AUSTRALIA'S STRESS TESTING EXPERIENCE

Introduction

In early 2006, the International Monetary Fund (IMF) concluded an assessment of Australia's financial system under the auspices of the Financial Sector Assessment Program (FSAP).

An important part of the FSAP process was a stress-testing exercise of the banking system jointly undertaken by the IMF staff, the Australian authorities and the five largest Australian banks (these banks account for more than two-thirds of total resident Australian banking assets). The exercise consisted of two main parts: a macroeconomic stress test and a series of single-factor stress tests to gauge the sensitivity of bank profits to sharp movements in market interest rates. In addition, at the IMF's request, the Australian Prudential Regulation Authority (APRA) undertook a partial update of its 2003 mortgage portfolio stress test.[1]

The Approach

The approach used for the macroeconomic stress test was to specify a three-year macroeconomic scenario and then ask banks to assess how they expected to perform. The scenario, developed by the IMF in conjunction with the Reserve Bank, APRA and Treasury, focused on two potential risks previously identified by the IMF in its surveillance work. These were: a large fall in house prices contributing to a recession; and domestic banks having difficulty rolling over their foreign liabilities, resulting in higher funding costs and a significant depreciation of the exchange rate.

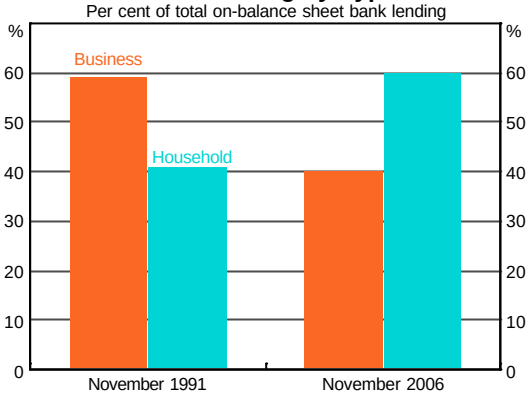
The focus on house prices reflected the fact that over the preceding fifteen years, the share of bank lending to households (which mainly comprises lending for housing) had increased by 20 percentage points to 60 per cent, and there had been a near tripling of house prices over the same period (Graph 1). Similarly, there had been a marked change in the way banks had raised funds, with the share of liabilities raised offshore increasing from around 10 per cent in 1990, to a little under 30 per cent in 2005 (Graph 2).

[1] In 2003, APRA conducted a stress test of the mortgage portfolios of 120 authorised deposit-taking intermediaries. APRA used a microeconomic model which estimated housing loan default rates and losses based on the characteristics of individual loans, in particular the loan-to-valuation ratio (LVR) at origination and the age of the loan. The model focused on the impact that a reduction in housing prices of 30 per cent (in real terms) over a one year period would have on the capital position of ADIs.

Graph 1

Bank Lending by Type

Per cent of total on-balance sheet bank lending

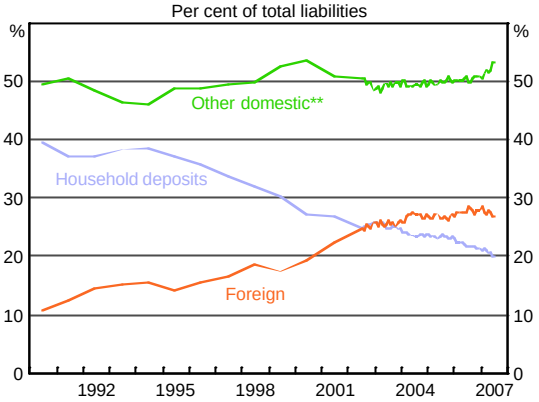


Sources: APRA; RBA

Graph 2

Banks' Liabilities*

Per cent of total liabilities



* All banks (domestic operations, on-balance sheet). Annual data up to June 2002 and monthly data from July 2002.

** Mainly debt securities and business deposits.

Sources: ABS; APRA

A small macroeconomic model developed by the Australian Treasury (known as TRYM) was used to ensure internal consistency of the macro-economic variables in the scenario.[2]

The Scenario

The scenario had the following key features:

- a 30 per cent fall in house prices, a 10 per cent fall in commercial (office) property prices and a 27 per cent fall in equity prices;
- a 37 per cent depreciation of the exchange rate, higher wholesale funding costs for banks and unchanged official interest rates;
- a short recession in which real GDP falls by 1 per cent in the first year, before recovering under the influence of the significantly lower exchange rate. The recession is driven by an unprecedented contraction in household consumption, which falls by 2½ per cent in the first year, is flat in the second year and recovers in the third; and
- an increase in the unemployment rate from around 5 per cent to around 9 per cent.

Movements in some of the key macroeconomic and financial variables are shown in Table 1.

[2] For a discussion of the model see *The Macroeconomics of the TRYM Model of the Australian Economy* (1996), Commonwealth Treasury

Table 1: Scenario Profiles for Key Macroeconomic Variables

	Actual	Projections (year end)		
	2005	2006	2007	2008
Economic variables				
Real GDP (a)	2.9	-1.0	2.2	4.0
Consumption (a)	2.5	-2.6	0.1	2.1
Exports(a)	2.1	7.1	5.1	3.5
Imports(a)	6.7	-15.3	-6.1	4.0
Consumer price index(a)	2.8	5.0	3.3	2.5
Unemployment rate (per cent)(b)	5.1	7.1	9.0	8.7
Asset prices and financial variables				
House prices(a)	2.1	-30.0	0.0	2.5
Commercial property prices(a)(c)	11.8	-10.0	0.0	0.0
3-year swap rate (per cent)(b)	5.6	8.0	7.3	6.8
10-year swap rate (per cent)(b)	5.7	8.2	7.4	6.9
10-year government bond yield (per cent)(b)	5.2	6.3	5.8	5.6
Corporate bond spreads (basis points)(b)	65	165	115	65
Bank bond spreads (basis points)(b)	50	250	150	50
Nominal TWI(a)	0.5	-36.5	9.7	7.3
Share market(a)	17.6	-27.0	8.0	10.0

(a) Year-ended percentage change
(b) 2005 observation is as at end December 2005
(c) Office property only
Source: RBA

The detailed scenario was provided to the banks in November 2005. An initial round of results was provided to the authorities in March 2006. Discussions were then held between the reporting banks, the Reserve Bank and the IMF, following which the banks submitted a second round of results in June.

The Results

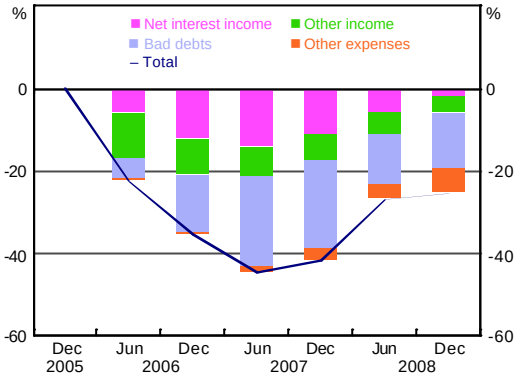
In aggregate, the results showed a decline of around 40 per cent in the banks' profits after around 18 months, although there was considerable variation across banks (Graph 3). By the end of the three-year scenario, profitability had recovered somewhat, but remained around 25 per cent lower than in December 2005. The reduction in profits largely came from higher bad-debt expenses, although banks also reported lower net interest income due to higher funding costs. Those banks with large funds management operations also reported a decline in profits from asset management.

The reported credit losses on housing loan portfolios were smaller than those on business loan portfolios despite a significant fall in house prices and a sharp increase in unemployment (Graph 4). The increase in credit losses primarily occurred not because households could not repay their housing loans, but because households cut back consumption, partly in the effort to service their loans, causing problems for the business sector and thus for banks' business loan portfolios. In the banks' modelling, losses on housing loans were ameliorated by the ability of borrowers to draw on buffers built up through previous repayments being higher than those scheduled and also through the use of mortgage insurance. Moreover, the impact of the problems in the business sector on bank performance was not as severe as it might otherwise have been, owing to the good shape of business balance sheets, and an improvement in the

performance of export and import-competing industries due to the depreciation of the exchange rate.

Graph 3

Contribution to Profits under FSAP Scenario*

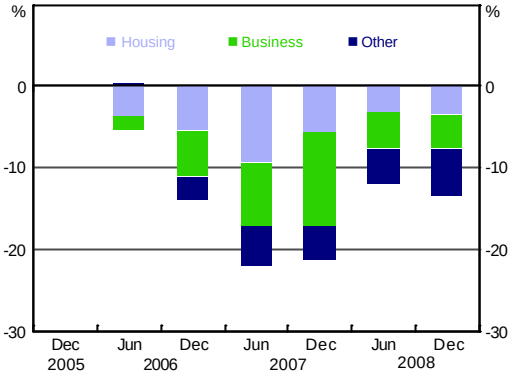


* Profits before tax relative to December 2005 half-year profits, five largest banks

Source: RBA

Graph 4

Contribution to Profits – Bad Debts by Loan Type*



* Bad debts relative to December 2005 half-year profits before tax, five largest banks

Source: RBA

Some Observations

The limitations of the 'bottom-up' approach to stress testing were clearly evident in this exercise. Notwithstanding the fact that the business models of the banks that were tested are very similar, the results across banks showed considerable variance in terms of the losses incurred, the profile of these losses over time and their composition. While these differences may be partly explained by variations in the structure of individual bank balance sheets, they also reflect the very different approaches used by the banks to model their outcomes. Some banks took a very granular approach, modelling the impact of the scenario at individual business levels, while others took a highly aggregated top-down approach.

Conversely, having banks undertake the exercise themselves provided a number of valuable insights, particularly into the way banks run their businesses and how they think about the risks they manage.

For those institutions where stress testing is an integral part of their risk management framework, the stress test scenario formed the basis for a discussion of the effect of the event on individual business units and the linkages across businesses. Some banks, for example, reacted to the weaker domestic growth and large depreciation in the exchange rate by assuming a shift of resources from business units which focussed primarily on domestically oriented industries, such as service industries, and the household sector, to those that were more export oriented. For these banks, the stress test was a useful means of communicating senior management's risk appetite across the various levels of the firm (with the results being signed off by the Board of one bank). These banks were more likely to use a mix of quantitative and judgemental assessments.

Other banks tended to either rely primarily on judgements, or were very model driven. The reduction in profits from the event tended to be smaller for the model-driven banks, perhaps reflecting their models' reliance on a long period of very good performance of the Australian economy. On the other hand, institutions that relied

mainly on judgements tended to take a more short-term approach. Some banks, for example, assumed an increase in dividend payments from subsidiaries or generous offsets to losses from net interest income by assuming a 'flight-to-quality' related increase in bank deposits. This could of course have reflected the design of the stress test, to the extent that the eventual recovery of the economy was known (see below).

There was no evidence of banks taking into account second-round effects, with each bank acting in its own interest.

More broadly, the exercise provided a good communication vehicle between the authorities and banks, particularly those of us without supervisory responsibilities. It was an effective, albeit indirect, means of communicating and exploring with banks issues that were of concern to us, as well as an opportunity for the banks to allay some concerns, such as those relating to their relatively heavy reliance on offshore markets for funding.[3]

The way ahead

The Australian Council of Financial Regulators, which comprises the heads of the Australian Treasury, APRA, the securities regulator and the Reserve Bank, will repeat the exercise on a regular basis, with the next exercise occurring in 2008. Based on our experience from the FSAP exercise, the most likely way forward is:

(i) It is likely that a 'bottom-up' approach will be repeated, notwithstanding the shortcomings of the bottom-up approach – in particular the difficulties of aggregating individual bank results. The most appealing feature of the 'bottom-up' approach is that it lends itself to greater communication between the authorities and the individual banks.[4] Rather than concentrating on one point in the tail of the distribution of returns, it gives the authorities greater scope to explore with each bank other points in the tail of the distribution.

(ii) Scenarios may need to be more stressful. The scenario involved a domestic recession amid an ongoing expansion of the global economy. All previous recessions in Australia have been associated with a global downturn, and incorporating a weaker world economy in the FSAP scenario would have made for a significantly more challenging environment for the banking sector. In addition, the stress scenario may need to be combined with a significant financial event (see point (v) below).

(iii) One important limitation of the FSAP scenario was that banks were provided with the future path of all the key macroeconomic and financial variables. This significantly reduced the uncertainty that each bank faced, thereby removing behavioural elements that are of particular interest in exploring how financial institutions respond to severe stress. The strategic response from banks in the

[3] The exercise also identified a number of definitional inconsistencies across banks, which APRA will follow up on.

[4] The 2005 report of the Working Group established by the Committee on the Global Financial System, entitled *Stress testing at major financial institutions: survey results and practice* noted that one of the more important attributes of an effective stress testing regime is its ability to get a conversation started within an organisation about the risks that it is running.

first year was limited owing, presumably, to their knowledge that a recovery was in prospect over the following two years. Ideally, the process would be iterative. While this would make the exercise more resource intensive, the results would better mimic the real world. It would also promote a better dialogue within the individual banks and between the authorities and each bank.

(iv) Similarly, an iterative approach would facilitate taking into account second-round effects. The FSAP exercise was based on our best estimate of how a scenario would play out in both the real and financial sectors based on existing statistical relationships. An iterative exercise which took into account second round effects, however, would allow the estimated trajectory of key economic and financial variables to be varied as financial institutions, firms, households and policy makers reacted to the unfolding scenario.

(v) Ideally, severe market liquidity disruptions would be incorporated into a stress test scenario, similar, for example, to that experienced most recently in asset-backed markets. This, however, will not be easy. The CGFS report on stress testing practice noted that most institutions run separate funding liquidity stress test scenarios, rather than incorporating them into single stress tests; moreover, institutions rarely incorporate feedback effects, which measure the second-round impact of firms' own activities on prices, as they are difficult to measure.[5] A next-best solution would be to undertake a separate stress test scenario which focussed on the effect on both direct and indirect commitments of a significant reduction in market liquidity (either the complete closure or the withdrawal of a significant market maker). In any case, we would look to make use of information collected independently from banks, such as information on inter-bank exposures collected through the inter-bank payments settlement system.

Conclusion

Despite the limitations that I have listed, the stress test exercise provided a valuable vehicle for promoting a useful dialogue between the authorities and the banks regarding the measurement and management of risk. The exercise highlighted the importance of banks looking beyond historical experience in assessing the risk in their mortgage portfolios and the importance of taking into account the changing nature of the correlations between these portfolios and commercial loan portfolios. Reflecting the value of the FSAP exercise, stress testing will be repeated on a regular basis.

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29 October 2007

[5] *Stress testing at major financial institutions: survey results and practice* (2005), Committee on the Global Financial System, Bank for International Settlements, Switzerland