Secrétariat général de la Commission bancaire

Stress Testing Credit Risk: The French experience

Expert Forum on Advanced Techniques on Stress Testing

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Outline

1 . Introduction: FSAP Experience

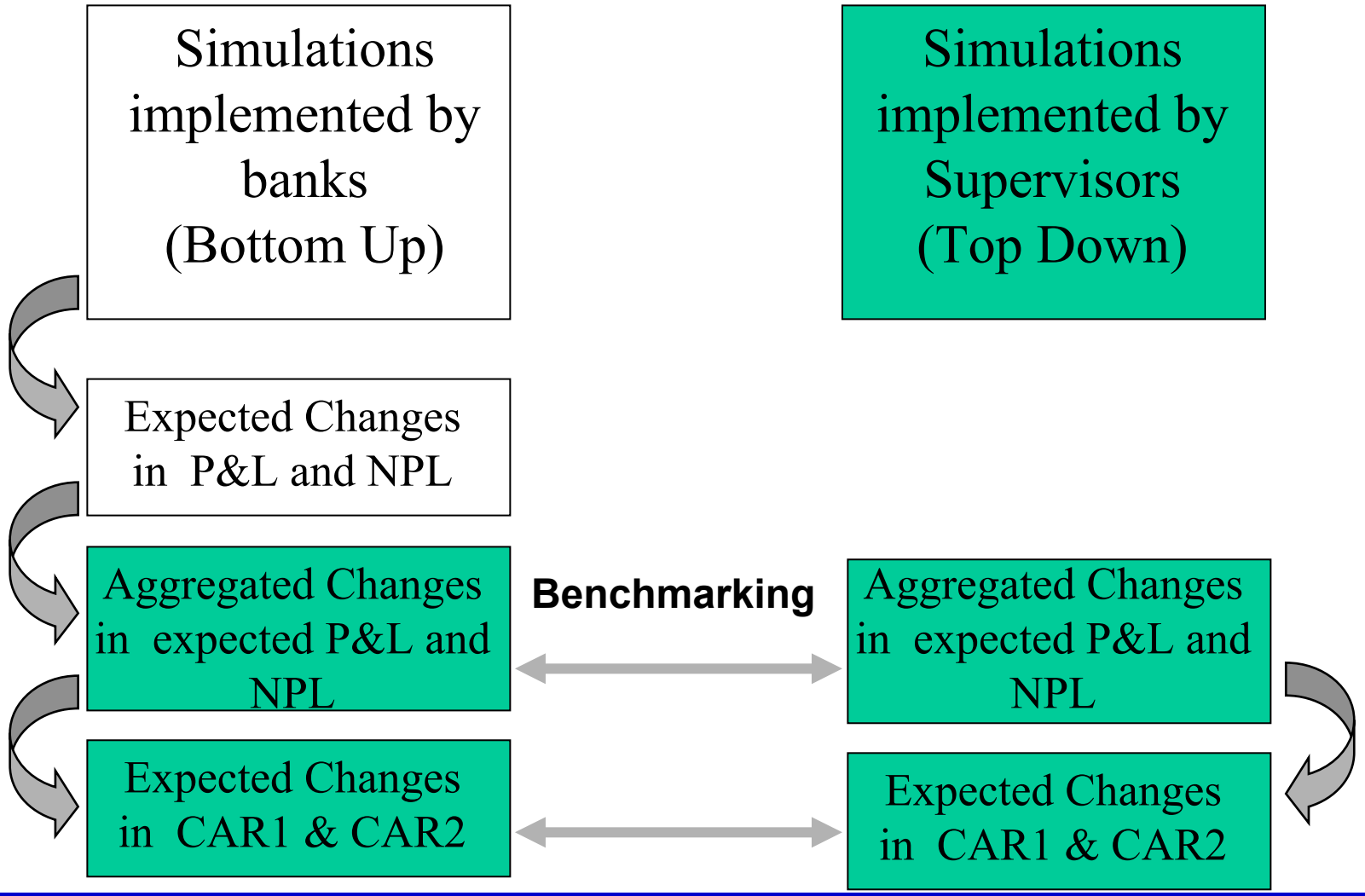
2 . Macro Stress Testing

3. Credit Risk Stress Testing

1 - Introduction: FSAP Scenarios

- FSAP in France in 2004
- Scenarios built by IMF / Commission bancaire / Banque de France :
  - single factor shocks (instantaneous) :
    - Market type : interest rate curve, stock price, exchange rate, volatility of stock index
    - Systemic type : overall or sectoral degradation of credit spreads (ratings)
  - multifactor shocks (instantaneous) :
    - Combining interest rate and stock price scenarios
  - dynamic macroeconomic scenarios (2-year horizon) :
    - Drop in world demand
    - Rise in oil price (with & without reaction of the ECB)
    - Depreciation of US$ vs. €

1 - Introduction : FSAP process



2 - Macro Stress Test

- After the FSAP exercise, the Commission bancaire has performed macro stress testing:
  - based on the econometric models used for the FSAP exercise
  - on a regular basis (every six months)
  - restricted to the top-down approach
    - Market type shocks cannot be implemented efficiently
  - for internal purpose
  - to assess financial stability

2 - Macro Stress Test

- Financial stability is assessed through dynamic macroeconomic scenarios (2-year horizon)

- Scenarios are built by the Commission bancaire and the Banque de France :
  - expert judgement on potential macroeconomic risks
  - diffusion of the initial shock through the in-house econometric model Mascotte and Nigem

2 - Macro Stress Test

Profitability model

- Impact of economic fluctuations on the banks ' expected profitability (net of EL)
- Use of a structural banking profit and margin model relating them to economic factors
- Structural reduced form used to test economic stress scenarios
- Analysis of banks ' stressed profits and margins as first buffer to absorb shocks

2 - Macro Stress Test

Profitability model:

- Dynamic panel data model
- Structural model:

$$M_{i,t} = 0.64 + 0.68 M_{i,t-1} + 0.35\, p_t^* - 0.59 \sigma_{p,t}^{*\,2} + 0.29\, p_t^* \Delta L_{i,t} - 0.20 \pi_{i,t} + \varepsilon_t$$

$R^2 = 0.87$

$M_{i,t}$ credit margin for bank i

p_t^* 5y - 3m risk free interest rate slope

$\sigma_{p,t}^*$ volatility of 5y - 3m risk free interest rate slope

$\Delta L_{i,t}$ loan growth for bank i

π_t anticipated risk volatility for bank i

2 - Macro Stress Test

Capital requirements model:

- Transition matrix depends on the state of economy X_t
- Model the sensitivity of transition matrix to economic fluctuations (corporate)
- Use Banque de France ratings as benchmarks
- Element of Theory : GDP ⇗ ⇒ creditworthiness ⇗
- Goal :
  - Build a quantitative and operational tool
  - Simulation of UL needs to estimate the whole transition matrix (not only PDs of risk classes)

2 - Macro Stress Test

Capital requirements model:

– Rating transition model based on observed transition matrix M_t :

$$M_t = \left[\Pr(rating_t = j \mid rating_{t-1} = i)\right]_{ij}$$

$$z_{ijt} = \log\left(\frac{\Pr(rating_t \le j \mid rating_{t-1} = i)}{\Pr(rating_t > j \mid rating_{t-1} = i)}\right)$$

$$z_{ijt} = \theta_{ij} z_{ij,t-1} + \alpha_{ij} + \beta_{ij} X_t + \varepsilon^p_{ijt}$$

2 - Macro Stress Test

Capital requirements model:

$$\begin{cases} \mathbf{Z}_t = \mathbf{Z}_{t-1} \times \mathbf{M}_t(\mathbf{X}_t) + \boldsymbol{\upsilon}_t \\ \mathbf{K}_t = \mathbf{RW}' \cdot \mathbf{Z}_t \end{cases}$$

- Where X is a set of macroeconomic variables, and Z_t the (vector) risk distribution of the portfolio
- Model portfolio's composition dynamic under economic shocks through transition matrix.
- Computes minimum capital requirement K_t on new risk distribution Z_t.

2 - Macro Stress Test

Final analysis:

- Combination of the models
  - Assumption : RWA are unchanged when moving from Basel I to Basel II.
- Global impact on the key indicator Capital Adequacy Ratio (Basel II)
  - The CAR estimated under the baseline scenario (« baseline CAR ») is not a forecast of the CAR :
    - The model takes into account neither the new credit lines nor the reaction of bank induced by the shock
    - The « baseline CAR » is estimated under Basel II assumptions (capital requirements are risk-sensitive)
    - The « baseline CAR » is a benchmark
  - CAR estimated under stress-scenarios are analysed with respect to the benchmark.

3 - Credit Risk

Stress test on credit risk

- Based on ad hoc scenarios
  - Not derived from a macro-framework, since linkage « macro => micro » is difficult to establish
  - Stress assumptions directly applied to the micro-framework
- Analysis based on the corporate portfolio (through the Central Credit Register database)
- Global impact on the key indicator CAR (Basel II)

3 - Credit Risk

Credit Risk Scope:

- Static analysis
  - No feedback micro => macro
  - No reaction from banks
- The analysis is performed on the whole banking system, and on the biggest banking groups as well.
- Degradation of the creditworthiness of the portfolio (usually 1 notch)
  - Degradation with respect to the internal rating scale of the Banque de France
  - Benchmarking with other rating scales (S&P's) and default time series.

3 - Credit Risk

Credit Risk Shock:

- Instantaneous shock :
  - increase of the average probability of default = +x% (e.g. between +60% and +90%)
- Impact on credit risk variables :
  - Impact on EL : multiplication of EL by (1+x%)
  - Impact on RWA :
    - we first assume that RWA are unchanged when moving from Basel I to Basel II
    - the PD associated to each rating grade is multiplied by (1+x%)
    - RWA are computed with these new PDs = multiplication of RWA by (1+y%)

3 - Credit Risk

Credit Risk Analysis:

- Before shock : Tier 1 ratio = Tier 1 / RWA
- After shock :
  - EL is compared to the whole provisions. Tier1 is deducted of excess EL (if any). Otherwise, excess provisions are not taken into account (pessimistic hypothesis).
  - RWA are multiplied by (1+y%)

$$ratio\ Tier1 = \frac{Tier1 - \max(0, (1+x\%) * EL - provisions)}{RWA * (1+y\%)}$$

3 - Credit Risk

Credit Risk Results:

- 1-notch degradation on the BDF rating scale is consistent with external and historical benchmarks.
- Tier1 Ratios remain far above 4% after shock (for any large banking groups and at the banking system level).
- Possible to stress-test specific sectors (e.g. 2 notches down for specific industries)

Open issue:

- Estimate the probability of such a shock = quantify the link between the increase of PD and the probability of occurrence

3 - Credit Risk

Improvements under way:

- Profitability model:
  - Link it to the NPL ratio and the creditworthiness of the portfolio
- Capital requirements model:
  - Estimate new credit lines as a function of the economic state
  - Test different rating scales and different definitions of default
- Try to build a panel model to estimate NPL ratio.
- Integrate these different elements into a single framework.

3 - Credit Risk

Limits of the model:

– Contagion effects are not addressed here (current exploration of large exposures data)

– No feedback: reactions from banks (re-allocation strategy) are not taken into account in the model.

Bibliography

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- Baghli M., Brunhes-Lesage V., De Bandt O., Fraisse H., Villetelle J.P., 2004, April, Banque de France Bulletin « The Mascotte macroeconomic model »
- De Bandt & Oung: “Assessment of stress-tests conducted on the French banking system”, Banque de France Financial Stability Review, nov 2004

Appendix: Models and Instruments (1)

Overview of Non performing loans (NPL) model – provisional

General form is linear econometrics with economic and bank specific explanatory variables ($R^2 = 0{,}92$)

$$\Delta NPL_t = 0.61 * \Delta NPL_{t-4} - 0.11 * \Delta GDP_{t-4} + 0.1 * \Delta IR_{t-5} + 0.03 * \Delta Loan_{t-4}$$

ΔNPL_t increase in NPL ratio

ΔGDP_{t-4} 1 year lagged GDP growth

ΔIR_{t-5} lagged Interest Rate variation

$\Delta Loan_{t-4}$ lagged loan growth

In the process of being updated

Appendix: Models and Instruments (2)

Early Warning System SAABA

– Based on Credit Register, BdF rating scale and accounting databases.

– The general framework of the System is currently improved in order to be Basel compliant.

– Global Process :

- Estimation of EL through estimation of PDs and LGDs
- Impact of EL on own funds regarding SP and GP
- Estimation of stressed Gross Operating Income
- Calibration of an extremely negative shock
- Estimation of the impact of the shock on the solvency ratio.

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