The 49th Annual Monetary Studies Conference

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Liquidity Risk Measurement and Modelling: Evidence from the Trinidad and Tobago Banking System

November 9th, 2017

Dorian M. Noel
The University of the West Indies, St. Augustine, Trinidad
dorian.noel@sta.uwi.edu

Agenda

Motivations

Rationale

- Liquidity is a product of banks:
  - profitability depends on a readily available access to cheap and stable funding sources
  - funding depends on banks' liquidity services that facilitate immediacy of transactions and protect the liquidity value of wealth
- Pre-GFC, liquidity viewed as essentially free - zero liquidity risk
  - Banks did not charge liquidity cost to assets and liabilities
  - Regulators assigned a zero risk-weight for liquidity risk - liquidity was merely a solvency issue (reserve requirements and deposit insurance)
- Post-GFC, greater awareness of the fallacy of the composition - what's micro-prudent need not be macro-prudent
  - Illiquidity of assets coupled with the liquidity promised through liabilities leaves banks vulnerable to runs and financial crises
  - Importance of liquidity transfer pricing (LTP), risk-weighting for liquidity risk and liquidity stress-testing.

Liquidity Risk

Definition and Measurement

- Measuring and quantifying liquidity risk is critical to:
  1. optimal design of micro- and macro-prudential tools and policies (liquidity requirements and liquidity stress-testing) and
  2. efficient management of liquidity risk through LTP.
- But there is no clear consensus on how best to define and measure liquidity and liquidity risk
- The definitional challenge: you know it when you (do not) see it!
  - Systemic Liquidity Risk: the risk of the economy to drain out of liquidity.
  - Bank liquidity risk: the inability to meet obligations under normal business conditions without impairment of financial or reputational capital
    1. **Funding liquidity risk**: the inability to meet obligations with immediacy (Borio and Drehman, 2008)
    2. **Market liquidity risk**: asset sale and borrowing with market impact

Definition and Measurement, cont'd

- No agreed framework on how to measure liquidity risk
- Diamond and Dybvig (1983): maturity transformation activities of banks creates liquidity risk - mismatch between maturities of assets and liabilities quantifies liquidity risk
  - Liquidity Mismatch Index (Brunnermeier, et al. 2012) and funding gaps
  - Liquidity indicators (e.gs., LCR and NSFR, loan-to-deposit ratio and liquidity ratio)
  - Loss distribution approach (e.gs., LVaR and LaR)
  - Fragility measures (e.gs., stress-testing, CoVaR and liquidity shortfall)
- And for market liquidity risk, microstructure transaction cost models (either deterministic or stochastic)
- The measurement challenge: How can we measure (and manage) liquidity risk, especially in a quiescent period?

Banking Sector Liquidity Risk

Data

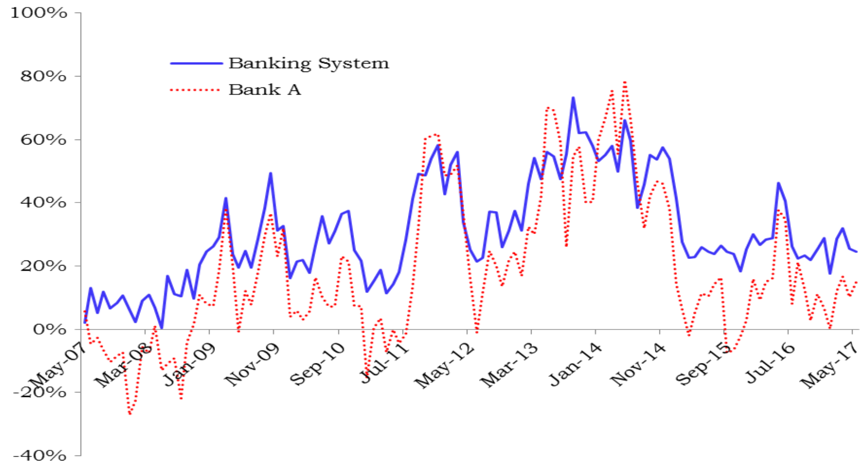
- Aggregated monthly banking system data from the CBTT, which covers the period from May 2007 to May 2017
- Treasury and balance sheet data from a local commercial bank
- Transactions data from the TTSE that covers the period from April 1, 2005 to June 2, 2011, total of 1,230 trading days
  - Focus on only trades in listed securities on the main market
  - Put-through transactions and cancelled trades were removed from the trade dataset
  - Multiple filled orders (7,542) were aggregated to their original single orders

Liquidity Risk Measures

- Tirole (2010) argues that liquidity risk cannot be measured by relying on a single metric
- We apply the following measures:
  - Loans-to-core deposit ratio
  - Core deposits to total assets (exclude statutory reserves)
  - Liquidity assets to short-term liabilities (with maturity less than 1 year)
    - Apply different run-off rates for liabilities
    - Also different market impact rates (risk weighting) apply to assets
  - Funding gaps (based on time-to-maturity of assets and liabilities)
  - Liquidity mismatch index
    - Again, different risk weights to balance sheet positions
  - All run-off rates and risk-weights are subjective

Banking System

Excess Reserves-to-Required Reserves (as a percent)



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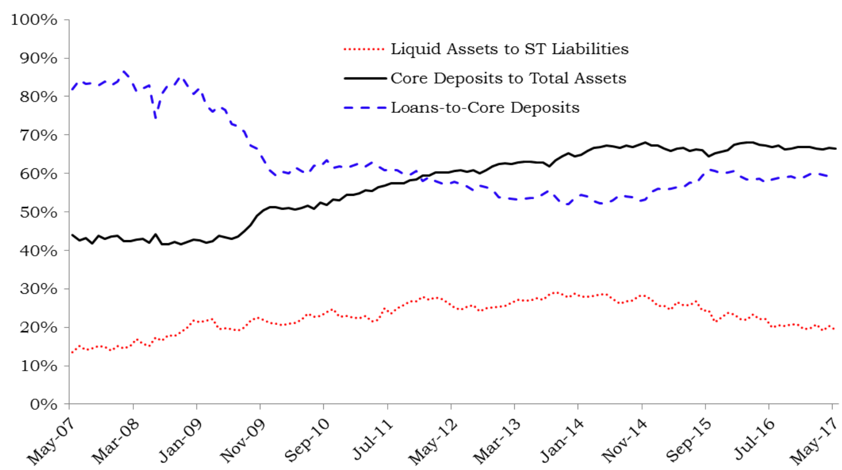
Banking System, cont'd

Liquidity Indicators (as a percent)



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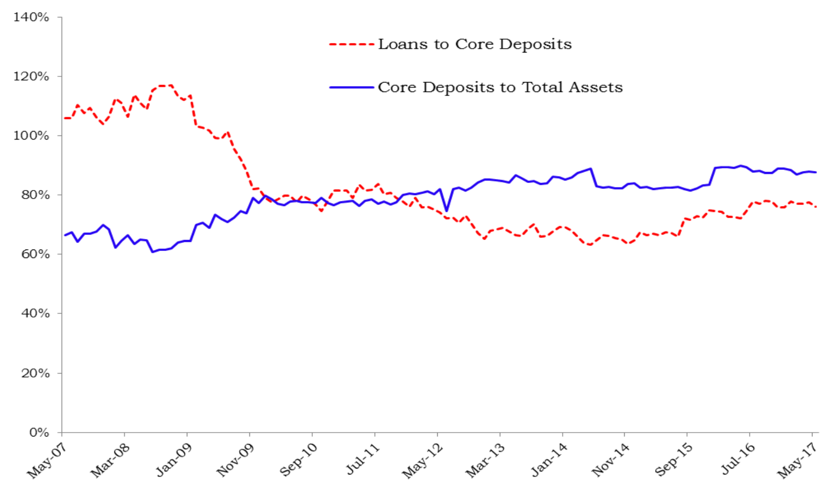
Commercial Bank A



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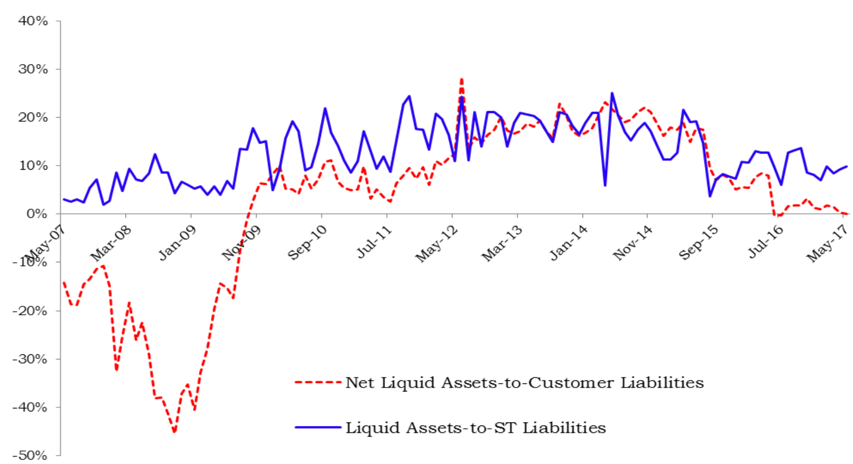
Commercial Bank A, cont'd



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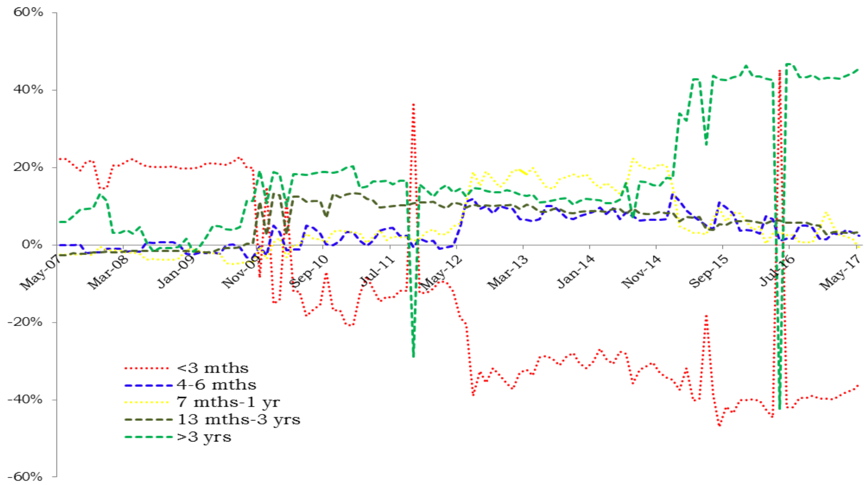
Commercial Bank A, cont'd

Funding Gaps (% Total Assets)



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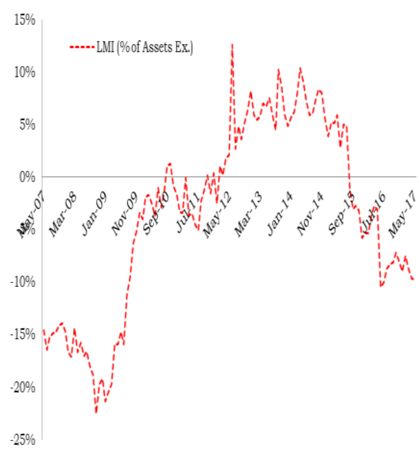
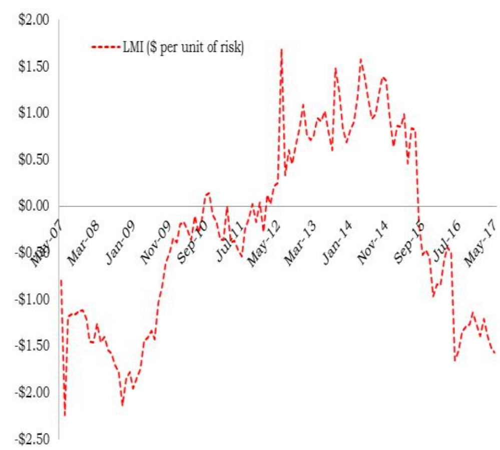
Commercial Bank A, cont'd

Liquid Mismatch Index





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Liquidity Stress Testing: Work-in-Progress

Modelling Issues

- Liquidity is stochastic in nature and time-varying: conditional models based on flow data
- Regional markets are inherently incomplete and hence, random obligations cannot be replicated with any high degree of probability by trading in available assets: (higher) risk weights relative to more advanced financial markets
- Banks hoard liquidity and funding liquidity is largely dependent on (stability) core deposits: systemic liquidity risk is likely to be exogenously driven and behavioural due to asymmetric information
- (Net) cashflow projections should incorporate behavioural elements and triggers: either stochastic or deterministic processes with jumps (for different scenarios)
- How to get the ingredients to stick together? Need to answer the all important question of aggregation

Conclusions

Summary

- Focus on liquidity measurement and stress-testing in regional banking system
- A work-in-progress:
  - some preliminary analysis
  - a few data challenges still to be sorted - bankers or regulators support is needed (corroboration is possible)
  - the exercise requires critical thinking due the inherent nature of liquidity risk and microstructure of the banking market
- Working towards a daft paper by year's end.

Q&A

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