Stress Testing: Second-Round Effects

Keith Hall
Reserve Bank of Australia

Hosted by the International Monetary Fund
Washington, DC– May 2-3, 2006

The views expressed in this paper are those of the author(s) only, and the presence of them, or of links to them, on the IMF website does not imply that the IMF, its Executive Board, or its management endorses or shares the views expressed in the paper.
Stress Testing: Second-Round Effects

Expert Forum on Advanced Techniques for Stress Testing
Washington DC, 2-3 May 2006
Second-Round Effects

• What do we mean by second-round effects?

• How we might think about incorporating them in stress tests – with reference to the Australian FSAP?

• Do we worry about them too much?
What do we mean by second-round effects?

- ‘First-round’ – our best estimate of how a scenario will play out in both the real and financial sectors based on existing statistical relationships.

- ‘Second-round’ – changes in the estimated trajectory of key economic and financial variables as financial institutions, firms, households and policy-makers respond endogenously to the unfolding scenario.

- If the stress test replicates a recent adverse event then statistical relationships will incorporate both ‘first’ and ‘second-round’ effects.
Examples of second-round effects

• **Individual banks**: price and volume adjustments in response to an increase in risk – *behavioural* or strategic effects.

• **Banking system**: contagion effects arising from individual bank distress and, *in extremis*, failure; ‘flight to quality’ as depositors move from weaker to stronger institutions.

• Market participants: credit rating adjustments may trigger adverse *financial market* effects driving up funding costs for banks.

• **Monetary authorities**: policy adjustments in response to the *feedback* effects from the financial sector to the real economy e.g. credit crunch.
Background to Australia’s FSAP
Office Property Indicators

Real office property prices (RHS, June 1992 = 100)

Office construction (LHS, per cent of nominal GDP)

Sources: ABS; Jones Lang LaSalle; RBA
Profit before Tax
Return on shareholders’ funds, five largest banks*

* Four largest banks only prior to 1993
Sources: Banks’ annual reports
Bank Lending by Type
Per cent of total on-balance sheet bank lending

Source: APRA
Household Indebtedness
Per cent of household disposable income*

* Household sector excludes unincorporated enterprises. Disposable income is after tax and before the deduction of interest payments.
** Includes the imputed financial intermediation service charge.
Sources: ABS; RBA
Household Debt
Per cent of household disposable income

Sources: National sources; OECD; RBA

* Includes unincorporated enterprises.
^ Disposable income is after the deduction of interest payments.

Canada*
US
Australia
New Zealand*
Germany*^
Netherlands*
UK*
France*^

* Includes unincorporated enterprises.
^ Disposable income is after the deduction of interest payments.
Sources: National sources; OECD; RBA
House Prices

1995 = 100

Index

ABS

APM*

REIA

* Composition-adjusted median

Sources: ABS; APM; REIA
Structural developments: changes in residential lending standards.

- Increased reliance on brokers to originate loans.
- Rapid growth in ‘low doc’ lending.
- An increase in permissible debt-servicing burdens.
- Maximum LVRs raised – low and no deposit loans.
- Genuine savings requirements sometimes waived.
- Use of alternative property valuation methods.
Banks’ Liabilities*
Per cent of total liabilities

Wholesale – domestic

Retail deposits

Wholesale – foreign

* All banks (domestic operations, on-balance sheet)
Source: APRA
The FSAP Scenario: ‘The Perfect Storm’

A multi-variable scenario in which:

- an exogenous shock triggers a sharp fall in house prices;
- negative wealth effects undermine consumption spending bringing the economic expansion to an abrupt end; and
- offshore investors lose confidence in Australian banks resulting in a sharp capital-account-induced fall in the exchange rate and widening of credit spreads.
FSAP stress test: how we went about it.

• Harnessed three capabilities:
  – the macro-modelling capabilities of the Australian Treasury and the RBA;
  – the micro-modelling capabilities of APRA – the prudential regulator; and
  – the internal modelling capabilities of the five largest banks seeking accreditation for advanced IRB status under Basel II.
Macro-modelling capabilities: the Australian Treasury Macro-economic model (TRYM)

- Small quarterly model with 30 behavioural equations
- Supply (neo-classical) determined long-run and demand (Keynesian) determined short-run
- Three production sectors: enterprise, household and Government
- In financial markets, Australia is treated as a small open economy so that in the long run interest rates are determined by world interest rates and exchange rate is determined by uncovered interest parity
Macro-modelling capabilities: TRYM

What TRYM delivers:

- A good national accounting framework for checking the internal consistency of the macro-economic variables in the scenario.
- Smooth quarterly profiles
- Buy-in from Treasury (Ministry of Finance)
Macro-modelling capabilities: TRYM

What TRYM doesn’t deliver:

• An explicit credit channel

• A number of key variables requested by banks e.g. industrial production and retail sales. So need some off-model estimations.

• An answer to the familiar issues of non-linearity and the time variability of key statistical relationships in reduced form models (i.e. you need to inject a fair amount of ‘expert judgement’ along the way).
### ‘Perfect Storm’ Scenario

<table>
<thead>
<tr>
<th>Scenario horizon</th>
<th>Current</th>
<th>Q4 2006</th>
<th>Q4 2007</th>
<th>Q4 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year-ended house price growth (%)</td>
<td>-0.4</td>
<td>-30</td>
<td>0</td>
<td>2½</td>
</tr>
<tr>
<td>Year-ended commercial property (%)</td>
<td>9.6</td>
<td>-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nominal TWI (May-1970 = 100)</td>
<td>64</td>
<td>41</td>
<td>45</td>
<td>48</td>
</tr>
<tr>
<td>Year-ended real GDP growth (%)</td>
<td>2.6</td>
<td>-1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Year-ended consumption growth (%)</td>
<td>3.0</td>
<td>-2½</td>
<td>0</td>
<td>2¼</td>
</tr>
<tr>
<td>Year-ended industrial production* (%)</td>
<td>2.2</td>
<td>-8½</td>
<td>¼</td>
<td>5½</td>
</tr>
<tr>
<td>Trade balance (% of GDP)</td>
<td>-2.2</td>
<td>½</td>
<td>1</td>
<td>-¼</td>
</tr>
<tr>
<td>Year-ended CPI inflation (%)</td>
<td>2.5</td>
<td>5</td>
<td>3¼</td>
<td>2½</td>
</tr>
<tr>
<td>Unemployment rate (%)</td>
<td>5.1</td>
<td>7</td>
<td>9</td>
<td>8¾</td>
</tr>
<tr>
<td>3 year swap rate (%)</td>
<td>5.8</td>
<td>8</td>
<td>7¼</td>
<td>6¾</td>
</tr>
<tr>
<td>Year-ended housing credit growth (%)</td>
<td>15</td>
<td>0</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Year-ended business credit growth (%)</td>
<td>12</td>
<td>1</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

* Measured as the sum of gross value added of manufacturing, electricity, gas and construction.
Thinking about possible second-round effects:

(1) Are contagion effects likely to be important;

(2) Can we factor in some financial market reaction to the unfolding of the scenario;

(3) How should we think about incorporating the strategic or behavioural response of individual banks into the scenario; and

(4) Is there anyway of capturing feedback effects to the real economy?
(1) Second-round effects: contagion

Pre-positioning work – three questions:

(i) What were the chances of ‘first round’ casualties in this scenario – remembering that only the largest (strongest) banks would be involved directly in the ‘bottom-up’ stress test?

(ii) Are smaller banks likely to be more vulnerable – which may; generate some ‘flight to quality’; and

(iii) In extremis, do we have any feel for the direct credit effects from individual bank failures?
(1) Second-round effects: contagion

Used APRA’s microeconomic model to assess the resilience of individual banks to a mortgage shock.

- Expected loss = (PD x LGD x Exp) – mortgage insurance
- PD f(LVR, Age, Loan Size, Loan Type) and LGD f(LVR, Age)
- Built up a PD and LGD matrix for different types of mortgages
- Stressed the base case for a 30% fall in property prices.
(1) Second-round effects: contagion

APRA’s modelling work suggested that:

- Banks could ride out a very large jump in mortgage default rates without failing, or coming close to failing.

- Banks that have been pursuing aggressive lending strategies will suffer more. (So flight to quality considerations can’t be ruled out.)

- So our ‘prior’ was that a shock to household balance sheets and a sharp fall in house prices would not lead to solvency issues in the first-round.

- Nonetheless, still wanted a ‘feel’ for the size of any ‘direct’ contagion effects through inter-bank exposures.
(2) Second-round effects: financial markets

- Scenario assumed that overseas investors would be reluctant to roll-over their holdings of Australian bank paper at current exchange rates and interest rates. This acts as the trigger for a *sharp capital account-induced depreciation*.

- Although no change in cash rate, the scenario incorporated a significant increase in the cost of funds for banks. Based on historical experience, *the three- and ten-year swap rates assumed to rise by around 250 basis points*. 
(3) Second-round effects: behavioural

• Banks provided with the full macro-economic profile and asked to model the impact on balance sheet and profit and loss accounts.

• A 1st ‘run’ with no restrictions on the endogenous response – each bank free to adjust key funding and lending rates and capital management policies.

• A 2nd ‘run’ to then provide for some commonality in key variables.

• If you provide banks with the full scenario and they can see the good times returning – the behavioural response is muted.
(3) Second-round effects: behavioural: towards an ‘iterative’ approach

- Why not provide banks with just the first year of the scenario?
Credit
Year-ended percentage change

Source: RBA
Second-round effects: feedback to the real economy – an ‘iterative approach’.

- Provide banks with only the first year of the scenario – which will include a demand side shock to household and business credit.

- Credit growth will be subsequently shaped by the banks’ strategic response to the new demand conditions and their ability to generate acceptable rates of return on various business lines.

- Adjust macro-forecasts in response to banks’ forecasts for financial variables – provide 2nd year profile.

- Introduce policy adjustments to the scenario when and where appropriate.
(4) Second-round effects: feedback to the real economy – an ‘iterative approach’.

• In practice – ‘iterative’ approaches are time consuming and difficult to accommodate within a tight timetable – at least at the first attempt.

• As banks build up their stress testing capabilities under Basel II it should become easier to contemplate scenarios that take on the characteristics of a multi-period game.
Second-round effects: should we worry about them?

• Stress testing is primarily an exercise in communication between the authorities and the financial sector – both searching for a better fix on potential vulnerabilities. The more you talk, the better the results.

• Capturing second-round effects will certainly provide a fuller picture of the exposure of a financial system to adverse shocks – gives us more to talk about.

• But at this stage of the evolution of stress testing, still plenty of work to be done around measuring first-round effects across portfolios.
Thank you