IMPERIAL BUSINESS INSIGHTS – IMPERIAL COLLEGE

The Financial Sector After The Crisis

Lecture by the Governor of the Bank of Italy
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Introduction[1]

The financial crisis has brought to the fore a number of problems. It has been severe and widespread, and has affected different economies in different and long-lasting ways. Financial stability has once again become a fundamental objective of policy making, and central banks are being heavily involved in this endeavour. This calls for a substantial overhaul in financial regulation and supervision, and the financial system of tomorrow will most likely be rather different from the one that has developed over the last two decades. Scepticism has grown about the role of finance in the economic system, and especially its apparent separation from, if not conflict with, the real economy. We should take stock of what has gone wrong, and in so doing reflect on the way forward, as it is already taking shape, as well as, perhaps, on how to better link our theories to real world developments.

In the decade before the financial crisis both the size of the financial system and its role and pervasiveness in the economy increased dramatically. The process has only slowed down with the crisis. In the euro area, the overall amount of financial resources collected by the private sector (bank credit, bonds issued domestically and stock market capitalization) rose from 160 per cent of GDP in 1996 to 240 in 2007, and then declined to 230 in 2011. A similar pattern is found for the United States, where the ratio rose from 230 per cent in 1996 to 330 in 2007 and then declined to 260 in 2011, and for the UK, where the ratio increased from 240 to 330 per cent and then edged down to 320 per cent. The total outstanding notional amount of over-the-counter (OTC) and exchange-traded derivatives has risen from about 94 trillion U.S. dollars at the end of 1998 to around 486 trillion at the end of 2006, to reach 700 trillion in June 2012.

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[1] This text, which has also been used for a lecture in Italian at the Accademia dei Lincei, in Rome, on 8 March 2013, partly draws on "What does society expect from the financial sector?", panel discussion remarks following the Per Jacobsson Lecture by Dr. Y. V. Reddy, in Basel, on 24 June 2012, and on "The financial crisis and economists' forecasts", lecture at "La Sapienza" University, Rome, on 4 March 2009 (downloadable, respectively, from http://www.bis.org/events/agm2012/sp120624_visco.htm and http://www.bis.org/review/r090423f.pdf?frames=0). I wish to thank for useful discussions and help Fabrizio Balassone, Paolo Del Giovane, Alessio De Vincenzo and Giuseppe Grande.

Financial deepening, by allowing greater diversification of risk and making finance accessible to larger numbers of countries and firms, can be instrumental to broadening economic development. But there is a risk that finance turns into an end in itself, with consequences that can be more damaging as the system becomes more interconnected and the potential for externalities increases. The correct conduct of credit and financial business requires competence and good faith on the part of intermediaries as well as appropriate regulatory and supervisory regimes.

"Good" finance as a force for good

Finance has long been viewed as a morally dubious activity. My appeal to authority on this matter is a reference to a lecture delivered by Amartya Sen more than twenty years ago as the first Paolo Baffi Lecture on Money and Finance at the Banca d'Italia. Sen wondered: "How is it possible that an activity that is so useful has been viewed as being morally so dubious?".[2] He recalled a series of historical episodes: Jesus driving the money lenders out of the temple, Solon cancelling debts and prohibiting many types of lending in ancient Greece, Aristotle describing interest as an unnatural and unjustified breeding of money from money.

Superimposed on this "structural" mistrust, one can detect cyclical patterns in the public's attitude towards finance, affected by the conditions of financial systems and shifts in the political mood about state intervention in the economy. Until the 1970s it was taken for granted that market failures required the presence and response of a regulator to avoid suboptimal results. Then came the great inflation of the 1970s, combined with high unemployment, and the emphasis shifted to government failures. Governments, central banks and other regulators were blamed for failing to prevent these developments. This eventually led to an ideological swing: a push to reduce the extent of state intervention. The failures of the "regulated economy," the pace of technological advance and the rapid expansion of international trade after the end of the Cold War fuelled a protracted process of financial deregulation that was halted only by the financial crisis that broke out in 2007. The latter triggered a move toward re-regulation – or better regulation – that is still under way. The pendulum keeps swinging and will certainly continue to do so.

The global financial crisis, with its huge costs for the whole society, has caused a further deep erosion of the trust in financial institutions. Witness to this are the widespread protests against the financial industry, from the Occupy Wall Street movement to the "Indignados" in Spain and

[2] A. Sen, *Money and value: on the ethics and economics of finance*, Paolo Baffi Lecture on Money and Finance, Rome, Bank of Italy, 1991, p. 28.

their counterparts in other European countries. Anger has been fuelled not only by the discovery of wrongdoings and perverse incentives, but also by a perceived lack of action against those responsible, in a context of exceptionally high remunerations. The integrity of financial intermediaries' codes of conduct has been called into question under many dimensions: honesty, the ability to manage financial risks and the commitment to take care of the interests of their clients.

In the first place, public attention was caught by cases of investment fraud, in which Ponzi schemes or other types of malpractice and malfeasance led many people to lose their savings. Feelings were exacerbated by the generous severance packages paid to top managers after distressed financial institutions were rescued with taxpayer money. Dubious practices were found in key junctures of the financial systems, such as credit ratings and interbank reference rates, not to mention the allegations of financial institutions' involvement in activities related to money laundering and other fraudulent practices.

Most importantly, the crisis has shown that market participants were not capable of mastering the inherent complexity of the system that they themselves had contributed to develop over the course of the last two decades. Favoured by the breakthroughs in information technology and telecommunications, the securitization of banks' assets expanded considerably, together with the supply of so-called structured financial instruments (ABSs, CDOs, etc.). The traditional model of credit intermediation gave way, especially but not only in the United States, to a system in which loans granted were rapidly transformed into other financial products having these loans as collateral and sold on the market: the so-called originate-to-distribute model (OTD). To the inherent difficulty of evaluating the quality of loans, these developments added the problem of fully understanding the effective role of structured financial products.

Structured finance products and the OTD intermediation model can facilitate risk management. The granting of mortgages to households is favoured by the possibility of managing the related interest-rate risk; the internationalization of firms depends crucially on the possibility of hedging foreign exchange risk; and the provision of retirement saving products at low cost over very long time horizons benefits from the ability to mitigate the impact of fluctuations in security prices. With the OTD model, credit risk is not concentrated in the banks' books, but is potentially dispersed among a multitude of investors. By making bank loans tradable, it reduces their illiquidity premium thus decreasing their cost.

However, we now understand that structured finance and OTD intermediation, coupled with lack of transparency, favoured excess risk taking and opportunistic behaviour. Transactions often took place through scarcely regulated financial intermediaries characterized by high leverage and risk exposure, in particular as regards their valuation (in which a crucial role was played by rating agencies, without any particular control by regulatory authorities or information providers), by means of statistical models and often carried out on the basis of incomplete and insufficient data. In many instances complexity was instrumental to opportunistic behaviour fuelled by a distorted system of incentives especially with reference to executive compensation. The high leverage and complexity typical of structured financial instruments allowed them to be used to take high-risk, speculative positions.

Unnecessarily complex and opaque assets were used to prevent a correct assessment of creditworthiness or mask the economic impact of previous transactions, exploiting the ample scope for interpretation allowed by accounting standards. Banks' misuse of these instruments may also be linked to the drying-up of the sources of income from traditional credit business. This may have triggered actions designed to conceal from the market and from supervisors the real object of derivatives transactions.

The bottom line is that financial innovation can allow more efficient allocation of credit risk, but it also entails a number of dangers, some of them intrinsic to its mechanism, others more generally related to the greater interdependence of the financial system. The ongoing process of financial consolidation and the OTD model have produced intermediaries that are closely intertwined with the capital markets. This has had some important consequences for financial stability: a more connected world improves risk diversification and can make markets more resilient, but when contagion is actually set off, an interlinked financial system heightens the risk that it may spread more widely.

But the negative perception of banking and finance should not lead to a blind backlash. As Amartya Sen argued, "finance plays an important part in the prosperity and well-being of nations".[3] It is crucial for sharing and allocating risk, especially for poorer societies and people, insofar as risk aversion decreases with wealth. It is crucial for transferring resources over time and removing the liquidity constraints that hamper the economy and the exploitation of ideas. It is very important in promoting economic growth, especially by fostering innovation.

[3] A. Sen, *ibidem,* p. 28.

Indeed, we have countless historical examples of good financial innovations. Think, for example, of the "letters of exchange" introduced by Italian merchants in the Middle Ages: they were probably the first fiduciary money, and trade benefited enormously from this financial instrument. More recently, consider the development of "micro-finance" in the 1970s: an innovation that has enhanced financial inclusion, helping poor borrowers to smooth their income and cope with illness or other temporary shocks. And, in the last two decades, recall the role of the "venture capital" industry in the promotion of successful innovative corporations such as Apple, Intel and Google.

Some countries are now increasingly investing in efforts to improve the financial literacy of the public, and this too is important. On the one hand, it helps to build the demand side of a more inclusive finance. On the other, financially literate citizens are better able to understand the efforts of regulators and policy makers to improve supervision and regulation, and less likely to subscribe to the simplistic view that "finance is evil". But we should realise that – as the case of Bernard Madoff and others in the US and elsewhere clearly show – this is no panacea (Madoff's customers were surely much better educated than average). Therefore, for purposes of consumer protection in the financial services industry, financial regulation and good supervision are the necessary complements to financial education and inclusion.

Complexity was also used, somewhat perversely, as an argument in favour of a sort of benign neglect on the part of regulators. The big financial players argued successfully that financial innovation was too complex and too opaque for the regulators to get their heads around. Indeed, they said, to safeguard the international financial system from systemic risk, the main priority was promoting an "industry-led" effort to improve internal risk management and related systems. This, in a nutshell, was the view espoused by the Group of Thirty report following the outbreak of the Asian crisis.[4] But this thesis was often accompanied by the argument to the effect that "you, regulators and supervisors, will always be behind financial innovation; it would be better to allow us, the big financial international players, to self-regulate; we are grown-ups, we can take care of ourselves". And, after all, "if someone makes mistakes some will gain what others lose; why can't we be left alone to play this zero-sum game of ours?"

The regulators did not, in fact, have either the ability, or the right incentives to acquire the necessary information, for two reasons. First, the big financial players are global, and national regulators had powers too narrow to be able to confront them. The difficulties in coordinating the regulators'

[4] Group of Thirty, *Global institutions, national supervision and systemic risk*, 1997. See also the article by J. Heimann, with the same title, and comments therein, in the special issue of *Banca Nazionale del Lavoro Quarterly Review* on "Globalization and stable financial markets", March 1998.

actions, in the face of a natural tendency to preserve each one's particular sphere of influence, was a powerful drag on the ability to rise to the challenge posed by a finance gone global. Second, the phenomenon of regulatory capture was a definite reality. Powerful political and economic influences were at play, and in some cases prevailed.

Accepting the idea that benign neglect was the right course of action was, however, a critical mistake. The global financial crisis has highlighted the limits of the idea that self-regulation and market discipline are sufficient to ensure stable financial systems. Financial regulation and supervision have to keep pace with developments in the financial industry. National authorities need to be aware of the risk that their powers become narrow compared to the sphere of influence of the global financial players; the coordination of financial supervision across borders and across sectors is a key condition for the stability of the global financial system. More importantly, regulators and supervisors have to pay attention to keeping financial industry lobbies at due distance.

All this calls for a major effort, at a national but especially at an international level, to adjust and strengthen the regulatory and supervisory financial framework. And it explains why the work that is carried out at various levels of relevance and responsibility in international fora is so important. In what follows I will review and assess recent reforms in financial regulation, highlighting those improvements that still need to be achieved. I will also discuss the importance of advances in our analytical understanding of the workings of financial markets and of its deviations from stationarity.

In search of a better regulatory and supervisory regime

Over the last few years the crisis has heightened appreciation of the benefits of a more stringent regulatory regime. At an international level, under the political impulse of the G-20, the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS) have introduced substantial regulatory changes to reduce the frequency of financial crises and increase the resilience of economic systems. Much has been already achieved.

The quantity and quality of capital that banks need to hold has been significantly enhanced to ensure that they operate on a safe and sound basis. Minimum capital requirements have been raised. The improvement in the quality of capital aims to ensure that banks are better able to absorb losses on both a going concern and a gone concern basis. The risk coverage has been increased, in particular for trading activities, securitisations and exposures related to off-balance sheet vehicles

and arising from derivatives. An internationally harmonised maximum leverage ratio is going to be introduced, to serve as a backstop to the risk-based capital measure and to contain the build-up of excessive leverage in the system.

The BCBS has also introduced international standards for bank liquidity and funding, designed to promote the resilience of banks to liquidity shocks. A milestone agreement was recently reached among Central Bank Governors and Heads of Supervision to adopt a minimum requirement for the ratio between high quality liquid assets and net liquidity outflows that banks would face over a one-month horizon in stress conditions (Liquidity Coverage Ratio – LCR). The minimum LCR will increase gradually in the coming years, so as to ensure that the new liquidity standard will not hinder the ability of the global banking system to finance recovery. And countries with distressed banking systems will have flexibility in its application.

At the behest of the G-20, the FSB has promoted initiatives to strengthen the regulation of the OTC derivatives market. The aim is to reinforce market infrastructures, in order to minimise contagion and spill-over effects among players that have become more and more interconnected. These initiatives increase market transparency through a number of measures: contract standardization, the requirement to trade on regulated markets, settlement through central counterparties, the reporting of the terms and conditions of transactions to trade repositories.

But further progress is needed in important areas. Capital and liquidity regulation must be accompanied by improvements in internal risk control arrangements and by actions aimed at correcting incentives to excessive risk-taking. Board members and senior managers should possess a thorough understanding of the bank's overall operational structure and risks. It is also fundamental that supervisors regularly assess banks' corporate governance policies and practices. Compensation policies also need to be revised, in order to better align remuneration with risk-adjusted long-term performance and avoid excessive risk-taking and short-termism. In particular, when designing compensation policies, banks should take into account a number of issues: the variable portion of the compensation of risk takers must be paid on the basis of individual, business-unit and firm-wide measures that adequately assess risk-adjusted performance; bonuses must reward the achievement of stable earnings, not simply the fruit of extraordinary operations; executives' severance packages too must be clearly and effectively bound to the results attained, and reflect a more general evaluation of the manager's performance; compensation must be deferred long enough to validate the true quality of management.

The debate that has started with the so-called Volcker rule on the organizational structure of banks and the need to separate traditional credit business from activity in the financial field has been recently reinvigorated at a European level by the reports of the Vickers Commission in the United Kingdom and the Liikanen Group for the European Commission. Both the Volcker rule and the reports call for a much needed discussion around business size and complexity in the financial sector; the experience of the crisis has indeed shown that we should not be shy to thoroughly re-assess relative merits and costs of both (size and complexity). These reports trace out possible lines of intervention. Protecting retail deposits and taxpayers' money from the risks implicit in trading activities (what used to be called "speculation") – the rationale behind these proposals – is crucial. The experience of the crisis has shown that, even if no specific business model has performed particularly well or poorly, the banks' organizational structure has an impact on the propensity of managers to engage in excessively risky activities. We should recognize that both retail and investment banking, even if organizationally or institutionally separate, should be properly regulated, and should be careful not to have a too ample definition of market making activity.

At all events, in today's globalized world it is crucial to make sure that countries cooperate and agree on the appropriate stringency of financial regulation. Countries should not compete by relaxing rules in order to attract financial intermediaries, as this generates negative externalities for other countries. This is a most delicate issue, and while a perfectly level playing field may not be achievable, we have to be conscious of the consequences of a "beggar-thy-neighbour" approach to regulation. The transition to a uniform system of rules and oversight of the financial sector must be hastened. In the euro area, and in the European Union at large, the plan for a banking union is ambitious, but it goes in the right direction.

Some progress has been made on the convergence towards a single set of global accounting standards; but much remains to be done. The International Accounting Standards Board and the US Financial Accounting Standards Board expect to make progress on the two key outstanding issues of impairment of loans, where their deliberations should be completed by the end of the year, and insurance contracts, where both Boards will be holding public consultations this year. Of these two outstanding issues, the need for convergence on a new forward-looking expected loss approach to provisioning is of most immediate concern for end-users and from a financial stability perspective.

One element that is essential for guaranteeing systemic stability is the method of measuring risk-weighted assets (RWA), the denominator of capital adequacy ratios. RWA measures have recently attracted increasing attention from market analysts, banks and supervisory authorities. It has been

argued – and this seems to be actually the case – that the methodologies for computing RWAs may not be comparable across institutions and, especially, across jurisdictions, and that they should more properly reflect risk in order to avoid ultimately jeopardising financial stability. These problems highlight the relevance of supervisory practices in determining banks' capital requirements (for example, in validating internal banks' models for calculating risk weights). Here, rigorous micro-prudential supervision is essential. We really need to work out a single rulebook, to move with determination towards taking joint responsibility and using peer reviews as much as possible in our supervisory activity.

As for the initiatives to strengthen the regulation of the OTC derivatives market, these complex reforms are taking somewhat longer than originally planned. It is therefore necessary to pick up the pace, overcoming the difficulties of implementation and the industry's resistance. Authorities must make all efforts to remove the uncertainties arising when transactions involve a cross-border dimension, which is a recurrent condition in a global market. This is necessary to pre-empt regulatory arbitrage and, ultimately, to achieve the G20 objectives. Work is also in progress on other relevant issues at an international level (capital requirements for exposures to central counterparties, margining standards for non-centrally cleared transactions, guidance on resolution of central counterparties, as well as on authorities' access to trade repository data) and at a regional and national level. In Europe, at the end of next week a comprehensive set of standards for the implementation of the European Market Infrastructure Regulation will enter into force, complementing the European legal framework for the so-called "clearing obligation" embodied in the G20 statement of September 2009. From a global perspective, however, the regulatory effort needs to be carried out by the widest range of jurisdictions as made clear at the recent G20 meeting in Moscow.

Significant efforts are also expected from the industry. The last FSB report on the implementation of the OTC derivatives market reform estimates that "approximately 10 per cent of outstanding credit default swaps and approximately 40 per cent of outstanding interest rates derivatives had been centrally cleared as of end-August 2012".[5] These shares should grow rapidly, so as to leave to customized OTC derivatives the sole purpose of meeting the specific hedging needs of financial and non financial counterparts which cannot be met by standardised, clearing-eligible contracts.

It will be crucial to ensure that stricter regulation and supervision of banks will not push bank-like activities and risks towards non – or less – regulated institutions (the so-called "shadow banking"

[5] FSB, *Fourth progress report on implementation of the OTC derivatives market reforms*, 31 October 2012.

sector). Let us not forget that the financial crisis originated in the US securitization market, largely populated by unregulated or scantily regulated operators. While we have to address bank-like risks to financial stability emerging from outside the regular banking system, the approach should be proportionate, focussed on those activities that are material to the system, using as a starting point those that were a source of risk during the crisis. The FSB is currently refining the set of recommendations issued in November of last year. One should bear in mind, however, that the new recommendations will be able to address the specific risks that arose during the crisis, and we all recognise the ability of the shadow banking sector to innovate.

Although new regulations on systemically important financial institutions have recently been approved, the "too-big-to-fail" issue is still a major concern, and it merits strict monitoring. Some progress is being made in developing and testing methodology for the identification of global systemically important insurers (G-SIIs), and in developing appropriate supervision guidelines. An identification methodology for all non-bank financial institutions of global systemic relevance is also under preparation. For banking institutions (G-SIFI) the implementation of the framework recently agreed upon has much farther to go; we need to rapidly move forward.

Negative externalities associated with banks' behaviour (especially for large, interconnected financial firms) must be taken into account. A broad consensus has emerged on the idea that "macroprudential" policies directed towards preserving financial stability should limit systemic risk by addressing both the cross-sectional dimension of the financial system, with the aim of strengthening its resilience to adverse real or financial shocks, and its temporal dimension, to contain the accumulation of risk over the business or financial cycle. Moreover, given the complementarity between macroeconomic stability and financial stability, and that between the instruments to pursue them, the exchange of information and the co-ordination between macroprudential and monetary authorities are crucial to counter at the same time the risks for price stability and the systemic risks for financial stability. I would dare to say that proper understanding of how this can be effectively achieved is still in the making.[6]

Finally, even after the completion of the regulatory overhaul, it would be foolish to pretend that defaults can always be avoided. They may be the result of imprudent behaviour or of fraudulent operations. We need to be prepared for their occurrence, as the costs of public support tend to be

[6] P. Angelini, S. Neri and F. Panetta, "Monetary and macroprudential policies," Banca d'Italia, Working Papers, 801, March 2011 (http://www.bancaditalia.it/pubblicazioni/econo/temidi/td11/td801_11/td_801/tema_801.pdf). See also P. Angelini, S. Nicoletti-Altimari and I. Visco, "Macroprudential, microprudential and monetary policies: conflicts, complementarities and trade-offs", Banca d'Italia, Occasional Papers, 140, November 2012 (http://www.bancaditalia.it/pubblicazioni/econo/quest_ecofin_2/qef140/QEF_140.pdf).

very high. According to the latest data gathered by the European Commission, the outstanding amount of public recapitalizations as of June 2012 came to 0.1 per cent of GDP in France, 1.8 in Germany, 2.0 in Spain, 4.2 in the UK, 4.3 in Belgium, 5.2 per cent in the Netherlands, and over 40 per cent in Ireland. For Spain and Ireland these amounts are at their highest since 2008, in the other countries they are lower than the peaks reached in 2009. For the Spanish banks, a programme of recapitalization using European funds of up to €100 billion was authorized in July, of which €41 billion (3.9 per cent of GDP) has already been disbursed. In Italy, even taking into consideration the public support provided last month to the Banca Monte dei Paschi di Siena, public recapitalizations have been limited to 0.3 per cent of GDP. These figures indicate that the ongoing work on resolution regimes is very important in this regard, and rapid progress should definitely be made. This is particularly relevant in the euro area, where the new single supervisor mechanism (the SSM) is being implemented.

Observations on the analytical implications of economic and financial instability

Economic systems constantly evolve and transform. Changes in institutional arrangements, technological innovation and revisions in economic policy paradigms continuously reshape the framework in which economic agents (consumers and businesses) make their decisions. This in turn leads to changes in economic agents' behavioural patterns. When there is marked discontinuity with the past, such changes may be far-reaching and the past fails to provide enough guidance for the present (never mind the future). We should always remember that the financial system is part of a richer social, economic and political environment. The real world is subject to shocks that at times may have dramatic consequences, such as those that we have experienced in the last twenty years or so, with the end of the cold war, globalization and the sudden emergence of new major economic actors, the ICT revolution, and substantial (not completely anticipated) demographic changes.

However, a stationarity assumption of sorts underpins our theoretical and statistical models, in the case of economic forecasting and (macro) policy making as well as in the case of financial analysis and risk management. In general, the basic tenet is that future outcomes will be drawn from the same population that generated past outcomes, so that the time average of future outcomes cannot be persistently different from averages calculated from past observations and future events can be predicted with a certain degree of statistical accuracy. In non-ergodic environments, on the contrary, at least some economic processes are such that expectations based on past probability distribution functions can differ

persistently from the time averages that will be generated as the future unfolds.[7] In case of acute uncertainty, no analysis of past data can provide reliable signals regarding future prospects.

The challenges posed by the non-ergodic nature of economic systems may be met by recognizing that our models are by necessity "local" approximations of very complex economic and financial developments. One needs to be modest, using theory and empirical models as starting points for, not straightjackets in, our decision making. And perhaps not enough attention has been paid by the financial community to the need for establishing institutional and behavioural norms to reign on patterns of instability and developing proper learning devices to deal with major shocks and regime changes.

These challenges are compounded by another general characteristic of the quantitative analysis of economic phenomena: the difficulty of running parallel worlds, i.e. producing data through experiments designed and controlled by the researcher. Even when economic forces do follow repetitive patterns, it may not be easy to spot empirical regularities, because contingencies – especially the exceptional ones – cannot be re-created at will, in the laboratory, for cognitive purposes. Our experience will always be limited, partial and episodic. These aspects are not always taken into account in economics or finance. As Charles Kindleberger noticed: "For historians each event is unique. Economics, however, maintains that forces in society and nature behave in repetitive ways".[8]

Why is it that the parameters and laws governing economic systems tend to change over time? A distinction can be made between exogenous uncertainty, when an individual's actions do not affect the probability of an event occurring, and endogenous (or behavioural) uncertainty, when they do.[9] In economic systems, this second type of uncertainty can be particularly important. This has not been sufficiently recognized, I believe, in the way (applied) macroeconomics and finance have evolved since the 1980s, with the ascendency of the rational expectations revolution in the former and the efficient market hypothesis in the latter.

In macroeconomics this may have led to placing too much faith in the ability of dynamic stochastic general equilibrium (DSGE) models to represent or sufficiently approximate the real world on

[7] P. Davidson, "Is probability theory relevant for uncertainty? A Post Keynesian perspective", *Journal of Economic Perspectives*, 5, 1, 1991.

[8] C. P. Kindleberger, *Manias, panics and crashes: a history of financial crises*, New York: Basic Books, 1989, p. 14.

[9] I. Visco, "On the role of expectations in Keynesian and today's economics (and economies)", translated from "Sul ruolo delle aspettative nell'economia di Keynes e in quella di oggi", in Accademia Nazionale dei Lincei, *Gli economisti postkeynesiani di Cambridge e l'Italia*, Convegno Internazionale, Rome, 11-12 March 2009 (http://www.bancaditalia.it/interventi/intaltri_mdir/en_Visco_110309.pdf).

which economic policy is applied. These fundamentally linear models are the result of the intertemporal optimization by representative agents of objective functions under conditions of uncertainty, given technological and budget constraints and the "rationality" of their expectations (i.e. perfect foresight barring a random error). Indeed, going beyond the assumption that society and nature always behave uniformly and consistently over time has deep implications in policy making as well. This can be easily seen in monetary policy, where no mechanistic use of forecasting models can be made if one allows for the possibility of structural changes.[10]

An important lesson of the financial crisis – one that is generating substantial research activity – is that the interactions and feedbacks between the real and the financial sectors and the non-linearities that emerge especially during crises are not adequately captured by the available models. Many of the effects associated with financial and asset price imbalances are likely to be highly non-linear and complex. The reaction of monetary policy should then also be non-linear and it should respond to asset price misalignments and financial imbalances. When the probability of a crisis becomes non-trivial, the interest rate path towards ensuring monetary stability might be different than in ordinary circumstances. These aspects were not well captured in the empirical models used to support monetary policy decisions, something understood but perhaps not adequately recognized in discussions on flexible inflation targeting frameworks that took place a decade or so ago.[11]

One of my preferred quotes is from Herbert Simon:[12]

> Good predictions have two requisites that are often hard to come by. First they require either a theoretical understanding of the phenomena to be predicted, as a basis for the prediction model, or phenomena that are sufficiently regular that they can be simply extrapolated. Since the latter condition is seldom satisfied by data about human affairs (or even by the weather), our predictions will generally be only as good as our theories. The second requisite for prediction is having reliable data about the initial conditions – the starting point from which the extrapolation is to be made.

We must recognize that empirical models reflect historical experience in the values of their parameters and are mostly reliable when it is "business as usual", that is, as long as our systems are not subjected

[10] See, among others, J. Vickers, "Inflation targeting in practice: the UK experience", *Bank of England Quarterly Bulletin*, November 1998.

[11] See C. Borio and P. Lowe, "Asset prices, financial and monetary stability: exploring the nexus", BIS Working Papers, 114, July 2002 (http://www.bis.org/publ/work114.pdf). See also C. Bean, "Asset prices, financial imbalances and monetary policy: are inflation targets enough?", BIS Working Papers, 140 (with discussions by I. Visco and S. Whadwani, http://www.bis.org/publ/work140.pdf).

[12] H. A. Simon, *The sciences of the artificial*, MIT Press, Cambridge, Mass., 1972, p. 170.

to unusual pressure. It can be argued that their contribution to making informed decisions is limited, as they tend to become unreliable precisely when, following signs of structural discontinuity, the benefits of correct forecasting are greatest. Indeed, anomalous observations that do not fit the main mechanisms at work in the historical period used for statistical estimates are frequently put aside ("dummied-out"), their information content is neutralized. This is reasonable, as episodic observations of exceptional phenomena are generally inadequate to capture complex inter-relations between economic and financial variables. And yet those very deviations from the norm may contain precious information on how the economy works in conditions other than those usually prevailing.

Much of the same reasoning applies to the analysis of financial market developments. The wave of financial innovation in the last two decades was fuelled by the idea, in principle correct and fruitful, that the proliferation of new (and complex) financial instruments, allowing agents to insure against many dimensions of risk, was a way to "complete the markets", to get closer to the theoretical Arrow-Debreu world, enabling investors to transfer resources efficiently across time, space and states of the world. But this idea relied on the presumption that the world is basically stationary, that the future is pretty much the same as the past, that we can extrapolate from relatively small samples, and that there is a single "data generating process" that we can identify and understand.

But we know that the real world is more complicated. The determinants of asset prices are not fixed, but vary over time. Asset returns do not follow a normal distribution, as it is assumed by conventional valuation formulas. Myopic behaviour, herding and other types of distorted incentives on the part of individuals and financial institutions can generate negative externalities and move financial markets' expectations and risk premia away from fundamentals. And, lately, scholarly work has been attributing a new, enhanced role to psychological elements and the recognition that there are limits to what one can know. In the field of the so-called behavioural finance this may even go as far as to validate "irrational" actions. And eminent economists argue that these elements play a role in explaining both conservative attitudes and speculative bubbles.[13]

The potential limitations of quantitative analysis are therefore not limited to macroeconomics, econometric modelling and forecasting but also apply to finance. And they may have dire consequences. The case of the CDOs is instructive. These credit derivatives, that in the first half of the last decade recorded an impressive growth, were priced according to valuation models whose results were very sensitive to modest imprecision in parameter estimates and highly exposed to

[13] G. A. Akerlof and R. J. Shiller, *Animal spirits: how human psychology drives the economy and why it matters for global capitalism*, Princeton, Princeton University Press, 2009.

systemic risk (i.e. strongly affected by the performance of the economy as a whole).[14] As a result, CDOs not only did not increase the risk bearing capacity of the economies, but their implosion between mid-2007 and mid-2008 was at the core of the global financial crisis. Innovative financial instruments with unsound theoretical foundations may exacerbate negative externalities and be sources of instability in their own right.

Rather than in the development of unlikely "catch-all" models, the key to tackling the problems created by discontinuity must lie, first of all, in a better understanding of its nature and so in defining models in which the relations are based on parameters that remain stable in the long term. Research must therefore aim to identify sufficiently fundamental and reasonably dependable mechanisms that do not change over time. To provide sensible accounts of rational choices, quantitative models necessarily have to focus on systematic factors, and draw their own conclusions on the basis of key relations. In this respect it is worth recalling Bruno De Finetti's argument for a "theory of finance", made as early as 1957:[15]

> In order for a theory of behaviour to say something, it must necessarily be restricted to that which is derived as the consequence of a few main concepts and criteria and which can accordingly (if somewhat arbitrarily) be defined as 'rational behaviour'. Then the theory will set out conclusions that are valid in the absence of accessory factors. This is not to deny or downplay the possible presence or importance of such factors; only, it is preferable to shift the study of deviations from the 'theoretical' behaviour implied by those conclusions to a later moment and to the detailed plane of complementary observations, rather than cloud all distinctions in a single theoretical construct which, in the attempt to embrace and set on an equal plane the congeries of systematic and accessory factors, would be reduced to a non-theory suitable solely to conclude that all kinds of behaviour are equally possible (for caprice or madness, even, as is in fact the case).

Obviously, De Finetti's "later moment" should not be overlooked in applied research. Against the risk that the theoretical paradigms underlying the approximation of reality implicit in a model may prove particularly inadequate in certain situations, it is useful to employ a battery of different models and cross-checks. This "multi-pronged" approach to modelling and forecasting also makes it possible to more effectively filter and interpret the great mass of partial and fragmentary or even contradictory data that gradually become available. But in dealing with non-ergodic processes, what really is all the more essential is to integrate the signals provided by quantitative models with

[14] See J. Coval, J. Jurek and E. Stafford, "The economics of structured finance", *Journal of Economic Perspectives*, 23, 1, 2009.

[15] B. De Finetti, *Lezioni di matematica attuariale*, Roma: Edizioni Ricerche, 1957, p. 71 (my translation).

information outside the models, take stock of related historical experience in its entirety, and intervene on the basis of both theory and good sense.

In both empirical microeconomics and finance work is under way to deal with the issues that have been considered here. Deviations from the assumption of normal distributions, "fat tails" and the modelling of extreme events are being taken into account both in research and applications. And it should be recognized that the importance of human behaviour does not imply that economic systems necessarily have to be prone to instability. In fact, the very existence of behavioural uncertainty may tend to create a set of institutions, as well as conventions and habits, which help to deal with the problems highlighted in Keynes' "beauty context" example and ensure the stability of the main economic processes, as emphasized by Herbert Simon.[16] Still, I believe, more attention should be paid to how to account for learning in the crucial adjustment periods that follow extreme events that cannot be simply taken as random extractions from a stable, even if non-normal, probability distribution. Widening the class of probability distributions remains however, for the time being, the practical response to phenomena such as the ones we have been dealing with in this difficult period.

Final remarks

The crisis has shown that benign neglect should never have been an option. It has called for a major overhaul of the regulatory and supervisory financial framework, especially at an international level. In a globalized financial marketplace, with large and powerful participants, individual action by national authorities would be bound to fail. By the same token, the boundaries of supervision should be widened to encompass all relevant intermediaries, regardless of the specific industry sector they belong to. I have discussed the work underway, highlighted the results achieved and stressed the areas where more effort is needed.

The correct conduct of credit and financial business also requires competence and good faith on the part of intermediaries, both factors being decisive to ensure sound and prudent management and preserve the confidence of savers. This necessity is heightened by the complexity of the external environment, by the presence of large intermediaries, and by the economic and reputational damage that can result from illicit behaviour. No market can function without rules, nor is prudent management possible without correct conduct, embodied not only in scrupulous compliance with the law and the supervisory rules but also in complete adherence to business ethics.

[16] H. A. Simon, "The role of expectations in an adaptive or behavioristic model", in M. J. Bowman (ed.) *Expectations, uncertainty and business behavior*, New York, Social Sciences Research Council, 1958.

The dramatic events of the past five years have highlighted the limitations of modelling and quantitative analysis in finance and in economics. The common assumption of stationarity is at odds with the unpredictably changeable nature of the real world. This is not to say that all the analytical efforts of the past and the progress achieved should be disregarded. It means rather that in order to make the best out of them one needs to remember that models are by necessity "local" approximations to very complex phenomena and they should be used with good sense as a framework, not a straightjacket, for our decision-making. Quantitative analysis and modelling can also help to establish institutional and behavioural norms to rein in patterns of instability and developing proper learning devices to deal with major shocks and regime changes. In turn, models should take into account the impact of such norms on economic developments.

Central banks have a crucial role to play. There are clear complementarities between financial and monetary stability. Sometimes these are formally recognized in their official mandate, but even when this is not the case, central banks must take them into account in their policy decisions. In this respect, I would like to quote from a book by the brilliant Bank of Italy economist Curzio Giannini, who passed away prematurely about ten years ago. In that "beautifully written and illuminating" work, as Charles Goodhart describes it in his foreword, Curzio clearly saw the likely consequences of financial developments, and concluded:[17]

> In the years to come, the most interesting developments will probably be precisely in the sphere of supervision and regulation. […] Whatever its detractors may say, the central bank has no need to move into new lines of business. Capitalism generated the central bank and capitalism will come to it again, even if the current infatuation with the financial markets' self-regulating capacity were to endure. […] The central bank produces an intangible but essential good – trust – of which capitalism (based as it is on a pyramid of paper if not mere electronic signals) has an immense need. We must not forget that trust, or its synonym "confidence", derives from the Latin fides, meaning faith, which cannot be produced simply by contract. In fact the legitimacy of central banks does not lie in their policy activism, or the ability to generate income, or even, save in a highly indirect sense, their efficiency. Rather, […] it derives from competence, moderation, the long-term approach, and the refusal to take any tasks beyond their primary role. If, as I am sure, there is another phase in the development of central banking, it will spring from these values.

In the end this is, perhaps, what society should expect, if not from the financial sector, from those who are called to look after financial stability.

[17] C. Giannini, *The age of central banks*, Cheltenham, UK, Edward Elgar, 2011, p. 255 and pp. 258-259, English translation, *L'età delle banche centrali*, Bologna, Il Mulino, 2004.