HPCF 2010: Workshop on High-Performance Computing Applied to Finance

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Foreword

The *Workshop on High-Performance Computing applied to Finance* (HPCF) focuses on the computational issues in the solution by advanced architectures of financial problems, particularly concerning the evaluation of financial instruments, asset and liability portfolio management, measuring and monitoring of risks and assessment of solvency requirements.

Kontoghiorghes, Nagurney and Rustem – in the year 2000 – in the guest editorial of a special number of Parallel Computing (in economics, finance and decision-making)[1] stated that "[parallel] computing has evolved into an essential tool in the solution of complex, large scale problems arising in [...] finance, in particular. Nevertheless, [...] its potential to solve problems in [...] finance has neither been fully addressed nor explored."

This statement is at the moment partially still true for high-performance computing.

The critical issue is yet the lack of complex valuation systems, for advanced computing architectures, able to provide "market-consistent evaluation" of values and risks and to perform timely measurements, as required by markets and regulations, in order to carry out continuous verification. The development of such a system requires a strong synergy between high-level theory and high-level technology, that is a synergy between models and techniques of quantitative finance, computational schemes and data management. The appropriateness of data quality and models as well as accuracy and efficiency of computation and the adequacy of the IT infrastructure are more and more preconditions for an efficient governance of financial companies and an effective monitoring of market stability.

The Financial Services Authority (FSA), in a document on Solvency II project[2], stated indeed that to develop, implement and maintain an "internal model" insurance undertakings must make "a cross-functional team: comprising finance, actuarial, risk and IT functions" [p. 29. 5.4], and that "an adequate system of

[1] Kontoghiorghes, J., Nagurney, A., Rustem, B., Parallel computing in economics, finance and decision-making - Guest editorial, Parallel Computing, 26 (2000), 507-509.

[2] Financial Services Authority, Insurance Risk Management: The Path To Solvency II, FSA, September 2008.

M.R. Guarracino et al. (Eds.): Euro-Par 2010 Workshops, LNCS 6586, pp. 409–411, 2011.

governance should be carried out by persons with sufficient knowledge of actuarial and financial mathematics and [...] able where appropriate to demonstrate their relevant experience and expertise" [p. 16, 3.19]. Mario Draghi – Governor of Banca d'Italia – in the Concluding Remarks of year 2007[3] claimed as well that "the consolidation of our banking system [...] must be accompanied by a significant acceleration in the integration of networks, organizational structures, IT systems [...] to enable banks to manage the new and complex risks.".

The integration between high-level theory and high-level technology requires a close collaboration between experts in finance, in modelling, in computational mathematics and in computer science. In addition, the new banking regulation (Basilea 2) and insurance and reinsurance regulation (Solvency II) strongly affect the governance of financial companies, thus requiring decision-makers and regulators to make their own contribution to the design, development and validation of valuation systems.

From the hardware point of view, a wider spread of high-performance computing can be achieved by exploring new technology solutions that trade off costs and performance, such as blade systems, cloud computing, gpu computing, many-core processors and so on.

The workshop aims at providing a forum for researchers and practitioners on the challenge of fully addressing the potential of high-performance computing to realize effective systems for the estimation of values and risks that can be used in a business and industry context.

The contributions of the authors certainly concur both to the advance of knowledge in the computational finance field and to the effective solution of financial problems by the application of innovative ideas of other research areas, such as data processing, numerical analysis and high-performance computing, and further stimulate the research on these topics.

The choice of invited lectures has been inspired by the main problem of asset-liability management and in particular by the actual debate on the Solvency II implementing measures.

The first lecture by Gilberto Castellani and Luca Passalacqua addresses computational problems deriving from Solvency II compliance in the context of Italian life insurance. They present DISAR (Dynamic Investment Strategy with Accounting Rules), a relevant example of "internal model" designed for the monitoring of portfolios of "profit sharing" Italian life insurance policies with minimum guarantees, linked to "segregated funds", working on a grid of conventional computers.

The second lecture by Andreas Grothey focuses on asset-liability management of portfolio optimisation by large long-term investors. He shows that realistic simulations lead to problems with many millions of unknowns that now can be really faced-up using stochastic dynamics models on massively parallel architectures. He reviews some of the results and challenges in this framework.

[3] Banca d'Italia, The Governor's Concluding Remarks - Ordinary Meeting of Shareholders, 2007 - 114^{th} Financial Year, Rome 31 May 2008.

Both the contributions represent notable examples of synergy between high-level theory and high-level technology and meet the requirement of a strong community of interests between scientific and business and industry context.

Acknowledgments

I wish to thank the Europar organizers for providing the opportunity to carry out the workshop in conjunction with the EuroPar 2010 conference. My gratitude also goes to Gilberto Castellani, Luca Passalacqua and Andreas Grothey for accepting my invitation to give a lecture. For their support in the workshop program's definition, I want to thank the members of the Program committee. Financial support from Università degli Studi di Napoli "Parthenope" and EuroPar, is gratefully acknowledged.

November 2010 Francesca Perla