Integrating Capital and Liquidity in Stress Testing

Systems and Feedback

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Disclaimer

The views expressed in this presentation are those of the author, and do not necessarily represent the views of the Federal Reserve Bank of New York or of the Federal Reserve System.

Commentary on the CCAR Stress Tests

- "Stress tests should consider both sides of the balance sheet, and explicitly consider fire sales, runs by wholesale creditors, common exposures and credit crunches."
  - Greenlaw, Kashyap, Schoenholtz, and Shin (2012) "Stressed Out: Macroprudential Principles for Stress Testing"

- "The stress scenario projections do not make explicit behavioral assumptions about the possible actions of a BHC's creditors and counterparties in the scenario, except through the Supervisory Stress Scenario's characterizations of financial asset prices and economic activity."
  - Board of Governors of the Federal Reserve System (2012) "Comprehensive Capital Analysis and Review 2012: Methodology and Results for Stress Scenario Projections"

- "By design, the stress tests to date have not covered other sources of stress, such as funding and interest rate risks, which are the subjects of other supervisory exercises."
  - Gov. Daniel K. Tarullo, April 10, 2012

BHC-specific Capital and Liquidity

- Current state of play for supervisory stress testing in the U.S. has separate stress tests for capital and liquidity.

- Capital stress tests start with a macroeconomic scenario and ask what happens to net income and capital for each BHC under this scenario.
  - Assessing the possibility that capital will fall to "dangerously" low level
  - 5% Tier 1 common target in CCAR implicitly aimed at risk of liquidity event

- Liquidity stress tests assume some triggering event has occurred and ask what cash inflows and outflows would be in the event and will the BHC have enough "cash" to meet outflow demand.

Integrated Capital-Liquidity Stress Tests

- Stress testing by some central banks focuses on links between bank-specific outcomes and risks of a systemwide liquidity problem.
  - Risk and incidence of fire sales, credit contraction, contagion
  - Bank of England, de Nederlandsche Bank, Hong Kong Monetary Authority
  - ***Information below based on public working papers, typically from research units***

- In these approaches, low capital at individual banks triggers bank-specific actions that can cascade in various ways.
  - Individual banks can face funding liquidity problems.
  - The system as a whole can face market liquidity problems.

- These systems produce both bank-specific estimates and projections of the stability of the banking system.
  - Often simulation based (many iterations), leading to probabilistic results

Key Questions for CCAR-related Stress Tests

- CCAR is focused on individual BHCs
  - Decisions on capital plans made on firm-by-firm basis
- How can we integrate liquidity into the CCAR stress tests?
  - What elements of the integrated systemwide tests can provide a more complete assessment of the risks facing individual BHCs?
- Can/should a single stress test be designed to assess individual BHCs and the system as a whole?

Capital-Liquidity Stress Tests for Individual BHCs

Three generic approaches:

- Static
  - Current CCAR approach

- Dynamic within a BHC
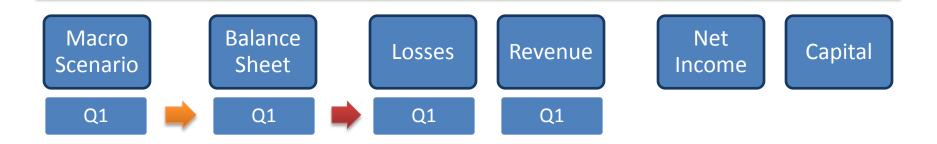 - Firm-specific effects

- Dynamic across BHCs
  - Similar approach to integrated systemwide models
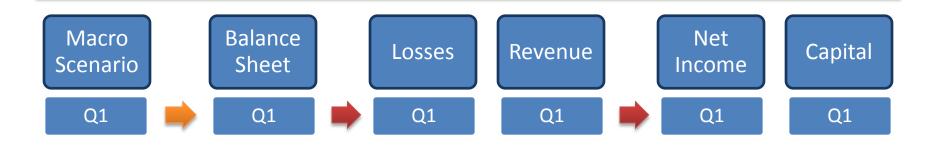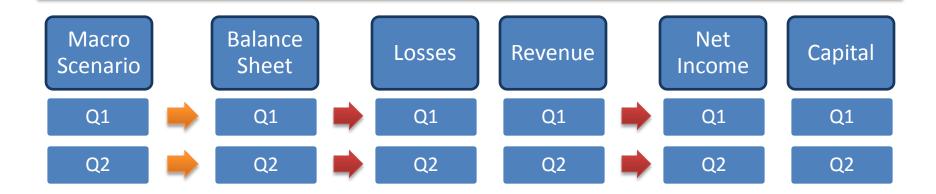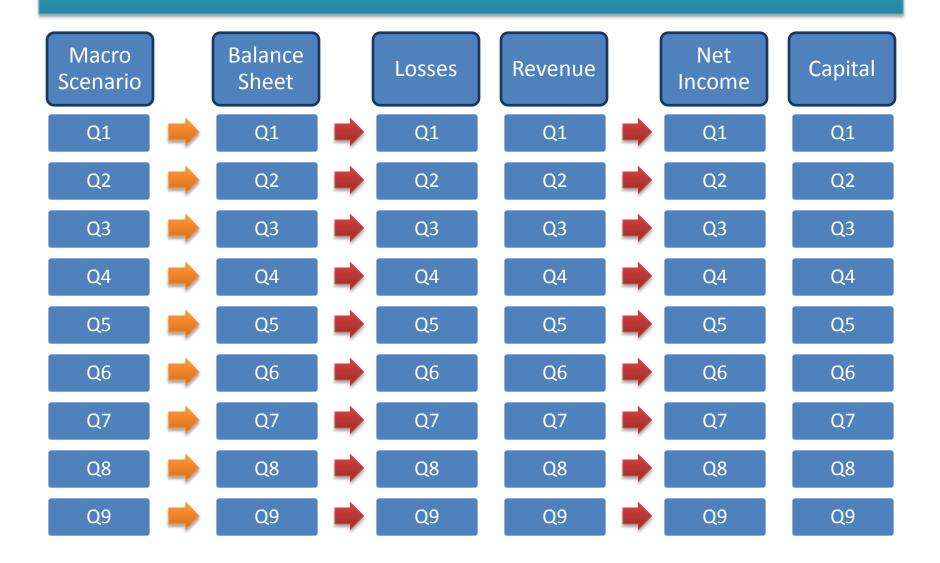
Method 1: Static Approach

Static Approach

Macro Scenario → Balance Sheet → Losses → Revenue → Net Income → Capital

Static Approach

Macro Scenario	Balance Sheet	Losses	Revenue	Net Income	Capital

Q1

Static Approach

Macro Scenario	Balance Sheet	Losses	Revenue	Net Income	Capital
Q1	→ Q1				

Static Approach

Macro Scenario	Balance Sheet	Losses	Revenue	Net Income	Capital
Q1	Q1	Q1	Q1		

Static Approach

Macro Scenario		Balance Sheet		Losses	Revenue		Net Income	Capital
Q1	→	Q1	→	Q1	Q1	→	Q1	Q1

Static Approach

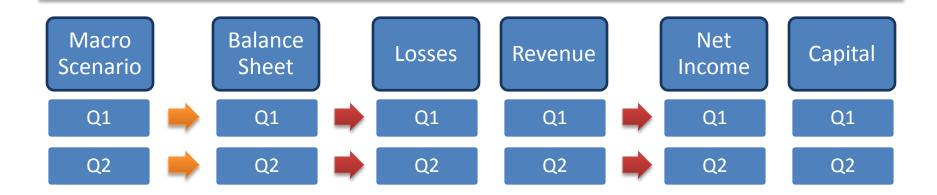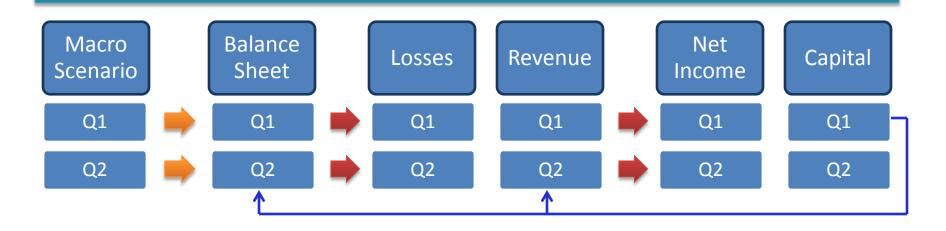| Macro Scenario		Balance Sheet		Losses	Revenue		Net Income	Capital
Q1	→	Q1	→	Q1	Q1	→	Q1	Q1
Q2	→	Q2	→	Q2	Q2	→	Q2	Q2

Key Features of the Static Approach

- For each quarter, flow is in one direction
  - From scenario to losses/revenue to income/capital
  - From left to right

- No specific links from quarter-to-quarter
  - Except through scenario, AR properties of the variables, or balance sheet/income statement identities
  - Down each "column"

- Each "column" can be estimated independently (in sequence)
  - Given the scenario, losses, revenues, expense estimates are independent
  - Dependency only from left to right
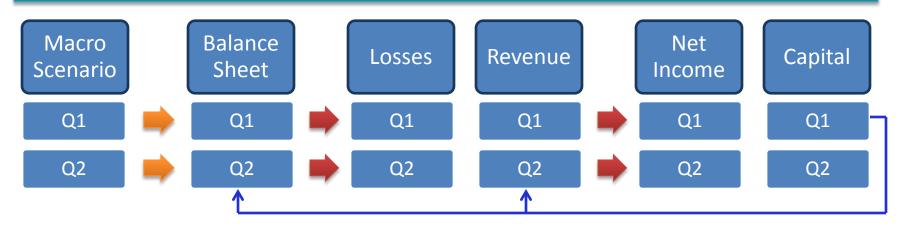
- The current CCAR approach
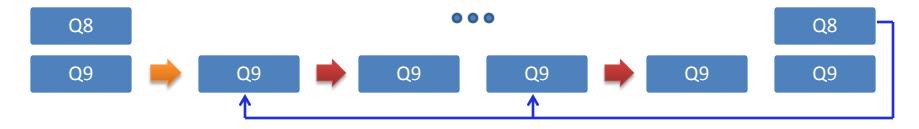
Method 2: Dynamic within BHC

Dynamic within BHC

Macro Scenario		Balance Sheet		Losses	Revenue		Net Income	Capital
Q1	→	Q1	→	Q1	Q1	→	Q1	Q1

Dynamic within BHC

Macro Scenario		Balance Sheet		Losses		Revenue		Net Income		Capital
Q1	→	Q1	→	Q1		Q1	→	Q1		Q1
Q2	→	Q2	→	Q2		Q2	→	Q2		Q2

Dynamic within BHC

Macro Scenario		Balance Sheet		Losses	Revenue		Net Income	Capital
Q1	→	Q1	→	Q1	Q1	→	Q1	Q1
Q2	→	Q2	→	Q2	Q2	→	Q2	Q2

- Balance sheet adjustments based on firm-specific capitalization and performance

  - Low capital ➔ funding not available

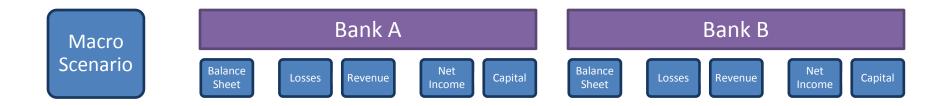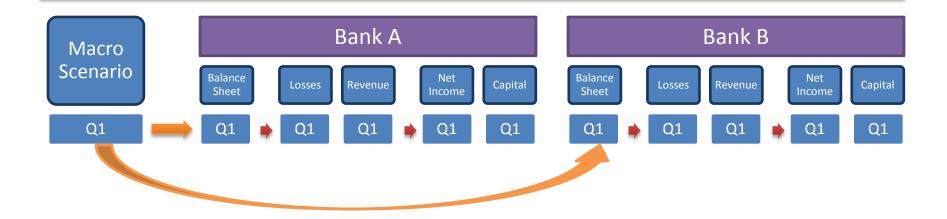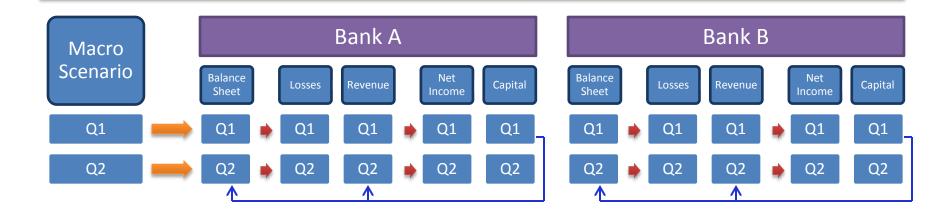- Financing costs based on capitalization and performance
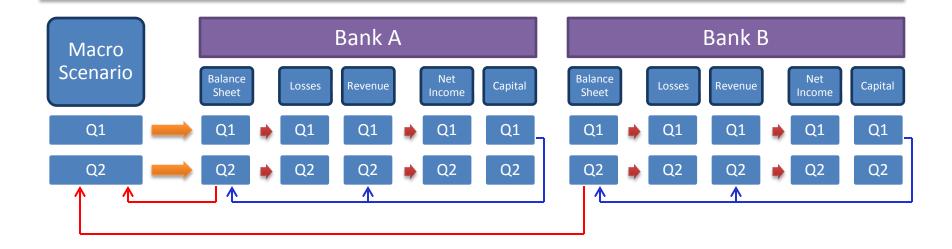
Key Features of the Dynamic Approach

- Flow is in two directions and across quarters
  - Outcomes for each BHC affect subsequent actions/reactions
  - Capital ratios affect balance sheet, revenues, possibly other variables

- Each "column" can no longer be estimated independently in sequence
  - Each row (quarter) must be estimated singly in sequence

- More complex and logistically difficult than current CCAR approach
  - Requires models/assumptions for feedback from outcomes to next quarter's balances, revenues, etc.
  - Requires churn of whole process (from scenario to capital) for each quarter, before the next quarter can be estimated

Method 3: Dynamic across BHCs

Dynamic across BHCs

Macro Scenario

Bank A

| Balance Sheet | Losses | Revenue | Net Income | Capital |

Bank B

| Balance Sheet | Losses | Revenue | Net Income | Capital |

Dynamic across BHCs

Macro Scenario

Bank A

Balance Sheet	Losses	Revenue	Net Income	Capital

Bank B

Balance Sheet	Losses	Revenue	Net Income	Capital

Q1

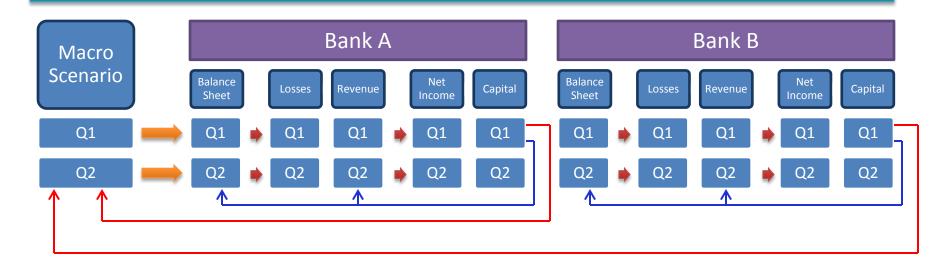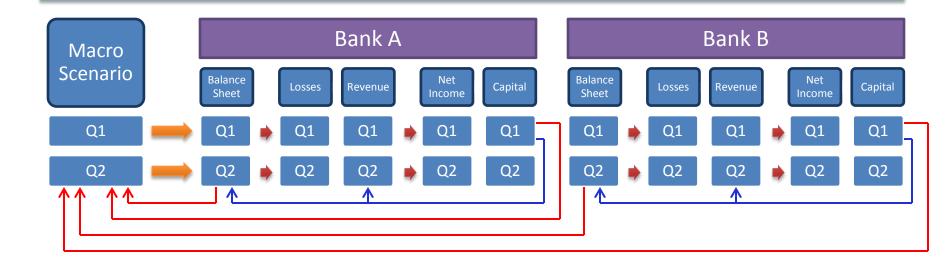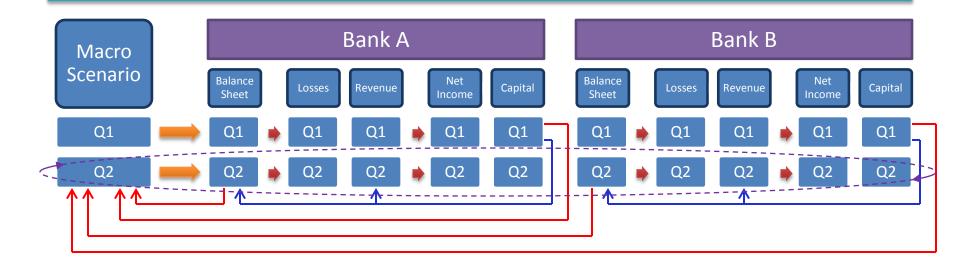Dynamic across BHCs

Dynamic across BHCs

Impact of balance sheet changes

- Asset sales/fire sales ➔ asset prices

- Portfolio choices, liquidity hoarding ➔ market funding costs and funding availability
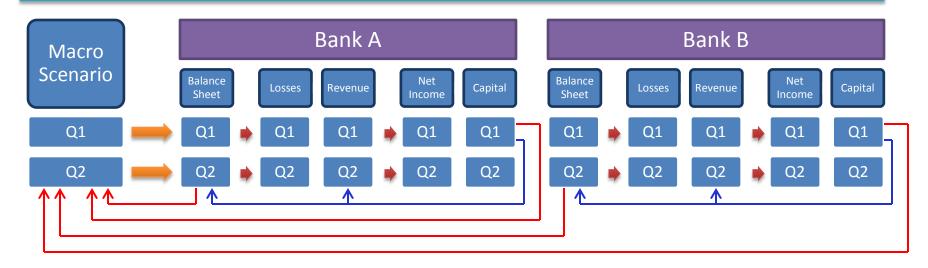
Dynamic across BHCs

Impact of capital and profitability of banking system
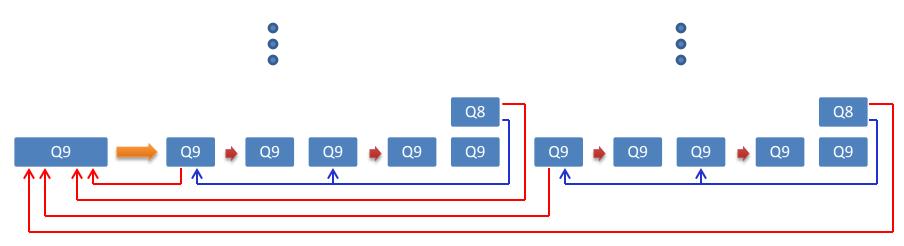
- Banking sector strength ➔ economic growth

- Portfolio choice / growth rate ➔ market lending rates

- Low capital ➔ funding markets closing

Dynamic across BHCs

Dynamic across BHCs

	Bank A					Bank B				
Macro Scenario	Balance Sheet	Losses	Revenue	Net Income	Capital	Balance Sheet	Losses	Revenue	Net Income	Capital
Q1	Q1	Q1	Q1	Q1	Q1	Q1	Q1	Q1	Q1	Q1
Q2	Q2	Q2	Q2	Q2	Q2	Q2	Q2	Q2	Q2	Q2

- Iteration to until convergence (no further reaction by banks)

Dynamic across BHCs

Key Features of the Systemwide Dynamic Approach

- Flow is in two directions, across quarters, across BHCs
  - From scenario to individual BHC results to systemwide results, and back again

- Results cannot be estimated independently for each "column" OR for each BHC
  - Each row (quarter) must be estimated jointly across BHCs, with iteration

- Very significantly more complex than current CCAR approach
  - Requires models/assumptions for feedback both within and across BHCs and from BHCs to market/scenario
  - Current implementations of such models based on simulation (many, many runs) to generate probabilistic results

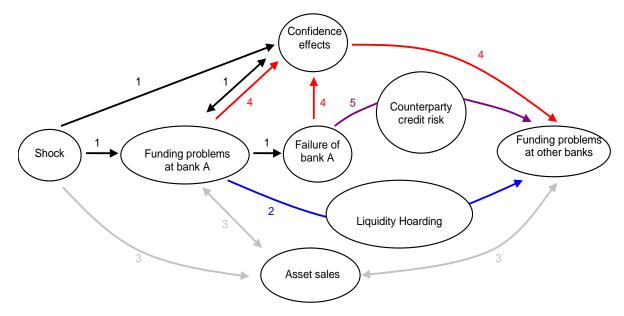# Integrating Liquidity in Stress Tests for Individual BHCs

- If static approach is retained, is it sufficient to recognize liquidity implicitly through capital targets?
  - Should these targets vary based on each BHC's liquidity position?
  - How do we determine the appropriate capital-liquidity tradeoff function?

- Is the dynamic within BHC approach a reasonable middle ground?
  - Do additional liquidity elements justify the complexity?
  - Does this approach mean modeling "failure"?
    - What happens if the model suggests an individual BHC experiences a funding run?
    - Should this possibility be incorporated into the model?
  - Implementing the approach requires supervisory modeling of the balance sheet.
    - How to retain BHC-specific strategic element of balance sheet projections while recognizing feedback?
    - Or should reaction function be the same for all?

- How can the dynamic cross-BHC approach be adapted to focus on individual BHCs?
  - Important point of these types of models is system stability (possibility of liquidity crisis)
  - Should this possibility be incorporated?
  - What does that mean for individual BHCs – modeling failure?
  - Does question become is capital enough to withstand a systemwide liquidity crisis?

Appendix Slides

APPENDIX

Flow Chart for Representative Integrated Systemwide Model

Figure 1: Funding Crises in a System-Wide Context

Kapadia, Drehman, Elliott, Sterne (Bank of England) 2012

Compare and Contrast

	BHC-specific / Current CCAR	Integrated Systemwide
Focus	Individual BHCs	System and individual banks
Linkages	Scenario → BHCs	Scenario → Banks Bank(s) → Other Banks Banks → Scenario, via market conditions
Capital	Explicit	Explicit
Liquidity	Implicit, via capital targets	Explicit, via bank funding and market conditions
Failure?	Not modeled explicitly	Yes, if bank experiences liquidity event
Results	Individual BHC capital ratios	Probability the system will experience a liquidity crisis and individual bank results
Individual bank results published?	Yes	No (or not always)