

## INCORPORATING RISK CONSTRAINTS INTO PRICING MEASURES

### OVE GÖTTSCHE

In his PhD research project, Ove Götttsche is focusing on mathematical models in finance. The goal of the project is to structure and support final pricing and trading decisions in modern finance, not to predict future market prices. This difference is often misunderstood in the media.



How mathematicians deal with risk in modern finance is difficult to grasp, even for analysts. Too often, they change their expectations of the value of businesses according to short-term information, usually in response to extremely good or extremely bad news. Ove Götttsche and Professor Arun Bagchi of the CTIT Financial Engineering Group are investigating useful and secure, long-term models that are crucial for risk management, asset pricing and portfolio management.

"Our main focus is on pricing and risk", notes Bagchi. "High-finance modelling involves actual trading techniques, which is highly mathematical already. Risk creeps into the model at all levels. It is possible to adjust the model accordingly, at least to some extent. However, the risk that the entire market will collapse, for example, when trading stops or liquidity ends, should be avoided at all costs. Mathematical models can deal with that to some extent. Compare it to flood risk in case of a dyke

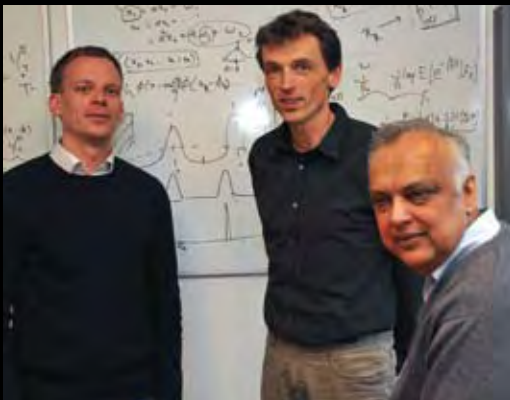
breach in the Netherlands. They are constructed such that a disaster might occur under extreme circumstances once every 1500 years."

#### TECHNOLOGY FOUNDATION STW

Technology Foundation STW supports many of the projects of the Financial Engineering (FE) Group. Bagchi stresses that the Netherlands is heavily dependent upon the financial services industry, which comprises thirty percent of all national income. The FE Group is part of the CTIT Strategic Research Orientation on Industrial Engineering and ICT. The expertise is derived from analytical finance, stochastic mathematics and signal theory. Götttsche explains that long-term global developments have changed financial markets in recent years. "Volatility is an important parameter, both now and in the near future", he states. "It will intensify in response to decreasing diversity of information and increasing complexity in financial markets."

"These trends contain paradoxical elements. Because information is easily accessible, almost all participants in the markets around the world are using the same financial news services. Combined with the globalization of financial networks, this can lead to herding behaviour in the decision-making processes of the analysts."

"Furthermore, the increase of mathematical models in finance makes it difficult to decide whether the departure of theoretical prices from the market prices could increase the possibility of risk-free profits, or whether it simply indicates the need for new models." Nonetheless, Götttsche is convinced that it is possible to control financial markets, even though such control is difficult to achieve. The supervision of stock and even currency markets on an international level is a worthy objective. "With the help of mathematical methods and rational decision-making by national governments, it might be possible to achieve these goals."



#### THE COST OF RISK

The price of certain liabilities (for example, case derivatives) is determined by using methods that take the cost of risk into account. Many regulators require financial institutions to keep a certain level of cash reserves on hand in order to counterbalance their risks. It should therefore be possible to quantify these costs as losses, due to the passive holding of cash.

This type of framework could lead to program for optimizing the ratio of assets to liabilities that can deal with long-term risks. It could also be applied in the context of markets in which it is not always possible to trade assets in the quantities desired, due to restricted liquidity in the underlying markets. "Incorporation will be an integral part of the analysis in our projects", Bagchi states.