



Market liquidity, financial stability and the impact of bond scarcity

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Outline

- Motivation
- Liquidity: Concept, measures & illustrations
- Market conditions & developments
- Analytic framework & results

Why liquidity is a problem?

- Market inefficiency
- Pricing errors
- Impact on government budget

Key factors affecting liquidity

- Central bank quantitative easing
- Level and growth of government debt
- Regulation

Transaction data: MiFID I & II

- Unique transaction data: MiFID I & II reporting obligations for investment firms
 - Used for market surveillance purposes and market analysis
 - Detailed information about transactions on a wide set of financial instruments
 - Time periods: 2012 to 2017 (MiFID I), 2018 onwards (MiFID II)
- Over 360,000 observations for government bonds after filtering
- Reference data on bond issuances from EIKON and Swedish Debt Office

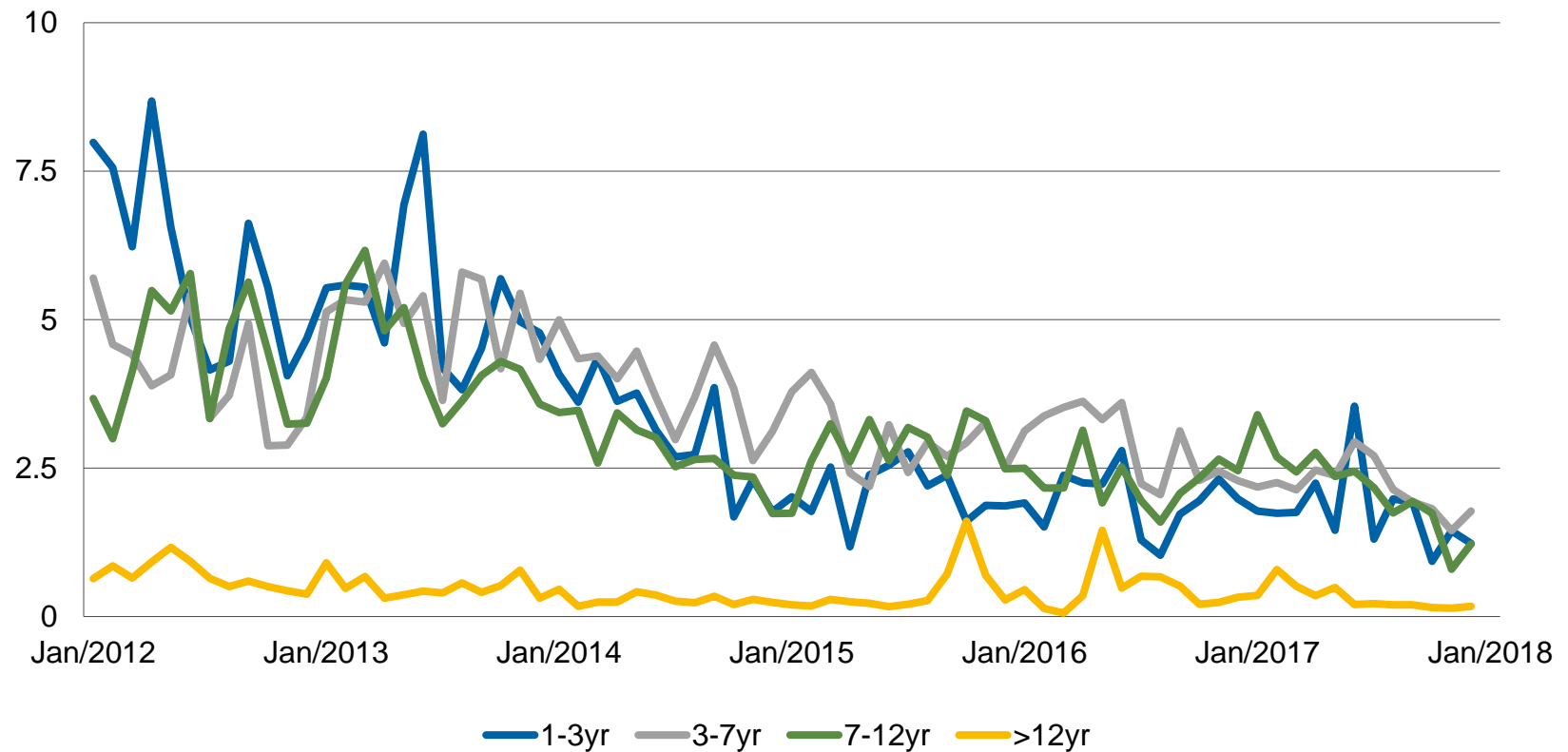
Liquidity dimensions and measures

	Immediacy	Tightness	Breadth	Resilience
Zero-trading days (ZTD)	✓			
Turnover ratio	✓			
Intraday volatility		✓	✓	
Market efficiency coefficient (MEC)				✓

Turnover is decreasing

Average daily turnover on nominal Swedish government bonds

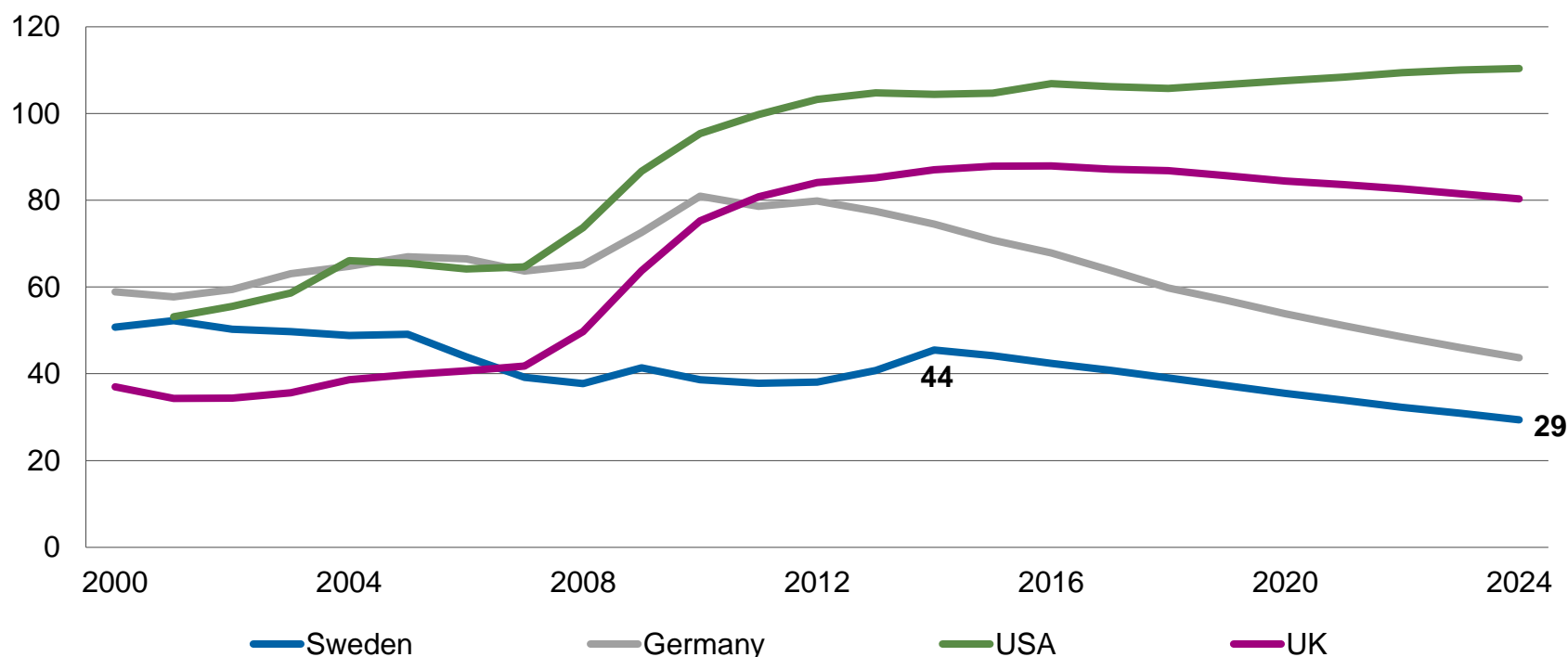
Billions SEK



Evolution of government debt in Sweden and selected countries

General Government Gross Debt

Percent of GDP (Estimates from 2019)



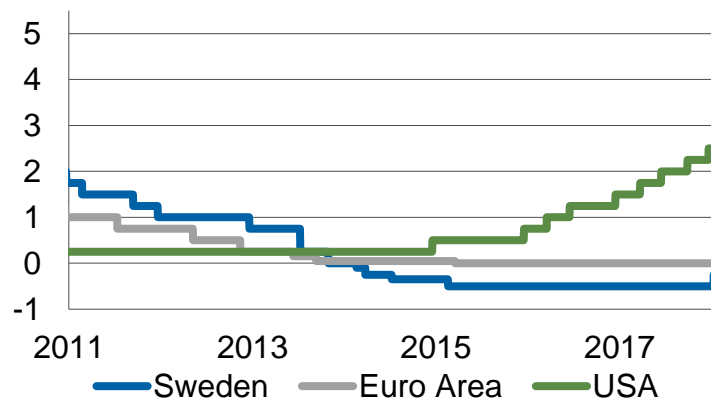
Source: IMF

The regulatory measures that impact government bond market

- **Basel III: stricter definition of capital and higher liquidity buffers.**
- **Other regulatory measures:**
 - MiFID II (January 2018)
 - Solvency II (2016) & IORP 2 (2019)
 - EMIR (2008): CCP are required to accept only high-quality liquid assets (HQLA) as eligible collateral.
 - Indirect effect on government bond market: Amended terms and conditions for collateral at the Swedish Central Bank (18/12/2015) limit the use of covered bonds as collateral for loans at the Central Bank

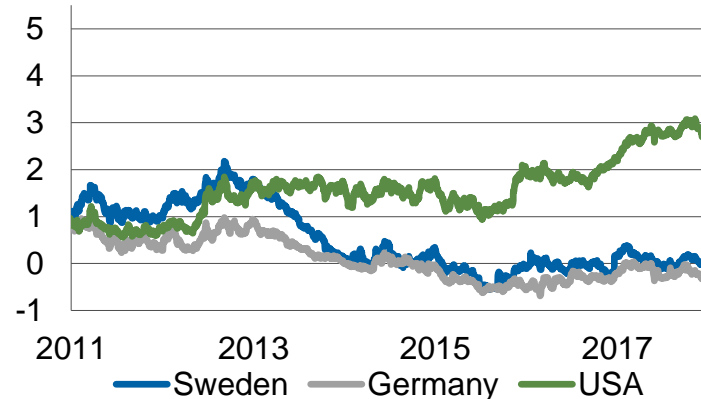
Central bank's quantitative easing programs

Central bank policy rates
Percent



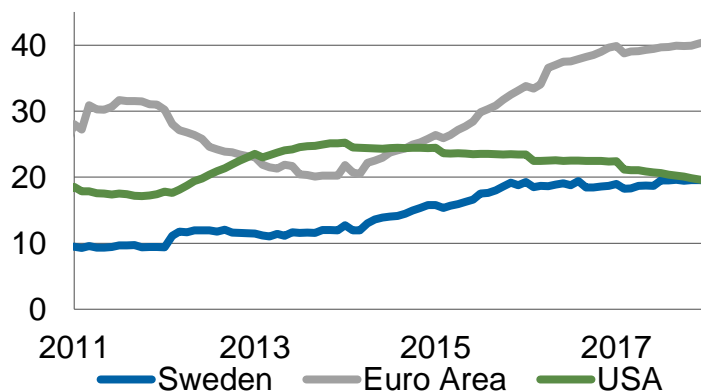
Source: Riksbanken, ECB, Federal Reserve

5 year government bond yields
Percent



Source: Riksbanken, ECB, Federal Reserve

Central bank balance sheet
Percent of GDP

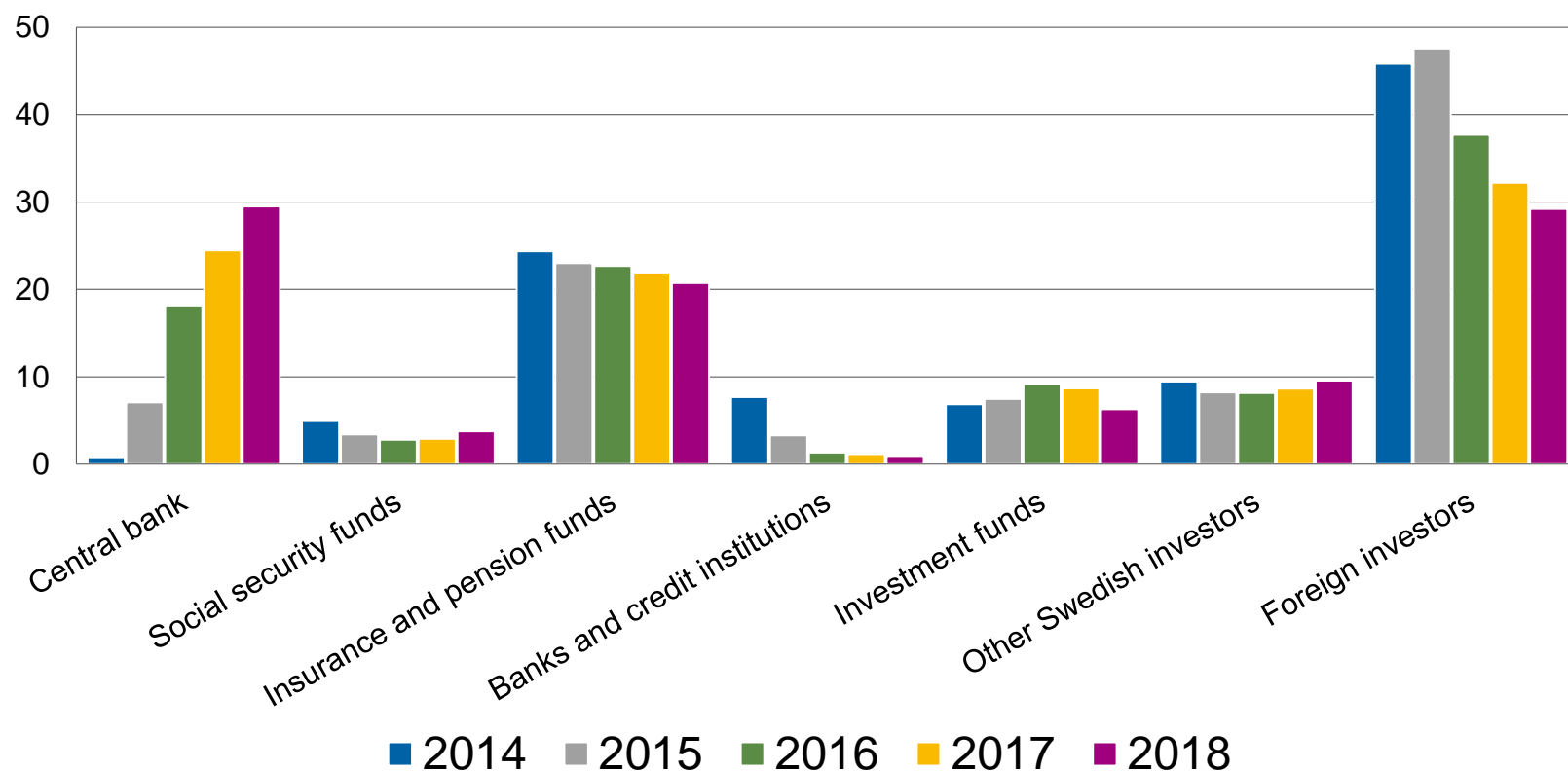


Source: Riksbanken, SCB, ECB, Eurostat,
Federal Reserve, U.S. Bureau of Economic

Crowding out in the government debt market?

Holdings of fixed-income securities issued by the Swedish state

Percent

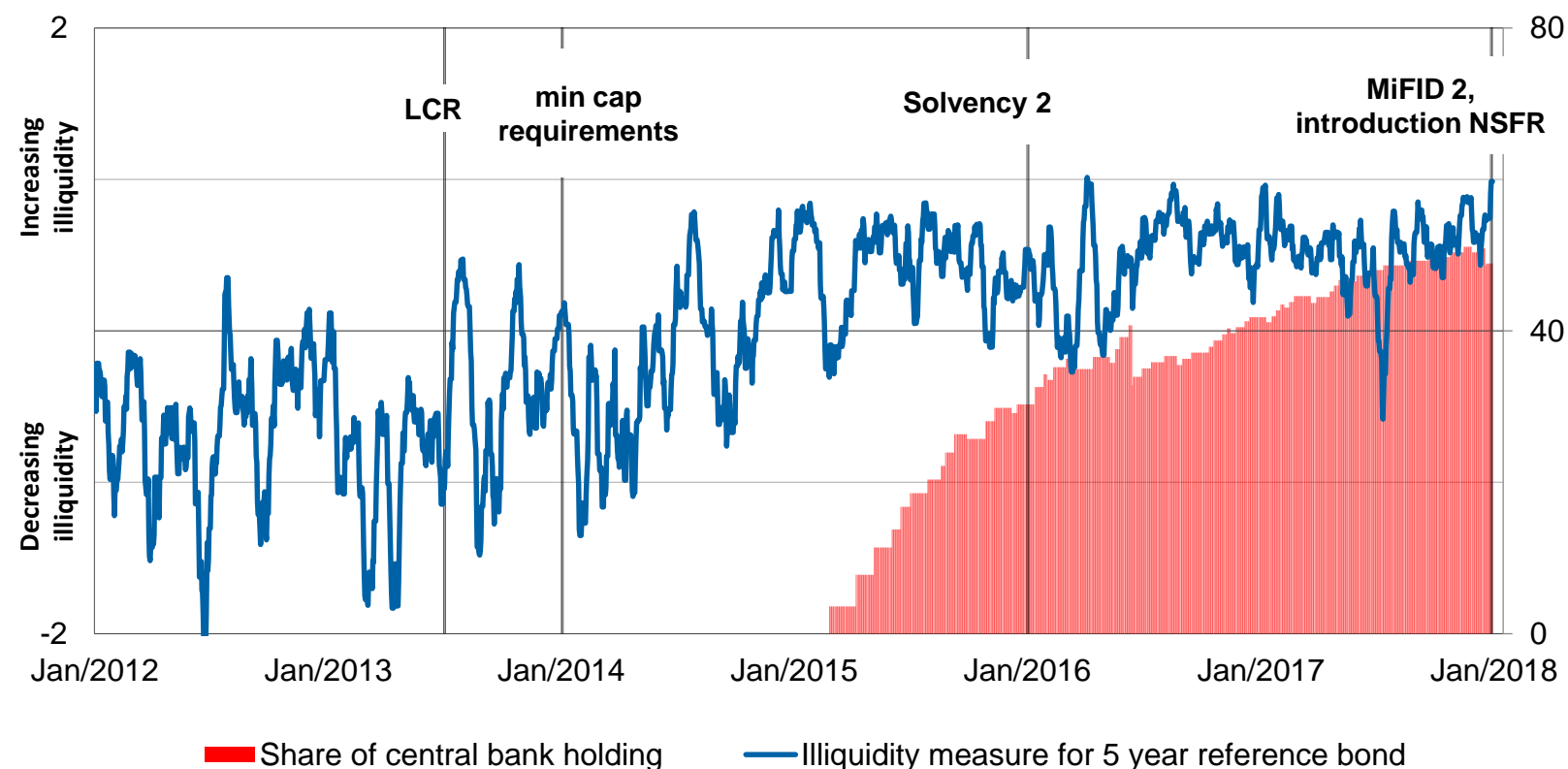


QE, key regulatory reforms and liquidity conditions

Standardized illiquidity measure based on turnover ratio

20 day moving average

Percent of outstanding stock



Analytical framework

- $$Liquidity_t = \alpha_0 + \alpha_1 Purch_t + \alpha_2 Holds_{t-1} + \alpha_3 Purch_t * Holds_{t-1} + \sum_k \beta_k Control_{k,t} + \sum_l \gamma_l Regulation_{l,t} + \varepsilon_{T,t}$$
- Panel data with security-specific fixed effects.

Preliminary Results

Illiquidity measures based on	Turnover	MEC	Intraday vol	ZTD
Purchased_t	-17,47*** (2,35)	-1,41 (2,76)	0,70 (1,76)	-0,32 (0,89)
Holdings_{t-1}	2,69*** (0,35)	1,06* (0,54)	0,43** (0,20)	-0,11 (0,20)
Purchased_{t-1} * Holdings_{t-1}	4,05 (6,73)	-4,40 (9,17)	-11,87*** (4,40)	1,68 (3,39)
DMO issuance	-131,31*** (22,06)	25,09 (23,32)	-17,95*** (3,41)	-1,86 (3,15)
Bond size	-25,87*** (3,92)	-0,27 (3,14)	-1,49** (0,72)	-1,44 (1,59)
Debt ratio	7,55 (5,06)	-5,72 (7,72)	2,13 (2,40)	-2,06 (5,10)
DMO repo facility	-6,51** (3,00)	-4,23*** (1,13)	-0,38 (0,48)	-0,84 (0,77)
Economic Tendency Indicator	-0,01 (0,01)	-0,02** (0,01)	0,00 (0,01)	0,00 (0,01)
Vix	-0,02 (0,11)	0,08 (0,15)	0,15*** (0,06)	-0,09 (0,06)
Liquidity premium	0,35*** (0,13)	0,09 (0,41)	-0,19 (0,14)	-0,24 (0,18)
Yield curve slope	-0,30 (0,20)	-0,34** (0,16)	0,00 (0,07)	0,09 (0,07)
Regulation				
2013	0,04 0,2852	0,39*** 0,0813	-0,22*** 0,0419	0,09 0,1615
2014	0,50* 0,2722	0,59*** 0,1082	-0,42*** 0,0569	0,10 0,1711
2015	0,56** (0,25)	0,47*** (0,13)	-0,35*** (0,06)	0,11 (0,20)
2016	0,61** (0,30)	0,14 (0,26)	-0,53*** (0,08)	-0,04 (0,11)
2017	0,86** (0,35)	-0,05 (0,43)	-0,61*** (0,13)	-0,02 (0,13)
Security specific fixed effects	yes	yes	yes	yes
R²	19%	5%	5%	2%
N° obs	13 499	13 024	12 577	13 700

Summary

- We have a unique dataset of transaction data
- Compute a variety of liquidity measures on daily basis.
- We look at the impact of central bank QE and regulation:
 - We find two opposite effects of QE on liquidity:
 - Outright purchases of the central bank tend to improve some dimensions of liquidity, in the short term.
 - At the same time, central bank holdings lower liquidity, through a “scarcity” effect, in the long run.
- *Moving forward:*
 - Further improve the liquidity measures.
 - Extend data (>2018) using MiFID II transaction reporting.
 - Bifurcation effects.

APPENDIX :Liquidity measures

➤ Zero-trading days: $ZTD_{day} = \frac{\text{Number of days without trades}}{T}$

where T is a chosen window

➤ Turnover ratio: $TR_{day} = \frac{\text{Trading Volume during day}}{\text{Issued Amount}}$

➤ Intraday volatility: $\text{Intraday Vol}_{day} = \sqrt{\frac{\sum_1^N (r_i - \bar{r})^2}{(N-1)\log(\text{volume})}}$

where N is the number of trades during *day*, r_i is the transaction prices, \bar{r} is the daily mean of r_i , and volume is the SEK trading volume during *day*.

➤ Market efficiency coefficient: $MEC_{day} = \left| \frac{\text{Var}(5\text{-day return})}{5 \times \text{Var}(\text{daily return})} - 1 \right|$

where Var (5-day return) is the variance of the 5-day return over 20 days.

APPENDIX :Definition of the regressors

- **Purchased:** Riksbank purchased amount on the specific date divided by outstanding amount (on instrument basis)
- **Holdings:** Riksbank holdings expressed as share of outstanding amount (on instrument basis)
- **Purchased * Holdings:** interaction expressed as the product of **Purchased** and **Holdings**
- **DMO issuance:** issued amount on a specific date (on instrument basis) divided by the total outstanding amount of all instruments in Swedish kronor
- **Bond Size:** the bonds share of the total outstanding amount of all instruments
- **Debt ratio:** ratio of the government debt to GDP
- **DMO repo facility:** SNDO's repo facility (only repo swaps) expressed as the repo volume divided by the total outstanding amount (on instrument basis)
- **Economic Tendency Indicator:** National Institute of Economic Research's Economic Tendency Indicator for Sweden
- **VIX:** log of VIX index
- **Liquidity premium:** difference between STIBOR T/N and policy rate
- **Yield curve slope:** difference between the Swedish 5 and 2 year government bond yield
- **Regulation:** dummy variables for each year with 2012 as base year

Robustness check

Illiquidity measures based on	Turnover	MEC	Intraday vol
Purchased_t	-7,44 (5,58)	-5,17 (4,06)	-1,25 (3,74)
Holdings_{t-1}	2,72*** (0,34)	1,05* (0,54)	0,42** (0,20)
Purchased_t * Holdings_{t-1}	-60,93*** (21,11)	22,17 (27,26)	12,37 (14,25)
DMO issuance	-131,45*** (22,02)	25,24 (23,40)	-17,66*** (3,37)
Bond size	-25,90*** (3,91)	-0,26 (3,13)	-1,46** (0,73)
Debt ratio	7,54 (5,06)	-5,72 (7,72)	2,08 (2,40)
DMO repo facility	-6,47** (3,01)	-4,24*** (1,13)	-0,39 (0,48)
Economic Tendency Indicator	-0,01 (0,01)	-0,02** (0,01)	0,00 (0,01)
Vix	-0,02 (0,11)	0,08 (0,15)	0,15*** (0,06)
Liquidity premium	0,35*** (0,13)	0,09 (0,41)	-0,19 (0,14)
Yield curve slope	-0,30 (0,20)	-0,34** (0,16)	0,00 (0,07)
Regulation			
2013	0,04 0,2851	0,39*** 0,0812	-0,22*** 0,0419
2014	0,51* 0,2721	0,59*** 0,1083	-0,42*** 0,0572
2015	0,56** (0,25)	0,47*** (0,13)	-0,35*** (0,06)
2016	0,62** (0,30)	0,14 (0,26)	-0,53*** (0,08)
2017	0,86** (0,35)	-0,05 (0,43)	-0,61*** (0,13)
Security specific fixed effects	yes	yes	yes
R²	19%	5%	5%
N° obs	13 499	13 024	12 577

Reference bonds: bifurcation?

Illiquidity measures based on	Turnover	MEC	Intraday vol	ZTD
Purchased_t	-18,27*** (1,55)	4,54 (4,24)	-0,59 (1,81)	3,69 (4,00)
Holdings_{t-1}	0,27 (0,29)	-0,81*** (0,21)	0,61*** (0,08)	-2,25*** (0,51)
Purchased_{t-1} * Holdings_{t-1}	22,40* (13,01)	17,54 (13,88)	-2,38 (6,18)	14,93 (14,91)
DMO issuance	-71,06*** (8,98)	27,13*** (3,89)	-10,32 (9,82)	-9,17 (6,48)
Bond size	-2,52*** (0,76)	5,09** (2,30)	1,40 (1,40)	1,45 (2,61)
Debt ratio	15,77*** (5,66)	-7,26* (4,35)	3,97* (2,38)	-6,86 (14,17)
DMO repo facility	-1,24 (1,44)	0,86* (0,46)	1,22 (0,80)	0,99 (2,00)
Economic Tendency Indicator	0,00 (0,00)	-0,02** (0,01)	0,00 (0,00)	0,01*** (0,00)
Vix	0,01 (0,04)	0,09 (0,23)	0,18 (0,17)	-0,11 (0,08)
Liquidity premium	0,54** (0,22)	-0,28 (0,35)	0,08 (0,07)	-1,23** (0,58)
Yield curve slope	-0,33*** (0,09)	-0,50 (0,34)	0,12 (0,12)	-0,22 (0,66)
Regulation				
2013	0,20 0,1316	0,35** 0,1364	-0,18*** 0,0552	-0,03 0,301
2014	0,75*** 0,2308	0,63*** 0,1428	-0,32*** 0,0448	-0,08 0,337
2015	1,15*** (0,28)	0,60*** (0,11)	-0,23*** (0,08)	0,54 (0,34)
2016	1,59*** (0,50)	0,58* (0,30)	-0,21*** (0,01)	0,54*** (0,16)
2017	2,19*** (0,63)	0,49 (0,35)	-0,28* (0,15)	0,37* (0,19)
Security specific fixed effects	yes	yes	yes	yes
R²	32%	6%	2%	5%
N° obs	4 503	4 440	4 450	4 485