

# Impact of the Liquidity Coverage Ratio on Security Prices

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# Motivation

- Introduction of the Basel III Liquidity Coverage Ratio (LCR)
- LCR requires banks to hold sufficient High Quality Liquid Assets (HQLA) relative to the expected Net Cash Outflows (NCOF)
- We evaluate to what extent the classification of securities as HQLA and non-HQLA has an impact on security prices
- We define this price impact as “HQLA-premium”

# What we do...

- Evaluate and describe the difference between HQLA and non-HQLA securities
- Develop a simple model to analyze the impact of the LCR on security prices (HQLA-premium)
- Quantify the HQLA-premium empirically for securities denominated in Swiss francs (CHF)

## ...and what we find

- Theoretical considerations: HQLA-premium depends on...
  - ▶ ...how strict the LCR is and on the elasticity of the HQLA supply
  - ▶ ...monetary policy environment (supply of reserves and interest rates)
- Empirical analysis: we find weak evidence for the existence of a HQLA-premium (up to 3bp) for securities denominated in CHF
- Assessment: estimation of the lower bound HQLA-premium primarily due to the current monetary policy environment

# Agenda

- 1 Introduction
- 2 Background
- 3 Literature
- 4 Theoretical considerations
- 5 Empirical analysis
  - Regulatory change
  - Descriptive statistics
  - Measuring the HQLA-premium
  - Discussion
- 6 Implications
- 7 Conclusion

# Liquidity regulation under Basel III

- Basel III introduces internationally harmonized regulatory frameworks for banks' liquidity risks
- Two concepts:
  - ▶ Liquidity Coverage Ratio (LCR)
  - ▶ Net Stable Funding Ratio (NSFR)
- LCR requires banks to hold sufficient unencumbered HQLA relative to the expected NCOF for a 30 days stress scenario

$$LCR = \frac{HQLA}{NCOF} \geq 1 \quad (1)$$

- Implementation: 4-year phase-in starting January 2015

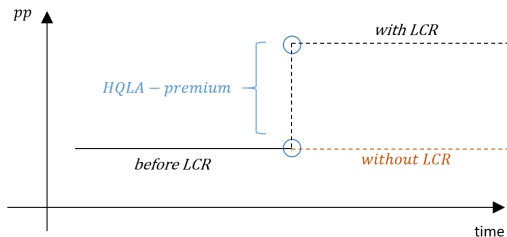
- HQLA consist of Level 1 and Level 2 assets:
  - ▶ Level 1: central bank (CB) reserves and securities; government and supranational debt, which fulfill requirements regarding their credit quality (regulatory haircut: 0%)
  - ▶ Level 2: Level 1 category securities with lower credit qualities; covered bonds and corporate debt (regulatory haircut: 15%; 40% threshold)
- Non-HQLA: all other assets (regulatory haircut: 100%)
- LCR by currency: cover NCOF in CHF with HQLA in CHF

- Bech and Keister (2014) model the impact of the LCR in jurisdictions with scarcity of HQLA
- Stein (2013) discusses the determinants of the HQLA-premium
- Bonner (2012) and Bonner and Eijffinger (2012) study balance sheet adjustments triggered by the Dutch liquidity regulation
- Bindseil and Papadia (2006) estimate the so-called “Central Bank Eligibility Premium”
- Bartolini et al. (2010) show that the price differentiation by collateral type in the US repo market is state dependent



# HQLA-premium

- Definition: change in the pricing of a security triggered by the different regulatory treatment under the LCR
- Measurement: change in the yield spread between Level 1 and Level 2 (non-HQLA) securities



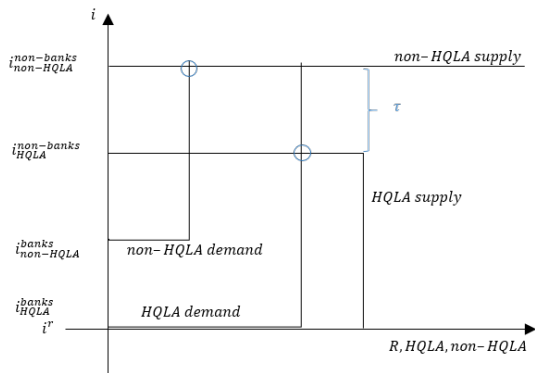
# A simple model (I)

- Continuum of profit maximizing banks and non-banks
- Two types of securities: HQLA securities and non-HQLA securities
- Two periods
  - ▶ Period 1: Banks are funded with deposits ( $\bar{D}$ ) and equity ( $\bar{E}$ ) and they hold CB reserves ( $R$ ). Non-banks hold HQLA and non-HQLA securities.
  - ▶ Period 2: Frictionless, perfectly competitive securities market opens...
- ...and banks can acquire HQLA or non-HQLA securities against reserves from non-banks

## A simple model (II)

- HQLA (non-HQLA) securities are risk-free (risky)
- Non-banks and banks take into account credit and liquidity risks  $\tau$
- Non-banks' reservation prices:  $i_{non-HQLA}^{non-banks} > i_{HQLA}^{non-banks}$
- Banks' reservation prices:  $i_{non-HQLA}^{banks} > i_{HQLA}^{banks}$
- CB steers the risk-free rate and pays  $i_r$  on reserves
- Banks prefer to hold securities instead of reserves if  $i_{HQLA} > i_r$
- Banks maximise risk-adjusted profits subject to
  - ▶ Balance sheet constraint:  $HQLA + non-HQLA + R = \bar{D} + \bar{E}$
  - ▶ LCR constraint:  $\frac{HQLA+R}{\theta \bar{D}} \geq 1$

# Equilibrium without LCR

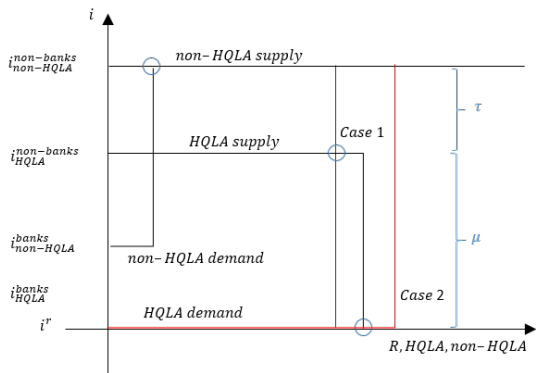


Characterisation of equilibrium:

$$\Rightarrow i_{non-HQLA}^* - i_{HQLA}^* = \tau$$

$$\Rightarrow HQLA^* + non-HQLA^* = \bar{D} + \bar{E} ; R^* = 0$$

# Equilibrium with LCR

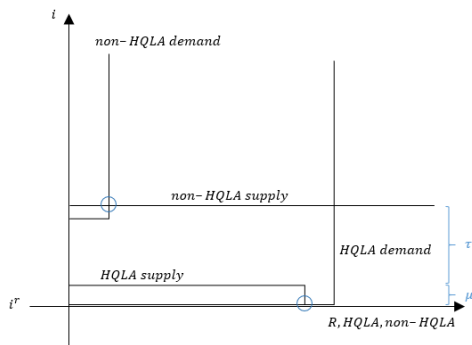


Characterisation of equilibrium (case 2):

$$\Rightarrow i_{non-HQLA}^* - i_{HQLA}^* = \tau + \mu$$

$$\Rightarrow HQLA^* + non-HQLA^* + R^* = \bar{D} + \bar{E} ; R^* > 0$$

# Equilibrium with LCR and floor system



Characterisation of equilibrium:

$$\Rightarrow i_{non-HQLA}^* - i_{HQLA}^* = \tau + \mu, \text{ where } \mu \text{ is close to zero}$$

$$\Rightarrow HQLA^* + non-HQLA^* + R^* = \bar{D} + \bar{E}; R^* > 0$$

# Hypotheses for empirical analysis

- **Hypothesis 1:** Without LCR, the pricing of HQLA securities and non-HQLA securities differs due to credit and liquidity risk considerations.
- **Hypothesis 2:** If the LCR is a binding constraint and the supply of HQLA securities is not fully elastic, an HQLA-premium is added to the existing yield differentiation between HQLA and non-HQLA. The size of the HQLA-premium depends on how strict the LCR is, whether there is a shortage of HQLA and the degree to which banks can reduce their NCOF.
- **Hypothesis 3:** If the yield on HQLA securities and the interest rate the CB pays on reserves are identical and there are sufficient reserves, the HQLA-premium is zero as banks are indifferent between holding reserves or HQLA securities in order to fulfill the LCR.

# Former liquidity regulation in Switzerland

- Cover short-term liabilities with “liquid assets”
- Definition of liquid assets less strict than definition of HQLA
  - ▶ SNB-eligible securities were deemed to be liquid assets
  - ▶ No regulatory haircut
- With the announcement of the LCR, formerly liquid assets were classified as either Level 1, Level 2 and non-HQLA (on SNB-website)
- Regulatory value of formerly liquid assets changed as follows

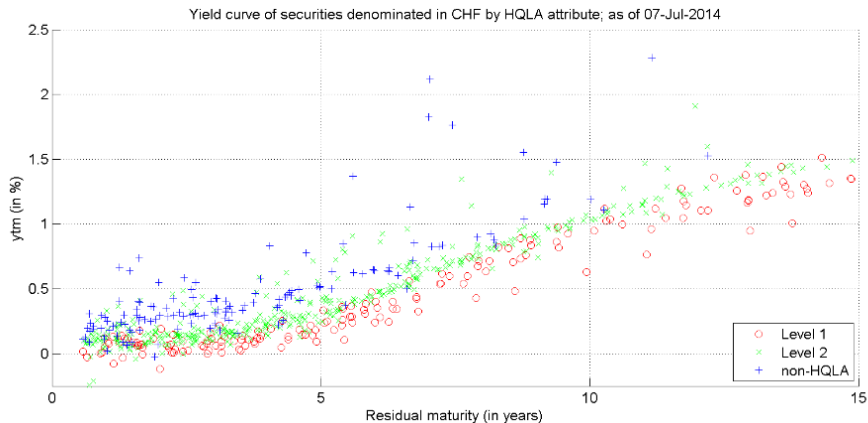
$$\text{Regulatory value} = \begin{cases} \text{Level 1} & \text{unchanged} \\ \text{Level 2} & \text{regulatory downgrade} \\ \text{non-HQLA} & \text{regulatory exclusion} \end{cases}$$



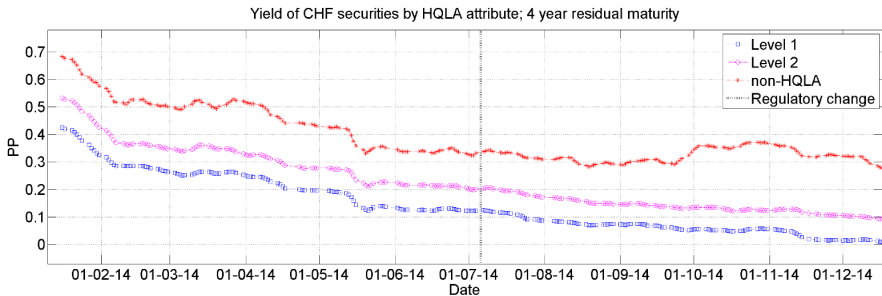
# Dataset

- CHF- and EUR-denominated SNB-eligible securities (i.e. liquid assets under the former liquidity regulation)
- Observation period 6 January 2014 until 17 December 2014
- Only securities with maturity date  $\geq$  1 February 2015 and no new issuances (fixed dataset)
- Only fixed coupon securities; i.e. exclusion of floating rate securities
- In total 1,628 securities

# Yield curves for different HQLA attributes



# Development of securities denominated in CHF (const. maturity yield)



# Difference-in-Difference (DiD) methodology (I)

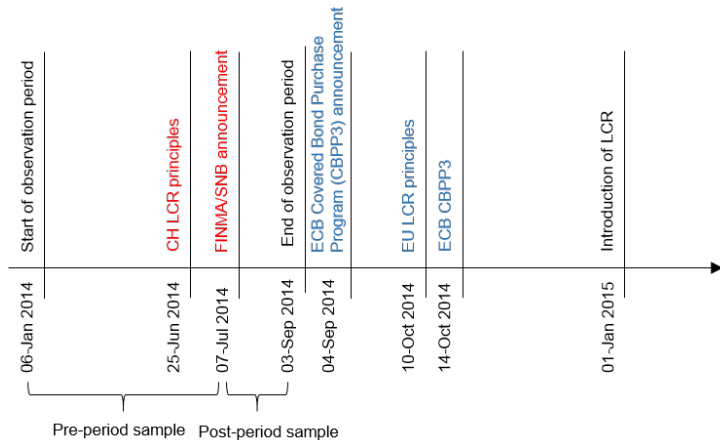
- Compare yield changes of CHF-denominated securities (treated group) with EUR-denominated securities (non-treated group)
- Use the fact that LCR was announced three months later in EU
- Following Degryse et al. (2009) and Cerqueiro et al. (2015)
  - ▶ Divide sample into two periods (pre- and post-sample)
  - ▶ Calculate average yield for each security in pre- and post-sample
  - ▶ Calculate yield change for each security between pre- and post-sample
- Regress yield changes on HQLA attributes, dummy variables for the treated and non-treated groups as well as interaction terms (HQLA attributes of the treated group) while controlling for the yield curves

# DiD methodology (II)

- Treatment and control group...
  - ▶ include fairly homogeneous securities (fulfill SNB-eligibility criteria)
  - ▶ behave similar without treatment (parallel trend assumption; see e.g. placebo regression results)
- HQLA classification was publicly available
- Announcement of LCR details “exogenous” (FINMA/SNB)

⇒ Quasi-natural experiment (peer comparison: very nice and clean set-up)

# Timeline and key events



# DiD regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	Placebo	CH-issuer	3 days	1 day	LiqV	Volume 250	nonHQLA Oct
L2_CHF	0.0270*** (2.80)	0.000255 (0.06)	0.0391*** (3.54)	0.00595*** (3.33)	0.00856*** (5.96)	0.0262*** (2.70)	0.0299*** (3.14)	
CHF non-HQLA	0.0176 (0.98)	0.00601 (0.73)	0.0170 (0.88)	0.00119 (0.34)	0.00428 (1.26)	0.0173 (0.95)	0.0265 (1.41)	0.0449** (2.32)
L2	-0.0419*** (-6.70)	-0.00674*** (-3.13)	-0.0419*** (-6.69)	-0.00216*** (-3.12)	-0.00752*** (-11.88)	-0.0423*** (-6.68)	-0.0419*** (-6.70)	
non-HQLA	-0.0348** (-2.25)	0.00331 (0.69)	-0.0348** (-2.24)	-0.000731 (-0.49)	-0.00775*** (-4.11)	-0.0353** (-2.25)	-0.0348** (-2.24)	-0.0585*** (-3.40)
CHF	0.145*** (9.97)	0.0293*** (4.32)	0.153*** (7.68)	0.00156 (0.65)	0.00112 (0.52)	0.154*** (10.47)	0.155*** (9.18)	0.219*** (10.09)
Maturity CHF	-0.0548*** (-18.63)	-0.0155*** (-11.39)	-0.0550*** (-15.52)	0.00103*** (2.66)	0.00112*** (2.74)	-0.0546*** (-18.36)	-0.0587*** (-13.33)	-0.0604*** (-12.79)
Maturity EUR	-0.0581*** (-19.05)	-0.0122*** (-14.06)	-0.0581*** (-19.02)	-0.00227*** (-12.32)	-0.00266*** (-14.59)	-0.0563*** (-18.31)	-0.0581*** (-19.03)	-0.0561*** (-11.45)
Maturity_sq. CHF	0.00175*** (11.69)	0.000574*** (9.01)	0.00166*** (10.10)	-0.0000267* (-1.96)	-0.0000340** (-2.32)	0.00177*** (11.72)	0.00178*** (7.23)	0.00187*** (7.96)
Maturity_sq. EUR	0.00126*** (9.28)	0.000309*** (8.17)	0.00126*** (9.26)	0.0000558*** (7.74)	0.0000610*** (8.34)	0.00124*** (9.04)	0.00126*** (9.27)	0.00127*** (6.13)
Constant	-0.110*** (-11.71)	-0.0634*** (-20.18)	-0.110*** (-11.69)	-0.0116*** (-15.22)	-0.00980*** (-13.92)	-0.121*** (-12.70)	-0.110*** (-11.70)	-0.179*** (-11.28)
Observations	1628	1628	1160	1628	1628	1628	1293	810
Adjusted R <sup>2</sup>	0.784	0.387	0.780	0.250	0.328	0.774	0.807	0.769

*t* statistics in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Robustness checks

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# Discussion of results

- Some evidence for a HQLA-premium of up to 3bp
- Empirical findings are consistent with hypotheses 2 and 3
  - ▶ Is the LCR binding?
  - ▶ Role of ALA-options applied in Switzerland
  - ▶ Low interest rate environment
  - ▶ Large excess reserves due to FX interventions (creation of HQLA)
- Methodological issues
  - ▶ Exogeneity of policy announcement (underestimation)
  - ▶ Short post-period sample (underestimation)

# Policy implications of a non-zero HQLA-premium (I)

- Implementation of monetary policy

- ▶ LCR might introduce a new premium and reinforces the yield differentiation between HQLA and non-HQLA securities
- ▶ Larger CB balance if insufficient HQLA securities
- ▶ Can affect the choice of exit strategies

⇒ *“Implementing monetary policy may be significantly more difficult”*  
Bech and Keister (2014)

- Primary bond markets

- ▶ The LCR affects issuance conditions
- ▶ The LCR favors government debt compared to private debt (incentives to produce such securities)

# Policy implications of a non-zero HQLA-premium (II)

- Collateral frameworks
  - ▶ Banks prefer CB funding against non-HQLA (assumption: CB-haircuts remain constant)
  - ▶ Might cause systemic arbitrage (see Fecht et al. (2015))
  - ▶ CB might need to adjust haircut policy or collateral eligibility
- Financial stability
  - ▶ The literature as well as our findings suggests that banks have adjusted their security portfolios towards HQLA
  - ▶ More exposed to price changes (concentration risk and fire-sales)

# Conclusion

- We evaluate the impact of the LCR on security prices
- Key findings from theoretical analysis suggest that the price impact depends on whether the LCR is binding, on how strict the LCR is and on the monetary policy environment
- Empirical analysis: some evidence for an HQLA-premium of up to 3bp for securities denominated in CHF
- Our analysis contributes to the broader understanding of the LCR

# Literature

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