta}_S^{LIQ}$	$\hat{\beta}_L^{LIQ}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Cred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{Rm}$	$\bar{R}^2$
dGDPR	0.008	**-0.008**	0.003	0.000	-0.006	0.001	0.022	0.13
	(7.40)	**(-3.66)**	(1.01)	(0.74)	(-2.48)	(0.09)	(2.35)	
dUE	0.002	0.030	-0.042	-0.006	0.053	-0.029	-0.259	0.12
	(0.26)	(1.66)	(0.09)	(-1.78)	(3.61)	(-0.81)	(-4.00)	
dCONSR	0.008	-0.001	0.002	0.001	-0.002	0.000	0.028	0.08
	(8.32)	(-0.37)	(0.54)	(2.00)	(-1.19)	(0.10)	(3.17)	
dINV	0.006	**-0.019**	0.010	0.004	-0.022	0.015	0.065	0.18
	(2.10)	**(-3.45)**	(1.09)	(2.25)	(-4.03)	(1.13)	(2.51)	

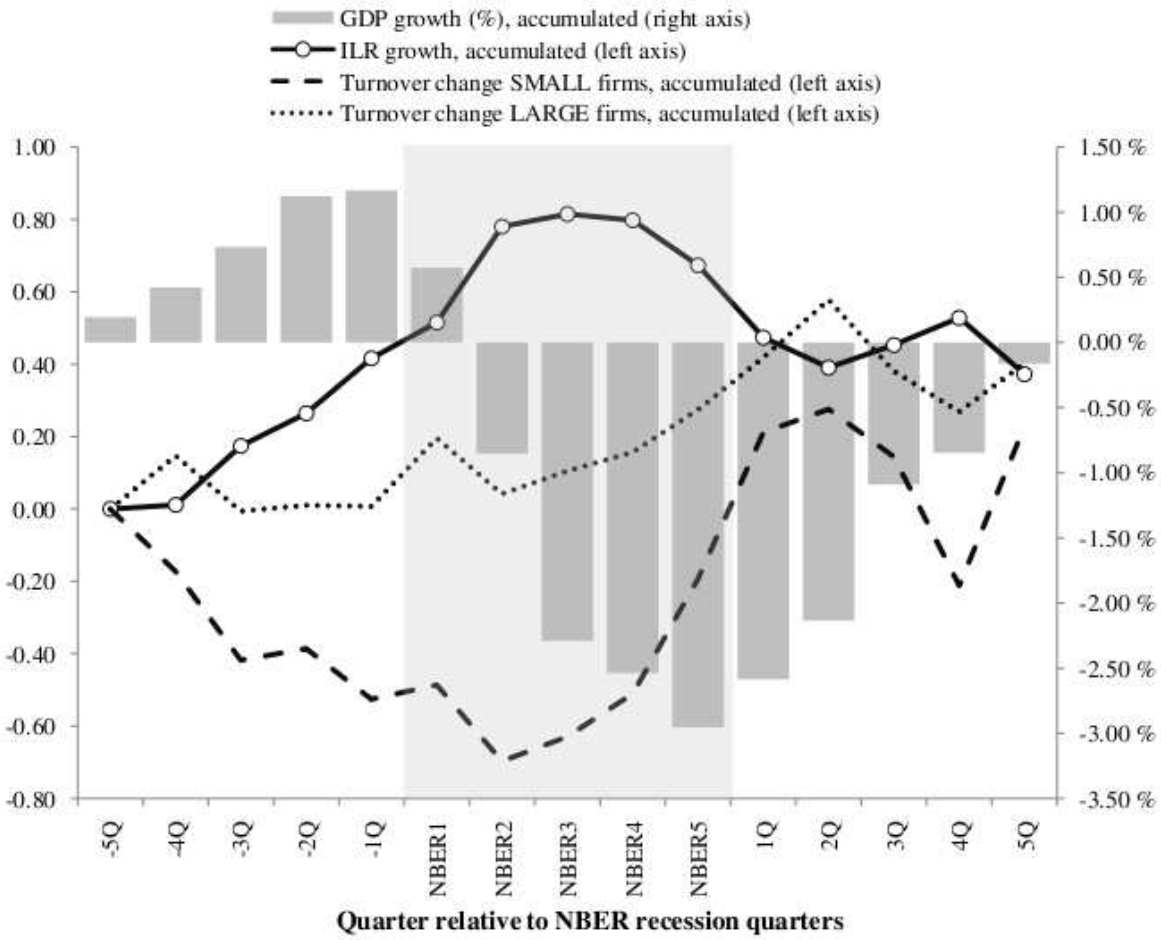
Comparing large and small stocks – Granger causality tests

Liquidity variable (LIQ)	$dGDPR \nrightarrow LIQ$		$LIQ \nrightarrow dGDPR$	
	χ^2	p-value	χ^2	p-value
ILR^S	4.34	0.23	10.33	0.02
ILR^L	6.86	0.08	1.32	0.72
$Roll^S$	0.67	0.72	6.44	0.04
$Roll^L$	0.19	0.91	5.60	0.06
LOT^S	3.19	0.07	9.84	0.00
LOT^L	0.20	0.65	0.03	0.87

Comparing large and small stocks – turnover?

Is this related to movement in and out of small stocks?

Add information about turnover.



Concluding – large vs small stocks

The predictive content of liquidity is coming from the smallest firms.

Causes of the results?

Important question: What is it about equity liquidity that links it better to the business cycle than e.g. stock prices?
Standard equity microstructure literature:
Liquidity driven by differently informed investors in one asset
– no room for systematic time series variation.
Equity asset pricing theory: Time varying hedging demand, contribution to future consumption – however – this intuition would say stock prices should be the better forecasting variable.
Possible way to go:
Liquidity has an interpretation as the *price of immediacy*, i.e. it is an asset price too. May it more cleanly identify the times when the price of immediacy is more important – recessions?

Portfolio composition – empirical investigation

One economic role of stocks: Vehicle for *saving*.
Subject to *demand* from investors (households, pension funds...)
Households: When foreseeing downturns in the economy, want to shift to more liquid assets.
Should observe

- – Movement *out* of the stock market
- – Movement *from* illiquid (small) stocks *to* liquid (large) stocks.

Use Norwegian equity ownership data to actually look at this.

Norwegian ownership data

Data for stock market ownership for all investors at the Oslo Stock Exchange.
All ownership of stocks at the Exchange is registered in a single, government-controlled entity, the Central Securities Registry (VPS).
Monthly observations of the equity holdings of the complete stock market (anonymized).
Construct complete portfolios of individuals investors
Knowing portfolios see when one person

- leave market – participation
- leave group of stocks (small firms) – portfolio composition

Investor	Number of investors			Fraction of investors		
type	entering	leaving	net	entering	leaving	net
All	15220	11934	3286	24.1	18.5	5.6
Personal owners	13445	10087	3358	24.3	17.5	6.8
Foreign owners	862	1119	-256	33.7	35.3	-1.6
Financial owners	51	44	6	14.8	12.4	2.4
Nonfinancial owners	1013	838	175	24.4	19.6	4.8
State owners	14	11	3	20.8	15.1	5.7

Correlation liquidity and change in stock market participation

	Firm size quartiles									
	All firms		Q1 (smallest)		Q2		Q3		Q4 (largest)	
All owners	-0.07	(0.32)	-0.35	(0.00)	-0.10	(0.22)	-0.20	(0.07)	-0.11	(0.22)
Personal owners	-0.02	(0.45)	-0.33	(0.01)	-0.09	(0.25)	-0.18	(0.09)	-0.08	(0.28)
Foreign owners	-0.18	(0.09)	-0.30	(0.01)	-0.16	(0.12)	-0.25	(0.03)	-0.23	(0.04)
Financial owners	-0.06	(0.33)	-0.11	(0.21)	0.01	(0.46)	-0.09	(0.25)	-0.08	(0.27)
Nonfinancial owners	-0.16	(0.12)	-0.35	(0.00)	-0.11	(0.21)	-0.21	(0.06)	-0.20	(0.06)
State owners	-0.06	(0.34)	-0.20	(0.07)	0.19	(0.08)	-0.10	(0.23)	-0.06	(0.34)

Summary of main results

Strong relation between equity market-liquidity and economic activity

- equity market liquidity contains information about **current and future macro fundamentals**

Where is information coming from?

- Mainly from the liquidity of small firms

Variation in market liquidity coinciding with changes in equity portfolio composition

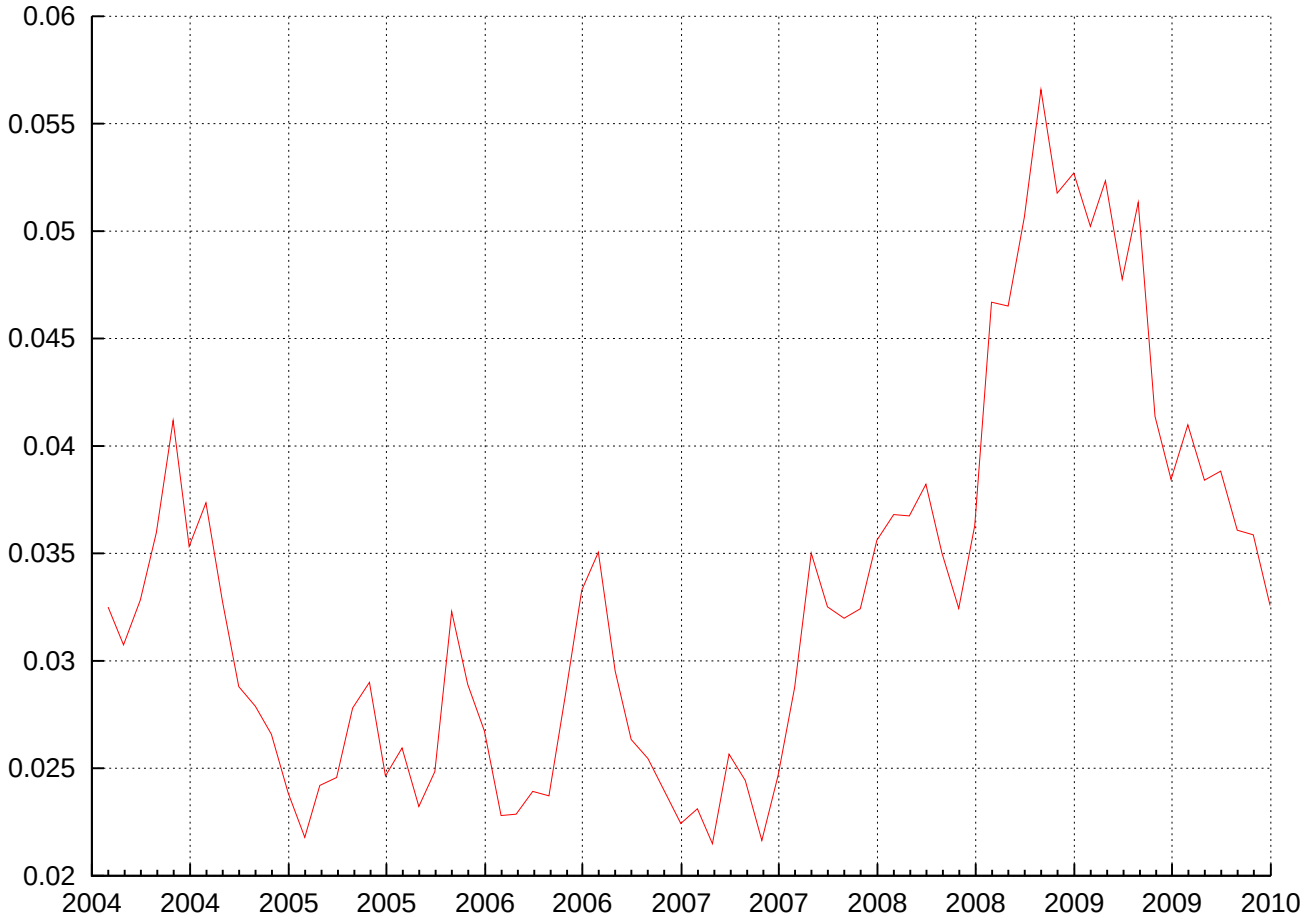
- liquidity worsens simultaneously with investors trading/moving out of small stocks

Planned work..

- **Additional markets**
  - Country crossection – fund flows
- **Investment link**
  - Equity market as a source of investment capital – reflect in general price of funds available for risky investments? [Skjeltorp and Ødegaard, 2010]
- **Forecasting/"nowcasting"** (Policy related)
  - Which liquidity measure has the best/most robust forecasting performance?
  - Common liquidity factor á la Chollete, Naes, and Skjeltorp [2007, 2008]
  - Policy use (see following pictures)

Rounding off: Is the Norwegian crisis over?

Relative spread, Oslo Stock Exchange, 2004–2009



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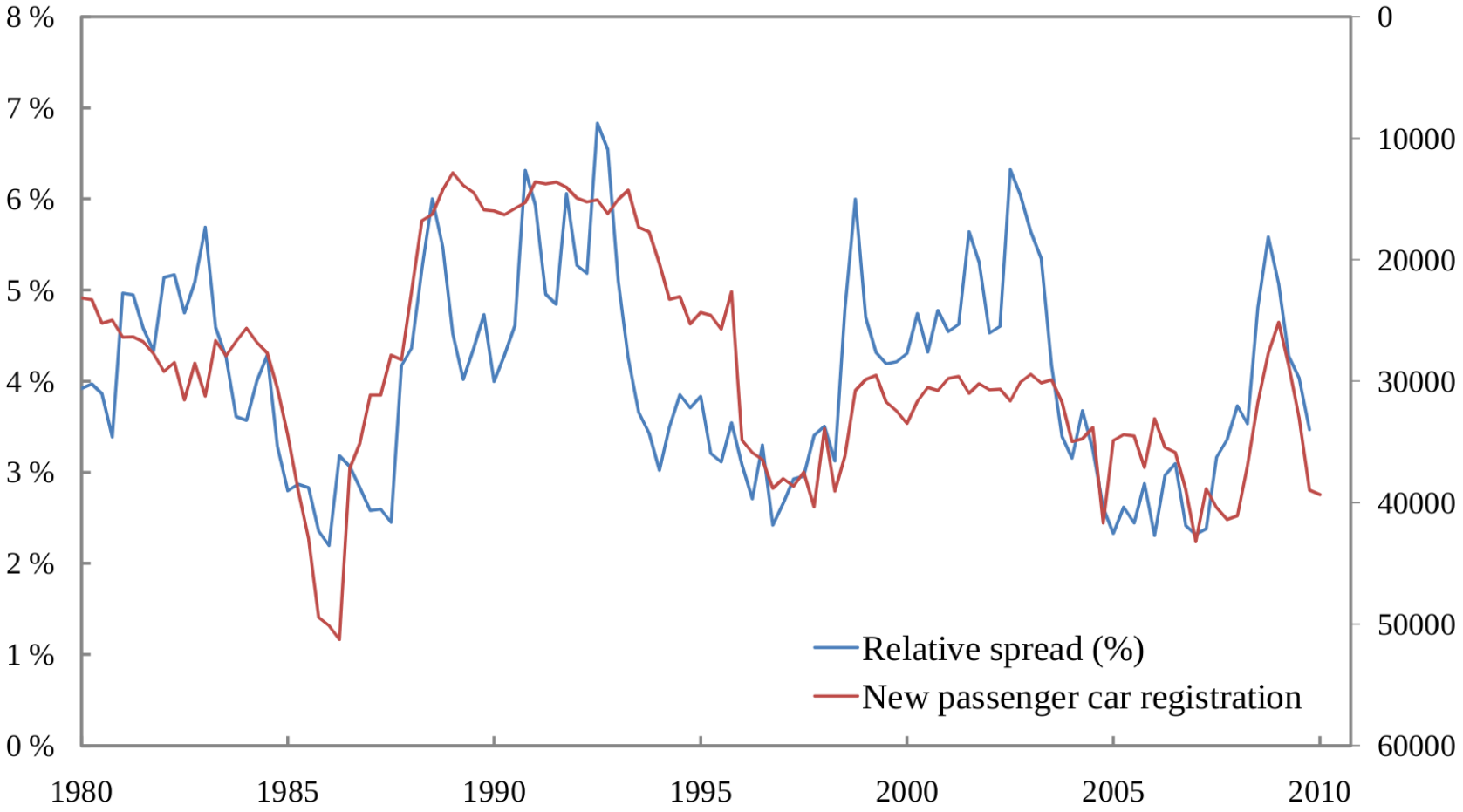
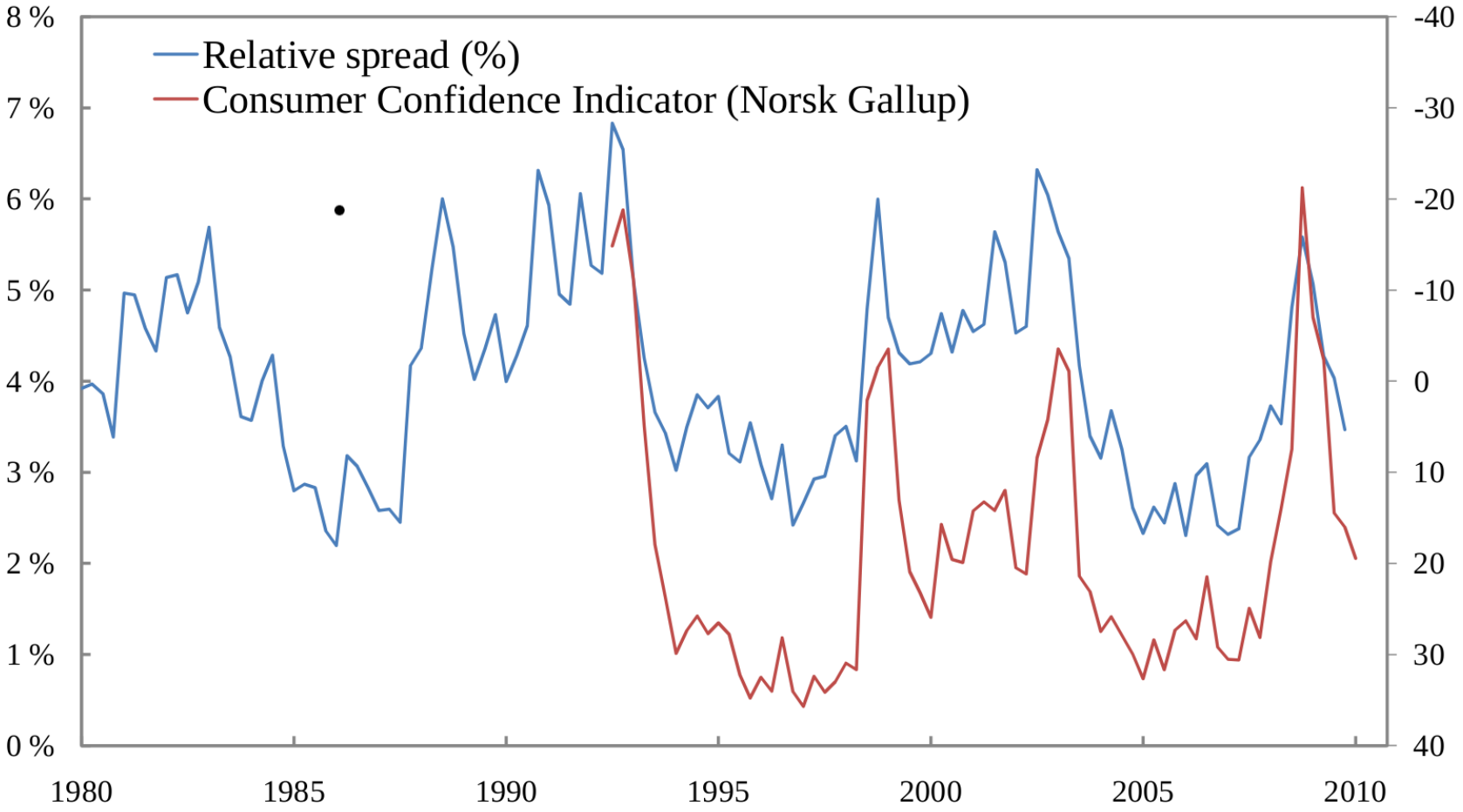
Relationship with other confidence variables

New car registrations (right axis, reversed)



Relationship with other confidence variables (cont.)

Consumer confidence indicator (right axis, reversed)



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