

BRANDEIS INTERNATIONAL  
BUSINESS SCHOOL

# Inspecting Basel III

Stephen G. Cecchetti and Anil K Kashyap

[www.moneyandbanking.com](http://www.moneyandbanking.com)

WORLD  
READY

# Banks: Activities & Externalities

- Credit transformation: too much risk
- Liquidity transformation: too little liquidity
- Maturity transformation: too big a duration mismatch

# Banks:

## Activities, Externalities & Responses

- Credit transformation: too much risk  
⇒ capital requirements
- Liquidity transformation: too little liquidity  
⇒ liquidity coverage ratio
- Maturity transformation: too big a duration mismatch  
⇒ net stable funding ratio

# The Basel III Standards

- 1) Leverage Ratio (Lev)
- 2) Risk-Weighted Capital Ratio (Risk)
- 3) Liquidity Coverage Ratio (LCR)
- 4) Net Stable Funding Ratio (NSFR)

# Capital Requirements: Weighted & Unweighted

Purpose: Increase individual institution resilience and reduce moral hazard created by the combination of limited liability, deposit insurance and implicit government guarantees.

- Risk weighted (Risk):  
More risk requires bigger buffers.
- Unweighted leverage ratio (Lev):  
Potential underestimation of risk, require a minimum.

# Liquidity Requirements: LCR

To promote short-term resilience of a bank's liquidity risk profile, the Basel Committee developed the Liquidity Coverage Ratio (LCR). This standard aims to ensure that a bank has an adequate stock of unencumbered high quality liquid assets (HQLA) which consists of cash or assets that can be converted into cash at little or no loss of value in private markets to meet its liquidity needs for a 30 calendar day liquidity stress scenario.

The LCR has two components:

- (a) the value of the stock of HQLA; and
- (b) total net cash outflows,

and is expressed as:

$$\frac{\text{Stock of HQLA}}{\text{Total net cash outflows over the next 30 calendar days}} \geq 100\%$$

# Liquidity Requirements: LCR

To promote short-term resilience of a bank's liquidity risk profile, the Basel Committee developed the Liquidity Coverage Ratio (LCR). This standard aims to ensure that a bank has an adequate stock of unencumbered high quality liquid assets (HQLA) which consists of cash or assets that can be converted into cash at little or no loss of value in private markets to meet its liquidity needs for a 30 calendar day liquidity stress scenario.

The LCR has two components:

- (a) the value of the stock of HQLA; and
- (b) total net cash outflows,

and is expressed as:

$$\frac{\text{Stock of HQLA}}{\text{Total net cash outflows over the next 30 calendar days}} \geq 100\%$$

*Loosely speaking:*

*Match runnable liabilities with liquid assets*

# Liquidity Requirements: NSFR

9. The NSFR is defined as the amount of available stable funding relative to the amount of required stable funding. This ratio should be equal to at least 100% on an ongoing basis. "*Available stable funding*" is defined as the portion of capital and liabilities expected to be reliable over the time horizon considered by the NSFR, which extends to one year. The amount of such stable funding *required* ("Required stable funding") of a specific institution is a function of the liquidity characteristics and residual maturities of the various assets held by that institution as well as those of its off-balance sheet (OBS) exposures.

$$\frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} \geq 100\%$$



# Liquidity Requirements: NSFR

9. The NSFR is defined as the amount of available stable funding relative to the amount of required stable funding. This ratio should be equal to at least 100% on an ongoing basis. "Available stable funding" is defined as the portion of capital and liabilities expected to be reliable over the time horizon considered by the NSFR, which extends to one year. The amount of such stable funding required ("Required stable funding") of a specific institution is a function of the liquidity characteristics and residual maturities of the various assets held by that institution as well as those of its off-balance sheet (OBS) exposures.

$$\frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} \geq 100\%$$

Loosely speaking:

Fund illiquid assets with stable funding

# Basel Committee on Banking Supervision reforms - Basel III

Strengthens microprudential regulation and supervision, and adds a macroprudential overlay that includes capital buffers.

Capital					Liquidity	
Pillar 1		Pillar 2		Pillar 3		
Capital	Risk coverage	Containing leverage	Risk management and supervision	Market discipline		
All Banks	<p><b>Quality and level of capital</b> Greater focus on common equity. The minimum will be raised to 4.5% of risk-weighted assets, after deductions.</p> <p><b>Capital loss absorption at the point of non-viability</b> Contractual terms of capital instruments will include a clause that allows – at the discretion of the relevant authority – write-off or conversion to common shares if the bank is judged to be non-viable. This principle increases the contribution of the private sector to resolving future banking crises and thereby reduces moral hazard.</p> <p><b>Capital conservation buffer</b> Comprising common equity of 2.5% of risk-weighted assets, bringing the total common equity standard to 7%. Constraint on a bank's discretionary distributions will be imposed when banks fall into the buffer range.</p> <p><b>Countercyclical buffer</b> Imposed within a range of 0-2.5% comprising common equity, when authorities judge credit growth is resulting in an unacceptable build up of systematic risk.</p>	<p><b>Securitisations</b> Strengthens the capital treatment for certain complex securitisations. Requires banks to conduct more rigorous credit analyses of externally rated securitisation exposures.</p> <p><b>Trading book</b> Significantly higher capital for trading and derivatives activities, as well as complex securitisations held in the trading book. Introduction of a stressed value-at-risk framework to help mitigate procyclicality. A capital charge for incremental risk that estimates the default and migration risks of unsecuritised credit products and takes liquidity into account.</p> <p><b>Counterparty credit risk</b> Substantial strengthening of the counterparty credit risk framework. Includes: more stringent requirements for measuring exposure; capital incentives for banks to use central counterparties for derivatives; and higher capital for inter-financial sector exposures.</p> <p><b>Bank exposures to central counterparties (CCPs)</b> The Committee has proposed that trade exposures to a qualifying CCP will receive a 2% risk weight and default fund exposures to a qualifying CCP will be capitalised according to a risk-based method that consistently and simply estimates risk arising from such default fund.</p>	<p><b>Leverage ratio</b> A non-risk-based leverage ratio that includes off-balance sheet exposures will serve as a backstop to the risk-based capital requirement. Also helps contain system wide build up of leverage.</p>	<p><b>Supplemental Pillar 2 requirements.</b> Address firm-wide governance and risk management; capturing the risk of off-balance sheet exposures and securitisation activities; managing risk concentrations; providing incentives for banks to better manage risk and returns over the long term; sound compensation practices; valuation practices; stress testing; accounting standards for financial instruments; corporate governance; and supervisory colleges.</p>	<p><b>Revised Pillar 3 disclosures requirements</b> The requirements introduced relate to securitisation exposures and sponsorship of off-balance sheet vehicles. Enhanced disclosures on the detail of the components of regulatory capital and their reconciliation to the reported accounts will be required, including a comprehensive explanation of how a bank calculates its regulatory capital ratios.</p>	<p><b>Global liquidity standard and supervisory monitoring</b></p> <p><b>Liquidity coverage ratio</b> The liquidity coverage ratio (LCR) will require banks to have sufficient high-quality liquid assets to withstand a 30-day stressed funding scenario that is specified by supervisors.</p> <p><b>Net stable funding ratio</b> The net stable funding ratio (NSFR) is a longer-term structural ratio designed to address liquidity mismatches. It covers the entire balance sheet and provides incentives for banks to use stable sources of funding.</p> <p><b>Principles for Sound Liquidity Risk Management and Supervision</b> The Committee's 2008 guidance <i>Principles for Sound Liquidity Risk Management and Supervision</i> takes account of lessons learned during the crisis and is based on a fundamental review of sound practices for managing liquidity risk in banking organisations.</p> <p><b>Supervisory monitoring</b> The liquidity framework includes a common set of monitoring metrics to assist supervisors in identifying and analysing liquidity risk trends at both the bank and system-wide level.</p>
	SIFIs	<p>In addition to meeting the Basel III requirements, global systemically important financial institutions (SIFIs) must have higher loss absorbency capacity to reflect the greater risks that they pose to the financial system. The Committee has developed a methodology that includes both quantitative indicators and qualitative elements to identify global systemically important banks (SIBs). The additional loss absorbency requirements are to be met with a progressive Common Equity Tier 1 (CET1) capital requirement ranging from 1% to 2.5%, depending on a bank's systemic importance. For banks facing the highest SIB surcharge, an additional loss absorbency of 1% could be applied as a disincentive to increase materially their global systemic importance in the future. A consultative document was published in cooperation with the Financial Stability Board, which is coordinating the overall set of measures to reduce the moral hazard posed by global SIFIs.</p>				







# The Basel III Standards

- 1) Leverage Ratio (Lev)
- 2) Risk-Weighted Capital Ratio (Risk)
- 3) Liquidity Coverage Ratio (LCR)
- 4) Net Stable Funding Ratio (NSFR)

Do we need all *four*?  
Which ones matter *when* and for *which* banks?

# How can we compare them?

On-balance  
sheet assets

Generic Bank Balance Sheet	
Assets	Liabilities
$\left. \begin{array}{c} A_1 \\ A_2 \\ \vdots \\ A_n \end{array} \right\}$	$\left. \begin{array}{c} L_1 \\ L_2 \\ \vdots \\ L_k \end{array} \right\}$
	$E$

On-balance  
sheet liabilities

Equity

Also there are off-balance sheet “exposures” [ $OBS_1, \dots, OBS_j$ ]

All four requirements can be written as:

$$\sum a_i A_i + \sum b_j OBS_j \quad \boxed{?} \quad \sum c_k L_k + dE$$

(The OBS can appear on either side of the balance sheet)

Weighted Average  
of Assets

>  
=  
<

Weighted Average  
of Liabilities



All four requirements can be written as:

$$\sum a_i A_i + \sum b_j OBS_j \quad \boxed{?} \quad \sum c_k L_k + dE$$

(The OBS can appear on either side of the balance sheet)

$$\text{Lev:} \quad \sum A_i + \sum b_{1j} OBS_j \leq \frac{1}{\lambda} E$$

$$\text{Risk:} \quad \sum a_{1i} A_i + \sum b_{2j} OBS_j \leq \frac{1}{\rho} E$$

Notice all four requirements can be written as:

$$\sum a_i A_i + \sum b_j OBS_j \quad \boxed{?} \quad \sum c_k L_k + dE$$

(The OBS can appear on either side of the balance sheet)

Lev:  $\sum A_i + \sum b_{1j} OBS_j \leq \frac{1}{\lambda} E$

Risk:  $\sum a_{1i} A_i + \sum b_{2j} OBS_j \leq \frac{1}{\rho} E$

LCR:  $\sum a_{2i} A_i - \sum b_{3j} OBS_j \geq \sum c_{1k} L_k$

NSFR:  $\sum a_{3i} A_i + \sum b_{4j} OBS_j \leq \sum c_{2k} L_k + E$

Notice all four requirements can be written as:

$$\sum a_i A_i + \sum b_j OBS_j \quad \boxed{?} \quad \sum c_k L_k + dE$$

(The OBS can appear on either side of the balance sheet)

$$\text{Lev:} \quad \sum A_i + \sum b_{1j} OBS_j \leq \frac{1}{\lambda} E$$

$$\text{Risk:} \quad \sum a_{1i} A_i + \sum b_{2j} OBS_j \leq \frac{1}{\rho} E$$

$$\text{LCR:} \quad \sum a_{2i} A_i - \sum b_{3j} OBS_j \geq \sum c_{1k} L_k$$

$$\text{NSFR:} \quad \sum a_{3i} A_i + \sum b_{4j} OBS_j \leq \sum c_{2k} L_k + E$$

$$\text{BS Identity} \quad \sum A_i = \sum L_k + E$$

# Capital Requirements: Simplest Case

Assets (A)	Liabilities
Safe Assets	Debt
Risky Assets = $\phi A$	Equity

OBS Exposure: Total =  $\theta A$

Risky =  $\psi A$

} Each is a fraction of total on-balance-sheet assets

# Capital Requirements: Simplest Case

Assets (A)	Liabilities
Safe Assets	Debt
Risky Assets = $\phi A$	Equity

OBS Exposure: Total =  $\theta A$

Risky =  $\psi A$

Each is a fraction of total on-balance-sheet assets

$$E \geq \lambda(A + \theta A) = \lambda(1 + \theta)A$$

Lev:  $E \geq$  fraction of total exposure

$$E \geq \rho(\phi A + \psi A) = \rho(\phi + \psi)A$$

Risk:  $E \geq$  fraction of RWA

## Lev binds when:

$$3) \lambda > \rho \frac{(\phi + \psi)}{(1 + \theta)} \quad \text{i.e., } \lambda > \rho \frac{\text{Total Risk Weighted Assets}}{\text{Total Leverage Exposure}}$$

Bank Type	$\phi$ <u>RWA</u> TA	$\theta$ OBS Total	$\psi$ OBS Risky	Break- even Lev if $\rho=12$	Break-even $\rho$ if Lev= 3
Investment banking	0.49	2.23	0.41	3.35	10.76
Retail/commercial banking	0.26	0.13	0.09	3.72	9.68
Specialized lender	0.42	0.10	0.06	5.24	6.87
Universal banking (retail/commercial and investment banking)	0.35	0.44	0.17	4.30	8.38
Building Societies (ex Nationwide)	0.26	0.05	0.03	3.24	11.11

# Capital: Findings

- 1) Only one of the ratios will bind at a time
- 2) Lev will bind for banks with:
  - low risk weights ( $\phi$ )
  - large off balance sheet assets exposures ( $\theta$ )
- 3) OBS positions sticky, but  $\phi$  can jump in stress tests  
→ A bank can move from Lev to Risk binding,  
but not vice versa

# Capital: Findings/**Conjectures**

- 1) Only one of the ratios will bind at a time
- 2) Lev will bind for banks with:
  - low risk weights ( $\phi$ )
  - large off balance sheet assets exposures ( $\theta$ )
- 3) OBS positions sticky, but  $\phi$  can jump in stress tests  
→ A bank can move from Lev to Risk binding,  
but not vice versa
- 4) **Can a bank use financial engineering to alter  $\phi$ ?  
Does that make the leverage ratio bind?**



# Capital: Findings/**Conjectures**

- 1) Only one of the ratios will bind at a time
- 2) Lev will bind for banks with:
  - low risk weights ( $\phi$ )
  - large off balance sheet assets exposures ( $\theta$ )
- 3) OBS positions sticky, but  $\phi$  can jump in stress tests  
→ A bank can move from Lev to Risk binding,  
but not vice versa
- 4) **Can a bank use financial engineering to alter  $\phi$ ?  
Does that make the leverage ratio bind?**
- 5) Liquidity stress tests don't change any of this ( $\phi, \theta, \psi$ )

# Liquidity Requirements: Special Case

- 1) no off balance sheet exposures
- 2) assets either perfectly liquid or illiquid
- 3) liabilities either totally runnable or stable

Assets	Liabilities
Liquid	Runnable
Illiquid	Stable

# Liquidity Requirements: Special Case

- 1) no off balance sheet exposures
- 2) assets either perfectly liquid or illiquid
- 3) liabilities either totally runnable or stable

Assets	Liabilities
Liquid	Runnable
Illiquid	Stable

$$\begin{array}{l} \text{LCR:} \quad \text{Liquid Assets} \geq \text{Runnable Liabilities} \\ \text{NSFR:} \quad \text{Illiquid Assets} \leq \text{Stable Liabilities} \end{array}$$

# Rewriting Liquidity Regulations

- LCR      Liquid – Runnable  $\geq 0$
- NSFR      Stable – Illiquid  $\geq 0$
- Identity      Total Assets = Total Liabilities  $\Rightarrow$   
Liquid + Illiquid = Runnable + Stable

# Rewriting Liquidity Regulations

- LCR            Liquid – Runnable             $\geq 0$
- NSFR          Stable – Illiquid             $\geq 0$
  
- Identity      Total Assets = Total Liabilities  $\Rightarrow$   
                  Liquid + Illiquid = Runnable + Stable

$$\underset{\text{LCR}}{\text{Liquid} - \text{Runnable}} = \text{Stable} - \underset{\text{NSFR}}{\text{Illiquid}}$$

In this special case the LCR & NSFR are identical!

# Liquidity Requirements: General Case

Assets	Liabilities
Liquid <small>(cover runnable)</small> ( $H$ )	Runnable ( $D$ )
Illiquid <small>(require stable)</small> ( $R$ )	Stable ( $B$ )
	Equity ( $E$ )
<b>Other Assets (<math>OA</math>)</b>	<b>Other Liabilities (<math>OL</math>)</b>

Off-balance sheet exposures:  $OBS_L$  and  $OBS_N$

# Liquidity Requirements: General Case

Assets	Liabilities
Liquid <small>(cover runnable)</small> ( $H$ )	Runnable ( $D$ )
Illiquid <small>(require stable)</small> ( $R$ )	Stable ( $B$ )
	Equity ( $E$ )
Other Assets ( $OA$ )	Other Liabilities ( $OL$ )

Off-balance sheet exposures:  $OBS_L$  and  $OBS_N$

$$\text{LCR: } H \geq D + OBS_L$$

$$\text{NSFR: } B + E \geq R + OBS_N$$

# Liquidity Requirements: General Case

Recall the balance sheet identity:

$$H + R + OA = D + B + E + OL$$

$$\Rightarrow H - D + (OA - OL) = B + E - R$$

$$\text{LCR: } H - D \geq \text{OBS}_L$$

$$\text{NSFR: } H - D \geq \text{OBS}_N + OL - OA$$

*LCR binds if and only if:*

$$\text{OBS}_L + OA \geq \text{OBS}_N + OL$$



# What are *Other Assets* (OA) and *Other Liabilities* (OL)?

- OA: assets that are neither fully HQLA nor fully require stable funding
  - recourse mortgages
  - loans w/ risk weight < 35%

count as 0 for the LCR and 0.65 for the NSFR
- OL: liabilities that are neither completely runnable nor entirely available as stable funding
  - unsecured wholesale funding with 1 to 6 month maturity

count 0 for LCR & provide 0 stable funding in the NSFR

# Example 1: LCR binds

## Assets

		LCR	NSFR	OA Weight	OA
HQLA	15	100%	5%	-5%	-0.8
Mortgages	85	0	65%	35%	29.6
Total	100	15	56		<b>28.8</b>

## Liabilities

		LCR	NSFR	OL Weight	OL
Demand Deposits	60	5%	95%	0%	0
Wholesale	30	<b>40%</b>	0%	<b>60%</b>	18
Equity	10	0	100%	0%	0
Total	100	15	57		<b>18</b>

**LCR just met (100%) & NSFR slack (102%)**  
 (large mortgage book & modest wholesale funding)

# Example 2: NSFR binds

## Assets

		LCR	NSFR	OA Weight	OA
HQLA	25	100%	5%	-5%	-1.3
Mortgages	75	0	65%	35%	26.3
<b>Total</b>	<b>100</b>	<b>25</b>	<b>50</b>		<b>25</b>

## Liabilities

		LCR	NSFR	OL Weight	OL
Demand Deposits	20	5%	95%	0%	0
<b>Wholesale</b>	<b>60</b>	<b>40%</b>	<b>0%</b>	<b>60%</b>	<b>36</b>
Equity	20	0	100%	0%	0
<b>Total</b>	<b>100</b>	<b>25</b>	<b>39</b>		<b>36</b>

LCR just met (100%) & **NSFR binding (78%)**  
 (large wholesale funding)

# Implications of OA and OL

- Large mortgage businesses means large OA:  
**OA > OL → LCR binds**

# Implications of OA and OL

- Large mortgage businesses means large OA:  
**OA > OL → LCR binds**
- Large wholesale funding >30 days means large OL:  
**OL > OA → NSFR binds**

(Can't compute OL & OA from publicly reported data)

# What about OBS Exposures?

- $OBS_L$  comes from the **net** cash inflows and outflows over the next 30 days
  - Big outflows are committed lines of credit, derivative outflows (from downgrades of collateral or valuation changes)
  - Inflows are derivative receipts, funds from collateral swaps

# What about OBS Exposures?

- $OBS_L$  comes from the **net** cash inflows and outflows over the next 30 days
  - Big outflows are committed lines of credit, derivative outflows (from downgrades of collateral or valuation changes)
  - Inflows are derivative receipts, funds from collateral swaps
- $OBS_N$  comes from required stable funding associated with OBS exposures
  - Undrawn credit lines to non-financial entities weights <100%
  - Net unmargined derivatives

# What about OBS Exposures?

- $OBS_L$  comes from the **net** cash inflows and outflows over the next 30 days
  - Big outflows are committed lines of credit, derivative outflows (from downgrades of collateral or valuation changes)
  - Inflows are derivative receipts, funds from collateral swaps
- $OBS_N$  comes from required stable funding associated with OBS exposures
  - Undrawn credit lines to non-financial entities weights <100%
  - Net unmargined derivatives
- Conjecture that the OBS not fully independent of OL & OA
  - large wholesale funding might naturally be found along with lots of credit lines



# Calibrating $OBS_L + OA$ vs. $OBS_N + OL$

Small set of UK banks	Universal Banks	Building Societies
$OBS_L$ outflows	5.7%	3.4%
$OBS_L$ inflows	(0.9%)	(0.0%)
OA	23.0%	22.0%
$(OBS_L \text{ net}) + OA$	27.8%	25.4%
$OBS_N$	4.0%	1.0%
OL	13.7%	7.0%
$OBS_N + OL$	17.7%	8.0%
NSFR Reporting Coverage (diff)	94.8%	98.1%
$OL' = OL + (1 - \text{diff})$	18.9%	8.9%
$OBS_N + OL'$	22.9%	9.9%
	27.8% > [17.7, 22.9]	25.5% >> [8.0, 9.9]

# Calibrating $OBS_L + OA$ vs. $OBS_N + OL$

Small set of UK banks	Universal Banks	Building Societies
$OBS_L$ outflows	5.7%	3.4%
$OBS_L$ inflows	(0.9%)	(0.0%)
OA	23.0%	22.0%
$(OBS_L \text{ net}) + OA$	27.8%	25.4%
$OBS_N$	4.0%	1.0%
OL	13.7%	7.0%
$OBS_N + OL$	17.7%	8.0%
NSFR Reporting Coverage (diff)	94.8%	98.1%
$OL' = OL + (1 - \text{diff})$	18.9%	8.9%
$OBS_N + OL'$	22.9%	9.9%
	27.8% > [17.7, 22.9]	25.5% >> [8.0, 9.9]

For these cases: LCR binding implies NSFR binding

# Liquidity: Findings

- 1) LCR seems to bind, but for different reasons for different types of banks.

# Liquidity: Findings/**Conjectures**

- 1) LCR seems to bind, but for different reasons for different types of banks.
- 2) **Liquidity stress tests change LCR run-off rates. This can't make the NSFR bind (reduces OL).**

# Liquidity: Findings/**Conjectures**

- 1) LCR seems to bind, but for different reasons for different types of banks.
- 2) **Liquidity stress tests change LCR run-off rates. This can't make the NSFR bind (reduces OL).**
- 3) Conditions governing LCR vs NSFR distinct from those governing Lev vs Risk.

*Liquidity & capital regulations are separate.*

# Conclusions

- 1) Only 2 of 4 ratios bind at a time  
NSFR may not be doing what was envisaged
- 2) Stress tests can flip which capital requirement binds,  
but not which liquidity requirement binds
- 3) Separation principle appears to hold for  
the capital and liquidity requirements

# Conclusions

- 1) Only 2 of 4 ratios bind at a time.  
NSFR may not be doing what was envisaged
- 2) Stress tests can flip which capital requirement binds,  
but not which liquidity requirement binds
- 3) Separation principle appears to hold for  
the capital and liquidity requirements

Is this what we want?

BRANDEIS INTERNATIONAL  
BUSINESS SCHOOL

# Inspecting Basel III

Stephen G. Cecchetti and Anil K Kashyap

[www.moneyandbanking.com](http://www.moneyandbanking.com)

WORLD  
READY