

## *Systemic Risk Assessment – The Cornerstone for the Pursuit of Financial Stability\**

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First of all, let me extend a warm welcome to all of you to this vibrant city called Mumbai. We, in India, often call this city the 'Maximum City' – it is undeniably, like the punch-line of the advertisement of a global bank, a city which never sleeps. I hope all of you also take maximum advantage of your stay here in respect of the deliberations during the seminar and of the tremendous opportunities for entertainment that this city offers!

2. The subject of this conference – 'Operationalising tools for Macro-financial surveillance – ' is indeed very topical. Across the globe, in the wake of the financial crisis, efforts are underway to alter institutional arrangements to explicitly pursue financial stability as a policy objective and to put in place a framework for the macro-financial surveillance of the financial system. At the core of any robust framework for macro-financial surveillance lies a framework for the identification and assessment of systemic risks. A deeper understanding of systemic risks is the cornerstone of the policy toolkit for pursuit of financial stability and hence this is the subject, I thought, I would dwell upon as I flag off the deliberations during this seminar.

3. Abstracting from details, the prevalent policy framework prior to the crisis focussed on two main tenets – a monetary policy focus for achieving price stability and a microprudential focus for ensuring the health and stability of individual institutions. The crisis turned the foundations of existing policy frameworks on its head and focussed sharper attention on systemic risk assessment and on crisis prevention.

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### **Systemic risks – Definition**

4. So what are systemic risks? There is no commonly accepted definition of systemic risk at present. The precise meaning of systemic risk is ambiguous; it can mean different things to different people and different definitions have been attempted. The European Central Bank, for example, defines systemic risks as 'risk that financial instability becomes so widespread that it impairs the functioning of a financial system to the point where economic growth and welfare suffer materially'<sup>1</sup>.

5. Over a decade ago, a G10 Report on Consolidation in the Financial Sector (2001) suggested a working definition, which arguably remains relevant even today: '*Systemic financial risk* is the risk that an event will trigger a loss of economic value or confidence in, and attendant increases in uncertainty about, a substantial portion of the financial system that is serious enough to quite probably have significant adverse effects on the real economy.'

6. More recently, following the work of the IMF, the Financial Stability Board (FSB) and the Bank for International Settlements (BIS) for the G20<sup>2</sup>, systemic risk has been defined as 'a risk of disruption to financial services that is caused by an impairment of all or parts of the financial system and has the potential to have serious negative consequences for the real economy.'

7. In another case, systemic risks have been defined in terms of a lower 'normal' as the risk of a phase transition from one equilibrium to another, much less optimal equilibrium, characterised by multiple self-reinforcing feedback mechanisms making it difficult to reverse<sup>3</sup>.

<sup>1</sup> European Central Bank Financial Stability Report, June 2009.

<sup>2</sup> Guidance to assess the systemic importance of financial institutions, markets and instruments: initial considerations, October 2009.

<sup>3</sup> Hendricks, Darryll (2009) '*Defining Systemic Risks*', Pew Financial Reform Project.

8. These are just few of the definitions of systemic risk, which abound in literature and amongst policymakers, though a universally accepted definition remains elusive. Notwithstanding, there are several perspectives from which systemic risks can be viewed, depending on how the risks originate, how they affect and how they are transmitted across different institutions, markets, market infrastructure and the real economy. Understanding these different facets of systemic risks is central to the understanding of systemic risks *per se*.

9. One perspective is to describe systemic risk as the risk of experiencing a strong systemic event, *i.e.*, a 'big' shock that simultaneously and significantly affects most or all of the domestic economy. The risks of such a 'macro' shock could emanate from an exogenous shock or could emerge endogenously – from within the financial system or from within the economy at large.

10. Viewed from another perspective, systemic risks can be regarded as the risk of contagion. This is typically defined as the domino effect of an idiosyncratic problem affecting one institution then affecting other institutions/markets in the cross-section. Thus, the failure of a large bank could cause distress to other institutions connected to it directly or indirectly in a chain or 'knock-on' reaction. Systemic risks, viewed from this perspective, were aptly defined by Governor George of the Bank of England, way back in 1998<sup>4</sup>:

*'What we mean by 'systemic risk' specifically is the danger that a failure of one financial business may infect other, otherwise healthy, businesses. This could happen in either of two ways: first, through the direct financial exposures which tie firms together like mountaineers, so that if one falls off the rock face others are pulled off too; and second, by contagious panic which sweeps everyone off the mountain-side like an avalanche.'*

11. Another facet of systemic risk arises in the context of the build-up of widespread imbalances in the system and could, *inter alia*, take the form of credit booms,

build-up of similar third party exposures, and of maturity and leverage mismatches. When these imbalances unravel, as they must at some stage, they adversely affect a large section of the financial system. The more similar the imbalances across institutions, the greater will be the systemic impact of the 'correction'.

## Evolution of Systemic Risks

12. While the recent global financial crisis has brought the concept of systemic risks to the centre stage, one only has to look back into the history of financial crises to appreciate the fact that each of these crises were triggered by systemic disturbances in one form or the other. But while the concept of systemic risks is not new, the concept has evolved over the decades, growing in complexity and becoming more pervasive over time.

13. Till the mid-1980s, systemic risks essentially related to systemic disturbances that arose from bank lending and affected the banking sector. Over the years, different dimensions of systemic risk were revealed as markets grew and became more integrated; banks' reliance on funding markets grew; financial intermediation spread from banks to non-banking financial companies; financial and technological innovation fostered the growth of markets for derivatives and structured products; and market infrastructure developed with the introduction of multilateral netting, central counterparty arrangements, *etc.*

14. The concept of systemic risk concomitantly broadened along several dimensions to include non-banks along with banks; to include different kinds of financial activities and exposures in addition to traditional lending and to focus on interdependencies between market participants as well as their exposures to common risk factors, including institutions' reliance on core parts of market infrastructure<sup>5</sup>.

<sup>4</sup> George, E.A. (1998) *'The New Lady of Threadneedle Street'*, Vital Topic Lecture at the Manchester Business School, Bank of England.

<sup>5</sup> Icard, André (2005) *'Risk measurement and systemic risk'*, the Fourth Joint Central Bank Research Conference on Risk Measurement and Systemic Risk, European Central Bank, Frankfurt, November 8.

15. Appropriately, in this context, is an observation made in an IMF Staff Position note<sup>6</sup> in respect of the financial system prior to the crisis:

*'Financial systems and transactions became distorted along several dimensions, that is, financial system grew highly complex, opaque, over-leveraged and heavily interconnected; liquidity risk was higher than recognised; large complex institutions enjoyed the benefits of being 'too important to fail' and financial intermediation has increasingly shifted to the shadow banking sector.'*

### The two Dimensions of Systemic Risks

16. Cutting across specificities, the different perspectives of systemic risks can be grouped into two dimensions – a time-dimension and a cross-sectional dimension.

17. The time-dimension of systemic risks, or what is more commonly known as procyclicality, relates to the progressive build-up of aggregate risk over time. The second dimension of systemic risk – common exposures/interlinkages in the cross-section focuses on how risk is distributed within the financial system at any given point in time.

18. An analytical framework to identify systemic risks must operate in both dimensions.

### Assessing Systemic Risks

19. As I mentioned earlier, the international financial crisis has refocused policy attention on systemic risks and forced us all to think much harder – about what systemic risk means, how it can be measured and what implications does it have for policy. There is a general consensus that systemic risk was underestimated across-the-board before this crisis and also that there is a pressing need to assess and evaluate such risks on an ongoing basis.

20. Considerable efforts are ongoing, both internationally and amongst systemic regulators domestically, to develop a framework for assessing systemic risks and for potentially predicting systemic

events. The objective is to put in place an assessment infrastructure which is capable of raising 'flags', *i.e.*, signalling trends that could make markets or countries vulnerable to unanticipated events.

21. With the increasing realisation that systemic risks *per se* are generally complex, very often opaque, and always multifaceted, came the realisation that the identification of such risks is also far from straightforward. It was felt that in order to see '*both the forest and trees*'<sup>7</sup> effectively; there is a need to have a wide range of measures and tools covering different aspects of systemic risks. The objective is to develop a diagnostic tool that simultaneously traces the development of macro-financial conditions which pose risks to financial stability and identifies point-in-time risk conditions, while also assessing the joint impact of all these risk factors on systemic stability.

22. A host of quantitative models attempting to incorporate one or more of these elements have emerged in the policy and the academic arena since the crisis. The models variously attempt to quantify the contagion risks in the financial system, to capture distress dependencies amongst financial institutions or to measure the systemic importance of financial institutions. Others attempt to develop early warning indicators while yet another class of models aim to utilise aggregate information from segments of the financial system to develop coincident indicators of systemic stress. Yet another set of models – the macro stress tests – try to measure the resilience of the financial system or its key components to various stress factors by quantifying the link between macroeconomic variables and the health of either individual financial institutions or the financial sector as a whole.

23. The emerging models vary in statistical techniques used as well as in the type of available information used. They range from general equilibrium to game-theoretic models and can be either comparative static models or dynamic models. Some models attempt to assess systemic risks using credit risk conditions while others rely on data from financial markets.

<sup>6</sup> 'Shaping the New Financial System', (2010) IMF Staff Position Note SPN/10/15.

<sup>7</sup> Viñals, José (2011), '*Seeing Both the Forest and the Trees – Supervising Systemic Risk*', opening remarks at the Eleventh Annual International Seminar on Policy Challenges for the Financial Sector Washington D.C., June 2.

24. The development of these models is in a nascent stage and the learning curve is very steep. Identifying and assessing systemic risks requires a broad and deep information base and a wide range of tools to process the relevant information as well as analytical tools and techniques. While fertile research on these issues is underway, especially since the crisis, the progress has been slow given the large mass of uncertainties – both 'known' and 'unknown'. Let me briefly highlight some of these.

25. First, while the notion of systemic risks is clear, there is, as yet, as elucidated earlier, no universally accepted definition of systemic risk. Further, there is little agreement amongst regulators and academicians about the best way to operationalise a framework for the identification and measurement of systemic risks. The associated issues are further complicated by the fact that systemic risks are inherently unobservable. The main factors resulting in systemic risks – contagion risks, imbalances, *etc.*, are also difficult to observe and/or quantify. Adding to the difficulties are the facts that interconnections between financial institutions and correlations of risk factors often tend to behave differently during 'peace' times and during times of 'crisis'. The emergence of 'wrong-way' risks in derivative contracts wherein counterparty exposures reverse signs under stressed scenarios is a case in point. A framework for assessment of systemic risks would therefore need to infer or 'reverse engineer' assessments about the build-up of systemic risks.

26. Second, is the now well-debated issue of data gaps. To state that better data is required to support all the critical initiatives underway to identify systemic risks and to put in place a robust early warning framework is perhaps to state a truism. Regulators require better data at both the national and international level to ensure that they can recognise and address the build-up of risks in a timely manner. Absent such improvements, new macroprudential processes will operate in an environment characterised by major gaps in information, and will remain at significant risk of missing, yet again, emerging vulnerabilities that threaten global financial stability.

27. In the recent crisis, the lack of timely and accurate information has arguably proved very costly. The

current data architecture lags well behind the forces driving increased complexity and globalisation of financial systems, institutions and markets. There is currently little consistent information on the major bilateral linkages between large financial institutions, and on their common exposures to, and funding dependencies on, countries, sectors and financial instruments. Again, there are significant data gaps on funding risks and dependencies, on leverage, on maturity and liquidity mismatches and on risk exposures arising from off-balance sheet activities. Adding to these are the difficulties in collecting information from non-bank intermediaries and unavoidable reporting lags.

28. Associated with the need for plugging of data gaps, is the need to address issues related to the quality of data. The general concerns about the quality of historical data which are used in models for the assessment of systemic risks, means that even with a long time series of data available for some of the models/indicators for the assessment of systemic risks, it may be difficult to identify incipient risks/crises with precision.

29. There are efforts underway internationally on putting in place a framework to collect, pool and share relevant data on global financial institutions that would provide authorities with a clear view of the financial network and a powerful monitoring tool to assist them in their supervisory and macroprudential responsibilities. However, it appears unlikely that these informational barriers can be overcome rapidly, and in the interim, assessment of systemic risks will remain, at the most, a 'best' estimate. The role of judgement, therefore, for the assessment of systemic risks will remain crucial, for the time being, at least.

30. Third, even though an extensive analytical framework for identification of systemic risks is put in place, there are challenges in putting together all the 'flags' being raised, *i.e.*, in connecting the dots. For instance, many analysts cautioned against 'risk concentrations' in US housing, but there were few suggestions prior to the crisis that this could lead to dire macroeconomic consequences, particularly at a global level. The risks are even higher because systemic

risk assessment remains an inexact science with considerable scope for missing signals and raising false alarms, which makes it difficult to spur concrete policy action especially as such actions often involve taking away the proverbial punch bowl just as the party is going strong.

31. These challenges do not imply that technical work on measuring and monitoring systemic risk should not go forward; only that the task ahead is as large and time – consuming as it is critical. There is, therefore, a need that the momentum set in motion in the wake of the crisis be maintained. Promising work on measuring systemic risk is, in fact, now in progress – at international institutions such as the IMF, the Basel Committee for Banking Supervision and the Financial Stability Board; in central banks and other systemic risk regulators; and in the academic world; indeed, in each of the institutions which all of us collected here today represent. I had observed that the learning curve with respect to the identification and assessment of systemic risks is steep. However, treading on these uncharted territories can become easier and swifter through sharing of experiences and through greater collaborations. This seminar, a conglomeration of operational managers/experts on financial stability management across the globe, I hope, will be a giant step forward in this direction.

### The Indian Experience

32. Before I conclude, let me spend a few moments in outlining the framework in place in India for macroprudential surveillance and for the pursuit of financial stability.

33. In India, prior to the crisis, no agency was explicitly granted a mandate for financial stability though the Reserve Bank acted as the implicit systemic regulator for the country. In 2004, well ahead of the crisis, the Reserve Bank formally added financial stability as a policy objective, in addition to price stability and growth, in view of the growing size and importance of the Indian financial sector. The broad compulsions of financial stability have, in fact, underlined all major policy initiatives of the Reserve Bank especially since the balance of payment crisis of the early 1990s – much

ahead of the articulation of financial stability as an objective.

34. The Reserve Bank has, over the years, attempted to address both aspects of systemic risks – the time dimension (which essentially refers to pro-cyclicality) and the cross-sectional dimension (which refers to interconnectedness) within a macroprudential framework, without christening these policies as macroprudential policies. Organisational developments within the Reserve Bank, over the last couple of decades, have also reflected the Bank's commitment to maintaining financial stability. Two separate Committees of the Reserve Bank's Central Board, viz., the Board for Financial Supervision (BFS) and the Board for Payment and Settlement Systems (BPSS), are responsible for focused regulation and supervision of financial institutions regulated by the Reserve Bank and the payment and settlement infrastructure, respectively. Towards ensuring a co-ordinated approach to the supervision of the financial system, a High Level Co-ordination Committee on Financial Markets (HLCCFM) was functional since 1992 with the Governor of the Reserve Bank as Chairman, and with representations from the sectoral regulators and the Finance Ministry. The HLCCFM has now been replaced by the Sub-Committee of the Financial Stability and Development Council (FSDC). The FSDC is an inter-agency forum set up in the wake of the crisis with a specific mandate, *inter alia*, for systemic financial stability. A Sub-Committee of the FSDC, headed by Governor, Reserve Bank, functions as the primary operating arm of the FSDC. The Sub-Committee has also set up a dedicated Crisis Management Framework to facilitate the handling of crisis situations, should they arise.

35. Post the crisis, in July 2009, the Reserve Bank set up a Financial Stability Unit (FSU) with a mandate to, *inter alia*, conduct effective macro-prudential surveillance of the financial system on an ongoing basis to enable early detection of any incipient signs of instability. With the establishment of the FSU, the Reserve Bank started publication of half-yearly Financial Stability Reports (FSRs) – which now forms a critical tool for the Reserve Bank in its attempt to communicate

the potential systemic risks facing the financial system to all stakeholders of the system. Somewhat unique, in the Indian context, is the fact that our FSRs are discussed and deliberated upon in the meetings of the Sub-Committee of the FSDC which enables the views of all the sectoral regulators and the Government on risks to systemic stability to be incorporated in the FSR. The FSR, thus, presents a holistic assessment of the risks to the stability of the Indian financial system.

36. A number of initiatives have been taken to improve the financial stability analytics to take full account of the different sources of systemic risk. A series of indicators and indices have been developed to assess the health and resilience of the financial system on an ongoing basis. Let me discuss some of these very briefly as I am aware that there is a detailed presentation which will be made on these initiatives during the course of this seminar.

### ***Stability Indicators and Maps***

37. Stability indicators and maps represent coincident indicators of systemic stress in the financial system. They are constructed by aggregating information from different segments of the overall financial system and encapsulating the information in a single statistic which measures the current state of instability in the financial system.

38. The Financial Stability Map and Indicator in India depicts the overall stability condition in the Indian financial system. The Financial Stability Indicator is based on the three major segmental indicators, namely, the Macro-Stability Indicator, the Financial Markets Stability Indicator and the Banking Stability Indicator. Each of these indicators is, in turn, based on contemporaneous developments in a number of risk factors relevant to the respective segments. The Financial Stability Indicator is derived using a simple average of macro, financial markets and banking stability indicators.

39. Recognising the importance of fiscal health for financial stability, separate Fiscal Vulnerability and Fiscal Stress Indices have been developed to respectively assess inter-temporal changes in the vulnerabilities arising from the fiscal conditions and to indicate the

likelihood of crisis-like events. A Systemic Liquidity Indicator attempts to gauge the degree of stress in domestic liquidity conditions and to establish time-frames for potential extreme events.

### ***Banking Stability Measures and Expected Shortfall***

40. Banking stability measures, a cross-sectional econometric framework, capture the distress dependence among financial firms in a system using stock price data and thereby estimate the extent to which individual financial institutions contribute to overall systemic risk. These measures have been used in the Reserve Bank to measure the systemic importance of our banks through three different, yet, complementary perspectives, viz., (i) common distress of the financial institutions in a system, (ii) distress between specific institutions, and (iii) distress in the system associated by distress in a specific institution. A Banking Stability Index (BSI) is calculated, which captures the expected number of banks to become distressed given that at least one bank has become distressed. Separate Toxicity and Vulnerability Indices capture distress between specific institutions while the Cascade Effect attempts to measure the distress in the system associated with the distress of a specific institution. This method is also being used for estimation of Expected Shortfall of assets of banking system, in a bid to assess what would happen to a bank in an environment of a large negative shock.

### ***Network Analysis***

41. The intertwined nature of modern financial systems was amply revealed by the recent financial crisis. Such interconnected and complex financial systems make it particularly hard to predict the manner in which the cookie will crumble when distress situations emerge. Network models attempt to capture the intricate structure of linkages between financial institutions by depicting the causal chains between nodes. The contractual obligations between financial institutions comprise the bilateral flows of payoffs and determine the extant network structures. An actual crisis with default of counterparties engenders system-wide feedback loops and can trigger further contingent claims such as on derivatives obligations

and also large losses at default due to collapse in asset markets.

42. The techniques of network modelling have been used to develop a bespoke financial network analysis and contagion stress-testing platform for the Indian financial system. The analysis primarily looks into the interconnections that exist between different institutions in the financial system and tries to identify build-up of systemic risk. Graphical network representations have been developed which are being used to assess the degree of system-level interconnectedness and the stability of the system. A contagion simulator helps in assessing the possible loss of capital to the financial system due to a random failure of one or more financial institutions.

### ***Macro-Financial Stress Tests***

43. During the recent financial crisis, macro-financial stress tests were used by some central banks as a policy tool to restore market confidence and improve market functioning. Such stress-testing addresses the need to assess the impact of the system-wide nature of risk drivers. Macrofinancial stress testing quantifies the link between macroeconomic variables and the health of financial institutions and the financial system, to measure the resilience of the financial system to various stress factors. In India, we conduct two sets of macro-stress testing exercises at regular periodicities. The first set of stress-testing exercises use multivariate regression tools to evaluate the impact of a particular macroeconomic variable on the asset quality of banks and its capital adequacy ratio. The second set is based

on a vector autoregressive (VAR) model which assesses the impact of the overall economic stress situation on the asset quality and capital adequacy of the banking system taking into account the feedback effect of the macroeconomic performance of the economy on banks' stability.

### **Concluding Remarks**

44. Let me finish with a final observation. The events of the last four to five years have placed pursuit of financial stability at the centre stage for policymakers, domestically and internationally. The objective is to put in place a framework for macrofinancial surveillance which identifies, measures and manages systemic risks, as and when they occur, with a view to effective crisis prevention. The task is exciting. The challenge is to put in place a set of riskometers which help identify which of the myriad things that could go wrong in the financial system and the broader macro-economy. For this, we will need both 'thermometers' and 'crystal balls' – thermometers to determine risk indicators that, metaphorically, a policymaker can plug into the financial system to read off its 'heat'; and crystal balls to devise forward-looking early warning indicators that – to some extent – permit a glimpse into the future of financial stability conditions<sup>8</sup>.

45. The next two days at hand, as I see from the schedule, will be quite hectic. But, I am sure that the deliberations in the Seminar will prove to be extremely useful for all the participants as it should tend to create an inventory of hands-on tools to manage systemic financial stability. I wish you all an enjoyable stay in Mumbai.

<sup>8</sup> Schwaab, Bernd, Siem Jan Koopman and André Lucas (2011), '*Systemic Risk Diagnostics, Coincident Indicators and Early Warning Signals*', ECB Working Paper Series, No 1327/April.