Internet Appendix to "Stock Market Liquidity and the Business Cycle" *

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This Internet appendix contains additional material to the paper "Stock Market Liquidity and the Business Cycle." The appendix contains the following additional material:

1. **A Microscope on the Recent Financial Crisis**
   We show the evolution of liquidity measures for the period 2004 to 2008 for the U.S., and 2004 to 2009 for Norway.

2. **Liquidity Correlation across Countries**
   We show the correlation of liquidity measures, both across liquidity measures and across countries.

3. **Predictability of U.S. Macroeconomy, Alternative Time-Series Liquidity Specifications**
   We rerun the analysis in Tables IV, V, and VII in the paper for two alternative time-series transformations of the *ILR* and *LOT* liquidity measures (demeaning and Hodrick-Prescott filtering).

4. **Predicting U.S. Macroeconomic Variables with Liquidity, VAR Specifications**
   We rerun the analysis in Table IV in the paper using a VAR (vector auto regression) specification. We report Granger causality tests between all variables in VAR and analyze the impulse response functions (we focus on the response of *dGDPR* to a shock in *dILR*) and examine the robustness of the response function to different orderings of the endogenous variables.

5. **Additional U.S. Size Results**
   We report estimation results for liquidity measures constructed separately for small and large firms for additional macro variables (*dUE*, *dCONSR*, and *dINV*). This supplements Table VII in the paper.

6. **Additional Model Specifications for the U.S., Excluding Market Liquidity**
   In table IV in the paper, we show the adjusted R^2 for models where we exclude the liquidity variable. We show the estimated models behind these numbers. We also show various alternative model specifications for models excluding market liquidity.

7. **Predictability Results and Causality Tests for Norway** We report the results for Norway, discussed in Section IV in the paper.

I. A Microscope on the Recent Financial Crisis

The recent financial crisis is of particular interest for the purposes of this paper, because it has been argued to be a prime example of lack of liquidity leading to a crisis and in turn a real economic recession. To illustrate how stock market liquidity has "played out" during the crisis in the markets considered in the paper, we provide some time-series plots of the various liquidity measures, starting in 2004, for both the U.S. (figure IA.1) and Norway (figure IA.2).

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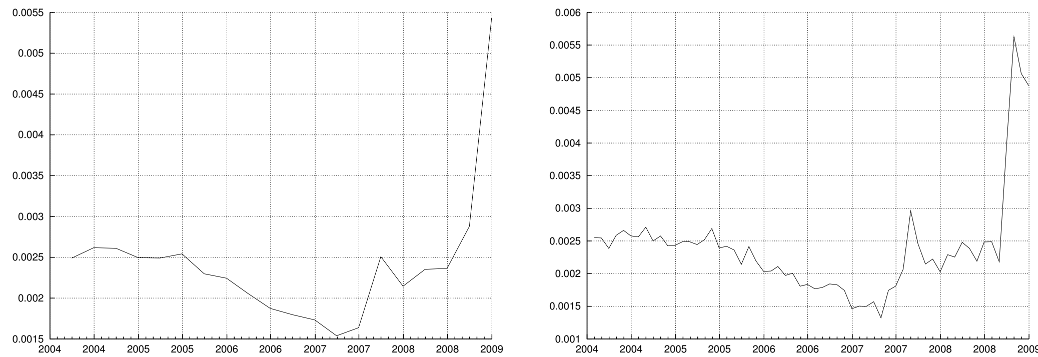
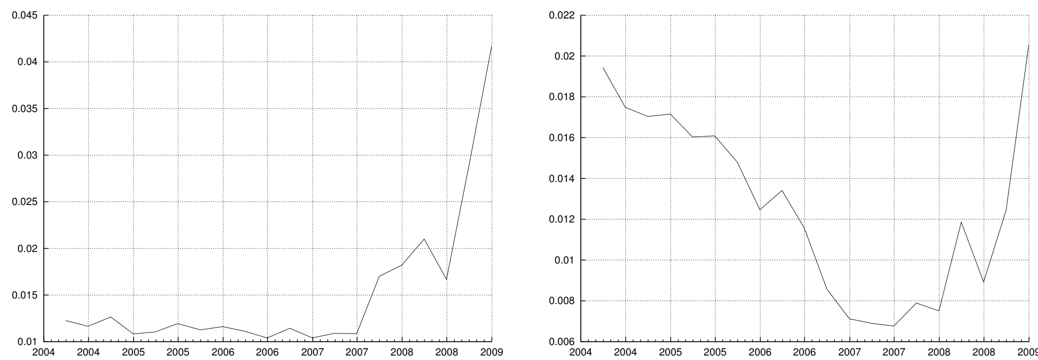
Panel A: Relative Spread, quarterly (left) and monthly (right)



Panel B: Quarterly *Roll* (left) and *LOT* (right)



Panel C: *ILR*, quarterly (left) and monthly (right)

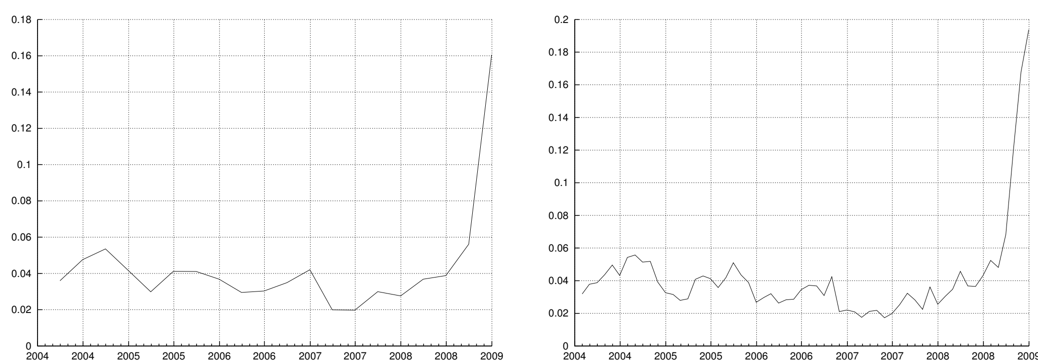
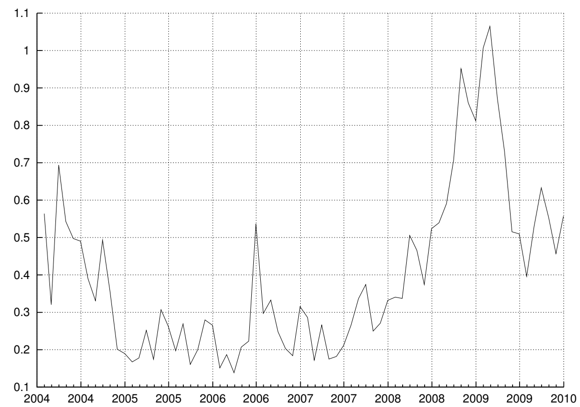
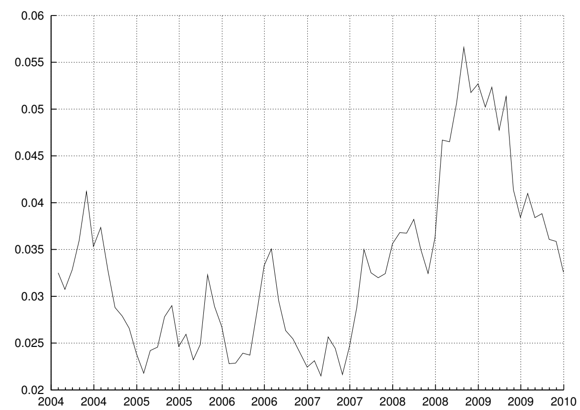


Figure IA.1. Liquidity evolution of NYSE in the period 2004 to 2008. The figures show time-series of aggregate measures of liquidity at the NYSE in the period 2004 to 2008. The measures are calculated for each firm at the NYSE using data for either one month or one quarter. We then calculate (equally weighted) averages of the liquidity measures calculated for individual firms. In panel A we show the relative spread, calculated as quarterly (left) or monthly (right) averages over daily closing spread. In panel B, the *Roll* (left) and *LOT* (right) measures are calculated using one quarter of daily returns. In panel C, the *ILR* measure is calculated using one quarter (left) or one month (right) worth of daily measures.

Panel A: *ILR* liquidity measure



Panel B: Relative spread



Panel C: Monthly turnover

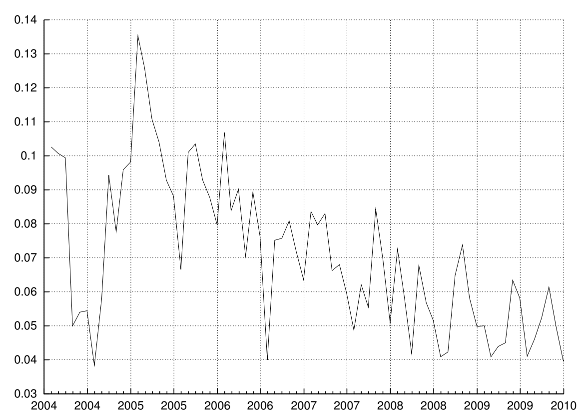


Figure IA.2. Liquidity evolution in Norway during the period 2004 to 2009. The figures plot the evolution of various liquidity measures at the Oslo Stock Exchange in the period 2004 to 2009. The *ILR* is Amihuds illiquidity ratio, calculated with data for one month, the relative spread is the average over the month of the cross-sectional averages of (end of day) relative spreads. The turnover is the fraction of a stock's outstanding equity traded during a month.

II. Liquidity Correlation across Countries

In the paper we show correlations between liquidity measures by calculating different liquidity measures for the same stock in a given quarter, and use this as the basic observation for calculating the correlation between liquidity measures. An alternative way of calculating a correlation between liquidity measures, which also allows for comparisons across exchanges, is to instead use a cross-sectional liquidity measure for the whole market as the basic observation used to calculate the correlation. In Table IA.I we show such correlations of the aggregate liquidity measures, both within and across exchanges, i.e. the correlations between two time-series of cross-sectional averages.

Table IA.I
Correlations between Time-series of Average Liquidity Measures

The table shows correlations between time-series of average liquidity measures. For each liquidity measure, on each date, we calculate the equally weighted average across all stocks present at that date. The numbers in the table are correlations between the resulting time-series of averages. The time-series used differ. For the U.S., we have *LOT*, *ILR*, and *Roll* for 1947 to 2008. The relative spread (*RS*) for NYSE starts in 1980, the same time as the Norwegian data start. All series stop at the end of 2008.

	US *RS*	US *LOT*	US *ILR*	US *Roll*	Norway *RS*	Norway *LOT*	Norway *ILR*
US *LOT*	0.66						
US *ILR*	0.40	0.07					
US *Roll*	0.18	0.35	-0.06				
Norway *RS*	0.35	0.45	0.55	0.49			
Norway *LOT*	0.41	0.57	0.56	0.39	0.84		
Norway *ILR*	0.25	0.60	0.65	0.16	0.67	0.72	
Norway *Roll*	0.35	0.33	0.32	0.59	0.67	0.68	0.44

III. Predictability of U.S. Macroeconomy, Alternative Time-series Liquidity Specifications

In Subsection I.D of the paper we discuss our choices of time-series transformations of *ILR* and *LOT* to achieve stationarity, and in the paper we end up using (log) differences for *ILR* and *LOT*. But there are alternative ways to achieve stationarity. In this section of the appendix we show two alternative transformations. First we show the results when we demean the *ILR* and *LOT* measures using a two-year (backward-looking) moving average. Second we show results using a Hodrick-Prescott filter to detrend *ILR* and *LOT*. Note that the series using a Hodrick-Prescott filter can not be used in our out-of-sample forecasting analysis, since it is estimated using future data. The first method, however, only uses data available when the mean is removed, and could be used in forecasting exercises. In the paper we use the first (log) differenced versions of the liquidity variables for both the in-sample and out-of-sample analysis.

A. Time demeaned versions of ILR *and* LOT

In the following tables we rerun the analysis reported in tables IV, V and VII in the paper using the time demeaned versions of *ILR* and *LOT* to make each series stationary. The demeaning is done by taking the difference between the quarter t realization of the variable and the moving average over the most recent eight quarters. Essentially, we are removing a time-varying trend in the *ILR* and *LOT* series.

Table IA.II
In-sample Prediction of Macro Variables - Demeaned *ILR* and *LOT*

The table shows the results from predictive regressions where we regress next quarter growth in different macro variables on three proxies for market illiquidity for the period 1947 to 2008. Market illiquidity (LIQ) is proxied by one of two illiquidity measures: the Amihud illiquidity ratio (*ILR*) and the *LOT* measure. Both *ILR* and *LOT* are demeaned relative to their two-year moving average. The model estimated is $y_{t+1} = \alpha + \beta \text{LIQ}_t + \gamma' \mathbf{X}_t + u_{t+1}$, where y_{t+1} is real GDP growth (*dGDPR*), growth in the unemployment rate (*dUE*), real consumption growth (*dCONSR*), or growth in private investment (*dINV*). We include one lag of the dependent variable (y_t) in addition to *Term*, *dCred*, *Vola*, and er_m as control variables. The Newey-West corrected *t*-statistics (with four lags) are reported in parentheses below the coefficient estimates, and $\bar{R}^2$ is the adjusted R^2. The last column reports the adjusted R^2 when we exclude the liquidity variable in the respective models.

Panel A: *ILR* liquidity measure (demeaned)

Dependent variable (y_{t+1})	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{dCred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{er_m}$	$\bar{R}^2$	ex.liq. $\bar{R}^2$
dGDPR	0.007	-0.016	0.005					0.22	0.03
	(9.71)	(-4.81)	(0.08)						
dUE	0.009	0.146	0.102					0.33	0.07
	(1.73)	(6.42)	(1.80)						
dCONSR	0.006	-0.006	0.241					0.12	0.08
	(5.96)	(-1.90)	(2.43)						
dINV	0.007	-0.030	0.118					0.14	0.06
	(3.15)	(-2.39)	(1.65)						
dGDPR	0.007	-0.014	0.016	0.000	-0.010			0.24	0.10
	(6.78)	(-4.23)	(0.25)	(0.50)	(-2.83)				
dUE	0.015	0.133	0.121	-0.006	0.054			0.35	0.15
	(2.23)	(6.00)	(2.12)	(-1.50)	(2.41)				
dCONSR	0.005	-0.005	0.251	0.001	-0.002			0.14	0.12
	(3.48)	(-1.60)	(2.62)	(2.09)	(-0.83)				
dINV	0.003	-0.022	0.128	0.003	-0.036			0.22	0.17
	(0.87)	(-1.88)	(1.94)	(2.24)	(-4.32)				
dGDPR	0.008	-0.013	0.030	0.000	-0.009	-0.002	0.015	0.25	0.15
	(7.47)	(-3.68)	(0.47)	(0.26)	(-2.74)	(-0.33)	(1.90)		
dUE	0.010	0.120	0.146	-0.005	0.057	-0.020	-0.127	0.36	0.22
	(1.54)	(5.02)	(2.50)	(-1.38)	(2.48)	(-0.66)	(-2.78)		
dCONSR	0.005	-0.003	0.274	0.001	-0.002	0.001	0.024	0.18	0.18
	(4.41)	(-0.93)	(2.99)	(2.01)	(-0.86)	(0.29)	(3.81)		
dINV	0.005	-0.017	0.154	0.003	-0.036	0.004	0.056	0.24	0.22
	(1.58)	(-1.43)	(2.35)	(2.08)	(-4.08)	(0.31)	(2.96)		

Table IA.II (Continued)

Panel B: *LOT* liquidity measure (demeaned)

Dependent variable (y_{t+1})	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{dCred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{er_m}$	$\bar{R}^2$	ex.liq. $\bar{R}^2$
dGDPR	0.007	-0.812	0.142					0.08	0.03
	(8.12)	(-3.39)	(2.21)						
dUE	0.003	5.758	0.240					0.11	0.07
	(0.52)	(2.76)	(4.00)						
dCONSR	0.006	-0.415	0.270					0.10	0.08
	(6.94)	(-2.27)	(3.48)						
dINV	0.007	-2.212	0.187					0.10	0.06
	(3.21)	(-3.10)	(2.87)						
dGDPR	0.006	-0.586	0.141	0.000	-0.014			0.13	0.10
	(5.67)	(-2.82)	(2.22)	(0.73)	(-3.35)				
dUE	0.012	3.737	0.254	-0.008	0.096			0.17	0.15
	(1.62)	(2.13)	(4.30)	(-2.39)	(3.18)				
dCONSR	0.005	-0.271	0.278	0.001	-0.004			0.12	0.12
	(3.97)	(-1.58)	(3.70)	(2.10)	(-1.15)				
dINV	0.003	-1.372	0.182	0.003	-0.040			0.19	0.17
	(0.92)	(-2.30)	(2.94)	(2.30)	(-4.49)				
dGDPR	0.008	-0.628	0.134	0.000	-0.013	0.005	0.029	0.17	0.15
	(6.64)	(-3.23)	(2.31)	(0.23)	(-3.35)	(1.07)	(3.68)		
dUE	0.002	4.290	0.269	-0.005	0.094	-0.070	-0.264	0.23	0.22
	(0.35)	(2.56)	(5.39)	(-1.75)	(3.10)	(-1.93)	(-5.58)		
dCONSR	0.005	-0.294	0.283	0.001	-0.003	0.004	0.027	0.18	0.18
	(4.86)	(-1.73)	(3.93)	(1.85)	(-1.07)	(0.97)	(4.45)		
dINV	0.006	-1.537	0.186	0.003	-0.040	0.020	0.077	0.24	0.22
	(1.89)	(-2.74)	(2.96)	(1.90)	(-4.31)	(1.39)	(3.94)		

Table IA.III
Granger Causality Tests - Demeaned *ILR* and *LOT*

The table shows Granger causality tests between the quarterly real GDP growth (*dGDPR*) and the demeaned versions of the Amihud Illiquidity ratio (*ILR*) and the *LOT* measure. Both *ILR* and *LOT* are demeaned relative to their two-year moving average. The test is performed for the whole sample, and different sub-periods. For each measure we first test a null hypothesis that real GDP growth *does not* Granger cause market illiquidity and then whether market illiquidity *does not* Granger cause real GDP growth. We report the χ^2 and p-value (in parenthesis) for each test. We choose the optimal lag length for each test based on the Schwartz criterion. For each illiquidity variable the test is performed on the whole sample period (1947q1-2008q4) and the first (1947q1-1977q4) and second (1978q1-2008q4) halves of the sample, and for rolling 20-year subperiods overlapping by 10 years. The first two rows report the number of quarterly observations covered by each sample period and the number of NBER recession periods within each sample.

	Whole sample	First half	Second half	20-year subperiods				
	1947-2008	1947-1977	1977-2008	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
Panel A: $dILR$ (demeaned)								
H_0: $dGDPR \nrightarrow dILR$								
χ^2	2.21	1.32	3.66	3.58	3.34	3.50	1.17	4.53
p-value	0.33	0.52	0.16	0.17	0.19	0.17	0.56	0.10
H_0: $dILR \nrightarrow dGDPR$								
χ^2	46.8**	32.44**	11.79**	25.1**	18.73**	11.72**	13.89**	10.73**
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Panel B: $dLOT$ (demeaned)								
H_0: $dGDPR \nrightarrow dLOT$								
χ^2	1.92	0.83	1.26	2.10	0.83	1.18	0.21	0.48
p-value	0.17	0.36	0.26	0.15	0.36	0.28	0.65	0.49
H_0: $dLOT \nrightarrow dGDPR$								
χ^2	11.06**	12.25**	1.72	10.54**	9.82**	8.59**	2.31	1.42
p-value	0.00	0.00	0.19	0.00	0.00	0.00	0.13	0.23

Table IA.IV
Predicting Macroeconomic Variables with Market Liquidity - Size Portfolios (Demeaned *ILR* and *LOT*)

The table shows the multivariate OLS estimates from regressing next quarter macro variables on current market illiquidity of small and large firms and four control variables. We examine two different proxies for market illiquidity, sampled for small and large firms. Both *ILR* and *LOT* are demeaned relative to their two year moving average. The estimated model is $y_{t+1} = \alpha + \beta_S^{LIQ} LIQ_t^{small} + \beta_L^{LIQ} LIQ_t^{large} + \gamma \mathbf{X_t} + u_{t+1}$, where y_{t+1} is real GDP growth (*dGDPR*), growth in the unemployment rate (*dUE*), real consumption growth (*dCONSR*), or growth in private investments (*dINV*), LIQ^{small} is the respective illiquidity proxy sampled for the 25% smallest firms, LIQ^{large} is the illiquidity of the 25% largest firms, $\mathbf{X_t}$ contains the control variables (*Term*, *dCred*, *Vola*, and er_m), and γ is the vector with the respective coefficient estimates for the control variables. The Newey-West corrected t-statistics (with four lags) are reported in parentheses below the coefficient estimates, and $\bar{R}^2$ is the adjusted R^2.

Panel A: *ILR* liquidity measure (demeaned)

Dependent variable (y_t)	Const.	β_S^{LIQ}	β_L^{LIQ}	$\hat{\gamma}_1^{\,Term}$	$\hat{\gamma}_2^{\,dCred}$	$\hat{\gamma}_3^{\,Vola}$	$\hat{\gamma}_4^{\,er_m}$	$\bar{R}^2$
dGDPR	0.008	-0.004	-0.019	0.000	-0.010	-0.001	0.016	0.25
	(7.80)	(-3.27)	(-0.46)	(0.29)	(-2.76)	(-0.24)	(1.95)	
dUE	0.008	0.047	-0.045	-0.004	0.059	-0.027	-0.121	0.31
	(1.10)	(5.24)	(0.87)	(-0.91)	(2.44)	(-0.85)	(-2.48)	
dCONSR	0.007	-0.001	-0.033	0.001	-0.002	0.000	0.020	0.12
	(6.95)	(-0.42)	(-1.15)	(1.83)	(-0.67)	(-0.08)	(2.97)	
dINV	0.006	-0.005	-0.045	0.003	-0.039	0.011	0.054	0.21
	(1.71)	(-0.91)	(-0.32)	(1.84)	(-4.07)	(0.92)	(2.39)	

Panel B: *LOT* liquidity measure (demeaned)

Dependent variable (y_t)	Const.	β_S^{LIQ}	β_L^{LIQ}	$\hat{\gamma}_1^{\,Term}$	$\hat{\gamma}_2^{\,dCred}$	$\hat{\gamma}_3^{\,Vola}$	$\hat{\gamma}_4^{\,er_m}$	$\bar{R}^2$
dGDPR	0.009	-0.317	-0.239	0.000	-0.014	0.007	0.030	0.16
	(7.79)	(-3.40)	(-0.47)	(0.00)	(-3.50)	(1.42)	(3.71)	
dUE	0.001	2.246	2.207	-0.003	0.100	-0.083	-0.246	0.16
	(0.10)	(3.39)	(0.62)	(-0.89)	(3.20)	(-2.30)	(-4.84)	
dCONSR	0.008	-0.080	-0.937	0.001	-0.003	0.005	0.026	0.11
	(8.14)	(-1.20)	(-1.89)	(1.52)	(-0.94)	(1.13)	(3.92)	
dINV	0.008	-0.669	-1.236	0.003	-0.044	0.030	0.078	0.21
	(2.45)	(-2.66)	(-0.99)	(1.56)	(-4.46)	(2.27)	(3.82)	

Table IA.V
Granger Causality - Size Portfolios (Demeaned *LOT* and *ILR*)

The table shows the results of Granger causality tests between real GDP growth and the illiquidity of small and large firms for the two different illiquidity proxies. Both *ILR* and *LOT* are demeaned relative to their two-year moving average. The first column denote the liquidity variable, columns two and three show the χ^2 and associated p-value from Granger causality tests where the null hypothesis is that GDP growth *does not* Granger cause the liquidity variables. Similarly, columns four and five show the results when the null hypothesis is that the liquidity variable *does not* Granger cause GDP growth.

Liquidity	$dGDPR \nrightarrow$ LIQ		LIQ $\nrightarrow dGDPR$	
variable (LIQ)	χ^2	p-value	χ^2	p-value
ILR^{S}	0.00	(0.97)	13.10**	(0.00)
ILR^{L}	0.40	(0.53)	1.39	(0.24)
LOT^{S}	0.67	(0.72)	6.44*	(0.04)
LOT^{L}	0.19	(0.91)	5.60	(0.06)

B. Hodrick-Prescott filtered versions of ILR *and* LOT

In the following tables we use a Hodrick-Prescott filter on *ILR* and *LOT* to detrend the series.

Table IA.VI

In-sample Prediction of Macroeconomic Variables - HP Filtered *ILR* and *LOT*

The table shows the results from predictive regressions where we regress next quarter growth in different macro variables on two proxies for market illiquidity for the period 1947 to 2008. Market illiquidity (LIQ) is proxied by one of two illiquidity measures: the Amihud illiquidity ratio (*ILR*), and the *LOT* measure. The *ILR* and *LOT* series are detrended using a Hodrick-Prescott filter. The model estimated is $y_{t+1} = \alpha + \beta \mathrm{LIQ}_t + \gamma' \mathbf{X}_t + u_{t+1}$, where y_{t+1} is real GDP growth (*dGDPR*), growth in the unemployment rate (*dUE*), real consumption growth (*dCONSR*), or growth in private investments (*dINV*). We include one lag of the dependent variable (y_t) in addition to *Term*, *dCred*, *Vola*, and er_m as control variables. The Newey-West corrected *t*-statistics (with four lags) are reported in parentheses below the coefficient estimates, and $\bar{R}^2$ is the adjusted R^2.

Panel A: *ILR* liquidity measure (HP filtered)

Dependent variable (y_{t+1})	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{dCred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{er_m}$	$\bar{R}^2$	ex.liq. $\bar{R}^2$
dGDPR	0.007	-0.007	0.095					0.09	0.03
	(8.01)	(-3.31)	(1.31)						
dUE	0.002	0.087	0.120					0.20	0.07
	(0.31)	(4.27)	(1.65)						
dCONSR	0.006	-0.002	0.272					0.09	0.08
	(6.36)	(-1.30)	(3.22)						
dINV	0.008	-0.016	0.155					0.09	0.06
	(3.43)	(-2.24)	(2.34)						
dGDPR	0.007	-0.006	0.094	0.001	-0.014			0.15	0.10
	(5.80)	(-3.15)	(1.32)	(1.17)	(-3.40)				
dUE	0.013	0.079	0.139	-0.009	0.086			0.26	0.15
	(1.66)	(4.09)	(1.96)	(-2.40)	(3.15)				
dCONSR	0.004	-0.002	0.274	0.001	-0.004			0.12	0.12
	(3.77)	(-1.20)	(3.32)	(2.38)	(-1.36)				
dINV	0.003	-0.014	0.147	0.004	-0.042			0.20	0.17
	(0.93)	(-2.18)	(2.47)	(2.61)	(-4.57)				
dGDPR	0.008	-0.006	0.099	0.000	-0.013	-0.001	0.025	0.18	0.15
	(6.87)	(-3.08)	(1.54)	(0.69)	(-3.23)	(-0.17)	(3.15)		
dUE	0.005	0.071	0.169	-0.007	0.082	-0.024	-0.216	0.30	0.22
	(0.67)	(3.79)	(2.72)	(-2.11)	(2.99)	(-0.72)	(-4.24)		
dCONSR	0.005	-0.001	0.287	0.001	-0.003	0.001	0.026	0.18	0.18
	(4.64)	(-0.92)	(3.64)	(2.23)	(-1.19)	(0.34)	(4.23)		
dINV	0.005	-0.012	0.166	0.003	-0.039	0.005	0.069	0.24	0.22
	(1.76)	(-2.01)	(2.82)	(2.33)	(-4.21)	(0.35)	(3.41)		

Table IA.VI (Continued)

Panel B: *LOT* liquidity measure (HP filtered)

Dependent variable (y_{t+1})	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{dCred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{er_m}$	$\bar{R}^2$	ex.liq. $\bar{R}^2$
dGDPR	0.007	-0.242	0.150					0.04	0.03
	(7.82)	(-1.97)	(2.34)						
dUE	0.002	2.066	0.231					0.08	0.07
	(0.39)	(2.02)	(3.72)						
dCONSR	0.006	-0.069	0.285					0.08	0.08
	(6.88)	(-0.66)	(3.81)						
dINV	0.007	-0.503	0.200					0.05	0.06
	(3.13)	(-1.11)	(2.98)						
dGDPR	0.006	-0.232	0.138	0.001	-0.015			0.11	0.10
	(5.60)	(-2.23)	(2.13)	(1.36)	(-3.58)				
dUE	0.015	2.060	0.236	-0.010	0.105			0.17	0.15
	(1.98)	(2.79)	(3.95)	(-3.00)	(3.34)				
dCONSR	0.004	-0.092	0.281	0.001	-0.004			0.12	0.12
	(3.87)	(-1.01)	(3.78)	(2.48)	(-1.44)				
dINV	0.002	-0.538	0.177	0.004	-0.044			0.18	0.17
	(0.66)	(-1.52)	(2.87)	(2.72)	(-4.70)				
dGDPR	0.007	-0.261	0.131	0.000	-0.014	0.002	0.029	0.16	0.15
	(6.80)	(-2.86)	(2.27)	(0.89)	(-3.46)	(0.36)	(3.71)		
dUE	0.005	2.358	0.250	-0.008	0.100	-0.050	-0.269	0.24	0.22
	(0.75)	(3.92)	(5.11)	(-2.71)	(3.21)	(-1.42)	(-5.64)		
dCONSR	0.005	-0.118	0.285	0.001	-0.003	0.003	0.027	0.18	0.18
	(4.80)	(-1.40)	(3.94)	(2.39)	(-1.25)	(0.60)	(4.45)		
dINV	0.005	-0.617	0.184	0.004	-0.042	0.011	0.078	0.23	0.22
	(1.66)	(-1.93)	(2.97)	(2.51)	(-4.35)	(0.80)	(4.01)		

Table IA.VII
Granger Causality Tests - HP Filtered *ILR* and *LOT*

The table shows Granger causality tests between quarterly real GDP growth (*dGDPR*) and the Amihud illiquidity ratio (*ILR*) and *LOT* measures. We use specifications of *ILR* and *LOT* that have been detrended with a Hodrick-Prescott filter. The test is performed for the whole sample, and different subperiods. For each measure we first test the null hypothesis that real GDP growth *does not* Granger cause market illiquidity and then whether market illiquidity *does not* Granger cause real GDP growth. We report the χ^2 and p-value (in parentheses) for each test. We choose the optimal lag length for each test based on the Schwartz criterion. For each illiquidity variable the test is performed on the whole sample period (1947q1-2008q4), the first (1947q1-1977q4) and second (1978q1-2008q4) halves of the sample, and for rolling 20-year subperiods overlapping by 10 years. The first two rows report the number of quarterly observations covered by each sample period and the number of NBER recession periods within each sample.

	Whole sample	First half	Second half	20-year sub-periods				
	1947-2008	1947-1977	1977-2008	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
Panel A. *ILR* (HP filtered)								
H_0: $dGDPR \nrightarrow dILR$								
χ^2	0.53	0.22	2.75	1.86	3.00	3.26	0.93	2.27
p-value	0.77	0.90	0.25	0.40	0.22	0.20	0.63	0.32
H_0: $dILR \nrightarrow dGDPR$								
χ^2	33.11**	22.59**	7.05**	15.09**	13.13**	10.01**	10.39**	7.60*
p-value	0.00	0.00	0.03	0.00	0.00	0.01	0.01	0.02
Panel B. *LOT* (HP filtered)								
H_0: $dGDPR \nrightarrow dLOT$								
χ^2	7.62*	6.25*	2.70	4.72	5.40	4.93	0.78	2.87
p-value	0.02	0.04	0.26	0.09	0.07	0.08	0.68	0.24
H_0: $dLOT \nrightarrow dGDPR$								
χ^2	11.51**	12.83**	1.74	7.86*	9.69**	7.69*	1.35	1.12
p-value	0.00	0.00	0.42	0.02	0.01	0.02	0.51	0.57

Table IA.VIII
Predicting Macroeconomic Variables with Market Liquidity - Size Portfolios (HP Filtered *ILR* and *LOT*)

The table shows the multivariate OLS estimates from regressing next quarters macro variables on current market illiquidity of small and large firms and four control variables. We examine two different proxies for market illiquidity, sampled for small and large firms. We use specifications of *ILR* and *LOT* that have been detrended with a Hodrick-Prescott filter. The estimated model is $y_{t+1} = \alpha + \beta_S^{LIQ} LIQ_t^{small} + \beta_L^{LIQ} LIQ_t^{large} + \gamma \mathbf{X_t} + u_{t+1}$, where y_{t+1} is real GDP growth (*dGDPR*), growth in the unemployment rate (*dUE*), real consumption growth (*dCONSR*), or growth in private investments (*dINV*). LIQ^{small} is the respective illiquidity proxy sampled for the 25% smallest firms, LIQ^{large} is the illiquidity of the 25% largest firms, $\mathbf{X_t}$ contains the control variables (*Term*, *dCred*, *Vola*, and er_m) and γ' is the vector with the respective coefficient estimates for the control variables. The Newey-West corrected *t*-statistics (with four lags) are reported in parentheses below the coefficient estimates, and $\bar{R}^2$ is the adjusted R^2.

Panel A: *ILR* liquidity measure (HP filtered)

Dependent variable (y_t)	Const.	β_S^{LIQ}	β_L^{LIQ}	$\hat{\gamma}_1{}^{Term}$	$\hat{\gamma}_2{}^{dCred}$	$\hat{\gamma}_3{}^{Vola}$	$\hat{\gamma}_4{}^{er_m}$	$\bar{R}^2$
dGDPR	0.008	-0.002	-0.029	0.000	-0.013	0.000	0.024	0.183
	(7.91)	(-1.34)	(-0.77)	(0.64)	(-3.32)	(-0.07)	(3.02)	
dUE	0.005	0.019	0.382	-0.007	0.082	-0.024	-0.178	0.265
	(0.73)	(2.39)	(0.20)	(-1.83)	(3.11)	(-0.76)	(-3.64)	
dCONSR	0.008	-0.001	-0.015	0.001	-0.003	0.000	0.024	0.101
	(8.20)	(-0.69)	(-0.60)	(1.98)	(-1.06)	(0.09)	(3.63)	
dINV	0.007	-0.005	-0.021	0.003	-0.042	0.013	0.068	0.210
	(2.23)	(-1.22)	(-0.19)	(2.13)	(-4.45)	(1.05)	(3.25)	

Panel B: *LOT* liquidity measure (HP filtered)

Dependent variable (y_t)	Const.	β_S^{LIQ}	β_L^{LIQ}	$\hat{\gamma}_1{}^{Term}$	$\hat{\gamma}_2{}^{dCred}$	$\hat{\gamma}_3{}^{Vola}$	$\hat{\gamma}_4{}^{er_m}$	$\bar{R}^2$
dGDPR	0.008	-0.119	-0.164	0.001	-0.015	0.003	0.029	0.144
	(7.49)	(-2.81)	(-0.64)	(0.92)	(-3.58)	(0.65)	(3.60)	
dUE	0.006	1.252	1.564	-0.008	0.107	-0.059	-0.247	0.172
	(0.76)	(4.29)	(0.79)	(-2.23)	(3.28)	(-1.71)	(-4.97)	
dCONSR	0.008	-0.049	-0.471	0.001	-0.003	0.003	0.027	0.108
	(8.48)	(-1.04)	(-1.51)	(2.07)	(-1.07)	(0.64)	(4.08)	
dINV	0.006	-0.284	-0.581	0.004	-0.047	0.021	0.077	0.193
	(2.07)	(-1.89)	(-0.65)	(2.36)	(-4.60)	(1.60)	(3.87)	

Table IA.IX
Granger Causality - Size Portfolios (HP Filtered *ILR* and *LOT*)

The table shows the results of Granger causality tests between real GDP growth and the illiquidity of small and large firms for the two different illiquidity proxies. We use specifications of *ILR* and *LOT* that have been detrended with a Hodrick-Prescott filter. The first column denotes the liquidity variable, columns two and three show the χ^2 and associated p-value from Granger causality tests where the null hypothesis is that GDP growth *does not* Granger cause the liquidity variables. Similarly, columns four and five show the results when the null hypothesis is that the liquidity variable *does not* Granger cause GDP growth.

Liquidity	$dGDPR \nrightarrow$ LIQ		LIQ $\nrightarrow dGDPR$	
variable (LIQ)	χ^2	p-value	χ^2	p-value
$dILR^{\mathsf{S}}$	3.08	(0.38)	22.13**	(0.00)
$dILR^{\mathsf{L}}$	6.61	(0.09)	1.76	(0.62)
$dLOT^{\mathsf{S}}$	7.59*	(0.02)	10.55**	(0.01)
$dLOT^{\mathsf{L}}$	3.16	(0.21)	0.58	(0.75)

IV. Predicting U.S. Macroeconomic Variables with Liquidity, VAR Specifications

Chordia, Sarkar, and Subrahmanyam (2005) argue that returns, volatility and liquidity are endogenous and should be estimated in a system. Thus, to supplement the predictive regressions in Table IV of the paper, we first estimate a VAR with endogenous equity market variables to examine the causal relationships between these variables. In addition, we include equity market turnover.[1] In the second set of VAR models we also include the credit spread (*dCred*) and term spread (*Term*) as endogenous variables. In the VAR estimations we use the first (log) differenced versions of *ILR* and *LOT*, while *Roll* is not transformed.

A. *VAR - only Equity Market Variables*

In Table IA.X we report the estimation results for a VAR system with *dGDPR*, er_m, *Vola*, and either *dILR* (Panel A), *dLOT* (Panel B), or *Roll* (Panel C). The model is estimated with a one quarter lag for all variables. The number of lags is obtained testing for optimal lag length using the Schwartz criterion. Looking first at the equation for *dGDPR*, shown in the first row in all panels, the results are very similar to the single-equation predictive regressions in the paper. The *dILR*, *dLOT*, and *Roll* measures are all very significant. For the equation for the respective liquidity measures (second row), we find that er_m is a strong predictor of both *dILR* and *dLOT*, although er_m does not have any predictive power for *Roll*. Next, in the equation for er_m, no variables enter significantly. In the equation for *dTurn* (stock market turnover), we find that both *dGDPR* and er_m enter significantly in all equations, and in Panel B we also find that *dLOT* is significant in the *dTurn* equation. Finally, in the equation for *Vola*, we find that lagged market returns er_m are significant in the VAR with the *Roll* measure.

In Table IA.XI we test the Granger causality between all the endogenous variables. In the table the null hypothesis is that the row variable does not Granger cause the column variable. For all three liquidity proxies we reject the null that the liquidity measures do not Granger cause *dGDPR*, while we cannot reject the reverse hypothesis that *dGDPR* does not Granger cause any of the liquidity variables. While there is no causality from er_m to *dGDPR* in the systems with *dILR* or *Roll*, we reject the null in favor of er_m (at the 5% level) Granger causing *dGDPR* in the system with *dLOT*. Interestingly, for all three models we find support for a strong one-way causality from *dGDPR* to *dTurn* and from er_m to *dTurn*. Finally, we also

[1] The turnover (*Turn*) is estimated for each stock as the fraction of the firm's equity capital traded in a given quarter. We then take equally weighted averages for all observations in the same quarter. In the analysis we use (log) differenced turnover, and label it *dTurn*.

find a strong causality from er_m to both *dILR* and *dLOT*, but not for *Roll*. The result that market returns cause liquidity is similar to what is documented in Chordia, Sarkar, and Subrahmanyam (2005), although we do not find causality between liquidity and volatility or volatility and returns. A possible reason for this difference is that they look at a daily frequency while we look at a quarterly frequency.

Table IA.X
Vector Autoregression - Equity Market Variables

The table shows the results from estimating a VAR with endogenous variables *dGDPR*, er_m, *dTurn*, *Vola*, and market liquidity proxied either by *dILR* (Panel A), *dLOT* (Panel B), or the *Roll* measure (Panel C). *dILR* and *dLOT* are first (log) differences. The VAR is estimated with a lag of one quarter and a constant term. We choose the optimal number of lags based on the Schwartz criterion.

Panel A: *ILR* liquidity measure

Dependent variable	Const.	*dGDPR* (-1)	*dILR* (-1)	er_m (-1)	*dTurn* (-1)	*Vola* (-1)	adj.R^2
dGDPR	0.005	0.308	-0.012	0.014	-0.006	-0.050	0.19
	(6.97)	(5.23)	(-3.10)	(1.56)	(-1.50)	(-0.26)	
dILR	-0.014	2.764	-0.256	-1.495	-0.023	6.135	0.15
	(-0.67)	(1.71)	(-2.52)	(-6.06)	(-0.20)	(1.14)	
er_m	0.014	0.033	0.045	0.129	0.034	1.009	0.00
	(2.08)	(0.06)	(1.32)	(1.56)	(0.86)	(0.56)	
dTurn	0.035	-4.075	0.089	0.672	-0.182	4.852	0.07
	(1.99)	(-2.92)	(1.01)	(3.15)	(-1.79)	(1.05)	
Vola	0.000	-0.005	0.000	-0.007	-0.002	-0.111	0.02
	(1.12)	(-0.18)	(-0.12)	(-1.75)	(-0.88)	(-1.24)	

Panel B: *LOT* liquidity measure

Dependent variable	Const.	*dGDPR* (-1)	*dLOT* (-1)	er_m (-1)	*dTurn* (-1)	*Vola* (-1)	adj.R^2
dGDPR	0.005	0.317	-0.014	0.021	0.003	-0.094	0.17
	(6.73)	(5.33)	(-2.19)	(2.33)	(0.94)	(-0.46)	
dLOT	0.013	-0.870	-0.119	-0.416	-0.054	2.215	0.13
	(1.42)	(-1.24)	(-1.59)	(-3.96)	(-1.46)	(0.91)	
er_m	0.015	-0.055	0.003	0.106	-0.002	2.031	-0.01
	(2.18)	(-0.10)	(0.05)	(1.30)	(-0.06)	(1.09)	
dTurn	0.036	-3.907	0.334	0.609	-0.258	1.474	0.09
	(2.04)	(-2.83)	(2.27)	(2.95)	(-3.53)	(0.31)	
Vola	0.000	-0.002	0.002	-0.007	-0.002	-0.154	0.02
	(1.10)	(-0.07)	(0.83)	(-1.79)	(-1.13)	(-1.67)	

Table IA.X (Continued)

Panel C: *Roll* liquidity measure

Dependent variable	Const.	*dGDPR* (-1)	*Roll* (-1)	er_m (-1)	*dTurn* (-1)	*Vola* (-1)	adj.R^2
dGDPR	0.013	0.287	-0.512	0.015	0.003	-0.165	0.18
	(4.18)	(4.67)	(-2.63)	(1.65)	(1.06)	(-0.89)	
Roll	0.003	0.001	0.806	-0.003	0.000	-0.093	0.50
	(3.17)	(0.05)	(13.61)	(-1.20)	(-0.17)	(-1.65)	
er_m	0.024	-0.107	-0.551	0.100	-0.001	2.246	-0.01
	(0.83)	(-0.19)	(-0.31)	(1.21)	(-0.04)	(1.32)	
dTurn	0.056	-4.364	-1.231	0.613	-0.251	7.344	0.07
	(0.76)	(-3.02)	(-0.27)	(2.87)	(-3.40)	(1.68)	
Vola	0.003	-0.019	-0.170	-0.009	-0.001	-0.063	0.04
	(2.16)	(-0.70)	(-1.94)	(-2.15)	(-0.97)	(-0.75)	

Table IA.XI
Granger Causality Tests between Equity Market Variables

The table presents χ^2 statistics of pairwise Granger causality tests between the endogenous variables. The null hypothesis is that the row variable does not Granger-cause the column variable, and * and ** denote rejection of the null at the 5% and 1% significance levels, respectively.

Panel A: *ILR* liquidity measure

	dGDPR	*dILR*	er_m	*dTurn*	*Vola*
dGDPR		2.94	0.00	8.55**	0.03
dILR	9.59**		1.75	1.03	0.01
er_m	2.43	36.72**		9.93**	3.05
dTurn	2.24	0.04	0.75		0.78
Vola	0.07	1.31	0.32	1.10	

Panel B: *LOT* liquidity measure

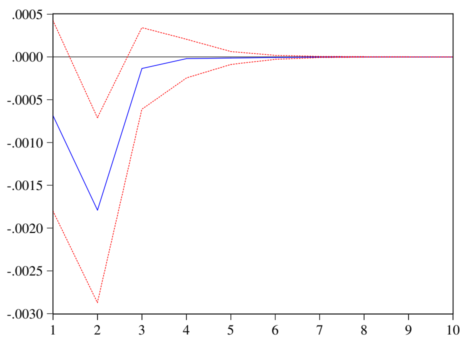
	dGDPR	*dLOT*	er_m	*dTurn*	*Vola*
dGDPR		1.53	0.01	8.03**	0.00
dLOT	4.81*		0.00	5.15*	0.68
er_m	5.42*	15.65**		8.70**	3.21
dTurn	0.89	2.13	0.00		1.28
Vola	0.21	0.83	1.18	0.10	

Panel C: *Roll* liquidity measure

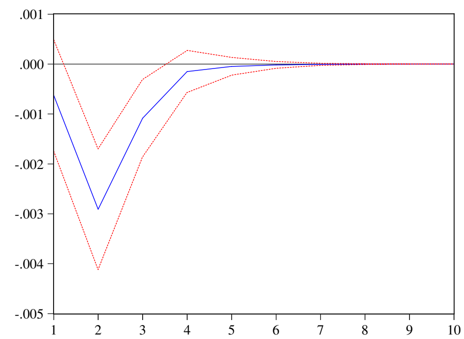
	dGDPR	*Roll*	er_m	*dTurn*	*Vola*
dGDPR		0.00	0.04	9.15**	0.49
Roll	6.93**		0.10	0.07	3.78*
er_m	2.72	1.43		8.24**	4.63*
dTurn	1.12	0.03	0.00		0.94
Vola	0.79	2.72	1.74	2.81	

A.1. Impulse Response Functions - only Stock Market Variables

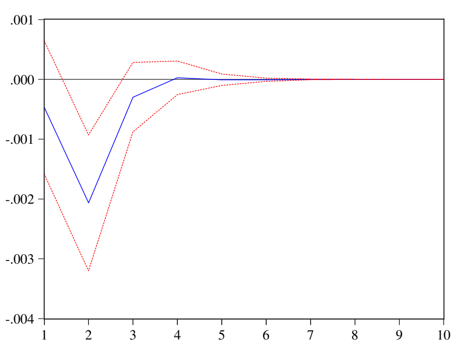
To examine more closely the dynamic relationship between market liquidity, stock returns, stock market volatility, turnover, and GDP growth, we compute impulse response functions (IRFs) for GDP growth. By "shocking" one variable by a one unit standard deviation, the IRF traces the impact on real GDP growth. The (inverse) Cholesky decomposition is used to orthogonalize the residual covariance matrix since the innovations are correlated. Also, it is important to note that the IRFs are sensitive to the ordering of the endogenous variables in the VAR. However, the ordering of the variables does not affect the results in the estimated VAR or the Granger causality tests. Since in the paper we are mainly interested in the information in liquidity about future GDP growth (and to keep the number of figures down) we show only the responses of GDP growth to a shock in *dILR*. We base the initial ordering of the variables on Chordia, Sarkar, and Subrahmanyam (2005), who argue that information and endowment shocks generally affect prices and liquidity through trading. Therefore, we place stock turnover (*dTurn*) first in the ordering. Chordia, Sarkar, and Subrahmanyam (2005) also note that the ordering of stock returns, stock volatility, and liquidity is unclear. We use their initial ordering of these variables, and for robustness also look at whether different relative orderings of these variables affect the response of *dGDPR* to shocks in *dILR*. Finally, since *dGDPR* at t is not observed by market participants before the following quarter, we always put *dGDPR* last in the ordering. Thus, our initial ordering of the variables is: *dTurn*, *Vola*, $\mathtt{er}_\mathrm{m}$, *dILR*, and *dGDPR*.



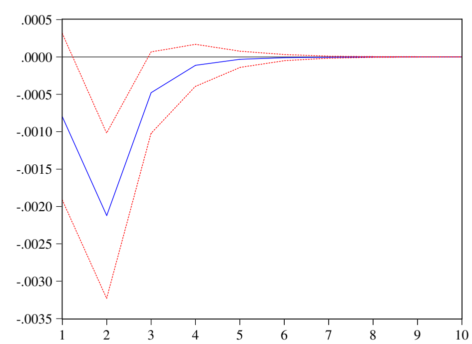
(a) *dTurn*, *Vola*, $\mathtt{er}_\mathrm{m}$, *dILR*, *dGDPR*



(b) *dTurn*, *dILR*, *Vola*, $\mathtt{er}_\mathrm{m}$, *dGDPR*



(c) *dTurn*, $\mathtt{er}_\mathrm{m}$, *dILR*, *Vola*, *dGDPR*



(d) *dTurn*, *Vola*, *dILR*, $\mathtt{er}_\mathrm{m}$, *dGDPR*

Figure IA.3. Impulse Response Functions - VAR with *dGDPR* and Stock Market Variables. The figures show the impulse response functions from a VAR of real GDP growth (*dGDPR*) and the equity market variables, *dILR*, $\mathtt{er}_\mathrm{m}$, *Vola*, and *dTurn*. The figures show the response of *dGDPR* to a Cholesky one-standard deviation *dILR* innovation. The ordering of the variables in the VAR is stated in the caption of each figure. The dotted lines show the +/- two standard deviation uncertainty band.

From Figure IA.3 we see that the response of *dGDPR* to a shock in *dILR* is not greatly affected by the relative ordering of the variables $\mathtt{er_m}$, *Vola*, and *dILR*. While we keep *dTurn* as the first variable across all four estimations, we also examined the effect of changing the ordering of *dTurn*. The results are insensitive to the placement of *dTurn* in the ordering.

B. VAR - All Market Variables

In the previous subsection, we estimated a system where we included only stock market variables in addition to *dGDPR*. In this section we estimate a VAR where we also include the two bond market variables *dCred* and *Term*. The main reason for this is that several other studies show that these variables have predictive power for GDP growth and are also related to stock market variables. Since we are mainly interested in adding them as control variables to see whether equity market liquidity contains additional information about future GDP growth, we have chosen not to put any restrictions on the equations for these variables. The first thing to note from Table IA.XII is that in the equation for *dGDPR* (first row in each panel), all three liquidity variables have significant coefficients of the same size as in the single-equation estimations reported in the paper. With respect to the additional variables, *dCred* and *Term*, there are a few interesting results. First, we find that $\mathtt{er_m}$ is significant and negative in the equation for *dCred* across all three models. Thus, a lower realized stock market return predicts an increase in the credit spread. Also, we find that the coefficient on *Roll* is significantly positive in the *Term* equation, indicating that a high spread costs predicts a larger term spread.

In Table IA.XIII we perform Granger causality tests between all the variables in the VAR. The results are very similar to those in the previous section; however, there are a few interesting additional results. In particular, we see that there is causality going from $\mathtt{er_m}$ to *dCred*, and also from *Roll* to *Term*.

Table IA.XII
Vector Autoregression - All Market Variables

The table shows the results from estimating a VAR with endogenous variables *dGDPR*, $\mathtt{er_m}$, *dTurn*, *Vola*, *dCred*, *Term* and market liquidity proxied either by *dILR* (Panel A), *dLOT* (Panel B), or the *Roll* measure (Panel C). *dILR* and *dLOT* are first (log) differences. The VAR is estimated with a lag of one quarter and a constant term. We choose the optimal number of lags based on the Schwartz criterion. Numbers in parentheses are *t*-values.

Panel A: *ILR* liquidity measure

Dependent variable	Const.	*dGDPR* (-1)	*dILR* (-1)	$\mathtt{er_m}$ (-1)	*dTurn* (-1)	*Vola* (-1)	*dCred* (-1)	*Term* (-1)	adj.R^2
dGDPR	0.005	0.282	-0.011	0.016	-0.007	0.079	-0.004	0.001	0.22
	(4.68)	(4.67)	(-2.85)	(1.74)	(-1.53)	(0.39)	(-1.72)	(1.10)	
dILR	0.014	3.088	-0.266	-1.501	-0.018	4.098	0.035	-0.023	0.18
	(0.50)	(1.87)	(-2.60)	(-6.05)	(-0.15)	(0.73)	(0.60)	(-1.67)	
$\mathtt{er_m}$	0.007	-0.009	0.046	0.127	0.032	1.364	-0.003	0.006	0.03
	(0.71)	(-0.02)	(1.34)	(1.52)	(0.82)	(0.72)	(-0.14)	(1.32)	
dTurn	0.001	-3.687	0.074	0.621	-0.188	3.886	0.070	0.024	0.11
	(0.06)	(-2.59)	(0.84)	(2.91)	(-1.87)	(0.81)	(1.40)	(1.96)	
Vola	0.000	0.000	0.000	-0.008	-0.002	-0.132	0.001	0.000	0.04
	(0.84)	(0.00)	(-0.21)	(-1.81)	(-0.88)	(-1.40)	(0.70)	(-0.15)	
dCred	0.092	-2.958	0.207	-0.864	0.252	1.906	-0.207	-0.024	0.09
	(2.37)	(-1.28)	(1.45)	(-2.49)	(1.54)	(0.24)	(-2.55)	(-1.20)	
Term	0.333	-5.604	-0.283	-1.349	0.175	-0.208	0.259	0.793	0.61
	(4.04)	(-1.14)	(-0.93)	(-1.83)	(0.50)	(-0.01)	(1.50)	(18.95)	

Table IA.XII (Continued)

Panel B: *LOT* liquidity measure

Dependent variable	Const.	*dGDPR* (-1)	*dLOT* (-1)	er_m (-1)	*dTurn* (-1)	*Vola* (-1)	*dCred* (-1)	*Term* (-1)	adj.R^2
dGDPR	0.005	0.285	-0.013	0.022	0.002	0.066	-0.004	0.001	0.21
	(4.59)	(4.69)	(-2.11)	(2.49)	(0.64)	(0.31)	(-2.01)	(1.04)	
dLOT	0.011	-0.687	-0.122	-0.426	-0.050	1.391	0.026	0.000	0.15
	(0.92)	(-0.95)	(-1.63)	(-4.02)	(-1.32)	(0.54)	(1.01)	(0.00)	
er_m	0.007	-0.074	0.004	0.102	-0.004	2.283	0.001	0.006	0.02
	(0.75)	(-0.13)	(0.07)	(1.24)	(-0.13)	(1.16)	(0.03)	(1.34)	
dTurn	0.001	-3.486	0.329	0.566	-0.253	0.205	0.072	0.024	0.13
	(0.05)	(-2.47)	(2.25)	(2.74)	(-3.46)	(0.04)	(1.45)	(2.00)	
Vola	0.000	0.003	0.002	-0.007	-0.001	-0.176	0.001	0.000	0.05
	(0.83)	(0.10)	(0.79)	(-1.83)	(-1.03)	(-1.80)	(0.64)	(-0.15)	
dCred	0.092	-2.798	0.496	-1.000	0.080	-1.618	-0.198	-0.023	0.10
	(2.39)	(-1.21)	(2.08)	(-2.97)	(0.67)	(-0.20)	(-2.47)	(-1.17)	
Term	0.331	-5.216	-0.037	-1.191	0.397	-5.630	0.239	0.793	0.61
	(4.01)	(-1.06)	(-0.07)	(-1.65)	(1.56)	(-0.32)	(1.39)	(18.91)	

Panel C: *Roll* liquidity measure

Dependent variable	Const.	*dGDPR* (-1)	*Roll* (-1)	er_m (-1)	*dTurn* (-1)	*Vola* (-1)	*dCred* (-1)	*Term* (-1)	adj.R^2
dGDPR	0.013	0.253	-0.556	0.016	0.002	0.015	-0.004	0.001	0.22
	(4.15)	(4.06)	(-2.80)	(1.71)	(0.78)	(0.07)	(-1.73)	(1.68)	
Roll	0.003	0.003	0.810	-0.003	0.000	-0.106	0.000	0.000	0.51
	(3.18)	(0.16)	(13.21)	(-1.18)	(-0.11)	(-1.74)	(0.35)	(-0.43)	
er_m	0.024	-0.170	-1.144	0.089	-0.002	2.676	0.002	0.007	0.02
	(0.83)	(-0.30)	(-0.62)	(1.06)	(-0.08)	(1.47)	(0.12)	(1.45)	
dTurn	0.061	-4.121	-4.002	0.537	-0.241	6.623	0.081	0.026	0.11
	(0.84)	(-2.81)	(-0.85)	(2.50)	(-3.27)	(1.42)	(1.62)	(2.11)	
Vola	0.003	-0.014	-0.184	-0.009	-0.001	-0.086	0.001	0.000	0.06
	(2.19)	(-0.50)	(-2.03)	(-2.25)	(-0.85)	(-0.96)	(0.94)	(0.32)	
dCred	0.046	-3.005	3.252	-0.943	0.086	5.364	-0.196	-0.025	0.08
	(0.39)	(-1.25)	(0.43)	(-2.70)	(0.71)	(0.71)	(-2.40)	(-1.24)	
Term	-0.362	-1.362	47.282	-0.676	0.339	-19.943	0.173	0.763	0.62
	(-1.47)	(-0.27)	(2.97)	(-0.93)	(1.35)	(-1.26)	(1.02)	(18.02)	

Table IA.XIII
Granger Causality Tests between All Market Variables

The table presents χ^2 statistics of pairwise Granger causality tests between the endogenous variables. The null hypothesis is that the row variables do not Granger-cause column variables, and * and ** denote rejection of the null at the 5% and 1% significance levels, respectively.

Panel A: *ILR* liquidity measure

	dGDPR	*dILR*	er_m	*dTurn*	*Vola*	*dCred*	*Term*
dGDPR		3.49	0.00	6.70**	0.00	1.63	1.29
dILR	8.12**		1.80	0.71	0.05	2.09	0.86
er_m	3.01	36.60**		8.45**	3.27	6.19**	3.33
dTurn	2.34	0.02	0.68		0.77	2.36	0.25
Vola	0.15	0.54	0.53	0.65		0.06	0.00
dCred	2.94	0.36	0.02	1.97	0.49		2.24
Term	1.21	2.80	1.75	3.82*	0.02	1.43	

Panel B: *LOT* liquidity measure

	dGDPR	*dLOT*	er_m	*dTurn*	*Vola*	*dCred*	*Term*
dGDPR		0.90	0.02	6.09**	0.01	1.47	1.12
dLOT	4.46*		0.00	5.07*	0.63	4.32	0.01
er_m	6.22**	16.19**		7.52**	3.36	8.82**	2.73
dTurn	0.41	1.74	0.02		1.06	0.45	2.42
Vola	0.09	0.30	1.34	0.00		0.04	0.10
dCred	4.04*	1.03	0.00	2.11	0.41		1.92
Term	1.07	0.00	1.80	4.01*	0.02	1.36	

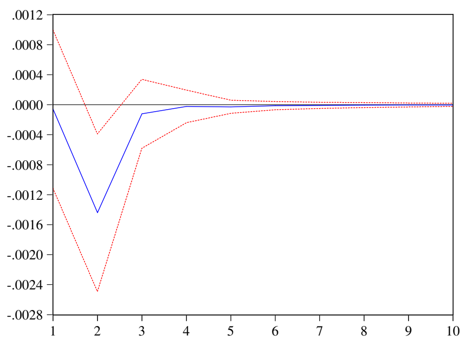
Panel C: *Roll* liquidity measure

	dGDPR	*Roll*	er_m	*dTurn*	*Vola*	*dCred*	*Term*
dGDPR		0.03	0.09	7.88**	0.25	1.57	0.07
Roll	7.84**		0.39	0.73	4.11*	0.18	8.80**
er_m	2.92	1.40		6.27**	5.08*	7.28**	0.86
dTurn	0.61	0.01	0.01		0.72	0.51	1.82
Vola	0.01	3.02	2.16	2.03		0.50	1.59
dCred	3.00	0.12	0.01	2.64	0.88		1.03
Term	2.83	0.18	2.10	4.47*	0.10	1.53	

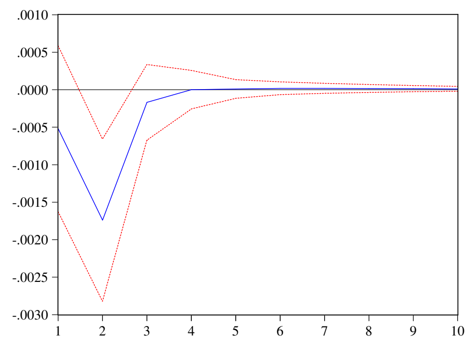
B.1. *Impulse Response Functions - All Market variables*

In Figure IA.3 we examined the IRFs in a system with only stock market variables. In Table IA.XII we estimated a full unrestricted VAR where we also added the credit spread (*dCred*) and the term spread (*Term*) as control variables, since these have been shown to contain important information about future economic growth. In Figure IA.4 we perform a similar analysis as in Figure IA.3, but now also include the two non-equity market variables *dCred* and *Term*.

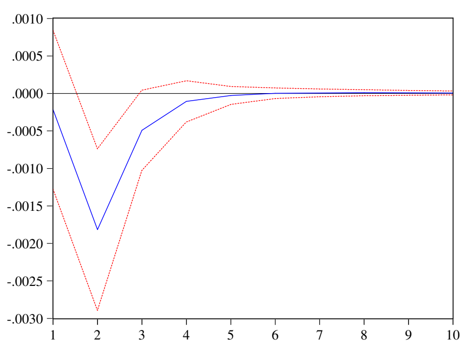
With respect to the ordering of the variables we base our main ordering on Chordia, Sarkar, and Subrahmanyam (2005) who in their initial ordering put bond market variables before stock market variables. Although we examine different types of variables than Chordia et al; we use their general ordering as our base case, and test how sensitive the response of *dGDPR* to a shock in *dILR* is to a change in the ordering of the variables. The initial ordering we use is: *dCred*, *Term*, *dTurn*, *Vola*, $\mathtt{er}_{\mathtt{m}}$, *dILR*, and *dGDPR*. In part (a) of Figure IA.4 we show the IRF for *dGDPR* from a shock in *dILR* in the base ordering case, in part (b) we move the bond market variables after the stock market variables, keeping the relative ordering of the stock market variables fixed as in (a), in part (c) we order the bond market variables first again and put *dILR* between *Vola* and $\mathtt{er}_{\mathtt{m}}$ while *dTurn* is kept fixed as the first of the stock market variables, and in part (d) we put *dILR* after *dTurn*, but before *Vola* and $\mathtt{er}_{\mathtt{m}}$. While we could have tried several other ordering schemes, we believe the selected orderings should detect whether the response function of *dGDPR* to a shock in *dILR* is sensitive to the ordering of the variables in the system.



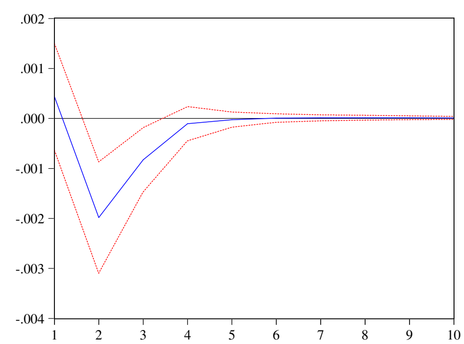
(a) *dCred*, *Term*, *dTurn*, *Vola*, $\mathtt{er}_{\mathtt{m}}$, *dILR*, *dGDPR*



(b) *dTurn*, *Vola*, $\mathtt{er}_{\mathtt{m}}$, *dILR*, *dCred*, *Term*, *dGDPR*



(c) *dCred*, *Term*, *dTurn*, *Vola*, *dILR*, $\mathtt{er}_{\mathtt{m}}$, *dGDPR*



(d) *dCred*, *Term*, *dTurn*, *dILR*, *Vola*, $\mathtt{er}_{\mathtt{m}}$, *dGDPR*

Figure IA.4. Impulse response functions - VAR with *dGDPR* and all market variables. The figures show the impulse response functions from a VAR of real GDP growth (*dGDPR*) and the equity market variables, *dILR*, $\mathtt{er}_{\mathtt{m}}$, *Vola* and *dTurn* and the bond market variables *dCred* and *Term*. The figures show the response of *dGDPR* to a Cholesky one standard deviation *dILR* innovation. The ordering of the variables in the VAR is stated in the caption of each figure. The dotted lines show the +/- two standard deviation uncertainty band.

From Figure IA.4 we see that the response of *dGDPR* to a shock in *dILR* is not greatly affected by the relative ordering of the variables *dCred*, *Term*, $\mathtt{er_m}$, *Vola*, and *dILR*.

C. VAR - Additional Macro Variables

We earlier supplemented the predictive regressions in Table IV in the paper by estimating a VAR. However, we only looked at *dGDPR* as our business cycle variable. We therefore also examine whether a VAR estimation for the three other macro variables affects the results in Table IV in the paper. We perform the analysis with *dILR* as our liquidity proxy.

Table IA.XIV
Vector Autoregression - Additional Macro Variables

The table shows the results from estimating a VAR with endogenous variables $\mathtt{er_m}$, *dTurn*, *Vola*, *dCred*, *Term* and market liquidity proxied by *dILR*. As business cycle variables we use *dUE* (Panel A), *dCONSR* (Panel B), or *dINV* (Panel C). *dILR* is in first (log) differences. The VAR is estimated with a lag of one quarter and a constant term. We choose the optimal number of lags based on the Schwartz criterion. Numbers in parentheses are t-values.

Panel A: *dUE*

Dependent variable	Const.	*dUE* (-1)	*dILR* (-1)	$\mathtt{er_m}$ (-1)	*dTurn* (-1)	*Vola* (-1)	*dCred* (-1)	*Term* (-1)	adj.R^2
dUE	0.017	0.392	0.027	-0.270	0.055	-0.072	0.032	-0.008	0.28
	(2.62)	(6.88)	(0.93)	(-3.96)	(1.61)	(-1.37)	(2.06)	(-2.11)	
dILR	0.041	-0.275	-0.261	-1.459	-0.034	0.149	0.026	-0.024	0.15
	(1.69)	(-1.30)	(-2.47)	(-5.75)	(-0.27)	(0.77)	(0.44)	(-1.68)	
$\mathtt{er_m}$	0.006	0.058	0.043	0.126	0.031	0.046	-0.005	0.006	0.00
	(0.73)	(0.81)	(1.20)	(1.48)	(0.73)	(0.70)	(-0.24)	(1.32)	
dTurn	-0.031	0.483	0.068	0.579	-0.178	0.090	0.077	0.024	0.08
	(-1.52)	(2.70)	(0.76)	(2.70)	(-1.67)	(0.55)	(1.58)	(2.00)	
Vola	0.014	-0.013	0.000	-0.202	-0.068	-0.146	0.016	-0.003	0.04
	(1.20)	(-0.13)	(-0.01)	(-1.67)	(-1.13)	(-1.58)	(0.58)	(-0.43)	
dCred	0.068	0.353	0.207	-0.872	0.241	0.046	-0.205	-0.024	0.06
	(1.98)	(1.18)	(1.39)	(-2.44)	(1.36)	(0.17)	(-2.52)	(-1.19)	
Term	0.289	1.495	-0.326	-1.385	0.136	-0.007	0.222	0.791	0.61
	(3.99)	(2.38)	(-1.04)	(-1.84)	(0.37)	(-0.01)	(1.30)	(18.91)	

Panel B: *dCONSR*

Dependent variable	Const.	*dCONSR* (-1)	*dILR* (-1)	$\mathtt{er_m}$ (-1)	*dTurn* (-1)	*Vola* (-1)	*dCred* (-1)	*Term* (-1)	adj.R^2
dCONSR	0.007	-0.013	-0.005	0.028	-0.008	0.009	-0.002	0.001	0.11
	(6.73)	(-0.20)	(-1.34)	(3.39)	(-1.83)	(1.40)	(-1.00)	(2.47)	
dILR	0.029	1.307	-0.263	-1.505	-0.011	0.108	0.026	-0.024	0.17
	(0.99)	(0.66)	(-2.50)	(-5.93)	(-0.09)	(0.56)	(0.44)	(-1.71)	
$\mathtt{er_m}$	0.009	-0.303	0.043	0.132	0.029	0.050	-0.004	0.006	0.03
	(0.91)	(-0.46)	(1.24)	(1.56)	(0.71)	(0.77)	(-0.22)	(1.34)	
dTurn	-0.009	-2.501	0.073	0.622	-0.190	0.118	0.081	0.025	0.09
	(-0.34)	(-1.46)	(0.80)	(2.84)	(-1.78)	(0.71)	(1.61)	(2.01)	
Vola	0.011	0.304	0.001	-0.215	-0.059	-0.161	0.019	-0.003	0.06
	(0.78)	(0.32)	(0.02)	(-1.79)	(-1.00)	(-1.76)	(0.69)	(-0.44)	
dCred	0.105	-4.564	0.200	-0.856	0.257	0.060	-0.215	-0.023	0.09
	(2.59)	(-1.66)	(1.37)	(-2.43)	(1.49)	(0.23)	(-2.66)	(-1.16)	
Term	0.361	-8.959	-0.293	-1.342	0.196	-0.020	0.242	0.795	0.61
	(4.19)	(-1.53)	(-0.94)	(-1.79)	(0.53)	(-0.04)	(1.40)	(19.01)	

Table IA.XIV (Continued)

Panel C: *dINV*

Dependent variable	Const.	*dINV* (-1)	*dILR* (-1)	$\mathtt{er_m}$ (-1)	*dTurn* (-1)	*Vola* (-1)	*dCred* (-1)	*Term* (-1)	adj.R^2
dINV	0.000	0.435	-0.017	0.054	-0.011	0.012	-0.016	0.003	0.38
	(-0.11)	(8.18)	(-1.87)	(2.49)	(-1.01)	(0.73)	(-3.21)	(2.71)	
dILR	0.032	1.076	-0.251	-1.504	0.000	0.085	0.031	-0.025	0.18
	(1.28)	(1.76)	(-2.39)	(-5.98)	(0.00)	(0.45)	(0.55)	(-1.79)	
$\mathtt{er_m}$	0.008	-0.194	0.042	0.131	0.028	0.053	-0.005	0.006	0.03
	(0.95)	(-0.94)	(1.19)	(1.56)	(0.67)	(0.82)	(-0.25)	(1.38)	
dTurn	-0.022	-0.975	0.070	0.609	-0.196	0.118	0.086	0.025	0.10
	(-1.01)	(-1.84)	(0.77)	(2.79)	(-1.83)	(0.71)	(1.75)	(2.08)	
Vola	0.010	0.393	0.007	-0.216	-0.054	-0.172	0.022	-0.003	0.07
	(0.88)	(1.35)	(0.14)	(-1.81)	(-0.93)	(-1.90)	(0.82)	(-0.50)	
dCred	0.076	-1.116	0.206	-0.888	0.256	0.033	-0.197	-0.022	0.09
	(2.21)	(-1.30)	(1.41)	(-2.53)	(1.48)	(0.13)	(-2.48)	(-1.12)	
Term	0.311	-3.058	-0.298	-1.395	0.182	-0.039	0.265	0.797	0.61
	(4.25)	(-1.69)	(-0.96)	(-1.87)	(0.50)	(-0.07)	(1.57)	(19.07)	

V. Additional U.S. Size Results

In Section III of the paper we look at liquidity measures calculated separately for small and large stocks, and run the predictive regression

$$y_{t+1} = \alpha + \beta_S^{LIQ} LIQ_t^{small} + \beta_L^{LIQ} LIQ_t^{large} + \gamma \mathbf{X}_t + u_{t+1}.$$

In the paper we only report the results with respect to GDP growth (*dGDPR*) as the dependent variable. In this appendix we show these regressions also for *dUE*, *dCONSR*, and *dINV* as dependent variables.

Table IA.XV
Predicting Macroeconomic Variables with Market Liquidity - Size Portfolios

The table shows the multivariate OLS estimates from regressing next quarter macro variables on current market illiquidity of small and large firms and four control variables for the U.S. sample. We examine three different proxies for market illiquidity, sampled for small and large firms. Both *ILR* and *LOT* are first (log) differenced for stationarity reasons while *Roll* is unaltered. The cross-sectional liquidity measures are calculated as equally weighted averages across stocks. The estimated model is $y_{t+1} = \alpha + \beta_S^{LIQ} LIQ_t^{small} + \beta_L^{LIQ} LIQ_t^{large} + \gamma \mathbf{X}_t + u_{t+1}$, where y_{t+1} is real GDP growth (*dGDPR*), growth in the unemployment rate (*dUE*), real consumption growth (*dCONSR*), or growth in private investments (*dINV*), LIQ^{small} is the illiquidity proxy sampled for the 25% smallest firms, LIQ^{large} is the illiquidity of the 25% largest firms, $\mathbf{X_t}$ contains the additional control variables (*Term*, *dCred*, *Vola*, and er_m) and γ' is a vector of the respective coefficient estimates for the control variables. The Newey-West corrected *t*-statistics (with four lags) are reported in parentheses below the coefficient estimates, and $\bar{R}^2$ is the adjusted R^2.

Panel A: *dILR* liquidity measure

Dependent variable (y_t)	Const.	β_S^{LIQ}	β_L^{LIQ}	$\hat{\gamma}_1{}^{Term}$	$\hat{\gamma}_2{}^{dCred}$	$\hat{\gamma}_3{}^{Vola}$	$\hat{\gamma}_4{}^{er_m}$	$\bar{R}^2$	ex.LIQ $\bar{R}^2$	ex.LIQ^S $\bar{R}^2$	ex.LIQ^L $\bar{R}^2$
dGDPR	0.008	-0.008	0.003	0.000	-0.014	0.001	0.021	0.14	0.12	0.12	0.14
	(7.64)	(-3.74)	(1.09)	(0.54)	(-3.16)	(0.21)	(2.31)				
dUE	0.002	0.030	-0.043	-0.006	0.109	-0.029	-0.253	0.13	0.13	0.13	0.13
	(0.20)	(1.70)	(0.08)	(-1.60)	(3.34)	(-0.83)	(-4.00)				
dCONSR	0.008	-0.001	0.002	0.001	-0.004	0.001	0.028	0.08	0.09	0.09	0.09
	(8.27)	(-0.35)	(0.57)	(1.91)	(-1.45)	(0.15)	(3.15)				
dINV	0.007	-0.019	0.011	0.003	-0.044	0.015	0.062	0.19	0.17	0.17	0.19
	(2.18)	(-3.53)	(1.17)	(2.08)	(-4.22)	(1.10)	(2.40)				

Panel B: *dLOT* liquidity measure

Dependent variable (y_t)	Const.	β_S^{LIQ}	β_L^{LIQ}	$\hat{\gamma}_1{}^{Term}$	$\hat{\gamma}_2{}^{dCred}$	$\hat{\gamma}_3{}^{Vola}$	$\hat{\gamma}_4{}^{er_m}$	$\bar{R}^2$	ex.LIQ $\bar{R}^2$	ex.LIQ^S $\bar{R}^2$	ex.LIQ^L $\bar{R}^2$
dGDPR	0.009	-0.014	0.000	0.000	-0.015	0.009	0.029	0.14	0.12	0.12	0.15
	(7.52)	(-2.12)	(-0.06)	(0.42)	(-3.61)	(1.58)	(3.55)				
dUE	0.003	0.108	0.014	-0.005	0.107	-0.099	-0.237	0.15	0.13	0.13	0.15
	(0.38)	(3.55)	(0.37)	(-1.40)	(3.26)	(-2.45)	(-4.62)				
dCONSR	0.008	-0.005	-0.005	0.001	-0.004	0.005	0.026	0.10	0.09	0.10	0.09
	(8.17)	(-1.39)	(-1.00)	(1.83)	(-1.35)	(0.98)	(3.91)				
dINV	0.007	-0.016	-0.012	0.003	-0.047	0.027	0.074	0.18	0.17	0.18	0.18
	(2.28)	(-1.17)	(-0.95)	(1.97)	(-4.63)	(1.85)	(3.63)				

Panel C: *Roll* liquidity measure

Dependent variable (y_t)	Const.	β_S^{LIQ}	β_L^{LIQ}	$\hat{\gamma}_1{}^{Term}$	$\hat{\gamma}_2{}^{dCred}$	$\hat{\gamma}_3{}^{Vola}$	$\hat{\gamma}_4{}^{er_m}$	$\bar{R}^2$	ex.LIQ $\bar{R}^2$	ex.LIQ^S $\bar{R}^2$	ex.LIQ^L $\bar{R}^2$
dGDPR	0.017	-0.306	-0.251	0.001	-0.013	0.007	0.022	0.15	0.12	0.14	0.15
	(5.14)	(-2.38)	(-0.91)	(1.39)	(-3.12)	(1.29)	(2.74)				
dUE	-0.051	2.463	0.768	-0.010	0.096	-0.075	-0.197	0.15	0.13	0.14	0.15
	(-1.75)	(2.74)	(0.31)	(-2.62)	(2.78)	(-1.89)	(-3.85)				
dCONSR	0.014	-0.298	-0.002	0.001	-0.002	0.005	0.023	0.11	0.09	0.10	0.12
	(4.67)	(-2.49)	(-0.01)	(2.87)	(-0.91)	(1.03)	(3.39)				
dINV	0.033	-1.092	-0.595	0.005	-0.040	0.034	0.056	0.23	0.17	0.20	0.23
	(4.00)	(-2.94)	(-0.65)	(3.11)	(-4.25)	(2.79)	(2.72)				

VI. Additional Model Specifications for the U.S., Excluding Market Liquidity

In Table IV in Section II of the paper we report the results for various predictive regressions for different U.S. macro variables. In that table, we include market liquidity in all models and only report the adjusted R^2 when we exclude market liquidity from the respective models. Table IA.XVI reports the regression results behind those R^2 numbers where we exclude market liquidity for a range of model specifications. We also report the results including market liquidity (*ILR*) as a benchmark case.

Table IA.XVI
Additional In-sample Predictive Regressions for the U.S.

The table shows the results from predictive regressions for different macro variables for the U.S. covering the period 1947 to 2009. The regressions estimated are $y_{t+1} = \alpha + \beta^{LIQ} LIQ_t + \gamma' \mathbf{X}_t + u_{t+1}$. In Panel A, the dependent variable (y_{t+1}) is quarterly real GDP growth (*dGDPR*), in Panel B the dependent variable is growth in the unemployment rate (*dUE*), in Panel C the dependent variable is real consumption growth (*dCONSR*), and in Panel D the dependent variable is the growth in private investments (*dINV*). LIQ is *ILR*, and the variables in $\mathbf{X}$ are *Term*, *Vola*, er_m, and the lag of the dependent variable. The Newey-West corrected *t*-statistics (with four lags) are reported in parentheses below the coefficient estimates, and $\bar{R}^2$ is the adjusted R^2 for the estimated model.

Panel A: Predicting real GDP growth (*dGDPR*)

Model	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Cred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{Rm}$	$\bar{R}^2$
1	0.006	-0.008	0.196	0.000	-0.012	0.000	0.015	0.174
	(5.82)	(-3.87)	(3.38)	(0.72)	(-2.99)	(0.07)	(1.95)	
2	0.007	.	0.166	0.000	-0.014	0.000	0.027	0.147
	(6.30)	.	(2.85)	(0.62)	(-3.51)	(-0.07)	(3.56)	
3	0.006	-0.013	0.224	.	.	.	.	0.133
	(7.58)	(-5.38)	(3.68)	.	.	.	.	
4	0.005	.	0.187	0.001	.	.	.	0.044
	(4.14)	.	(2.93)	(2.04)	.	.	.	
5	0.007	.	0.165	.	-0.017	.	.	0.102
	(8.08)	.	(2.6)	.	(-3.99)	.	.	
6	0.007	.	0.184	.	.	-0.013	.	0.047
	(7.52)	.	(2.91)	.	.	(-2.44)	.	
7	0.008	.	0.179	.	.	.	0.032	0.098
	(9.38)	.	(2.99)	.	.	.	(4.28)	
8	0.006	.	0.168	0.001	0.000	.	.	0.103
	(5.13)	.	(2.67)	(1.13)	(-3.68)	.	.	
9	0.007	.	0.180	.	.	-0.007	0.030	0.100
	(9.28)	.	(3.03)	.	.	(-1.23)	(3.89)	

Table IA.XVI (Continued)

Panel B: Predicting growth in unemployment rate (*dUE*)

Model	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Cred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{Rm}$	$\bar{R}^2$
1	0.005	0.021	0.302	-0.007	0.097	-0.033	-0.228	0.217
	(0.75)	(1.17)	(6.05)	(-2.44)	(3.16)	(-0.93)	(-4.54)	
2	0.004	.	0.297	-0.007	0.102	-0.031	-0.258	0.217
	(0.56)	.	(5.994)	(-2.41)	(3.19)	(-0.88)	(-5.39)	
3	0.003	0.074	0.300	.	.	.	.	0.126
	(0.61)	(3.68)	(5.14)	.	.	.	.	
4	0.020	.	0.291	-0.013	.	.	.	0.106
	(2.27)	.	(4.64)	(-3.57)	.	.	.	
5	0.002	.	0.263	.	0.128	.	.	0.139
	(0.31)	.	(4.57)	.	(3.86)	.	.	
6	0.002	.	0.276	.	.	0.080	.	0.080
	(0.34)	.	(4.55)	.	.	(2.23)	.	
7	-0.006	.	0.300	.	.	.	-0.291	0.164
	(-1.12)	.	(5.96)	.	.	.	(-5.62)	
8	0.014	.	0.277	-0.013	0.000	.	.	0.153
	(1.76)	.	(4.64)	(-2.82)	(3.40)	.	.	
9	-0.006	.	0.300	.	.	0.021	-0.283	0.162
	(-1.08)	.	(5.91)	.	.	(0.58)	(-5.34)	

Panel C: Predicting real consumption growth (*dCONSR*)

Model	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Cred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{Rm}$	$\bar{R}^2$
1	0.005	-0.001	0.301	0.001	-0.003	0.002	0.026	0.172
	(4.65)	(-0.35)	(4.36)	(2.19)	(-1.21)	(0.39)	(3.38)	
2	0.005	.	0.300	0.001	-0.003	0.002	0.027	0.176
	(4.93)	.	(4.40)	(2.20)	(-1.33)	(0.37)	(4.30)	
3	0.006	-0.006	0.305	.	.	.	.	0.107
	(7.08)	(-3.33)	(4.46)	.	.	.	.	
4	0.004	.	0.297	0.001	.	.	.	0.114
	(3.84)	.	(4.20)	(2.74)	.	.	.	
5	0.006	.	0.289	.	-0.007	.	.	0.094
	(7.06)	.	(4.02)	.	(-2.18)	.	.	
6	0.006	.	0.295	.	.	-0.007	.	0.085
	(6.95)	.	(4.09)	.	.	(-1.33)	.	
7	0.007	.	0.302	.	.	.	0.030	0.160
	(7.78)	.	(4.39)	.	.	.	(3.85)	
8	0.004	.	0.293	0.001	0.000	.	.	0.118
	(3.90)	.	(4.12)	(2.36)	(-1.52)	.	.	
9	0.007	.	0.302	.	.	-0.001	0.029	0.157
	(7.78)	.	(4.38)	.	.	(-0.20)	(4.21)	

Table IA.XVI (Continued)

Panel D: Predicting growth in private investment ($dINV$)

Model	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Cred}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{Rm}$	$\bar{R}^2$
1	0.003	-0.020	0.236	0.003	-0.037	0.007	0.045	0.239
	(1.21)	(-3.81)	(3.70)	(2.37)	(-3.87)	(0.50)	(2.02)	
2	0.005	.	0.215	0.003	-0.042	0.005	0.075	0.217
	(1.70)	.	(3.36)	(2.37)	(-4.33)	(0.38)	(3.84)	
3	0.006	-0.034	0.265	.	.	.	.	0.152
	(2.95)	(-6.19)	(3.97)	.	.	.	.	
4	0.000	.	0.228	0.006	.	.	.	0.103
	(-0.16)	.	(3.37)	(3.54)	.	.	.	
5	0.007	.	0.197	.	-0.053	.	.	0.147
	(3.57)	.	(3.14)	.	(-5.48)	.	.	
6	0.007	.	0.236	.	.	-0.035	.	0.064
	(3.07)	.	(3.39)	.	.	(-2.38)	.	
7	0.009	.	0.241	.	.	.	0.093	0.127
	(4.6)	.	(3.49)	.	.	.	(4.42)	
8	0.002	.	0.203	0.006	0.000	.	.	0.172
	(0.71)	.	(3.22)	(2.66)	(-4.69)	.	.	
9	0.009	.	0.245	.	.	-0.017	0.086	0.128
	(4.42)	.	(3.53)	.	.	(-1.14)	(3.97)	

VII. Predictability Results and Causality Tests for Norway

In Section IV of the paper we discuss the results from running predictive in-sample regressions, Granger causality tests, and out-of-sample tests for Norway, but do not give the actual results. In this appendix we report the estimation results for Norway.

Table IA.XVII
In-sample Predictive Regressions - Norway

The table shows the results from predictive regressions for different macro variables for Norway covering the period 1980 to 2009. The regressions estimated are $y_{t+1} = \alpha + \beta^{LIQ} LIQ_t + \gamma' \mathbf{X}_t + u_{t+1}$, where y_{t+1} is quarterly real GDP growth (*dGDPR*), growth in the unemployment rate (*dUE*), real consumption growth (*dCONSR*), or growth in private investments (*dINV*). LIQ is either *RS* or *ILR*, and the variables in $\mathbf{X}$ are *Term*, *Vola*, and er_m and the lag of the dependent variable. The Newey-West corrected t-statistics (with four lags) are reported in parentheses below the coefficient estimates, and $\bar{R}^2$ is the adjusted R^2 for the estimated model.

Panel A: *RS* liquidity measure

Dependent variable (y_{t+1})	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{er_m}$	$\bar{R}^2$
dGDPR	0.023	-0.397	-0.243				0.12
	(5.28)	(-4.03)	(-4.03)				
dUE	-0.443	11.387	-0.150				0.12
	(-3.94)	(3.95)	(-1.56)				
dCONSR	0.016	-0.216	-0.153				0.03
	(3.75)	(-2.43)	(-1.62)				
dINV	0.073	-1.686	-0.415				0.19
	(3.79)	(-4.01)	(0.19)				
dGDPR	0.019	-0.361	-0.259	0.001	0.240	0.001	0.11
	(3.11)	(-3.43)	(-4.25)	(1.64)	(0.62)	(0.08)	
dUE	-0.358	12.365	-0.166	-0.007	-14.022	-0.183	0.11
	(-3.20)	(3.05)	(-1.39)	(-0.57)	(-1.00)	(-0.77)	
dCONSR	0.018	-0.115	-0.127	0.000	-0.738	-0.010	0.03
	(2.83)	(-0.97)	(-1.33)	(0.22)	(-1.88)	(-1.20)	
dINV	0.052	-1.325	-0.418	0.003	0.547	0.044	0.18
	(1.56)	(-2.66)	(-5.03)	(0.93)	(0.24)	(0.73)	

Panel B: *ILR* liquidity measure

Dependent variable (y_{t+1})	$\hat{\alpha}$	$\hat{\beta}^{LIQ}$	$\hat{\gamma}^{y}$	$\hat{\gamma}^{Term}$	$\hat{\gamma}^{Vola}$	$\hat{\gamma}^{er_m}$	$\bar{R}^2$
dGDPR	0.012	-0.006	-0.225				0.11
	(5.99)	(-3.04)	(-3.69)				
dUE	-0.108	0.141	-0.080				0.06
	(-2.16)	(2.49)	(-0.82)				
dCONSR	0.011	-0.004	-0.142				0.04
	(5.85)	(-2.72)	(-1.49)				
dINV	0.021	-0.018	-0.404				0.16
	(2.23)	(-2.44)	(-4.94)				
dGDPR	0.010	-0.006	-0.231	0.001	0.165	0.007	0.10
	(2.36)	(-2.26)	(-3.42)	(0.85)	(0.45)	(0.67)	
dUE	-0.012	0.145	-0.085	-0.007	-10.323	-0.335	0.05
	(-0.14)	(2.22)	(-0.78)	(-0.45)	(-1.01)	(-1.39)	
dCONSR	0.016	-0.003	-0.128	0.000	-0.732	-0.007	0.04
	(3.71)	(-1.68)	(-1.32)	(-0.02)	(-1.85)	(-0.92)	
dINV	0.011	-0.009	-0.404	0.004	-0.071	0.057	0.16
	(0.50)	(-0.80)	(-4.96)	(1.06)	(-0.03)	(0.88)	

Table IA.XVIII
Granger Causality Tests, Norway

The table shows the results of Granger causality tests between growth in real GDP (*dGDPR*), unemployment (*dUE*), real consumption (*dCONSR*), and investments (*dINV*) and the two liquidity proxies for Norway (*RS* and *ILR*) using quarterly data for the period 1980 to 2009. The first column states which macro variable we are looking at. The second to fourth columns report Granger causality tests where we proxy for liquidity with the relative spread (*RS*), and columns 5 to 7 report the causality tests where we use *ILR* as our liquidity proxy. The second column (fifth column for *ILR*) states the null hypothesis tested, with associated χ^2 and *p*-value in the third and fourth columns (sixth and seventh columns for *ILR*), respectively. *, ** denote rejection of the null hypothesis at the 5% and 1% significance level, respectively.

	RS			*ILR*		
	H_0:	χ^2	*p*-value	H_0:	χ^2	*p*-value
(a) *dGDPR*	$dGDPR \nrightarrow RS$	2.58	0.11	$dGDPR \nrightarrow ILR$	2.52	0.11
	$RS \nrightarrow dGDPR$	14.64	0.00**	$ILR \nrightarrow dGDPR$	13.83	0.00**
(b) *dUE*	$dUE \nrightarrow RS$	0.38	0.54	$dUE \nrightarrow ILR$	4.23	0.04*
	$RS \nrightarrow dUE$	17.14	0.00**	$ILR \nrightarrow dUE$	9.58	0.00**
(c) *dCONSR*	$dCONSR \nrightarrow RS$	1.47	0.22	$dCONSR \nrightarrow ILR$	1.03	0.31
	$RS \nrightarrow dCONSR$	3.84	0.05*	$ILR \nrightarrow dCONSR$	5.05	0.02*
(d) *dINV*	$dINV \nrightarrow RS$	0.47	0.49	$dINV \nrightarrow ILR$	0.00	0.99
	$RS \nrightarrow dINV$	8.46	0.00**	$ILR \nrightarrow dINV$	3.17	0.07

Table IA.XIX
Granger Causality Tests Norway - Size Portfolios

The table shows the results of Granger causality tests between real GDP growth and the illiquidity of small and large firms for the two different liquidity proxies for the Norwegian sample for the period 1980 to 2009. The first column denotes the liquidity variable, and columns two and three show the χ^2 and associated *p*-value from Granger causality tests where the null hypothesis is that GDP growth *does not* Granger cause the liquidity variables. Similarly, columns four and five show the results when the null hypothesis is that the liquidity variable *does not* Granger cause GDP growth. *, ** denote rejection of the null hypothesis at the 5% and 1% significance level, respectively.

Liquidity	$dGDPR \nrightarrow$ LIQ		LIQ $\nrightarrow dGDPR$	
variable (LIQ)	χ^2	*p*-value	χ^2	*p*-value
RS^S	0.69	(0.71)	5.90*	(0.05)
RS^L	1.93	(0.37)	0.61	(0.73)
ILR^S	0.15	(0.67)	4.92*	(0.03)
ILR^L	1.63	(0.20)	0.66	(0.42)

Table IA.XX
Out of Sample Analysis for Norway

Panel A reports the results from nested model comparisons for predicting quarterly out-of-sample one-quarter ahead real GDP growth using relative spread (*RS*) and the illiquidity ratio (*ILR*). The first column shows the variables in the unrestricted model, and the second column shows the variables included in the restricted (baseline) model. Columns 3 to 5 show the relative MSE, the MSE-F test for equality of MSE, and the ENC-NEW test for the one-quarter-ahead forecast. Panel B shows the results from when the baseline model is an autoregressive model (of order one) for GDP growth. In that case the unrestricted model adds *RS* or *ILR* to the restricted model. ** and * denotes rejection of the null hypothesis (at the 1% and 5% level, respectively) of equal forecast precision for the MSE-F test, while it denotes a rejection of the null that the restricted model encompasses the unrestricted model for the ENC-NEW test.

Panel A: Liquidity vs. other financial variables

Unrestricted model	Restricted model	one quarter-ahead forecasts $\frac{MSE_u}{MSE_r}$	MSE-F	ENC-NEW
RS, $Term$	$Term$	0.974	1.590*	1.003
RS, $\mathtt{er_m}$	$\mathtt{er_m}$	0.963	2.243*	1.427*
RS, $Vola$	$Vola$	0.946	3.351*	2.087*
ILR, $Term$	$Term$	1.004	-0.246	-0.062
ILR, $\mathtt{er_m}$	$\mathtt{er_m}$	0.967	2.015*	1.249*
ILR, $Vola$	$Vola$	0.979	1.245	0.825

Panel B: Liquidity vs. an AR model for GDP growth

Unrestricted model	Restricted model	one quarter-ahead forecasts $\frac{MSE_u}{MSE_r}$	MSE-F	ENC-NEW
RS, $dGDPR$	$dGDPR$	0.888	7.43**	4.75**
ILR, $dGDPR$	$dGDPR$	0.938	3.89**	2.38*

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