Impact of the Liquidity Coverage Ratio on Security Prices

Lucas Fuhrer[†] Benjamin Müller[‡] Luzian Steiner[*]

Frankfurt: 7 December 2015

[†] Swiss National Bank and University of Zürich. [‡] Swiss National Bank and University of Basel. [*] Swiss National Bank. The views expressed in this presentation are those of the authors and do not necessarily represent those of the Swiss National Bank.

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

$$LCR = \frac{HQLA}{NCOF} \geq 1 \tag{1}$$

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

HQLA

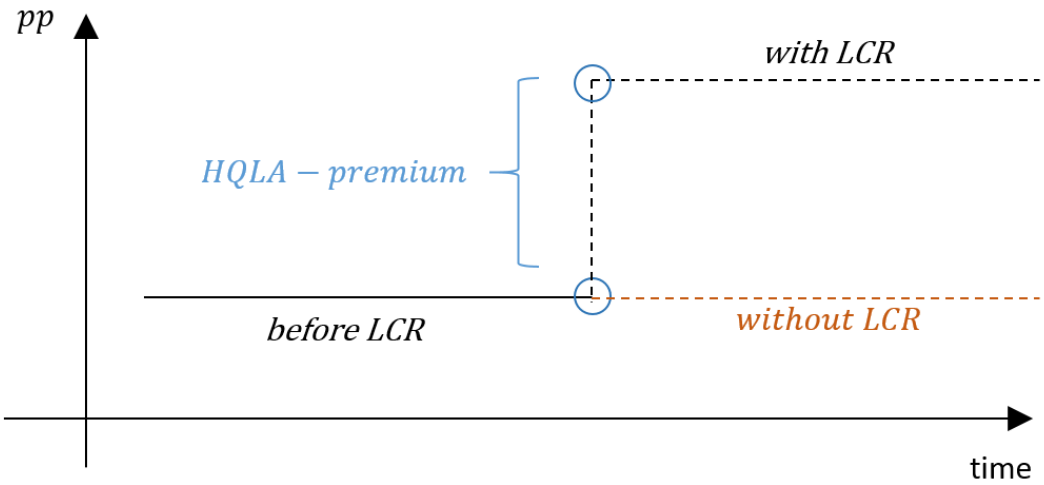
- HQLA consist of Level 1 and Level 2 assets:
  - Level 1: central bank (CB) reserves and securities; government and supranational debt, which fulfill requirements regarding their credit quality (regulatory haircut: 0%)
  - Level 2: Level 1 category securities with lower credit qualities; covered bonds 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

Literature

- 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



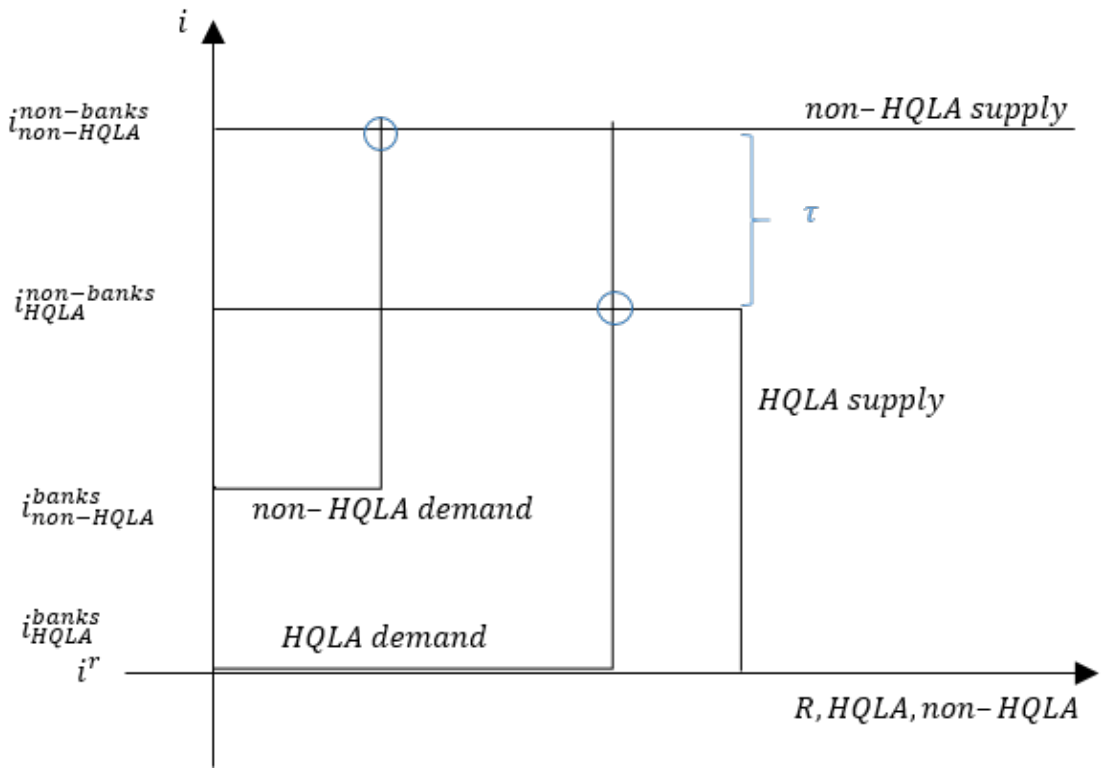
A simple model (I)

- 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 securites 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 τ
- Non-banks' reservation prices: $i^{non-banks}_{non-HQLA} > i^{non-banks}_{HQLA}$
- Banks' reservation prices: $i^{banks}_{non-HQLA} > i^{banks}_{HQLA}$
- 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: $HQLA + non\text{-}HQLA + R = \bar{D} + \bar{E}$
  - LCR constraint: $\frac{HQLA+R}{\theta \bar{D}} \geq 1$

Equilibrium without LCR

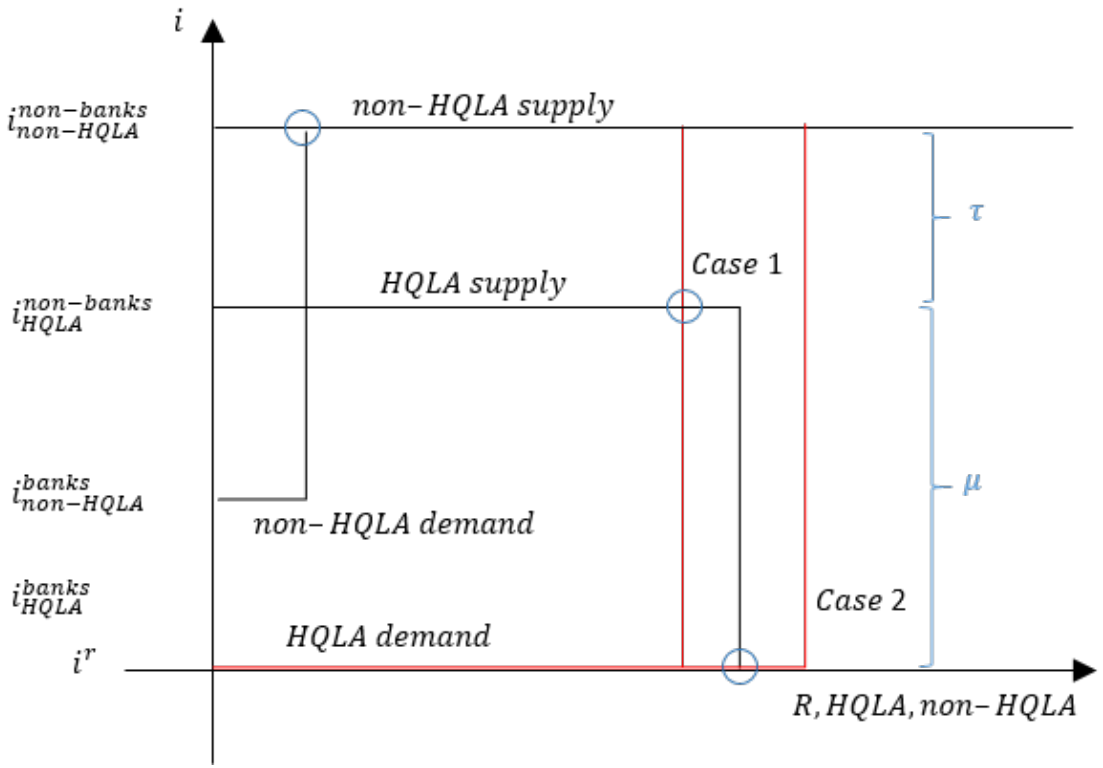


Characterisation of equilibrium:

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

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

Equilibrium with LCR

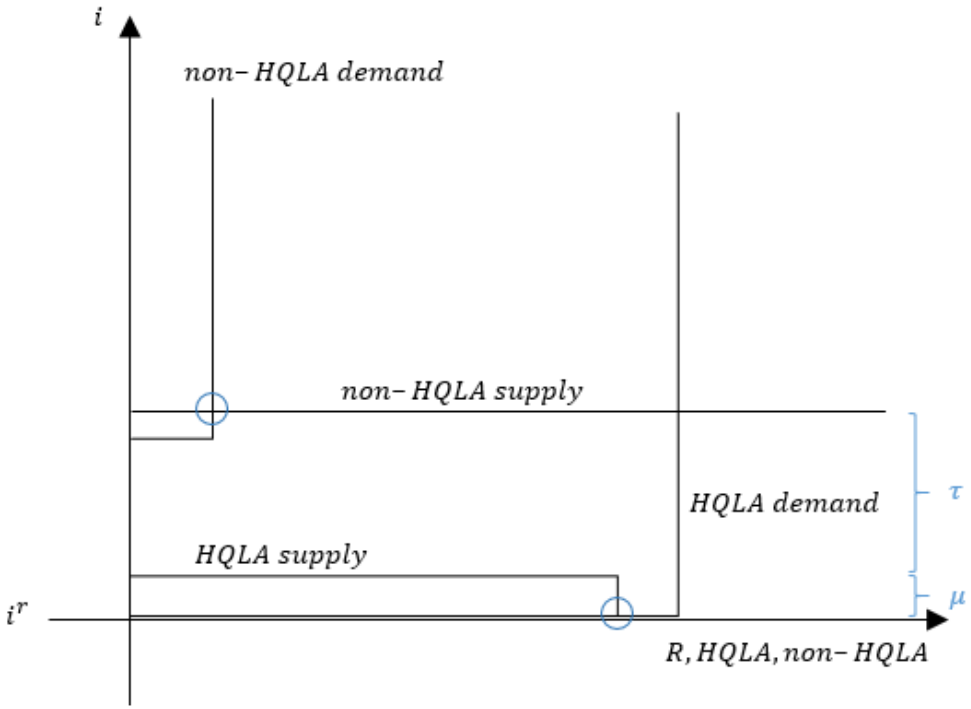


Characterisation of equilibrium (case 2):

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

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

Equilibrium with LCR and floor system



Characterisation of equilibrium:

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

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

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

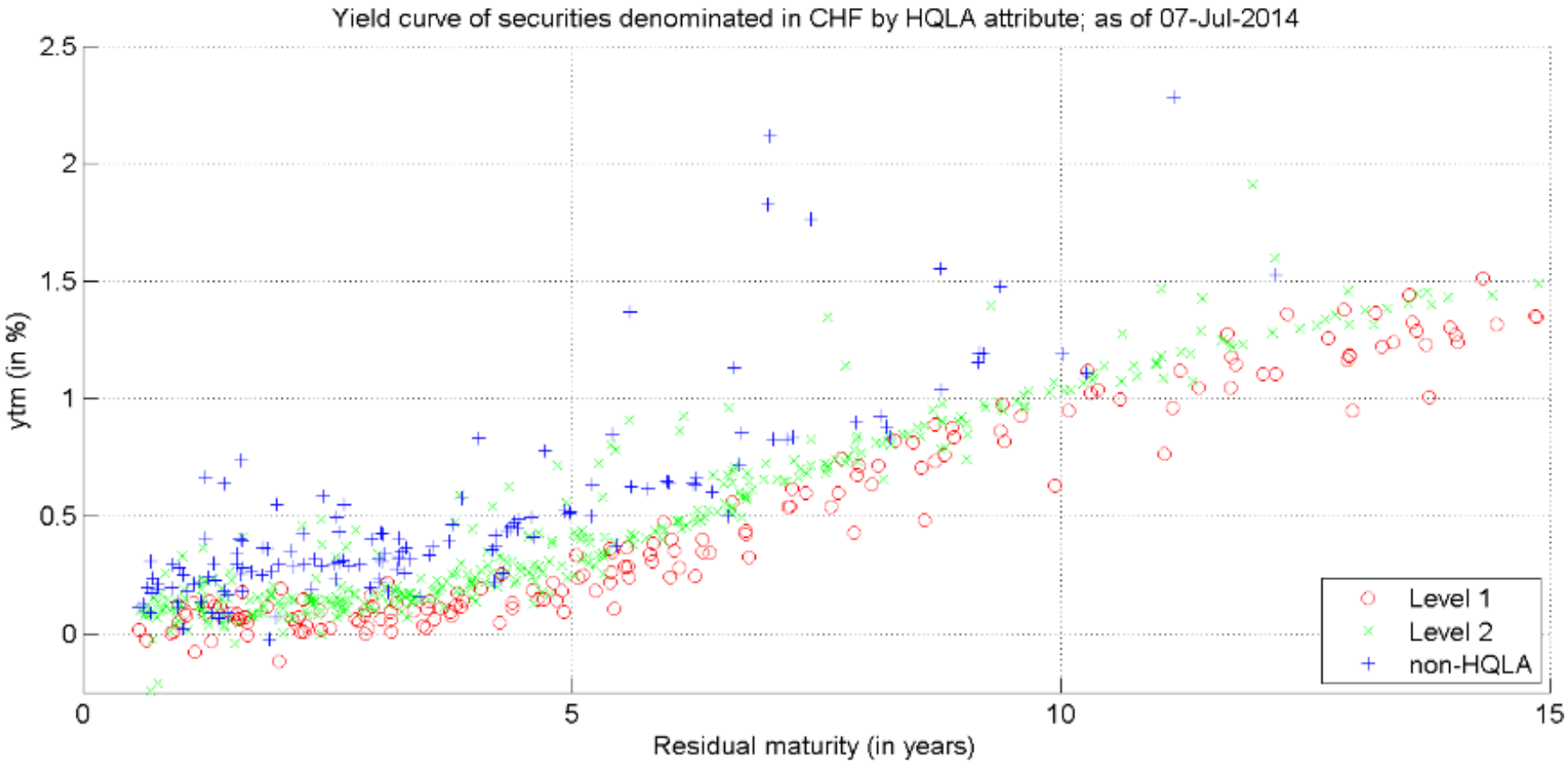
- Cover short-term liabilities with "liquid assets"
- Definition of liquid assets less strict than definition of HQLA
  - SNB-eligible securities were deemed to be liquid assets
  - No regulatory haircut
- With the announcement of the LCR, formerly liquid assets were classified as either Level 1, Level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

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

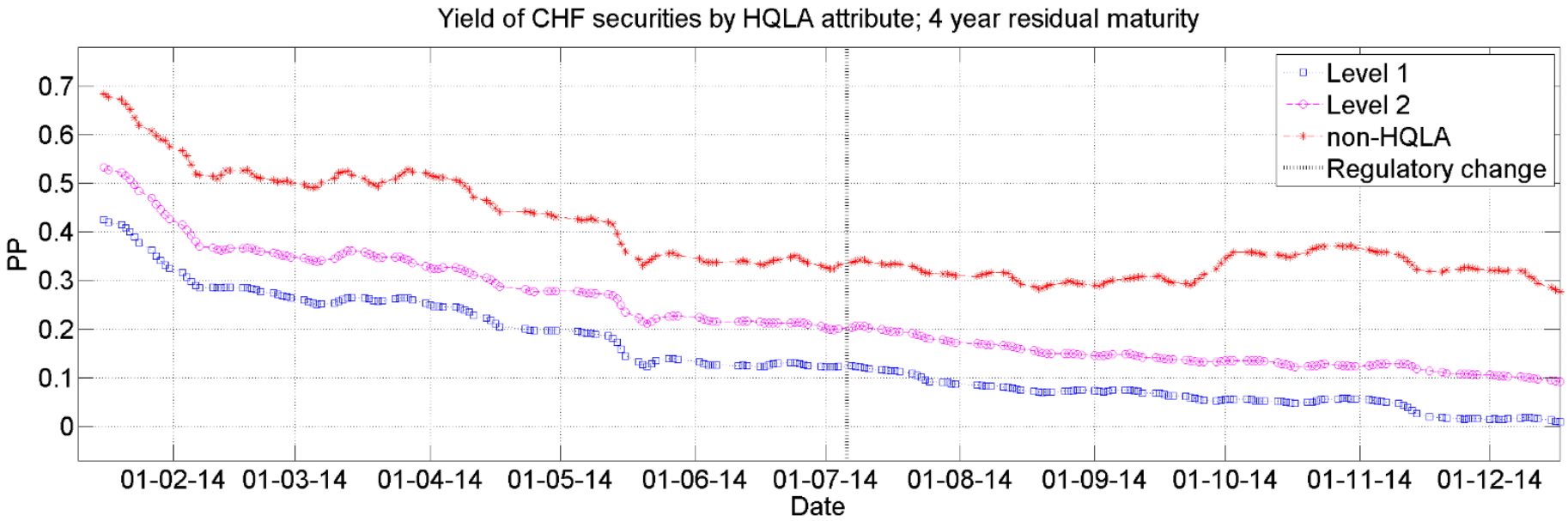
Dataset

- 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)

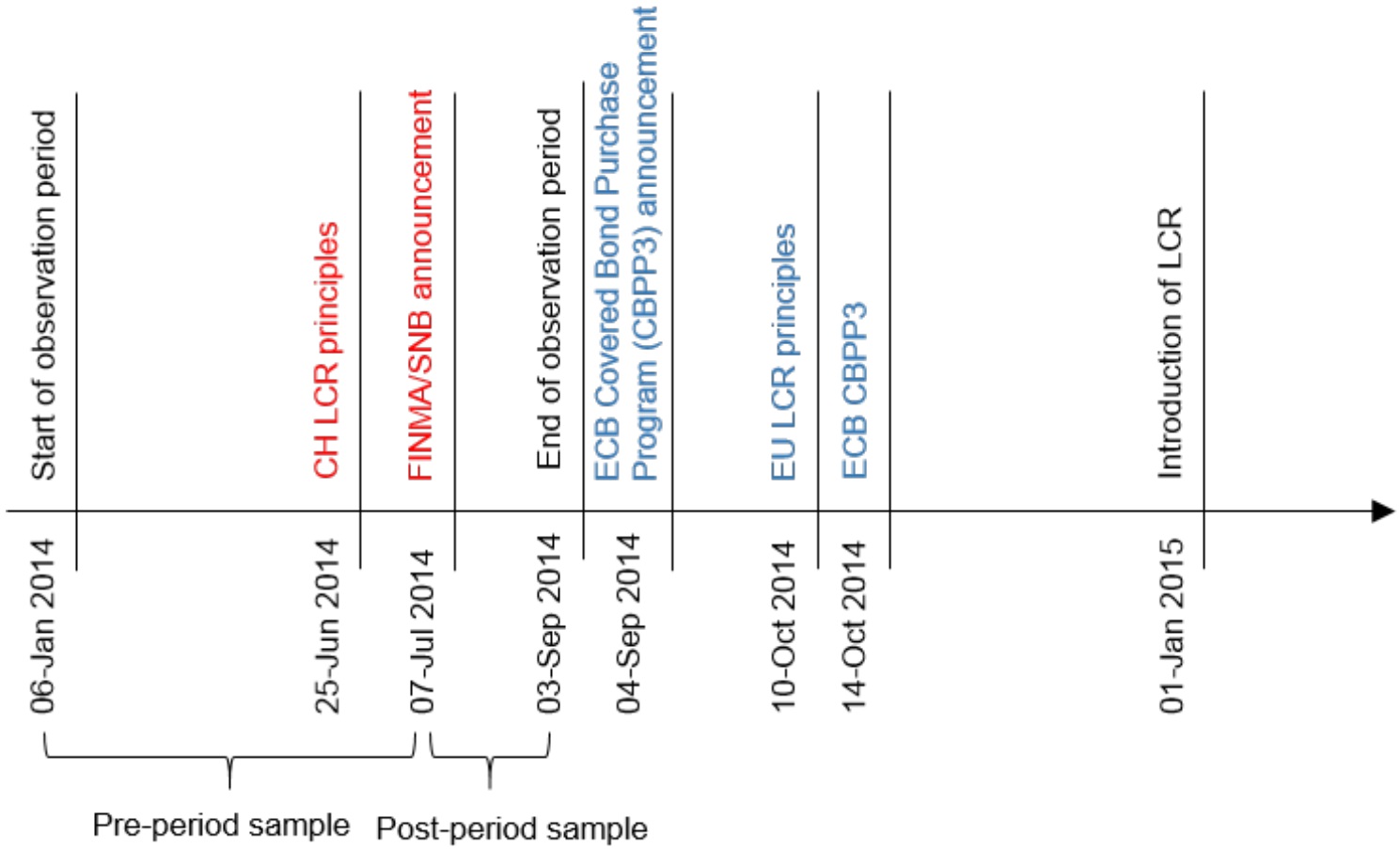
- Compare yield changes of CHF-denominated securities (treated group) with EUR-denominated securities (non-treated group)
- Use the fact that LCR was announced three months later in EU
- Following Degryse et al. (2009) and Cerqueiro et al. (2015)
  - Divide sample into two periods (pre- and post-sample)
  - 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)

$\Rightarrow$ Quasi-natural experiment (peer comparison: very nice and clean set-up)

Timeline and key events



DiD regression results

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

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

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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

  $\Rightarrow$ *"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

Bartolini, L., Hilton, S., Sundaresan, S., and Tonetti, C. (2010). Collateral values by asset class: Evidence from primary securities dealers. *Review of Financial Studies*, 24(1):248–278.

Bech, M. and Keister, T. (2014). On the economics of committed liquidity facilities. *BIS Working Paper*, 439.

Bindseil, U. and Papadia, F. (2006). Credit risk mitigation in central bank operations and its effects on financial markets: the case of the eurosystem. *ECB Occasional Paper*, No 49.

Bonner, C. (2012). Liquidity regulation, funding costs and corporate lending. *De Nederlandsche Bank Working Paper*, 361.

Bonner, C. and Eijffinger, S. C. (2012). The impact of the lcr on the interbank money market. *CEPR Discussion Paper*, 9142.

Cerqueiro, G., Ongena, S., and Roszbach, K. (2015). Collateralization, bank loan rates and monitoring. *Journal of Finance*, Forthcoming.

Degryse, H., Kim, M., and Ongena, S. (2009). *Microeconometrics of banking: methods, applications, and results*. Oxford University Press.

Fecht, F., Nyborg, K., Rocholl, J., and Woschitz, J. (2015). Collateral, central bank repos, and systemic arbitrage. *Swiss Finance Institute Research Paper*, forthcoming.

Stein, J. C. (2013). Liquidity regulation and central banking. In *Speech at the" Finding the Right Balance" 2013 Credit Markets Symposium sponsored by the Federal Reserve Bank of Richmond, Charlotte, North Carolina*.