SUPERVISORY STRESS TESTING (SST)

MOHAMED AFZAL NORAT

Financial Supervision and Regulation Division

Monetary and Capital Markets Department

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Stress Tests Variations

- **Stress Test Drivers**
  - Final Impacts
    - Solvency, Liquidity, Contagion
    - Thro B/S or Feedbacks
  - Stress Testing
    - Reverse Stress Tests
    - Macro
    - Scenario Thematic
    - Sensitivity

- **Stress Test Divisions**
  - Surveillance
    - Top Down: FSAPs, GFSR, CBs
    - Bottom Up: FSAPs, CBs
  - Macroprudential
    - Top Down: IMF Greece
    - Bottom Up: SCAP/CEBS/EBA
  - Crisis Management
    - Top Down: Models, B/S
    - Bottom Up: e.g. CCAR
  - Microprudential
  - Supervisory
    - Top Down: Conglomerates
    - Bottom Up: Solo-entity
  - Firm Based
  - Internal Risk Management

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  - Internal Risk Management
  - Firm Based
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SST Aims – Bank Safety & Soundness?

**Solvency**
- SSTs covers solvency impacts on banks’ assets/liabilities, income statement, other granular information, RWAs, credit risk parameters, loan type and geographical, sector breakdowns.
- Challenge banks’ capital levels (and plans) in relation to their risk profiles against shocks (multi-year) (Pillar I & II). Ensure banks able to function without state support. If gaps limit capital distribution, organic capital growth, deleverage (lower RWAs), capital issuance (equity, debt, cocos). In a crisis credible backstop, recapitalize survivors, take away problem loans from B/S (AMC).

**Liquidity**
- SSTs covers liquidity impacts (net outflows/net inflows) across all assets-liabilities through maturity matching, determination of run-off rates (deposits), asset (fire) sales, collateral write-downs (haircuts) including institution or market funding closure. Shocks cover normal and extreme impact.
- Challenge banks’ day-to-day liquidity planning, balance sheet structure, minimize taxpayer costs of liquidity support to banks through deposit insurance, central bank support (OMOs).

**Anything Missing?**
- Need to integrate liquidity and solvency – solvency impacts liquidity (funding – counterparty risks), liquidity impacts solvency (MTM losses due to asset sales). CCAR does not, others do - BoE, de Nederlandsche Bank, HKMA.
- Ignores system-wide (macroprudential) aspects – systemic and or contagion risks (integrate that?)
- Are shocks extreme enough – tail-risk credit parameters, re-calibration of RWAs, macro scenarios (Pillar III), reverse stress tests
- Sovereign risks – problematic challenging for banks.
- Feedback effect between stress shocks on balance sheets and impact on macroeconomy. But what about 2nd round, 3rd round feedbacks from macroeconomy to Banks’ B/S? (convergence – no further impacts on banks’ B/S)
SST encompass Pillar I & II

What about Pillar III? Would Stress Tests and Risks come out of Pillar III?
ICAAP Integrated Stress Testing

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ICAAP
SST Portfolio Granularity?

Residential mortgages net charge-off rates (NCOs) prior to crisis was low and well below extreme (1, 5%) or 99 or 95th Quantiles. Backtest through crisis do NCOs stay within Quantiles?

Source: Andreas Lehnert – Federal Reserve
SST Portfolio Granularity?

Backtest NCOs through Crisis - requires 4-quarter ahead forecasts

Source: Andreas Lehnert – Federal Reserve
SST Portfolio Granularity?

NCOs start to blow-out but Quantile model slow to adjust. Improve quality of data inputs. More extreme values - more loan modifications and other adjustments.

Source: Andreas Lehnert – Federal Reserve
SST Portfolio Granularity?

With better (more extreme) loan modifications assumed, also use silent seconds and payment shocks on HELOCs, Quantile model starts to catch up.
SST Portfolio Granularity?

Large NCOs reflect tail-values beyond pre-Crisis historical values. More frequent updating helps Quantile model to catch up.

Source: Andreas Lehnert – Federal Reserve
SST Portfolio Granularity?

Now Quantile model really takes off – some danger of overshooting at the tails?

Source: Andreas Lehnert – Federal Reserve
SST Portfolio Granularity?

Overshooting at the tails, actual NCOs now in line with expected median values

Source: Andreas Lehnert – Federal Reserve
SST Portfolio Granularity?

Quantile model starts to turn in line with most recent data, actual NCOs now contained within Quantiles. Granularity helps SST but so does accounting for tail-risks. Question: Do you believe the path of NCOs? Could they have been much larger than Banks recorded?

Source: Andreas Lehnert – Federal Reserve
Supervisors memory is short we often ignore history. But even if we don’t ignore - history is by definition backward-looking. SST need to be forward-looking, and tail-risk orientated for adverse and extreme scenarios.
Credit Risk Parameters for SST

Basel II AIRB is a Modified Vasicek (SFM) Model

Credit risk parameters (LGD, PD, EAD) are stochastic

\[ K = EAD \cdot \left[ LGD \times \Phi \left( \frac{1}{\sqrt{1-R}} \Phi^{-1}(PD) + \sqrt{\frac{R}{1-R}} \Phi^{-1}(0.999) \right) - PD \times LGD \right] \left( 1 + \frac{(M - 2.5)b}{1 - 1.5b} \right) \]

where,

\[ R = 0.12 \left( \frac{1 - e^{-50PD}}{1 - e^{-50}} \right) + 0.24 \left( 1 - \frac{1 - e^{-50PD}}{1 - e^{-50}} \right) \]

\[ b = \left( 0.11852 - 0.05478 \ln(PD) \right)^2 \]

Vasicek portfolio (asset) default rate distribution – non-gaussian – fat-tail - underestimates losses

Regulatory correlation function “fine tuned” to reduce procyclicality

Maturity adjustment factor specified to mimic KMV estimates - insufficient capital adjustment for very short-term facilities.

These features are policy parameters and are not derived from a formal credit risk model

K (capital charge would need to increase) to account of better calibration of credit risk parameters, fat tails and policy re-parameterization.
Higher loss rates or credit risk parameters results in greater solvency deterioration in different scenarios B-Baseline; S1 – Adverse (V-shaped recession); S2 – Adverse (low growth). Calibration is key to ensuring appropriate loss recognition in SSTs. Banks may be too reliant or blinded by past history!
Solvency (capital) deterioration is more marked assuming both higher credit risk parameters and prolonged low-growth period than baseline, wherein earnings capacity and asset quality of banks is low and deteriorating.
Networks and Contagion

Systemic risk complex to capture. Networks below suggest complex interconnections. Crude idea how systemic risk manifests itself through dynamic, nonlinear, chaotic, unknown evolutions.
Reverse Stress Tests can:

- Improve Bank capital and liquidity planning – explore vulnerabilities
- Improve Contingency planning
- Inform existing stress testing framework – explore tail risks, calibration of credit risk parameters

Not a tool to:

- Force banks to hold more capital or liquidity
- Stress single parameter to extreme – Sovereign risk?
- To replace traditional stress tests
Banks are hit hard on sovereign risk concerns:
Bank equities are sold, and their CDS spread and wholesale funding costs soar even before sovereign goes into severe distress (i.e. cannot finance in markets) and ahead of other financial institutions (insurance, pension funds).

Demanding investor base
Investors for bank equity and funding securities (CP, covered bonds) do not have specific incentive to hold these assets, unlike sovereign securities.

Shorter liability structure
Banks face higher risks to face short-term distress:

- Regulatory incentive from banks,
- Asset-liability matching and statutory demand from insurers and pension funds,
- Liquidity demand (repo-able assets, accepted by central banks),
- Demands for reserve currency,
- Some sovereign securities markets are too large to stay away.

Sovereign risk big factor for banks
Sovereign Risk Challenging for STs

- Risk concentration is usually tested by assuming default by large borrower(s)
- Outright sovereign default will kill banks (no test needed)
- Such assumption won’t appeal to the authority

**Concentrated exposures to sovereign risks**

- Default not only way to look at sovereign credit risk

**Sovereign risk causes broad spillover effects**

- Impact on various other asset prices and volatility
- Impact on real economy
- Difficult to model such correlated shocks

**“Extreme but plausible” scenario is usually built on past experience (own or other countries)**

- Sovereign default (on domestic debt) for advanced economies in history (with data)?
- European experience can guide other countries

**Gap between regulatory and economic assessment**

- Bank capital regulation treats sovereign securities favorably
- New liquidity regulation encourages banks to hold sovereign securities
- Maturity matching incentive for insurers and pension funds

**Little use of history**
Sovereign Risk Capture?

Credit Risk Options
- Sovereign rating downgrade
- RWA increase
- Higher Credit risk parameters

1. EBA approach
   - Add-on interest rate risk haircuts
   - On Trading Book, AFS not HTM

2. FSAP approach
   - European banks
   - Japan
   - Stress all accounts TB, AFS, HTM resistance by authorities.
   - Sovereign spreads
   - Funding costs and
   - Spillover from parents

3. GFSR approach
   - Balance-sheet
   - Sovereign CCA BSM option
   - Expected losses

General approach: sovereign risk as market risk
Haircuts on sovereign bonds

Basel II Flexibility
- Basel II actually allows jurisdictions to choose higher RWAs than zero
Including macroeconomic feedbacks impact Banks, their B/S and solvency

which in turn can impact funding, banks deleverage

which impacts lending, consumption, investment and growth. And banks

Process continues until no further bank impact. Feedbacks challenging to integrate

Integrating Feedbacks is very Challenging