



CALCULATION CAPACITY HELPS CREATE AND CALIBRATE MODELS FOR ECONOMICS



Financial economics is and has been a popular research area. In the 70's research was for the most part based on analytical methods that were used to find fresh angles to familiar issues. In the last decades a transition towards more computing based methods has been taking place, and nowadays computing is often necessary in implementing modern financial theories.

- When I first heard that we at the Tampere University of Technology had new and rapid distributed computing resources available to us with Techila, I quickly realized what this meant to my research into pricing models and volatility of options and other derivatives, says Juho Kanninen.

Data related to stock markets are publically available to everyone. That data has been used to estimate numerous models. Yet, the results might be somewhat different if the simulations of the complex models could drill down to more details with more computing resources. This and brand new research has been made possible by the Techila solution.

Estimation of GARCH-models

The developer of the (G)ARCH-model, Robert F. Engle, was awarded a shared Nobel Prize in Economics in 2003. The model provided methods of analyzing economic time series with time-varying volatility and economic time series with common trends. Earlier it was commonly assumed that fluctuations in the financial market do not vary to a great extent, that is, volatility remains fixed. GARCH-models are models of stochastic volatility. They can well explain the asymmetric distributions observed empirically.

In the 90's all models were based on historical time series data. It was acknowledged that this method did not give the best accuracy for the pricing of options, but the tools were not there for a better performance.

- The better idea is to estimate a volatility model using empirical option data so that the pricing model imitates the options market as well as possible, Juho Kanninen says.

- The first publication, which estimated the most popular GARCH-models using information on option prices came out in 2004.

- It is a computationally heavy process to calculate options prices repeatedly with GARCH-simulation. Now with Techila we have access to more precise estimations using information on large sets of option prices than ever previously.

- The current models do a fairly good job. But certainly when distributed computing technology gains more ground in simulation, we will get more precise estimation results. We need to estimate the parameters we use in simulation methods, and more computational power will facilitate the executions significantly and improve reliability, Juho Kanninen says.

When exotic derivatives need to be evaluated, the job becomes more complex than with vanilla options. Unlike traded vanilla options, exotic derivatives are not regulated by the market, but they are more subject to private contracts.



For more information:

www.techila.fi/downloads.html

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- We are actively studying how consistently “perfectly” calibrated volatility models price exotic derivatives

Accurate results with distributed computing

Simulation models require heavy distributed computation provided at the Tampere University of Technology by Techila. A distributed computing solution would be an ideal tool for all those that need to manage risk, such as banks, insurance companies and various other types of investment institutions. Naturally almost all economic research beyond pure theorists would benefit from an opportunity to drill down in the data they already have.

- I have done a number of runs on the distributed computing environment, using large sets of option prices, including over 9 000 observations, to get a long-term look at the behavior of volatility in the equity markets. When the estimation is based on an extensive data volume the optimization of the models’ parameters can be computationally very intensive. I have, together my students, numerous articles in the process, and having had access to Techila Distributed Computing Solution I am sure there will be interesting findings.

- I certainly feel that a solution for distributed computing is a major step forward in my line of research - and I know it is becoming a research enabler in many other fields as well, says Juho Kanninen.

Personal Profile: Dr. Juho Kanninen

•Adjunct Professor of Mathematical Finance, Department of Industrial Management, Tampere University of Technology

•Senior Lecturer of Finance, Department of Mathematics, Tampere University of Technology

Selected Publications

•Kanninen, J. , S. Mäkinen, R. Piche & A. Chakrabarti, “Forecasting the Diffusion of Innovation: A Stochastic Bass Model with Log-Normal and Mean-Reverting Error Process”, to appear in IEEE Transactions on Engineering Management

•Kanninen, J., R. Piché, and T. Mikkonen, 2009, “Use of Distributed Computing in Derivative Pricing,” International Journal of Electronic Finance, 3, 270-283.

•Kanninen, J., 2009, “On the Effects of Uncertainty on Investment Timing and Option Value,” Engineering Economist, 54, 175-196.

•Kanninen, J., 2009, “Can Properly Discounted Projects Follow Geometric Brownian Motion?” Mathematical Methods of Operations Research, 70, 435-450.

•Piché, R. and J. Kanninen, 2009, “Matrix-based numerical modelling of financial differential equations,” International Journal of Mathematical Modelling and Numerical Optimisation, 1, 88-100.

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