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Market Risk and Financial Markets Modeling

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Introduction

Financial Market and Systemic Risks

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The ongoing financial crises since 2007 painfully reminded us that systems can develop what scientists often refer to as “emergent” dynamics that are fundamentally different to what can be expected by studying their parts. The assumption that the economy as a whole can be understood by solely focusing on the equilibria resulting from utility optimization of its economic agents constitutes one of the major shortcomings of economics. A mantra in academic circles, exploited by bankers and policy makers to excuse their failures, is that, with the rise of recent technological and financial innovations, societal and economic networks have never been more complex and this complexity has reached unmanageable levels within the current understanding and methodologies. Many scholars as well as professionals call for novel and ambitious initiatives to improve our understanding of the dynamics of the financial and economic systems, using a transdisciplinary approach, typically based on adding system theory from various branches of the natural sciences, network analysis, and out-of-equilibrium agent-based models to traditional economics.

While these are crucial to advance the disciplines of finance and economics in the medium to long term, they are overlooking much needed short-term operational solutions. Rather than putting our hope in tackling the super complexity with super high tech solutions, we should remember simple truths that demonstrated their value in the past but have been by and large forgotten. Academic and institutional memory loss includes the role of banks in credit creation, the benefits of certain (lost) forms of regulations, and the crucial role of central banks as fighters (rather than promoters) of bubbles.

In macro-economic models such as the class of Dynamic Stochastic General Equilibrium (DSGE) models used by central banks, the banks as separate agents directly influencing the economy are conspicuously absent, apart from their influence through interest rates. Why should then taxpayers’ money bail them out if they are just transparent economic conduits? In contrast, stressing the role of banking in the wider context of economic systems was central to Austrian economists and scholars such as Hayek and Schumpeter. While not without weaknesses, the Austrian economic school emphasised correctly the role of banks and their cre-

ation of credit through the fractional reserve system. Too much credit, encouraged by artificially low interest rates set by central banks for instance, can lead to an unsustainable boom and the creation of economic and financial bubbles. This is exactly what happened in the run up to the current financial crises. The concept that banks are in large part responsible for credit creation was well understood 30 years ago and discussed and taught in major economic textbooks. This knowledge seems to have been forgotten in mainstream macroeconomics. This is a fundamental loss. Indeed, the forgotten problem is the misaligned interests between the credit creation chosen by banks in order to maximize their utility versus the amount of credit required by the real economy. Schumpeter also emphasised the crucial role of banks and credit markets through their function of active allocators of capital to entrepreneurs and hence fostering economic development. The reason for this memory loss may have been the inability and even resistance to apply these concepts in mathematical models. It seems, though, that much wisdom can be derived from revisiting these ideas, which carry valuable lessons on the role of banks within the financial and economic system.

What we are currently witnessing could be described as a system that has become unstable because some of its constituents act as mutually reinforcing destabilizers through positive feedback loops. That banks serve their own interests on the one hand and play a key role in lubricating the economy, thus serving as public good entities, on the other hand has been widely recognized in recent debates. Many discussions, with different emphasis across the Atlantic, focus of what kind of regulations should therefore be imposed to align the private interests of banks with the public interests. The recent Dodd-Frank act (2010) enacted in the US can be seen as a rather timid step towards a working solution, if not just because many of the changes implied by its implementation are not expected to be fully enacted until 2015 (five years is really like eternity for financial markets!). Consider in contrast that the fifty years following WWII have constituted arguably the most stable economic period in the history of the United States and of Europe. Most scholars attribute a key role for this stability to the Glass-Steagall Act of 1933, which successfully prevented the occurrence of systemic instabilities, by separating by law investment banking, commercial banking, retail banking and insurance. This disaggregation provided completely separated waterproof compartments to prevent any Titanic like event of crisis spreading. Only with deregulation that started taking place in the 1980s culminating in the repelling of the Glass-Steagall act by the Gramm-Leach-Bliley Act of 1999, banking mutated into a new highly interconnected form that recovered basically its pre-1929 role within the ecosystem. Much of the risks that we currently face both in Europe and in the US originate from too much leverage and uncontrolled indebtedness spreading across all networks that build on the incorrect belief that transfers of debts to bigger and bigger entities will solve the problem.

We cannot afford and do not need to wait another decade or more until new super high tech models are developed. Faster solutions are possible by revisiting policies that worked in the past and by relearning and expanding some of the old wisdom in economics, specifically related to the role of banks. These theories

should be anchored on rigorous analyses of empirical evidence and enhanced by fertilization with various branches of the natural sciences, network analysis, and out-of-equilibrium agent-based models.

The main bottleneck is not technical but political due to the control exerted by an oligarchy of bankers in effective control of the economy. But this essential truth is hidden in the smoke of complexity and loss of memory of past solutions. It is also convenient to foster the belief of an illusion of the “perpetual money machine”, promising unending economic growth from expanding leverage and indebtedness. It is due time that we stop being lulled by these sirens and used either as scapegoats or future prophets. Only then might a genuine science of out-of-equilibrium system economics become credible and useful.

In this context, the Proceedings of the International annual event “*Perm Winter School*” held in February, 2011 on Financial Market Risks is a demonstration of the progresses obtained in the last decade to rejuvenate the financial and economic culture among Russian university students, as well as among practitioners from the private and public sectors. The contributions are varied and cover a large spectrum of important problems with examples and applications relevant to the Russian market, from high-frequency trading, asset pricing models, hedging and liquidity issues, hedge-fund characteristics, models of interest rates, the influence of derivatives, role and limits of present regulation rules, the psychology of traders, the influence of strategic behaviors and the ubiquitous problem of insider trading, agent-based models aiming a reproducing stylized facts and emphasizing the critical behavior of markets and bifurcations, and more. These contributions illustrate that the Russian school of economics and finance has a lot of potential to grow in the future, building on its great mathematical tradition, its reservoir of excellent natural scientists and its growing business oriented economy. In that respect, the co-organization of the conference by Perm State University and the company Prognoz is exemplary even by western standards of the win-win situation provided by close ties between university and companies who share a same vision of achieving professional excellence and individual growth, training and fulfilling lifetime realizations.

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On the Development of Master in Finance & IT Program in a Perm State National Research University

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Currently, according to new Russian educational standards in higher education system there is a transition from qualification model to professional competence model. Areas of Higher School modernization associated with the adoption of Russia Bologna Declaration includes: the transition to a two-tiered “the bachelor – master” system of education, the introduction of ECTS credits for the convertibility of diplomas and international educational mobility, the creation of a system of certification and quality control in education (introducing a rating system for both teachers and students alike), development of scientific environment.

In the innovation economy specialist must be able not only to apply the knowledge and skills acquired during education, but also have the necessary competences such as creativity, ability to understand and identify problems and find solutions, teamwork, the ability to structure large amounts of information, etc. Competence that students must master after graduation is settled in the standards for both bachelors and masters. They are divided into competencies related to the subject area (profile, special) and universal (general).

Perm State University participated in the All-Russian competition in 2010 and received the status of a national research university (NRI). The educational process at NRI includes:

- strengthening the role of an independent and practical work of students;
- expansion of the teaching and use of foreign language;
- creation of a world-class laboratories, which conduct the major research work;
- active participation of students in research and development;

- transformation of the educational process, providing students with practical competencies, reducing the load of classroom teachers, individualized educational trajectories;
- opening of new educational programs on an international level.

Department of Information Systems and Mathematical Methods in Economics (ISMME) is deeply involved in the modernization of the educational process in connection with the introduction of a new generation of standards for higher professional education and the assignment of PSU status of a national research university. The department has formed a unique R&D cluster with Joint-Stock Company "PROGNOZ". The main activity is held in the development of Decision Support Systems for various industries and tasks, including, the analysis of financial markets as a complex systems. Such integration of academic and applied research and information technologies is even more important in nowadays economy of knowledge.

In the 2011/2012 academic year there were openings of two master's programs, "*Information-analytical systems in forecasting and management processes of socio-economic development of countries and territories*" and "*Master in Finance & Information Technologies (MiFIT)*". Both programs are implemented within the framework of scientific-educational complex (SEC) "*Predicting and managing the processes of socio-economic development of countries and territories on the basis of modern information technologies*", which is a structural unit of NRI. Implementation of master's programs provides an opportunity for further development of quality scientific and educational processes of the department. But at the same time it requires active human resources policy, stimulating research and educational performance, attraction of leading scientists and experts, professionals, economists, experts in the field of information technology to ensure competitiveness on the international level of academic and labor markets. One of the major challenges faced by the department and JSC "PROGNOZ" is the merger of the educational and R&D processes, assuming the attraction of students to research teams from the first grade.

The curriculum structure of the program is the key competitive point. Studying at the ISMME programs must master a variety of disciplines in three major areas: Math, Finance and Computer Science (IT). We analyzed several masters and undergraduate courses of the following universities and business school: Carnegie Mellon University, Princeton University, Baruch College, London School of Economics and Political Science, Cass Business School, Warwick Business School, Imperial College Business School, etc. So our programs were constructed to address the broader range of fields including:

- Stochastic processes;
- Operation research and optimization;
- Financial engineering;
- Data mining;
- Simulation and copula theory;
- Risk management;

- Data management;
- Information system design and programming;
- E-Commerce.

As part of the MIFIT program the international annual event “*Perm Winter School*” was introduced. The first school was held in February, 2011, organized jointly by PSU and “PROGNOZ” with the support of the Government of Perm Region, National Research University Higher School of Economics and Professional risk managers’ international association (PRMIA).

3-day school program focusing on market risks included lectures, master classes, round tables with participation of renowned researchers and representatives of major financial institutions, as well as evening student sessions.

At a roundtable organized at the second day of the school hot issues of financial market development and risk management were discussed by the Federal Financial Markets Service of Russia, National Bank of Belarus, Sberbank of Russia, investment companies and software vendors.

The school was attended by more than 140 participants from 38 universities and organizations from 6 countries (Belarus, India, Italy, Switzerland, etc.). Additionally 70 people joined the Perm Winter School online.

The successful experience of 2011 had proven this event to be efficient and consistent model of education. Direct communication with outstanding academics, leading practitioners and top managers, allows students to see the problems that still need to be addressed involving young scientists in the world of financial research.

