Microprudential Stress Testing

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14 Aug 2013
Microprudential stress test

- Institution-specific (as opposed to system level) risks
- Banks design the stress test with regulatory oversight.
- Several types of stress tests for different purposes
  - Single factor analysis vs scenario-based approach
  - Single risk types coverage vs firm-wide analysis
- Bottom-up approach:
  - Different banks stress different risk factors, depending on vulnerabilities. Similarly, different scenarios for the scenario-based approach.
  - Different level of sophistication: larger and complex banks expected to be more sophisticated.

Microprudential complements macroprudential stress testing

- Microprudential stress test captures institution-specific risks that may be missed or lightly covered in macroprudential stress test
Three Pillars of Basel II

Pillar 1

Minimum Capital Requirements

- Calculation of capital requirements
  - Credit risk
  - Operational risk
  - Market risk

Pillar 2

Supervisory Review Process

- Principles-based approach
- Covers all risks

Pillar 3

Market Discipline

- Disclosure requirements
  - Capital structure
  - Risk exposures
  - Risk assessment processes

Safe and Sound Banking System
Objectives of ICAAP / SREP

Ensure banks have adequate capital to support all risks.

- Risks covered under Pillar 1 – Banks should not rely on Pillar 1 numbers without determining whether the numbers are appropriate.

- Risks not covered under Pillar 1 – e.g. interest rate risk in the banking book (IRRBB), credit concentration risk, business and strategic risk, reputational risk, liquidity risk, residual risk.

- Factors external to the bank – e.g. economic cycle effects.

Ensure banks have adequate capital to withstand stress.

- Stress over a range of scenarios, under capital planning.

Encourage banks to develop and use better risk management techniques.

- Use of economic capital (EC) approaches has been spurred on, in part, by Pillar 2. EC is one way of assessing/measuring capital needs.
**Types of stress tests**

- Definition of stress testing (as defined by the Bank for International Settlements)
  - A risk management technique used to evaluate the potential effects on a bank’s financial condition of a specific event or movement in a set of financial variables

<table>
<thead>
<tr>
<th>By type:</th>
<th>Details</th>
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<tbody>
<tr>
<td>Sensitivity analysis</td>
<td>• Single-factor analysis</td>
</tr>
<tr>
<td></td>
<td>• Advantages: less complex; useful building block; easily understood</td>
</tr>
<tr>
<td></td>
<td>• Disadvantages: may not reflect reality</td>
</tr>
<tr>
<td>Scenarios analysis</td>
<td>• Multi-factor analysis</td>
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<tr>
<td></td>
<td>• Historical or hypothetical scenarios (see next slide for advantages</td>
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<tr>
<td></td>
<td>and disadvantages of each)</td>
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<table>
<thead>
<tr>
<th>By coverage:</th>
<th>Details</th>
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<tbody>
<tr>
<td>Risk-type bespoke</td>
<td>• Cover only specific risk types</td>
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<tr>
<td></td>
<td>• Well-established within banks</td>
</tr>
<tr>
<td>Group-wide</td>
<td>• Covers multiple risk types</td>
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<td></td>
<td>• Generally less evolved</td>
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## Range of Scenarios

<table>
<thead>
<tr>
<th>Scenario analysis</th>
<th>Details</th>
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| **Historical scenarios** | Use observed values of risk factors prevalent during actual past stress events to revalue current portfolios  
- Advantages:  
  - easily accepted by management (i.e. plausible)  
  - provide useful information about behaviour of risk drivers during times of stress  
- Disadvantage:  
  - recent changes in environment not captured  
  - relevance questionable |
| **Hypothetical scenarios** | Used to simulate “what-if” analysis on events that have not occurred but could be a significant threat  
- Advantage:  
  - platform for management to identify potential threats  
  - relevant  
- Disadvantage:  
  - may lack realism and thus susceptible to challenge  
  - a lot of judgement required |
ICAAP Process – Three Key Steps

ICAAP goes beyond capital accounting to capital management.

Organisational Structure and Governance
- Ownership, Clear lines of responsibilities, Sufficient expert resources dedicated, Internal controls

Risk Identification & Measurement
- Identify key current and emerging risks
- Quantify risks
  - Level of sophistication is tailored to size and complexity of risks
- Aggregation of capitalised risks
- Understand differences between internal capital and regulatory capital

Projection & Tolerance Setting
- Projection and stress testing: comprehensive suite of stresses and scenarios
- Specification of risk appetite (i.e. the amount of risk a bank is able and willing to accept) with respect to biz plan
- Main stakeholder expectations
  - Capital and earnings implications

Management & Communication
- Develop capital plan with respect to risk, taking into account the bank’s strategic focus and biz plan
- Regular monitoring and reporting
- Management actions
- Communication

Supporting Infrastructure (Data & IT)

Adapted from Oliver Wyman
ICAAP Process – Projection (incl. Stress Testing)

**Risk Identification**
- Identify potential risk sensitivities and vulnerabilities based on the bank’s risk exposures:
  - By risk types
  - By activities
- Understand interactions between risk types and dependencies between activities.

**Scenario Development**
- Develop, select and prioritise relevant risk scenarios for testing and reporting based on identified risk sensitivities, vulnerabilities and cross-risk/activity linkages
- Reverse stress test scenarios (that will lead to business failures) to help uncover hidden vulnerabilities

**Risk Quantification**
- Review the likelihood and severity of the scenarios
- Classify and align the risks with risk appetite (i.e. the risk the bank is able and willing to take) and business strategy
- Benchmark potential losses against capital adequacy

Adapted from Oliver Wyman
ICAAP Process – Projection (incl. Stress Testing)

**Static assessments**
- Economic Capital
  - Snapshot of risk-based capital requirements
  - Covering all material risks

**Capital planning**
- ‘Base’ capital projection
- Stressed capital projection
- Inclusion of mitigating actions
  - Multi-year projection of ECAP – the base case capital plan
  - Evolution of business plans used to forecast P&L, actual and required capital
  - Assumes a particular state of the economy
  - What would the impact of a severe downturn be?
    - On RWAs and ECAP?
    - On provisions, revenues, costs, and thus P&L?
  - Multiple stresses, which must be appropriately severe
  - What management actions could be taken to reduce the impact of a severe downturn?
  - What would be the expected impact of these actions?

**Interim assessment**
- Capital plan
  - Including the base capital requirement used as the basis for individual capital guidance (i.e., minimum capital levels)
  - Demonstration of capital adequacy in all scenarios over medium-term horizon

Adapted from Oliver Wyman
ICAAP Process – Projection (incl. Stress Testing)

Quantitative capital forecasting capabilities

- Evolution of balance sheet and major P&L items
- All risks and diversification impacts
- Resolution of PIT vs. TTC issues
- Impact of earnings volatility reflected

Current snapshot
- Robust input data
- Pillar 1 and internal risk-based capital estimate

Current portfolio structure

Base case forecasts
- Business plans and market intelligence
- Simplifying assumptions to make calculations tractable

Expected B/S & P&L evolution

Stress & scenario testing
- Realistic (dynamic) scenarios
- Applied consistently
- With/without mgmt actions

Stressed B/S & P&L evolution

From Oliver Wyman
Capital Planning and Pillar 2 Stress Testing

- Consideration of various perspectives; toggling necessary
  - Internal (creditors and shareholders)
  - Regulatory
  - Others (e.g. rating agencies, market)
- Definition of capital supply and capital demand may differ across perspectives

<table>
<thead>
<tr>
<th>Regulatory view</th>
<th>Internal view</th>
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<tbody>
<tr>
<td>Tier 2 capital</td>
<td>Available capital</td>
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<tr>
<td>Tier 1 capital</td>
<td>Economic capital</td>
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<td>Pillar 1</td>
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- Capital supply
- Capital demand
- Capital supply
- Capital demand
Capital Planning and Pillar 2 Stress Testing

- Emphasis on firm-wide scenario-analysis on capital adequacy
- Key expectations of a Reporting Bank under the capital planning element:
  - Forecast its future performance based on its business plan
  - Subject the capital plan to stress tests
  - Assess the financial impact on its capital plan and the level of required capital before and after management actions
  - Assess the credibility of management actions
  - Identify how future capital needs (as required under the above stress tests) will be funded

- Capital planning element is to make the ICAAP a forward-looking process, capable of enabling a bank to make timely responses to changes in risk profile and external environment. Stress testing is a crucial component.
Capital Planning and Pillar 2 Stress Testing

Part I: Assessment of process

Capital planning framework
- Capital planning structure
- Capital planning process

Stress testing framework
- Proportionality
- Role of senior management
- Calibration
- Communication
- Interpretation
- IT systems and resources
- Documentation and review

Part II: Assessment of capital plan

Capital plan and Pillar 2 capital stress test
- Robustness of capital plan
- Quality and composition of capital
- Pillar 2 capital stress tests (elements as above)

Overall supervisory assessment of the bank
### Overview
- Evolving industry practices, no single “correct” methodology

### Proportionality
- Assess if the complexity of the framework is commensurate with the size and sophistication of the bank

### Role of senior management
- Assess if senior management plays an active governance role

### Calibration
- Types of stress tests employed
  - Assess if the types of stress tests employed are appropriate
- Range of scenarios
  - Assess if the scenario is appropriate for the bank’s circumstances
- Severity
  - Assess if the scenario is sufficiently severe
### Assessment of Stress Testing Framework

**Reporting and communication**
- Assess if the stress test results are reported and communicated to senior management in a comprehensible and meaningful manner
- Assess management actions

**Interpretation of stress test results**
- Assess if the stress test results are used in business planning, risk management and capital planning

**IT systems, human resource and data quality**
- IT systems
- Human resource
- Data quality

**Documentation and review**
- Assess that there is proper documentation and review of the framework
### Assessment of the Capital Plan

#### Base case capital plan

- Assess the robustness of the base case capital plan

#### Pillar 2 Capital Stress Test scenario

**Calibration and approach**

- Assess if the scenario chosen is appropriate and sufficiently severe (i.e. one reflecting a severe economic downturn)
- Assess the robustness of the methodologies used to link the scenario to risk drivers, in order to derive the impact on capital demand and supply

#### Scope and coverage

- Assess if the scope and coverage of the stress test is appropriate
  - Material risks
  - Business units
  - Portfolios and exposures
  - Both regulatory and internal view of capital
Assessment of the Capital Plan

**Time horizon**
- Assess if the time horizon of the stress test appropriate

**Management actions**
- Assess if management actions have been considered and factored following the Pillar 2 Capital Stress Test results
- Assess if the proposed management actions are appropriate and credible

**Robustness of capital plan**
- Assess if the capital plan is sufficiently robust

**Reverse Stress Test**
- Review any reverse stress test by the bank.
- Review any measures to prevent or mitigate the vulnerabilities identified.
Macropuручdential Stress Testing

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Macroprudential stress test

- System-level (as opposed to single FI) risks
- Active involvement of regulator in the stress test design
- May be bottom-up or top-down in approach:
  - Bottom-up: application of common scenario(s) by FIs to their respective exposures; enables peer analysis which could be used to provide useful feedback to FIs to improve on their stress test methodologies;
  - Top-down: central bank/regulator’s internal models; may include various forms of financial linkages/connectedness which cannot be carried out through a bottom-up stress test; may incorporate reaction by FIs; may include macrofinancial linkages; may include policy action

Macroprudential complements microprudential stress testing

- Macroprudential stress test captures system-wide risks that would not be captured even if every bank conducts microprudential stress tests
Macroprudential Stress Testing - Participation

Participating FIs

• **Microprudential**: All FIs.

• **Macroprudential**: If possible, all FIs. Otherwise, at least FIs of systemic importance (size, interconnectedness, substitutability, etc) supplemented by supervisory judgment e.g. small banks with high growth or niche players

• FIs’ stress test capability is less of a consideration
  • allow simpler methods initially, for the less capable
  • useful just to get FIs to think about potential adverse developments, how they could be affected and therefore preventive measures to take
Setting of scenario in macroprudential stress testing

- Include relevant macroeconomic and financial variables for the Singapore financial system
  - False sense of comfort if relevant variables are excluded
  - Breakdown into more granular segments is useful to identify specific areas of vulnerabilities and for supervisory follow-up
- Useful to get inputs from onsite supervisors, in particular on new types of activities and risks
- Use of appropriate time horizon, which depends on financial cycle or length of time for financial stress to materialise on the banks’ books
- Use of more than one set of parameter values for market risk
  - Use a range of parameter values, else could miss certain risk such as those posed by barrier options. Biggest move in parameters may not result in the biggest losses.
Macroprudential Stress Testing - Scenarios

• Useful to know beforehand FIs’ business models (exposures and funding) e.g. whether they are net borrowers or lenders.

• Take note of risks which tend to be ignored, as indicated in recent IMF paper ("Macrofinancial Stress Testing – Principles & Practices”, Aug 2012)
  • sovereign, funding, systemic liquidity, counterparty, downgrade, contagion, cross-border, low profitability and regulation risk.

• Size of shocks: specific past crises, historical worst, multiples of standard deviation, model-based

• Use of macroeconometric model supplemented by satellite models on other variables; expert judgment
Scope and assumptions which could have impact on the results

• Coverage of exposures (off-balance sheet)
• Date of exposures/positions used: December exposures may not be reflective of typical exposures due to year-end winding down
• Management action and assumptions of FI’s ability to do so (e.g. raising capital); resolution/non-resolution of non-performing loans (NPLs); treatment of write-offs
• Static or growing balance sheet; assumptions for P&L items
• Assumptions on business as usual practices e.g. accounting rules
• Group vs single entity
• Trading vs booking basis
Macroprudential Stress Testing - Methodology

• Heterogenous set of FIs. Therefore
  • different business models
  • different regulatory regimes at HQ
  • different levels of sophistication

• Methodology
  • scorecard, econometric models, KMV-type models, expert judgment, etc

• Regardless of approach/methodology, FIs are asked to report results using standardised templates provided by MAS
• Check for reasonableness of results.
• Meet FIs to challenge methodologies and assumptions.
• Carry out peer analysis based on the bottom-up stress test conducted by FIs. Identify areas of vulnerabilities and weaknesses in methodology.
• Cross-check FIs’ bottom-up stress test results with MAS’ own top-down stress tests and other analyses (likelihood of observing results reported by FIs, common borrowers analysis, etc)
Macroprudential Stress Testing – Follow Ups

- Supervisors meet with FIs to better understand vulnerabilities and to discuss what needs to be done.
- Supervisor notes down areas for improvement in the industry-wide stress test process for the following year.
Macroprudential Stress Testing – Contagion

• For countries which host a large number of interbank players, it is important to assess if interbank stresses could cause financial instability
• Study how funding and solvency stresses propagate through the domestic interbank network
  • How many other bank failures as a result of initial bank failure(s), assuming varying degree of non-repayment and “haircuts”
  • Foreign bank branches do not have capital requirement, so “failure” occurs when some measure of net assets (i.e. liabilities over assets) turns negative; some banks already see negative values for this measure even before any stress test, so need another “failure” condition
• For efficiency, constructed a simulator to carry out exercise
Microprudential Stress Testing

• ICAAP is a forward-looking process, to enable a bank to make timely responses to changes in risk profile and external environment. Stress testing is crucial.
• Supervisors need to assess both the FI’s stress testing framework and the stress test results. Challenge FI’s assumptions and analysis.

Macroprudential Stress Testing

• Singapore started stress testing on a small scale.
• Gained much experience over time. Continue to enhance process.
Thank you