



Michel Vellekoop

Complex models in haute finance

Bjorn Alink has almost finished his PhD research on the prediction of mortgage prepayments. He developed an extended model that will help banks to control their financial risks. One of the main variables in Alink's model is the interest rate. Mathematician Michel Vellekoop introduced Alink to the computational tricks of interest rate models.

“With rising house prices, mortgage provision has become an even bigger business than it already was. In keeping with this, the risks have risen. Needless to say, failing to pay off is a serious risk. However, prepayment is also a risk, as it means that the bank paid too much for financing, as it assumed that the mortgage in question would have a longer duration. Risk management is therefore not only a matter of checking the customers' creditworthiness, it also involves trying to value the prepayment option. This prepayment option is the right of the borrower to prepay his loan. This was my research subject in a project sponsored by SNS Bank.”

“Using historical data from several banks, I developed a model for predicting mortgage prepayments. I had to identify the variables that influence prepayments in the Netherlands. Naturally, interest rates turned out to be of considerable influence. The more interest rates drop, the more people may decide to pay off their mortgage and take out a new one at a lower interest rate. So I turned to Michel Vellekoop for some support on complex interest rate models. But I found more variables, such as the age of the person with the mortgage. The younger people are, the more likely they are to move house, which often means taking out a new mortgage and paying off the old one. The same applies to people living in an apartment as opposed to single-family dwellings. Even the fact of whether the mortgage was obtained through an intermediary or directly via a bank office turned out to be of influence. This should really interest mortgage providers.”

“During my PhD project, I worked part-time with SNS Bank on mortgage-backed securities. My job was to securitise mortgages, that is collect them in portfolios and place them in independent legal bodies. In this capacity, I worked with accountants, investment bankers, rating agencies and lawyers. This introduction to the world of haute finance appealed to me, so after completing my PhD, I will take up a full-time position with SNS Bank. In these days of restructuring and staff reduction, risk management departments of banks still have vacancies for financial engineers.”

Project examples:

- Measuring effects of dependence on insurance portfolios
- Management control of credit risk
- Economic capital allocation and the impact of fair value accounting



NEW DIRECTIONS IN MATHEMATICS

In Spring 2002, the Dutch mathematical community presented a national strategy to the Ministry of Education for mathematical research and the related master programmes. The report, 'New dimensions, wider range' (In Dutch, 'Nieuwe dimensies, ruimer bereik') identified financial engineering as one of seven promising expressions of the umbrella theme of 'mathematics at the interface with other disciplines'. It also contained self-portraits of seven young mathematicians, as representatives of the Netherlands' bright hope in these areas of application. Michel Vellekoop from the University of Twente's faculty of Applied Mathematics was among them. Within the framework of CTIT's Financial Engineering research area, Vellekoop worked with Bjorn Alink to incorporate interest rate models in Alink's method for prediction of mortgage prepayments.

"Nowadays, mathematical models are used in stock exchanges all over the world to calculate prices of, for example, options. Using different techniques, such as probabilistic models for dynamic processes and stochastic simulations, prices of options on the underlying stock can be calculated. Many of the resulting equations cannot be solved precisely, so numerical analysis often has to be used as well. Moreover, in the hectic environment of a stock exchange, prices have to be calculated within milliseconds. This calls for very fast numerical algorithms. It is this combination of mathematical aspects that makes my work challenging. The models that are used to price derivatives on interest rate models are equally complex. It is therefore very encouraging that all the larger Dutch banks are expressing interest in this research. This was reflected in the large number of participants at the 'Derivatives Day Amsterdam' in the Beurs van Berlage, which was organised by CTIT's FE Lab and the Derivatives Technology Foundation. It shows that financial engineering has become essential to the Dutch knowledge-based economy."

