



## IV SPECIAL FEATURES

### A STRESS-TESTING BANKS IN A CRISIS

*This special feature describes the key characteristics of macro stress tests for banks specifically in relation to their use during financial crises. The analysis draws on recent experiences in the United States in 2009 and in the EU in 2010, where macro stress tests for banks were used in one of the most severe financial crises in decades.*

#### INTRODUCTION

Macro stress tests are a tool to measure the resilience of the financial system or its key components to various stress factors, based on the quantification of the link between macroeconomic variables and the health of either individual financial institutions or the financial sector as a whole.<sup>1</sup> Starting with the macro stress tests in the Financial System Assessment Programs (FSAPs) conducted by the International Monetary Fund (IMF) in the late 1990s, the use of macro stress tests has become common practice among central banks and international institutions.<sup>2</sup>

The focus on the systemic dimension of risk and resilience, and the link with a fully fledged macroeconomic scenario distinguish macro stress tests from so-called sensitivity analyses – where only a single risk factor is simulated to reach stressed levels – and from stress tests that are applied to an individual financial institution in isolation from other parts of the financial system. The latter two typologies of stress test are more commonly used by supervisory authorities, as they are more suitable for assessing the condition of individual institutions or if the focus is on the specific risk exposures of an individual financial firm. However, in both supervisory and macro stress tests the analysis is typically undertaken well before such stress factors have severely affected the viability of financial institutions. In other words, these are routine “health checks” that are conducted irrespective of whether the financial system or individual firms are in crisis.

This special feature takes a different perspective and restricts the analysis to the –

admittedly few – cases in which macro stress tests have been carried out during a financial crisis, i.e. at times when the system-wide resilience of the financial sector has been at stake. Because of their focus on systemic risk, macro stress tests can address the need to cover the system-wide nature of the drivers and the impact of a financial crisis. The focus is further narrowed to consider macro stress tests for banks only.<sup>3</sup>

The motivation for this approach is the experience gained in the recent financial crisis, where macro stress tests for banks were used as a policy tool to restore market confidence and improve market functioning. This indicates that macro stress tests can be employed to communicate with market participants and to increase transparency on the condition of financial institutions.

In this light, it is possible to identify three crucial features for the effectiveness of macro stress tests conducted in a crisis:

- synchronisation in the publication of results across institutions, authorities and possibly countries, and related communication policies;
- high levels of disclosure;
- complementarities with other policy actions for institutions that do not “pass” the test.

1 See ECB, Special Feature A, entitled “Country-level macro stress-testing practices”, *Financial Stability Review*, June 2006, for a discussion of the main features of macro stress tests.

2 For a recent overview of stress tests for the banking sector, see M. Quagliariello (ed.), *Stress-testing the Banking System, Methodologies and Applications*, Cambridge University Press, 2009. The practice and theory of macro stress tests is still being developed, and authorities continue to improve their stress-testing frameworks. For a brief discussion of their role in macro-prudential oversight, see ECB, Special Feature B, entitled “Analytical models and tools for the identification and assessment of systemic risks”, *Financial Stability Review*, June 2010.

3 Stress tests are also routinely carried out by supervisors on financial institutions other than banks. For instance, an EU-wide stress test was recently conducted for the insurance sector. For additional details, see Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS), “Results of CEIOPS EU-wide stress test for the insurance sector”, press release accompanying the publication of the results, 16 March 2010.

This special feature discusses these characteristics against the experience of the two most prominent examples in the recent crisis, i.e. the macro stress tests for banks conducted in the United States in 2009 and in the EU in 2010.<sup>4</sup> Although more insights will be gained over time,<sup>5</sup> and there is clearly room for improvement in implementing crisis stress tests,<sup>6</sup> the concluding remarks present the features that may be the most effective in similar circumstances in the future.

## TWO RECENT EXPERIENCES

In 2009 the US authorities conducted a macro stress test under the framework of the Supervisory Capital Assessment Program (SCAP).<sup>7</sup> The key publications associated with this exercise were the note on methodological features,<sup>8</sup> issued two weeks prior to the finalisation of the exercise, and the report presenting bank-level results and the associated policy prescriptions, issued in early May 2009.<sup>9</sup> 19 bank holding companies were included in the SCAP, covering approximately 66% of total US banking sector assets, on a global consolidated level. The exercise was run over a two-year horizon (2009 and 2010).

At the time of the SCAP, the major concerns over the resilience of the US banking sector were related to banks' exposures to real estate and their holdings of complex financial instruments used for trading purposes. The results from the SCAP provided detailed information on related losses under the baseline and the "more adverse" scenarios. Both the banking and the trading-book credit exposures of banks were covered (first and second lien mortgages, credit cards and other consumer loans, commercial and industrial loans, commercial real estate, and other loans), as well as holdings of complex trading instruments in the trading book for banks with trading account assets exceeding \$100 billion as of 31 December 2008 (projections of trading-related losses for the "more adverse" scenario including losses from counterparty credit risk exposures, potential counterparty defaults and credit valuation adjustments

on those counterparties where the probability of default was expected to increase during the stress event).

The minimum capital thresholds used in the exercise were 6% for the Tier 1 capital adequacy ratio and 4% for Tier 1 common capital. According to the methodological note, the probability of the "more adverse" scenario was roughly 10% in terms of house price dynamics, and roughly 15% in terms of GDP growth and unemployment.

In the EU, the stress-test exercise, coordinated by the Committee of European Banking Supervisors (CEBS) and developed in close cooperation with the ECB and the European Commission, was completed in 2010.

4 Other examples include the stress tests conducted by the UK Financial Services Authority in 2009, around the time of the US Supervisory Capital Assessment Program in May 2009, and by the Swiss Prudential Supervisor (FINMA) in 2010, around the time of the EU-wide stress test in July 2010. These examples are not described in detail here, but it is important to note that in both cases the level of disclosure was not as high as in the US and European exercises. This difference may reflect the fact that market concerns were focused on the United States and the EU in 2009 and 2010 respectively.

5 For the Supervisory Capital Assessment Program, several reviews from the official sector and academics have become available over time. See, for example, B. J. Hirtle, T. Schuermann and K. J. Stroh, "Macroprudential Supervision of Financial Institutions: Lessons from the SCAP", *Federal Reserve Bank of New York Staff Reports*, No 409, November 2009 and A. E. Wall, "The 2009 Stress Tests: A Model for Periodic Transparent Examinations of the Largest Bank Holding Companies", *LLM Long Paper, International Finance Seminar*, Harvard Law School, April 2010. An official review was undertaken by Congress; see the June Oversight Report, "Stress Testing and Shoring up Bank Capital", Congressional Oversight Panel, 11-12 June 2009.

6 Some of the areas for improvement of stress tests in a crisis are discussed at the end of this special feature. Other, more general deficiencies of macro stress tests (e.g. the need to improve the modelling of interconnectedness within the financial system or in capturing the two-way relationship between the financial sector and the economy at large), although applicable also to stress tests in a crisis, are not discussed here.

7 The SCAP was run jointly by the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation and the Office of the Comptroller of the Currency.

8 Board of Governors of the Federal Reserve System, "The Supervisory Capital Assessment Program: Design and Implementation", 24 April 2009.

9 Board of Governors of the Federal Reserve System, "The Supervisory Capital Assessment Program: Overview of Results", 7 May 2009.

The methodological note and test results were released on the same day in July.<sup>10</sup> The exercise covered 91 EU banks, representing around 65% of the assets of the EU banking sector, on a global consolidated level, and at least 50% of each EU country's total banking sector assets. Because of the cross-border operations of large European banks, seven EU countries were included in the exercise through subsidiaries of EU banks. Also in the EU case, the stress horizon was two years (2010 and 2011), and two scenarios, a benchmark and an adverse scenario, were used.<sup>11</sup>

Similarly to the SCAP, the European exercise devoted particular attention to a specific type of exposure, responding to the main source of market concerns at the time. In the European case, this was exposures to sovereign risk from EU countries on account of which interbank market liquidity had fallen markedly in Europe, especially in the euro area. The European exercise covered credit risk in the banking book, as well as market and sovereign risk in the trading book. To reflect the primacy of sovereign risk in the design of the EU-wide stress test, the deterioration in macroeconomic conditions under the adverse scenario was compounded by an additional increase in long-term interest rates, of a size comparable to that experienced in early May in the European sovereign bond markets.

The minimum capital threshold for “passing” the test was 6% Tier 1 capital. According to ECB estimates, the probability of the adverse scenario was roughly 5% in terms of GDP growth.

The European stress test involved a large number of countries and national supervisory authorities, but its success relied, among other factors, on the respective national efforts being consistent in terms of their methodology and underlying assumptions. To this end, the macroeconomic scenarios, which were designed by the ECB for each European country on the basis of the European Commission's forecasts and ECB computations for the adverse scenario, were to be employed by each country.

The ECB also provided reference values for the risk parameters (probability of default and loss given defaults for different types of portfolio in the banking book), although supervisors could allow some differences in the way the macroeconomic scenarios were translated into the risk parameters for the banks with the most sophisticated risk-modelling capacity. Nonetheless, participants made efforts to ensure the consistency of internal parameters with the ECB input. Haircuts on sovereign bonds in the trading book were computed for all EU sovereigns by the ECB, and were used in the same way by all banks. CEBS also provided detailed guidance for the computation of market risk in the trading book, as well as on the treatment of both accounting (i.e. adoption of the International Financial Reporting Standards, IFRS) and regulatory (i.e. adoption of Basel II) standards.

#### MAIN FEATURES

A number of features of the US and European exercises are relevant from the perspective of drawing lessons on the use of macro stress tests in a crisis. As a starting point, stress tests in a crisis must address the systemic dimension. Although modelling the interconnectedness within the financial system – a key aspect of systemic risk – remains work in progress, and the associated data needs are demanding and in part still unmet, at the very minimum all institutions that have a bearing on the resilience of the system should be included in the stress-test exercise. If necessary, this may require adjusting the sample of relevant institutions between normal and crisis times. Separately, the success of a stress test in a crisis is closely associated with its impact on market conditions, as the stress test is

<sup>10</sup> See Committee of European Banking Supervisors, “CEBS's press release on the results of the 2010 EU-wide stress testing exercise”, press release, 23 July 2010, and the CEBS summary report mentioned therein, entitled “Aggregate outcome of the 2010 EU-wide stress test exercise coordinated by CEBS in cooperation with the ECB”.

<sup>11</sup> An intermediate adverse scenario, excluding sovereign risk, was also constructed in the CEBS exercise. See Annex 2 of the CEBS summary report (op. cit.), which provides a detailed description of the scenarios.

employed as a policy tool to respond to the crisis. To achieve this goal, authorities need to engage in a dialogue with market participants that is more intense than in normal times.

Turning to the most distinguishing features of the recent US and European macro stress tests during the recent crisis, five can be identified and are presented below.

First, *communication* was carefully prepared ahead of the publication of the results, with a much higher profile than in normal times. For the US authorities, the release of the technical note two weeks before the results offered the opportunity to convey information on key details of the exercise, especially the severity of the “more adverse” scenario. In the European case, a CEBS press release issued on 18 June,<sup>12</sup> following the conclusions of the meeting of the European Council on 17 June,<sup>13</sup> officially announced the plan to publish bank-level results in July.<sup>14</sup> This news was highly significant. CEBS had conducted stress tests in the past,<sup>15</sup> and national authorities within the EU routinely run stress tests in line with best supervisory practices. However, the 2010 EU-wide exercise was to be critically different, in that detailed data were to be published, bank by bank. In addition, in a second communication three weeks prior to the finalisation of the exercise,<sup>16</sup> CEBS announced that the sample of banks had expanded to 91 banks, and their names were made public, in contrast to the 22 anonymous banks covered in 2009. This was done to respond to the systemic nature of the crisis and the need to increase transparency and dispel general market concerns.

A second and related feature was *synchronisation* in releasing the results, as this can critically contribute to the maximum market impact of stress tests in a crisis. In both the US and the European cases, publication was coordinated by the authorities in charge, although there were additional hurdles to be overcome in the latter case. The EU-wide exercise involved the supervisory authorities of all the EU countries, with the additional complication of the need to coordinate the release of information

by home and host authorities where cross-border banks were involved. Moreover, some national supervisory authorities did not have the power to release information on individual institutions, as the data were considered to be proprietary information of the banks. As can be evinced from CEBS’s accurate description of the timeline for the release of information,<sup>17</sup> synchronising the publication of the EU-wide exercise required careful planning.

Third, a high level of *detail on the methodology* employed in the exercise was provided by the time of the release of the results. This reflected the importance of market participants having confidence in the quality of the analysis. In particular, they needed to have sufficient information to be able to replicate the stress-test exercise, and the technical features were an essential component to this end. The detailed technical notes provided by the US and European authorities were made available to respond to this goal.<sup>18</sup>

Fourth, in both the SCAP and EU-wide exercises, the level of *disclosure* of the stress-test results was higher than in past macro stress tests or even supervisory stress tests.

12 See Committee of European Banking Supervisors, “CEBS’s press release on state of play with the 2010 EU-wide stress testing exercise”, press release, 18 June 2010.

13 See paragraph 14 of the Conclusions of the European Council, 17 June 2010.

14 The publication date was announced in Committee of European Banking Supervisors, “CEBS’s statement on key features of the extended EU-wide stress test”, press release, 7 July 2010.

15 For the exercise conducted in 2009, CEBS issued a press release summarising the main thrust of the results and the macroeconomic scenario. See Committee of European Banking Supervisors, “CEBS’s press release on the results of the EU-wide stress testing exercise”, press release, 1 October 2009.

16 See Committee of European Banking Supervisors, “CEBS’s statement on key features of the extended EU-wide stress test”, press release, 7 July 2010.

17 See Committee of European Banking Supervisors, “CEBS’s statement on the time of publication of the results of the EU-wide stress testing exercise”, press release, 19 July 2010.

18 As an example of the complications arising from incomplete disclosure of technical details, it can be recalled that some market commentaries were critical when discrepancies appeared between banks’ quarterly reports in late summer and their disclosure in July under the EU-wide stress test. This prompted a clarification from CEBS. See Committee of European Banking Supervisors, “CEBS Statement on the disclosure of sovereign exposures in the context of the 2010 EU-wide stress testing exercise”, press release, 8 September 2010.

By design, stress-tests are a “what if” type of exercise and are based on scenarios that are more adverse than the central forecasts. Because of this, and the market sensitivity of the results of a stress-test exercise, the output of routine macro stress tests has usually not been published, or only some aggregate information (e.g. across groups of banks) has been released.<sup>19</sup> The argument of market sensitivity was reversed in the crisis, as market reaction – via increased transparency and market confidence – was one of the goals of the US and the European exercises. Although in any macro stress test some institutions may not “pass” the test and there is a risk that they are penalised in the markets, in the recent financial crisis this concern was addressed by specific policy provisions, as explained below, rather than by making the results confidential. Moreover, even for institutions that were perceived to be weak, the publication of detailed results may have been beneficial as it reduced the scope for ongoing market pressure and put an upper bound on the potential scale of losses.<sup>20</sup>

A related point concerns additional disclosure in conjunction with the publication of the stress-test results. In the European exercise, all 91 banks were expected to disclose non-stressed exposures to each EU sovereign in their banking and trading books. As such, this disclosure was unrelated to the stress test but an important complement to it. In the US case, there was less emphasis on disclosure of the volume of exposures to real estate or complex financial instruments. This can be partly explained by the fact that information gathering on this type of exposure had already been organised at the international level, starting in 2008, although exposure data were typically disclosed only to national supervisory agencies.<sup>21</sup> Overall, this kind of additional information was useful to provide the context within which to assess losses from the stress test exercise.

Finally, *backstops* were put in place in both the United States and in each relevant EU country in case some banks were found to have capital buffers below the threshold adopted in the

stress-test exercise. Although in both the US and European exercises a market solution to increase banks’ solvency ratios was clearly preferred, publishing bank-level results during a financial crisis could have exposed weaker banks to a negative market reaction. To avoid this, authorities provided information on the type of backstop that would be available to the weaker banks. In the US case, banks that needed to increase their capital base in order to establish a buffer were required to develop a detailed capital-raising plan over the following thirty days and implement it in the following six months. This could include either applying to the US Treasury for capital via the Capital Assistance Program, or exchanging banks’ existing Capital Purchase Program preferred stock. In addition, several other programmes had been put in place by the US Treasury and the Federal Reserve System by that time.<sup>22</sup> In the European exercise, banks needing additional capital were expected

19 See, for instance, the format of the publication of banks’ stress tests in the financial stability reports by the Swiss National Bank, or by the IMF in the FSAP reports. On the other hand, Sveriges Riksbank publishes bank-by-bank results on a regular basis, based on banks’ reports and the central bank’s own risk models. Moreover, in June 2010 Sveriges Riksbank began publishing a new chapter in its Financial Stability Report, dedicated to macro stress tests and the discussion of bank-level results.

20 For instance, at the time of the EU stress test, market concerns about the condition of the Spanish savings banks (“cajas”), known to have large exposures to the troubled domestic residential real estate sector, were particularly acute. The especially large coverage of the Spanish banking sector in the 2010 EU-wide stress test is noticeable, and it may be ascribed to the decision to take advantage of the test to increase transparency and dispel market concerns about the smaller cajas.

21 The Financial Stability Forum (FSF) provided a template for this disclosure (page 63) in its report, entitled “Report of the Financial Stability Forum on Enhancing Market and Institutional Resilience”, April 2008, and home supervisory authorities of the major banks were expected to monitor compliance with this disclosure template in the context of the implementation of the FSF recommendations. CEBS contributed to the EU-level implementation of this FSF recommendation with the release of its own templates for disclosure, both in 2009 and 2010. The latest CEBS report on disclosure, entitled “CEBS Principles for disclosures in times of stress (Lessons learned from the financial crisis)”, was issued on 26 April 2010.

22 For an overview of various policy initiatives up to May 2010, see, for instance, S. M. Stolz and M. Wedow, “Extraordinary measures in extraordinary times – Public measures in support of the financial sector in the EU and the United States”, *Occasional Paper Series*, No 117, ECB, July 2010. For an assessment of these policies’ impact, up to end-2009, see the paper issued by the Bank for International Settlements, entitled “An assessment of financial sector rescue programmes”, *BIS Papers*, No 48, July 2009.



to take the necessary steps to reinforce their capital positions through private sector means and by resorting, if necessary, to facilities set up by Member State governments, in full compliance with EU state aid rules. In particular, they were expected to propose a plan to address the weaknesses revealed by the stress test, and the plan was to be implemented within a period of time agreed with the supervisory authority. As in the US case, a number of other policies, independent of the stress tests, had already been put in place to sustain market functioning and alleviate concerns over specific risk exposures. In particular, two programmes were launched earlier on in the EU in order to address market fears of sovereign default and were addressed at European sovereigns: the European Financial Stabilisation Mechanism (EFSM)<sup>23</sup> and the European Financial Stability Facility (EFSF).<sup>24</sup> Simultaneously, in early May 2010, the ECB established the Securities Markets Programme (SMP) to contain adverse movements in sovereign bond yields. The EFSM has been operational since 10 May 2010, and the EFSF became fully operational on 4 August 2010. The EFSF has been authorised to issue bonds in the market, which will be guaranteed by the euro area countries. Loans to a country in difficulty under the EFSM and EFSF must be accompanied by a detailed and demanding set of policy conditions.

Notwithstanding the many similarities between the US and European exercises, it is useful to bear in mind one important difference, related to the timing of the exercise in relation to the phases of the crisis. This difference can also shed light on useful features of macro stress tests in a crisis.

The SCAP was conducted at a time when the financial crisis had a truly global dimension with, at its core, the US financial system, and when the level of uncertainty regarding the resilience of the financial sectors in several countries was at its most acute. The European exercise came at a later phase in the financial crisis, at a time when the concerns were more localised, but also when financial firms had been further debilitated by a prolonged period of

stress.<sup>25</sup> The main implication is that the design of stress tests needs to reflect these factors, by adjusting not only the main risk drivers (e.g. sub-prime mortgages and complex trading instruments versus sovereign risk), but also the scope of the exposures at risk, i.e. those to which the stress factors are to be applied. By way of example, the European exercise covered a wider range of banking book exposures, including non-financial corporations, sovereign and other financial institutions, as well as all types of exposure to the household sector. This reflects the fact that as a financial crisis – i.e. a crisis that originates in the financial system – progresses, more traditional banking book exposures become increasingly relevant for the assessment of the resilience of banks. As a result, such exposures need to be given more prominence.

#### ARE MACRO STRESS TESTS USEFUL IN A CRISIS?

Following the example of the SCAP, an expectation may have started to build up among market participants that authorities will respond to a crisis with macro stress tests, among other tools. The EU-wide exercise is likely to have strengthened this perception and, as macro stress tests may be used again in the event of future financial crises, it is helpful to review here the most useful lessons.

It can be safely said that the publication of the results of both the European and the US exercises contributed to an immediate reduction in market tensions. However, over time, the market impact may be reinforced or weakened by intervening factors. For instance, the US macroeconomic outlook improved around the time the SCAP results were published, thus removing one major downside risk to the banks.

<sup>23</sup> See the press release of the Economic and Financial Affairs Committee, Council of the European Union, No 9596/10, 9/10 May 2010, announcing the establishment of the EFSM.

<sup>24</sup> More information is available on the EFSF website (<http://www.efsf.europa.eu>).

<sup>25</sup> By the time of the EU-wide stress test, several EU financial institutions had already received government support in the form of capital injections, impaired asset relief schemes or guarantees on liabilities (see S. M. Stolz and M. Wedow, *op. cit.*).

In the European case, just one business day after publication of the results, global regulators announced important progress in finalising the new regulatory framework for banks (Basel III) – in a direction that was seen as less demanding than banks initially feared. This boosted confidence in the banking sector in Europe and in other regions, irrespective of the EU-wide stress test.

Another qualifier concerns the underlying drivers of the crisis, which can adjust at different speeds across different financial crises. For instance, concerning holdings of complex financial instruments assessed in the SCAP, origination of these products had come to a halt by the time the SCAP was carried out, which helped to put a firm upper bound on banks' exposures and potential losses. In the European case, the risk content of exposures to sovereign risk could only change more slowly, as fiscal consolidation requires time, even after budgetary plans are agreed at the national level.

As regards the most critical features of a successful stress test in a crisis, it is clear that both in the US and European cases, disclosure was paramount. In both exercises, enough information was provided to put an upper bound on the losses of key banks, thus helping to dispel concerns about hidden exposures and related losses. It is important to recognise that three components are important for disclosure to be fully informative: volume of losses, remaining capital buffers, and methodology and assumptions. Such a level of disclosure can expose the exercise to criticism, as happened both in the US and European cases,<sup>26</sup> but will provide sufficient elements for market participants to replicate the exercise, and even apply potentially different assumptions.

A second lesson – closely related to the high levels of disclosure – is that stress tests cannot be used in isolation during crisis times. As already mentioned, it is necessary that stress tests be part of a package of other policy measures. This is essential for banks that need to increase their capital buffers based on the findings of

the exercise and, more broadly, to address the underlying drivers, such as sovereign risk in the European case.

A third lesson is that communication policies have to be carefully managed. Here it is important to strike a balance between early communication, so as to achieve some initial attenuation of market tensions and better reception by market participants, and the need to safeguard the position of the financial institutions under analysis before finalising the exercise. In the US and European cases, less than a couple of weeks passed between communicating the analytical details and publishing the results, and this time frame may be a useful benchmark for future stress tests. In this context, it is also important to emphasise the importance of synchronising the release of the results across authorities, firms and possibly countries. The simultaneous release of results has a number of advantages. It encourages market discipline, especially where financial firms themselves are expected to provide additional information,<sup>27</sup> and, more importantly, it avoids a situation where market pressure is concentrated on firms that disclose at a later stage. In addition, it allows for comparisons across institutions that are perceived to be in a similar position, thus increasing the credibility of the exercise, as cross-checks enable an assessment of the robustness of the methodology.

Finally, the challenge of coordination is obviously far greater when the exercise covers more than one country. Clear institutional arrangements supporting such cross-country coordination are needed for the success of joint exercises. In the European context, this was greatly facilitated by the roles played by CEBS, the ECB and the European Commission.

<sup>26</sup> For instance, the macroeconomic “more adverse” scenario in the SCAP was seen as too “soft” in some initial market commentaries; likewise, pre-publication leaks about the level of sovereign haircuts created some scepticism with regard to the European exercise.

<sup>27</sup> In the European exercise, a few banks did not publish information on their exposures to EU sovereign risk on 23 July 2010 according to the agreed format. Following negative reactions in market commentaries and a build-up of market pressure, these banks decided to release the information in compliance with the CEBS templates.

Overall coordination will be further enhanced by the participation, in the near future, of the European Banking Authority (EBA) and the European Systemic Risk Board (ESRB). Such a level of coordination may be far more difficult to achieve in other cross-country combinations.

Before concluding, it is important to point to areas where improvement in the conduct of macro stress tests in a crisis would be beneficial. Of special importance are features of stress tests that are harder to standardise across financial firms. For instance, profitability assumptions are very much dependent on the specific quality of each portfolio held by each financial firm, as well as a firm's business model. In both the SCAP and the EU-wide exercises, authorities engaged in extensive discussions with each bank in order to assess the validity of their profitability assumptions. To support this dialogue, further efforts in the research on bank profitability modelling would be beneficial, as the models' results could be used by authorities as a reference in their dialogue with firms.<sup>28</sup>

An additional area for improvement is the governance aspect of stress-test exercises. Supervisory authorities have the power to instruct banks to conduct a stress test. However, given the need for speed and consistent implementation across firms during a crisis, national and international authorities may consider whether more far-reaching provisions are necessary to facilitate the conduct of coordinated stress tests during a crisis.

## CONCLUDING REMARKS

This special feature has reviewed the recent experiences, in the United States and the EU, with macro stress tests for banks during a financial crisis. Disclosure of methodologies and final results, complementarities with other policies, and communication with market participants are key contributors to the success of this type of policy initiative. These attributes could be usefully retained in stress tests in future crises.

More broadly, these lessons could also be taken into account for future macro stress tests in normal times, in addition to the routine firm-specific stress tests conducted by supervisory authorities. For instance, in the United States, although there are no plans to repeat the SCAP, new legislation for the financial sector requires that large financial institutions undertake annual stress tests, and that each institution publish a summary of its own results.<sup>29</sup> In the EU, national and regional authorities have expressed interest in continuing the conduct of macro stress tests.<sup>30</sup> As already mentioned, the new institutional framework (EBA, ESRB) is expected to be used. In this context, regional and international cooperation can contribute to identifying best practices for macro stress tests and promoting their adoption.<sup>31</sup>

28 There are some useful examples in the literature (see, for example, R. Beckmann, "Profitability of Western European banking systems: panel evidence on structural and cyclical determinants", *Deutsche Bundesbank Discussion Paper*, Series 2, No 17/2007; U. Albertazzi and L. Gambacorta, "Bank profitability and the business cycle", *Journal of Financial Stability*, Vol. 5(4), 2009; W. Bolt, L. de Haan, M. Hoerberichts, M. van Oordt and J. Swank, "Bank Profitability during Recessions", *De Nederlandsche Bank Working Paper*, No 251, 2010), however the development of bank profitability models remains work in progress.

29 The Dodd-Frank Wall Street Reform and Consumer Protection Act was signed into law on 21 July 2010. The Act requires all financial companies that have total consolidated assets over \$10 billion and that are regulated by specified federal financial regulators (namely the federal banking regulators, the Securities and Exchange Commission and the Commodity Futures Trading Commission) to conduct an annual stress test. The federal financial regulators are required to issue rules implementing the annual stress-test requirement. Each agency's rules must, for entities regulated by it, define the term "stress test", establish methodologies for conducting the stress test that include at least three sets of conditions (baseline, adverse and severely adverse), and establish the form and content of a report regarding the stress test which must be submitted to the Federal Reserve Board and to the entity's primary federal financial regulator.

30 For instance, on 4 October 2010, the Informal ECOFIN issued a press release, entitled "Main results of the Informal ECOFIN", stating that ministers and governors had "a fruitful exchange of views on the lessons learned from the implementation of banks stress tests as a response to the financial crisis. 'Our discussion demonstrated the necessity to organize stress tests in a coordinated fashion to restore confidence in the banking sector. It is also crucial to publish the results and to repeat this exercise on a regular basis using a transparent and robust methodology', summarized the Belgian finance minister, Didier Reynders."

31 For instance, CEBS published the "CEBS revised Guidelines on stress testing" on 26 August 2010, which can be used by national authorities to achieve robust and methodologically sound results.