



“Complexity and the financial crisis”

**Jean-Pierre Landau,
Deputy Governor of the Banque de France**

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I am very pleased to welcome you to this second Banque de France-Bundesbank Conference on “The Macroeconomy and financial systems in normal times and in times of stress”.

Actually, the distinction between normal and stress times may be somehow misleading. It is of course fascinating and extremely useful to study the behaviour of financial systems under stress. But, from a policy perspective it is essential to recognise that the seeds of instability are sown in normal times. The crisis has shown that public authorities have very limited options in stress times but to keep the system afloat at all costs. This involves rescuing financial institutions whatever previous commitments have been previously made not to do so. Indeed, the doctrine of moral hazard may be one of the most prominent and lasting casualties of the crisis. So, collective efforts should mainly concentrate on detecting those features of financial systems which, even in (apparently) normal times create or amplify stress. This is the essence of the macroprudential approach to financial supervision. One of its main challenges is to grasp and deal with the full complexity of contemporary financial markets and institutions.

Financial systems are complex systems. Today I would like to reflect on that complexity and its consequences, drawing extensively on a recent illuminating paper by Andrew Haldane from the Bank of England as well as on previous work published by the Federal Reserve Bank of New York.

Complexity comes in two forms.

First, it appears in financial instruments themselves, as financial innovation has led, in recent years to a proliferation of so called structured – and, indeed, very complex – products.

Second, complexity shows up in the structure of the financial systems, which are based on interdependence between multiple actors and counterparties. Transmissions of shocks occur through networks whose structure and architecture is constantly transformed by financial innovation and regulatory arbitrage. This potentially creates numerous feedback loops and amplification effects.

Looking more specifically at the last decade, this increase in complexity had four main features and consequences:

- As techniques for managing and allocating risk became more sophisticated, the network of counterparties expanded in scale and in complexity. This was, truly, a systemic change that was properly understood but not fully captured by regulators at the time. Credit and market risk was supposedly more broadly spread. But counterparty risk increased. Overall, the overall impact on financial stability may well have been negative.
- Complexity led to loss of information, a point underlined by Gorton. Through the chain of tranching and distributing the risk, fundamental values and risk profiles of underlying assets became impossible to reconstruct, even for the most informed investors. There may be a deep paradox here. In principle, financial innovation is meant to increase efficiency. But, in financial markets, efficiency depends on the availability of information. And the nature of innovation that occurred in effect destroyed information. There was only one way out of this paradox: to create and construct market infrastructures which preserved information, its completeness and its integrity. As the failure of the rating process amply demonstrated, this did not happen.
- Increase in complexity did not come with more diversity. On the face of it, market participants looked more and more different in their legal status, investment strategies, and business objectives. It has now become apparent that, behind these veils of diverse colours, there was a profound uniformity in the approach to risk, its measurement, its management, as well as in the drivers of risk appetite. This uniformity had very destabilising consequences. In normal times, it helped and crystallise expectations on overvalued asset prices. In times of stress, it made the adjustment process extremely disorderly.
- Finally and most importantly, complexity resulted in an increase in overall uncertainty.

- Complex systems exhibit well-known features: non-linearity and discontinuities (a good example being liquidity freezes); path dependency; sensitivity to initial conditions. Together, those characteristics make the system truly unpredictable and uncertain, in the Knightian sense. Hence the spectacular failure of models during the crisis: most, if not all, were constructed on the assumption that stable and predictable (usually normal) distribution probabilities could be used to describe the different states of the financial system and the economy. They collapsed when extreme events occurred with a frequency that no one ever thought would be possible.

- Uncertainty itself has huge consequences. As shown by Caballero and Krishnamurthy episodes of flight to quality and liquidity hoarding can be best explained by a regime shift, from an environment where risk can be measured and probabilities attached to different states of nature to a world of total uncertainty. Such regime changes are "tipping points" for the system as a whole, whose behaviour is suddenly transformed. When they occur, agents respond by making decisions using "worst-case" scenarios and covering themselves against the possibility of their own demise. Doing so, they faced and created a collective action problem since the general rush for protection only aggravates the stress. This is the best way to rationalise and understand the liquidity and market freezes which occurred in August 2007 and, again, in September 2008. Facing such unprecedented reactions, policy makers may have wondered, "does the market know something that we don't". Actually, markets participants knew that they could not know. Because they were directly involved, they were aware it was impossible for them to fully master the complexity they had themselves created. And they acted accordingly.

Overall, complexity may have resulted in more fragility, an evolution already foretold by Minsky who saw structural changes in financial systems over time as an essential cause of their vulnerability.

Complexity has deep implications for public policy and the future of financial regulation.

- First, about transparency. Improving transparency is the first item on the G20 international agenda, for financial regulation reform. Transparency is normally considered as a prerequisite to the existence of efficient financial markets. More recently, full transparency on aggregate positions and exposures by main financial intermediaries tends to be seen by financial supervisors as necessary to assess potential systemic risk. However, when the system is constantly morphing into new structures, and permanently changing networks, a comprehensive, but static vision may prove inadequate, because it will not eliminate the uncertainty stemming from the potential discontinuities embedded in market dynamics. What is needed, at least, is an overall understanding of the complex dynamics at work, which may be better reached through a permanent reexamination of their structure and constantly testing against very adverse circumstances.

- Second, robustness. A natural reaction to financial fragility is to strengthen the ability of financial institutions to withstand shocks by increasing their capital and liquidity requirements. While necessary, it is doubtful whether this "buffer" approach will help when uncertainty settles in. Then, the net demand for both liquidity and capital becomes infinite, because gross demand is unknown and hoarding creates little or no supply. In sum, in times of stress, "enough" capital or liquidity is never enough. Even explicit countercyclical requirements may provide little or no relief. One possible solution is to offer – or impose – ex ante liquidity and capital insurance. Over the last two centuries liquidity insurance in times of stress has been provided through the lender of last resort. Proposals have been made to explicitly price that insurance which would better internalise its cost. Capital insurance, has also been suggested, among others, by Kashyap, Rajan and Stein and can be seen as a new – and potentially powerful – way to provide contingent support.

- Looking beyond individual institutions, the robustness of the system as a whole depends on the solidity of some of its key components (the "nodes" in the language of networks). This is today perfectly understood and it is widely expected that "systematically important institutions" will, in the future, be subject to more stringent regulatory requirements and closer supervision. This may, or not, be related to their size. "Too big to fail" certainly warrants special treatment. But, the position and role of even smaller or medium size actors may also put them in a situation to have a strong influence on the system's dynamics.
- Ultimately, however, robustness in complex financial systems may be best addressed by shaping the structure itself of those systems. Without prejudice to the answer, the crisis makes it legitimate to ask whether some separation or segmentation of financial activities between institutions with different legal status and abilities would be justified. While it is grossly exaggerated to argue that the abolition of Glass-Steagall is a cause of the present crisis, a case can be made for regulating activities that a same institution is allowed to engage into, thus limiting the potential interactions and feed back loops it can create or to which it would contribute.
- Finally, complexity can be limited through standardisation of financial instruments. Such standardisation would bring two benefits in: it would make products more transparent, hence their behaviour more predictable and would reduce or eliminate uncertainty created by the loss of information. And, second, it would allow them to be traded and/or cleared in organised exchanges and clearing houses, thus reducing by a considerable scale the size and complexity of the network of bilateral counterparties. Current efforts to set up central counterparties and clearing houses for credit derivatives are clearly a major step in that direction.

Obviously, there is a trade-off since standardisation could create obstacles to financial innovation. But it is also true that contemporary financial innovation, by creating enormous complexity in the financial system, all too often has contributed to conceal the true level of leverage and risk. It may be that, as in other economic activities, innovation in finance will inevitably entail increasing complexity. In most cases, whether we think of the pharmaceutical industry or big utility networks, the risks attached to this complexity have been identified and mastered. This may be more difficult when human behaviour is directly involved, as in financial or epidemiological systems, thus adding another, and different layer of complexity. Both the industry and regulators will have to rise up to this formidable intellectual and operational challenge and I am convinced that your conference to day will provide invaluable help in this regard.

Thank you.

REFERENCES

Caballero, Krishnamurty "Collective Risk Management in a Flight To Quality Episode" The Journal of Finance, VOL. LXIII, NO. 5, October 2008

Caballero, Simsek: Complexity and Financial Panics NBER Working Paper 14997, May 2009

Federal Reserve Bank of New York "New Directions For Understanding Systemic Risk" Economic Policy Review Volume 13, number 2, November 2007

Gorton : The panic of 2007. Paper presented at the Economic Symposium of the Federal Reserve Bank of Kansas City, Jackson Hole, August 2008

Haldane Andrew: "Rethinking the financial network", Speech delivered at the Financial Student Association, Amsterdam? April 2009 (available on the BOE website)

Kashyap, Rajan, Stein, "Rethinking Capital Regulation", paper prepared for Federal Reserve Bank of Kansas City symposium on "Maintaining Stability in a Changing Financial System", Jackson Hole, Wyoming, August 21-23, 2008

Landau: "Extreme events in finance: some reflexions", Remarks at the Conference on Extreme Events jointly organised by the Banque de France and Toulouse School of Economics (TSE), September 3, 2008