2019 EBA Policy Research Workshop

Determinants of banks' liquidity: a French perspective on interactions between market and regulatory requirements[1]

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[1] The opinions expressed in the paper represent the authors' personal opinions and do not necessarily reflect the views of the ACPR - Banque de France or their staff.

Outline

Motivation

The GFC put banks' liquidity risks to the forefront

- Increased attention from the supervisors to stressed banking liquidity but little has been done so far in terms of modelling
  - Main focus on solvency ratios in the literature
  - No agreed and widespread model integrating both components
- Need to better capture some interactions involving liquidity risks: market vs. funding liquidity; solvency and liquidity risks
- Discussion in the economic literature and among regulators regarding the use of liquidity buffers: see Goodhart (2011)'s 'last taxi' argument for the use of banks' liquid assets in crisis times
- This paper: Research questions
  - Liquidity shocks and liquidity ratio: What are the determinants of banks' liquidity ratios?
  - Are banks able to steer their liquidity ratio or does the level of their liquidity depend on the external financial environment?

This paper: contribution

- Estimation of banks' liquidity ratios taking into account interactions between market and funding liquidity (Brunnermeier and Pedersen, 2009)
  - Theoretical contribution: Partial equilibrium model including both liquidity and solvency: banks' profit maximisation under both constraints
  - Empirical contribution: simultaneous equations and IRFs
- Possible operational use as a Top-Down liquidity ST, use of a truly binding liquidity ratio (in contrast with Van den End and De Hann, 2011; Tabak, 2013; Cont et al., 2019)
- Interactions between liquidity and solvency from a quantity perspective (vs. price perspective: funding costs, BIS, 2015; Schmitz et al., 2019)

This paper: Main findings

- Positive effect of the **solvency** ratio on the **liquidity** coefficient
- Negative impact of the **financial risk variables**, only during periods of high **stress**
- Cash net outflows more impacted than the amount of liquid assets by financial risk variables in stress times

Theoretical model

⇒ Objective: determining optimal share of marketable securities in a bank's balance sheet

$Assets = A$		$Liabilities = L$	
L	r^l	D	r^d
G	r^g	K	r^k
$Total = A$		$Total = L = A$	

with the following inequalities: $r^d < r^g < r^l < r^k$

- Maximization of a representative **bank's profit** (Freixas and Rochet, Fraisse et al.)

$$\max_{G,L} \pi = r^l L + r^g G - r^d D - \frac{\gamma}{2}(\sigma_G^2 G^2 + 2\sigma_{GL} GL + \sigma_L^2 L^2) \qquad (1)$$

Theoretical model

- The **balance-sheet** constraint:

$$L + G = K + D \Leftrightarrow D = L + G - K \tag{2}$$

- The **leverage** constraint:

$$K \geq \eta D \tag{3}$$

- The **liquidity** constraint:

$$\beta G + (1 - \beta)\phi(s)G \geq \alpha(s)D \tag{4}$$

  - β the share of marketable securities maturing
  - $\phi(s)$ the fraction of the book value of the assets that are not maturing at $t \rightarrow$ liquidity of the bank's assets
  - $\alpha(s)<1$ the outflow rate on the liabilities

Theoretical model

- 2 possible hypotheses for the definition of G* and L*:
  - In the worst occurences of the state of nature, the liquidity constraint is **binding** and banks **hoard additional liquidity**.

    $\rightarrow$ *When the liquidity constraint is binding (λ>0), the demand for G increases as λ is multiplied by a positive term* $\left(A = \left(\frac{\beta+(1-\beta)\phi}{\alpha} - 1\right) > 0\right)$. *The covariance term σ_{GL} implies that the holdings of G and L are closer.*
  - In the worst occurences of the state of nature, the liquidity constraint is **not binding** and banks may **reduce their liquidity ratio**.

    $\rightarrow$ *In that case, α is small so that L and G are determined by the Markowitz portfolio as the liquidity constraint is not binding.*

From model to data

- 2 conclusions of the model:
  - *(i)* liquidity and solvency are **complementary**: they reinforce each other;
  - *(ii)* banks accumulate liquid assets in crisis times (they exhibit a liquidity hoarding behaviour) but only when the liquidity regulation kicks in.
- The main variables of interest in our empirical model will be:
  - the bank's liquidity ratio;
  - the bank's solvency ratio;
  - a proxy for marketable securities' liquidity $\phi(s)$.

Database

- **Liquidity ratio - solo basis**: Liquidity coefficient as a proxy for LCR

$$Coef\ Liq_{it} = \frac{\sum Weighted\ Liquid\ Assets_{it}}{\sum Weighted\ Net\ Outflows_{it}} \times 100$$

- **Solvency ratio - solo basis**: Risk-weighted capital ratio

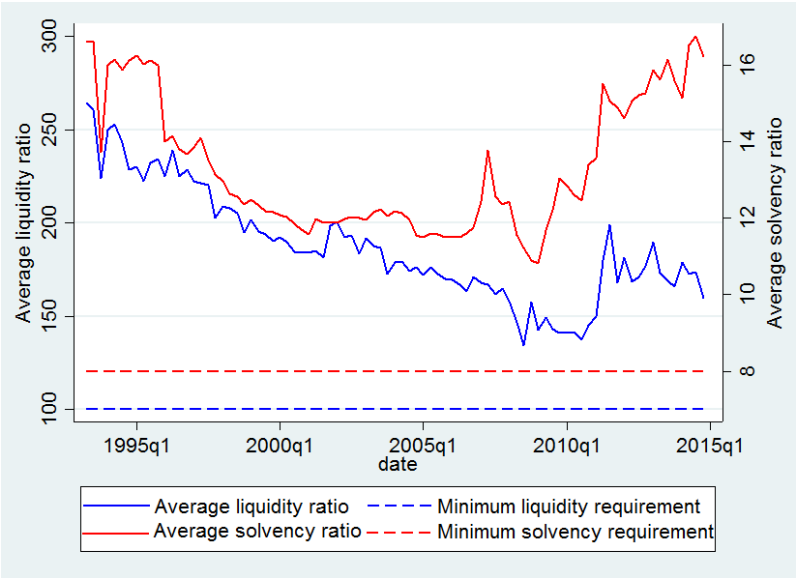
$$Cap\ Ratio_{it} = \frac{Own\ Funds_{it}}{Risk\ Weighted\ Assets_{it}} \times 100$$

- **Bank's balance sheet** variables: ACPR supervisory databases
- **Macroeconomic** variables : public databases (INSEE, Bloomberg)

$\Rightarrow$ Unbalanced panel dataset of 725 banks solo, 102 periods (1993 - 2015) and more than 23,000 observations after cleaning

Descriptive statistics

Figure : Liquidity Coefficient and Solvency Ratio over 1993-2015



- Liquidity coefficient and solvency ratio little binding
- A very large dispersion in the liquidity coefficient
- A more concentrated distribution of the solvency ratio

The liquidity coefficient as a proxy of the LCR

- LCR only reported consistently since its implementation in 2015

  $\rightarrow$ Use of the liquidity coefficient as a proxy

- Main differences between the LCR and the liquidity coefficient:
  - Consolidated vs. solo basis
  - Treatment of intragroup exposures and off-balance sheet items
  - Weights
  - Stricter definition of liquid assets in LCR

- Is the liquidity coefficient a good predictor of the LCR?
  - Analysis of the correlation between LCR and LC
  - Regression of the LCR over the LC components in gross terms

Econometric approach: Simultaneous equations

- Dependent variables: $\begin{cases} \textbf{Liquidity coefficient} \\ \textbf{Solvency ratio} \end{cases}$

- Liquidity and solvency ratios are endogenous: use of 2SLS regressor

$$Y_{i,t} = \alpha_i + \phi Y_{i,t-1} + \beta X_t + \gamma Z_{i,t-1} + \epsilon_{i,t} \tag{5}$$

with:

- Y a vector of two endogenous variables (liquidity coefficient and solvency ratio);
- X a vector of explanatory variables including aggregate financial risk variables, macroeconomic variables and dummy variables;
- Z a vector of bank-specific variables;
- α_i a vector of individual bank fixed effects;
- ϵ the vector of error terms.
- i referring to bank i and t to time t.

Results of the simultaneous equations estimation

VARIABLES	Liquidity ratio	Solvency ratio
Liquidity ratio (t-1)	0.625***	0.000***
	(0.005)	(0.000)
Solvency ratio (t-1)	5.202***	0.891***
	(0.643)	(0.003)
Vix	-0.124	-0.000
	(1.012)	(0.005)
Interbank	-4.659	-0.064
	(13.505)	(0.062)
GDP	-10.944**	-0.050**
	(5.109)	(0.023)
Inflation	3.806	-0.119**
	(10.854)	(0.050)
Size (t-1)	-281.002**	-0.163
	(129.351)	(0.594)
$\text{Retai}_{i,t-1}$	0.214	-0.003
	(0.710)	(0.003)
$\text{RoE}_{i,t-1}$		0.002
		(0.003)
2010 Dummy_t	-82.922***	0.552***
	(22.240)	(0.102)
Constant	935.021**	1.152
	(374.204)	(1.719)
Bank Fixed effects	Yes	Yes
Observations	23,264	23,264
Adjusted R-squared	0.767	0.947

High level of AR coefficient for solvency (but no unit root)
Positive impact of solvency on liquidity
→ Evidence of interaction between solvency and liquidity

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Negative impact of GDP growth

Negative impact of π (solvency only)

Negative impact of size (liquidity only)

Impact of financial variables during high stress periods

VARIABLES	Liquidity ratio	Solvency ratio
Liquidity ratio$_{i,t-1}$	0.625***	0.000***
	(0.005)	(0.000)
Solvency ratio$_{i,t-1}$	5.186***	0.891***
	(0.643)	(0.003)
Vix	0.785	-0.003
	(1.379)	(0.006)
Interbank$_t$	-14.631	-0.362***
	(22.555)	(0.104)
d_high_vix$_t$	277.724*	1.434*
	(162.366)	(0.746)
d_high_interbank$_t$	423.997**	-1.903**
	(171.167)	(0.787)
Vix * d_high_vix	**-7.330***	**-0.025**
	(4.075)	**(0.019)**
Interbank * d_high_interbank	**-151.619****	**1.166*****
	(75.753)	**(0.348)**
Macroeconomic variables	Yes	Yes
Bank controls	Yes	Yes
2010 Dummy	Yes	Yes
Constant	Yes	Yes
Bank Fixed Effects	Yes	Yes
Observations	23,264	23,264
Adjusted R-squared	0.767	0.947

Obj: Interaction terms to capture nonlinear effects

Liquidity negatively impacted by both financial variables
Solvency positively impacted by interbank spread

CCL: Nonlinear relationship between financial variables and regulatory ratios
→ Stronger during high stress periods

Various robustness tests

- Less liquid / less capitalised banks
  - No significant impact of the financial variables
- Contribution of a banking group membership
  - Positive impact of spread on solvency if group membership
  - Negative impact of financial variables if excess of liq/cap for the group
- Heterogeneous effects: the effect of banks' type
  - Higher sensitivity of the solvency ratio of commercial banks
- Disentangling numerator and denominator of the liquidity coefficient
  - Liquidity stress transmission through unstable liabilities

Orthogonalised Impulse-Response Functions from VAR(1)

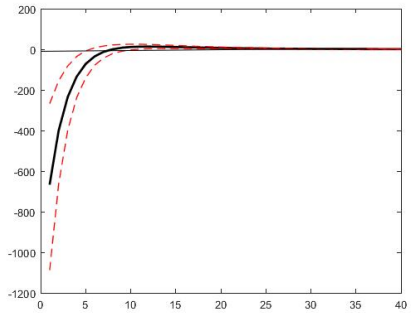


Figure : Spread shock (400bp) on liquidity

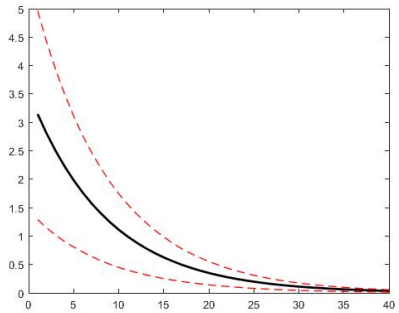


Figure : Spread shock (400bp) on solvency

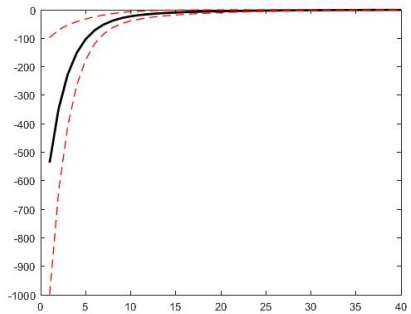


Figure : Vix shock (80bp) on liquidity

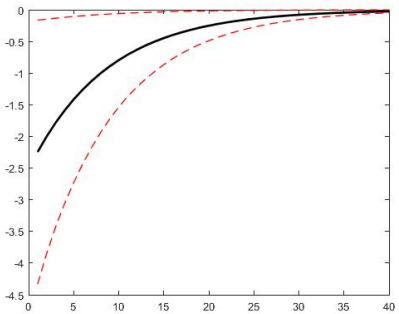


Figure : Vix shock (80bp) on solvency

→ **Liquidity ratio negatively** affected by the **VIX/spreads** shocks
→ **Solvency ratio negatively** affected by the **VIX** shock, but **positively** affected by the **spreads** shock

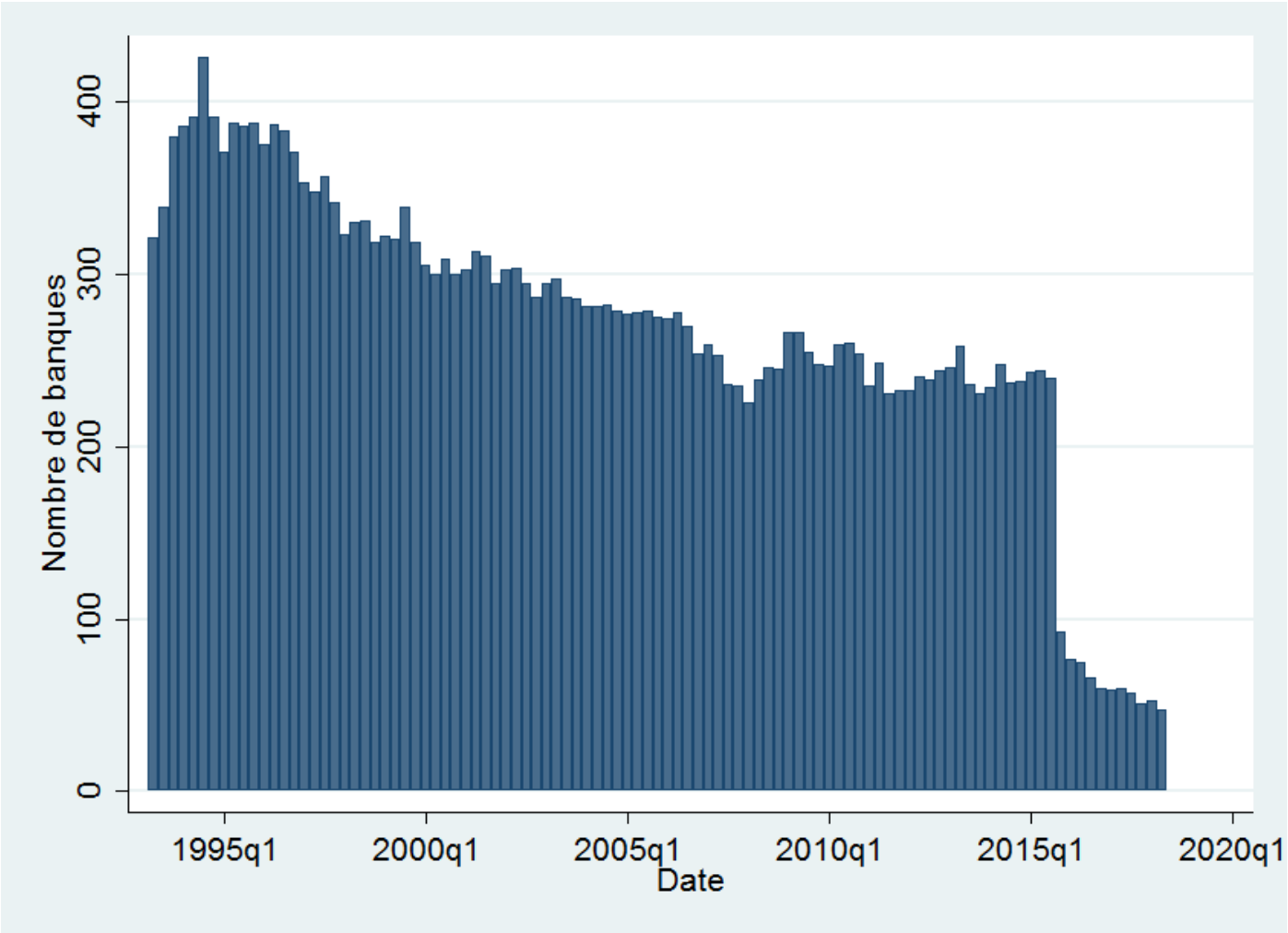
Conclusion

- Evidence of a **one-way relationship from solvency to liquidity ratios**;
- Negative impact of the **financial variables**, only when interacted with **high risk aversion periods** and **large spread periods**, with a larger adverse effect on liquidity than solvency;
- Financial risk channel materialising mostly on the liability side (net cash outflows);
- No evidence of liquidity management at group level, despite evidence of capital management;
- Commercial banks are the most affected by the financial risk variables, mainly on the solvency side.

Conclusion

- Possible extensions:
  - Adding some dynamics in our model by including funding costs and modelling the price impact of banks' fire sales;
  - Conducting a panel estimation based on LCR data once the series are long enough to compare the effects of financial stress across countries;

Annexes


Nombre de banques
0
100
200
300
400
1995q1
2000q1
2005q1
2010q1
2015q1
2020q1
Date