

**Macro-Prudential Stress Testing:  
Reflections on Current Practices and Future Challenges**

**Jaime Caruana**  
*Speaking notes*

1. Thanks to the ECB for inviting me. It is a pleasure to be here in Frankfurt to participate in this high-level conference.
  
2. As the title of this Conference implies, in order to develop good policies that preserve financial stability we need to be able to plausibly simulate financial instability, and to do that we need to understand the links between macroeconomic policies and developments in financial markets. This analysis is not easy because of the numerous and complex linkages between the financial system and the real economy due, in part, to innovations in risk transfer, new instruments, new players, increased cross-border capital flows, and globalization of financial institutions. These developments all broaden financial activities beyond the major, or “core,” financial centers. This increased complexity also implies that the disequilibrium dynamics in the aftermath of a shock are probably more important for financial stability than the final equilibrium. The costs could be severe for misunderstanding such market developments, and failing to react appropriately. Therefore, it is important to avoid failures in policy coordination by improving our analytical tools, diagnostic processes and frameworks for cooperation and dialogue.
  
3. In this global setting with ever-widening networks of interconnected balance sheet and off-balance sheets risk exposures among key institutions, the two-way dynamic relationships between financial markets and the real economy are becoming more nonlinear

and difficult to map. The techniques to model specific links exist, but they are not fully integrated. There is indeed an extensive literature on how to model the relationships: from general equilibrium frameworks that include financial variables, to the structural macroeconometric literature that estimates relationships between financial and real sector variables.

4. In reviewing this literature, it is clear that any practical work on the linkages between financial markets and the real economy calls for a variety of approaches rather than relying on one generally-applicable standard model. Given the complexity of balance sheet and off-balance-sheet linkages, there is no single widely accepted methodology for assessing financial sector stability. In practice, there is, however, a broad consensus that financial stability assessments need to cover a wide range of topics, and to take a holistic view of the financial system beyond the confines of national boundaries and major financial centers.

5. These are some of the issues a task force created at the IMF considered last year, to improve the integration of financial issues in our surveillance work. To make a long story short, the taskforce concluded that any sensible approach to integrate finance into macro surveillance should be eclectic, and should contain at least three elements: First, we must extract relevant information from continuous analysis of high-frequency financial data; A second element is to assess the efficacy and the robustness of financial sector: institutions, infrastructure and practices including i.e. Standards and Codes; and the third element is to use stress tests and scenario analysis to provide a more comprehensive picture of the interaction between underlying vulnerabilities and possible shocks. Although still under development, the Contingent Claims Approach may be a promising way to incorporate balance sheet and market data into our macro risk analysis.

6. The experiences of the 1990s made us all aware of the need to avoid traps such as “silo risk management”—treating the various components of risk separately without accounting for their interactions and potentially mutual amplification. Indeed, we learned that to be useful, strategic risk-assessments must help decision makers to understand better the factors affecting risk exposures, especially the linkages between the micro frames of reference for firm executives, and the macro environments of public policy makers.

### **Challenges**

7. There are, however, challenges and limitations in designing, implementing, and interpreting stress tests that need to be recognized. Macro stress tests are particularly demanding. We must first identify and accurately calibrate numerous transmission channels affecting firms in the system. Then we also have to model how, and to what extent, the macro shocks generate sufficient strains at the firm level to cause systemic concerns. A full assessment requires that we estimate the likelihood of a shock, the size of losses for a given shock or series of shocks, whether the shocks may be correlated, and whether such losses may spread and amplify throughout the system.

8. Furthermore, any practical analytical framework will almost certainly have to struggle with many imponderables, such as significant data deficiencies, non-linearities, and an as yet insufficiently fleshed-out analytical framework encompassing incomplete markets, non traded loan portfolios, market frictions, the effects of potential regulatory or institutional distortions, and the implications of changes in expectations and risk tolerance.

9. Our tools and methodologies for combining and ensuring consistency between shocks from the macroeconomic environment and their impact at the micro-level need further

development. For example, most macro models are equilibrium-based, and may not be well suited for insights when extreme shocks and states of disequilibrium dominate. As you all know, one of the most difficult tasks in designing macro stress scenarios is to translate a set of macro shocks into stresses on relevant income and balance sheet items for firms with very different balance sheet and income compositions.

10. Another challenge arises in accurately measuring risk exposures, particularly in the presence of complex instruments. These instruments contribute greatly to financial stability by dispersing risks more broadly. However, leverage and risk exposures may be hidden or blurred by some of these new instruments (such as seen recently among CDO-related instruments involving subprime mortgages). The lack of market liquidity, and the complexity of some of these instruments, have led to “marking-to-model” practices that greatly complicate our ability to estimate of the size of the potential losses. Moreover, the opaqueness of the securitization/ risk transfer process makes it difficult to identify the ultimate holders of these risks or even whether the incentives to maintain sound credit underwriting standards are weakened through the process.

11. A crucial but different set of challenges arise from interpreting stress tests and drawing policy conclusions. The term “stress test” conveys a sense of precision that may over promise what is actually delivered. Indeed, we may be victims of our own success. Policy-makers, and even some risk-management professionals, may be sometimes lulled into a false sense of comfort because of a belief that stress tests are an “all-in-one” tool for discovering a wide range of important risk exposures.

12. It is equally important to remember that techniques for risk aggregation across heterogeneous firms (banks and non-banks) and activities are still in their infancy. Research in this area remains very active—even leading some to propose “one number” risk measures (such as an aggregate “distance-to-distress”). However, there are currently no definitive answers on how to construct risk measures for an entire financial system.

### **The Way Forward**

13. Looking ahead, I see a busy, work program for improving the analytical usefulness of macro stress testing in developing policy advice. From a production standpoint, we must continue to work at bridging the cultural divide between macroeconomists on the one side, and risk practitioners on the other side.

14. These groups perceive and analyze risks from very different perspectives. *Macroeconomic modelers* work to make more precise the range of expected outcomes for key macro variables. By contrast, *financial risk modelers* tend to focus on events at the extreme “tails” of the distribution of outcomes. In other words, macro modelers live mainly in the “first and second moments” of the distribution of outcomes, while financial risk managers inhabit in the “third and fourth moments.” Successful macro-scenario stress testing requires combining the right blend of expertise: *macro modeling* for scenario design; *risk management expertise* to map the risks; and *quantitative skills* to measure the shocks.

15. It is important to marry these perspectives when designing a credible and informative stress scenario that includes realistic global shocks and transmission channels. Of course, this implies that macro stress testing is often resource intensive, and cost considerations may limit their frequency and scope.

16. On top of that, we know that the set of adverse risks and vulnerabilities are constantly changing. We are all familiar with the factors behind this dynamism: financial innovations, changing financial practices, regulatory changes, globalization, and structural economic and financial changes. These changes can wreak havoc with historical regularities and correlation structures that are critical for both macroeconomists and financial risk managers to estimate their models and calibrate other quantitative tools. Moreover, the “good times” experienced by the global financial system over the past five years may be distorting recent efforts to improve data collection. Data depicting such low volatility, and risk premiums may limit our freedom when designing historically plausible stress scenarios.

17. We do not know when or how the next crisis will occur. Markets have a keen ability to surprise everybody. As financial institutions are becoming more global and markets become increasingly interconnected, I suspect that the unfolding of the next crisis will likely involve more countries, institutions, and markets beyond the core financial centers; more asset classes will become highly correlated; the gap between perceived market liquidity and actual liquidity will become more evident and new intermediaries will play more influential roles in the transmission, and perhaps in the mitigation, of shocks.

18. In this context, it will be crucial to manage expectations and avoid coordination problems if a crisis occurs. This will not be an easy task. The cross-border linkages, the rapid diffusion of financial innovations and relevance of new players (such as hedge funds) in global markets potentially broadens the range of locations of future “flashpoints,” and may magnify the impact of global shocks. To try to defuse the build-up of incipient risks and adverse market dynamics, we will need relevant and timely information and an inclusive multilateral framework that facilitates dialogue and consultation among relevant

stakeholders. And relevant stakeholders, given the new role of many emerging markets, will most likely include more countries and institutions—not only those in the “core” financial centers.

19. I think that stress scenarios analysis and crisis simulation exercises are also communication tools that can help coordination issues. Trans-national exercises can help us to not only understand better the complex linkages across many countries, markets, and institutions, but also trace potential risk amplifiers from cross-country and cross-market spillovers. Most important of all, they can support an informed dialogue among all the relevant stakeholders.

20. To conclude, let me emphasize the importance that we in the public sector continue exploring ways to understand better how macro events may affect the distribution of financial risks. Appropriate responses will clearly require improving communications, cooperation and promoting more joint research and information exchanges between public- and private-sector risk-managers.

21. From our own IMF experience with stress testing in FSAPs, results are encouraging. The positive feedback from these exercises demonstrates the value of macro stress scenarios to both financial supervisors and private-sector risk managers. Nevertheless, we need to work harder to reduce the resource burden of macro stress tests, while adding value to the analyses that financial institutions already perform.

22. Notwithstanding the shortcomings about stress testing that I have noted, and the challenging agenda ahead, we must not let the perfect be the enemy of the good. Our current stress testing tools provide financial institutions as well as policy makers with important and

high-quality information and assessments about systemic risks and vulnerabilities. More importantly, they provide a framework for further analysis and discussion, at both the technical and policy levels. We must not underestimate the importance of this dialogue for advancing the frontiers, and that is why we at the IMF are pleased to be part of this discussion.

23. Thank you.