Liquidity and Stress Testing

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Potential conflicts of interest at www.stanford.edu/~duffie/
Bear Stearns’ Liquidity Pool ($ billions)

Data Source: Cox (2008)
Liquidity Stress Testing

• Objective: To test the ability of banks to meet near-term payment obligations, under funding loss and other counterparty cash drains.

• Liquidity loss can cause failure for almost any “well capitalized” bank, absent central bank LOLR.

• Place emphasis on central-bank-eligible unencumbered assets, bank-level and system-wide.

• Consider a “resolution liquidity” modeling.
Test Approaches

• Bank-internal liquidity risk models (e.g. R. Fiedler).
• Scenario tests, such as the Basel Liquidity Coverage Ratio (LCR) test, are based on deterministic stresses.
• Balance-sheet liquidity measures (e.g. Brunnermeier-Gorton-Krishnamurthy, NSFR) are “health indicators.”
• Probabilistic or dynamic stress models, such as RAMSI, are richer and highly model dependent.
• RAMSI and the Basel Net Stable Funding Ratio are based on short-run capital sufficiency, not cash flows.
Sources of Liquidity Stress

• Scheduled contractual gross cash outflows.
• Counterparty runs (deposit runs, cash hoarding, drawing on lines, prime brokerage runoff, “extra” collateral calls, ...)
• Lost access to funding: runoff, haircut increases, closure of interbank credit market, payment-settlement infrastructure failure (e.g. BONY on 9/11).
• Correlated shocks to prices and bid-ask spreads.
• Signaling: discretionary cash flows to customers.
• Requirement to continue passing liquidity stress test!
Lehman's tri-party repo book

Source: Copeland, Martin, Walker (2011) FRBNY

$176.8 billion

Prime Broker $56.4b

Prime brokerage liquidity loss
- New York $44.8 billion
- London $17.6 billion

Conduit finance roll off ($8.8 billion)
Derivatives collateral loss ($7.3 billion)
Debt maturing/buyback ($5.4 billion)
Repo haircut widening ($4.0 billion)
Other ($3.4 billion)

Duffie (2011)  Data: Morgan Stanley-FRBNY FCIC
Tiered Liquidity Sources

- Unencumbered assets (cash, pledgeable assets).
- Rolled over and new funding (not reliable).
- Drawing on lines and derivatives upfronts (not reliable).
- Emergency cash capital infusions (CoCos don’t apply here, liquidity equity puts might work).
- Fire sales.
- Merger.
- Nationalization.
- Failure resolution liquidity (stays, DIP financing).
Liquidity Alerts

- “Unencumbered” assets can be false (e.g. Valukas).
- Funding markets can “close” due to adverse selection.
- Contractual claims to cash can fail (e.g. repo, margins).
- Changes in clearing agreements are hard to refuse.
- Prime brokers rely on customers to fund each other.
- Typical metrics do not cover intra-day cash drains.
- Section 23a liquidity to a broker dealer is limited.
- CCP default guarantee fund calls are unlimited in cases.
- Cash hoarding has network externalities.
Liquidity Coverage Ratio > 100%

**Numerator**

**Cash sources**
- Unencumbered assets.
- Liquidity and risk based haircuts.
- At most 40% Level 2.

**Denominator**

**Cash sinks**
- Total net cash outflows over 30 calendar days.
- Outflows – Min \{inflows; 75% of outflows\}.
- Tabular run/draw rates.
- 3-notch downgrade impact.
LCR Alerts

• LCR tests net cash at 30 days, not before (R. Fiedler).
• No haircut on Basel 0%-weight “liquid” government securities.
• As little as 5% of “stable” deposits are assumed to run.
• Other runoff ratios seem arbitrary or “negotiated.”
• “Other contingent funding obligations” left up to nation (MMF support, derivatives margin,…).
• Prime brokerage liquidity risk is not well covered.
• Repos assumed not to fail.
Net Stable Funding Ratio > 100%

**Numerator**

- Weighted funding
  - Tier 1&2 capital (100%)
  - Preferred stock > 1 yr.
  - Liabilities >1 yr.
  - Stable deposits (90%)
  - Other deposits (80%)
  - Non-financial wholesale funding (50%)
  - Other funding (0%)

**Denominator**

- Weighted assets (weights based on liquidity and encumbrance)
  - Cash 0%.
  - Unencumbered gold 50%.
  - . . . .
  - Encumbered loans 100%.
Other Basel III Liquidity Metrics

- Contractual maturity mismatch.
- Concentration of funding (by provider, instrument, and currency).
- Available unencumbered assets.
- LCR by significant currency.
- Market-related monitoring tools (e.g. CDS).
RAMSI Model Architecture

Credit, market and income risk

UK banks’ balance sheets

Case-side (“market liquidity risk”)

Liability-side (“funding liquidity risk”)

Network model of UK banks and LCFIs

Macroeconomic and financial shocks

Feedbacks

Effects on bank lending

System assets / loss distributions

Source: Aikman, Alessandri, Eklund, Gai, Kapadia, Martin, Mora, Stern, Willison (BoE).
Total System Assets, Q12: With and Without Liquidity Risk and Feedbacks

Source: Aikman, Alessandri, Eklund, Gai, Kapadia, Martin, Mora, Stern, Willison (BoE).
RAMSI Model Dynamics

Source: Aikman, Alessandri, Eklund, Gai, Kapadia, Martin, Mora, Stern, Willison (BoE).
Closure of Funding Markets: A ‘Danger Zone’ Approach

- Information on individual institutions – as the information on the bank deteriorates, danger zone points accumulate.

- As the score crosses set thresholds, funding markets close to that institution.

Source: Aikman, Alessandri, Eklund, Gai, Kapadia, Martin, Mora, Stern, Willison (BoE).
Continental Illinois: Danger Zone Scores

Source: Aikman, Alessandri, Eklund, Gai, Kapadia, Martin, Mora, Stern, Willison (BoE).