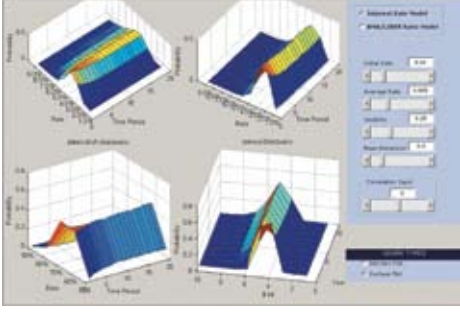


Intuitive Analytics Uses MATLAB to Build Quantitative Tools to Help Bond Issuers Manage Risk

To raise funds for public works projects, state and local governments typically issue bonds. When government agencies issue adjustable rate bonds, they are exposed to interest rate risk because the interest costs they must pay over the life of the bond vary with short-term interest rates. As interest rates rise, governments face increased expenses and pressure to raise taxes or service fees to pay for them.

Using MathWorks products, Intuitive Analytics has developed a set of quantitative tools that enables financial analysts to minimize the expected cost or risk a government incurs when managing a capital structure comprising debt and derivatives.

“Lacking more powerful analytical tools, analysts often assume and use a single short-term interest rate in a spreadsheet model with a 20-year analytic horizon. That’s like planning to wade across a river when all you know is that its depth is, on average, three feet,” says Peter Orr, CEO of Intuitive Analytics. “With MathWorks tools, we have developed interest rate models and cash flow analytics for the tax-exempt market that enable analysts to work within a spreadsheet to determine how to best decrease expected cost, expected volatility, or cash flow at risk.”



Using MATLAB development tools to provide visual representations of interest rate models.

marketer at JP Morgan Securities, Orr recognized a business opportunity in providing investment banks and financial advisors with tools for applying advanced methods and interest rate models and visualizing results to learn how rate model assumptions affect expected risk. To shorten time-to-market and accelerate adoption, Intuitive Analytics needed a development environment to build, test, and deploy sophisticated analytical tools that are accessible from Microsoft® Excel®.

THE SOLUTION

Orr and his team used MATLAB® and companion products to build quantitative analytical tools that incorporate Monte Carlo simulations, advanced interest rate models, and optimization methods. The tools provide financial analysts with quantitative answers to minimize cost and risk for bond issuers and their capital structures.

Using MATLAB, the group created a family of interest-rate models that simulate interest rates as well as the ratio between taxable and tax-exempt short-term rates. This ratio is important because municipalities often use

THE CHALLENGE

To build and market a quantitative tool for reducing expected cost and risk for municipal bond issuers

THE SOLUTION

Use MathWorks tools to develop algorithms, visualize results, and simplify deployment of an advanced analytical tool

THE RESULTS

- Development productivity increased by 90%
- Deployment simplified
- Visual environment created

THE CHALLENGE

Finance officers in municipal governments typically rely on investment banks and financial advisors to assess the risk and expected costs for bond issuers. However, these advisors often lack the background and tools to apply advanced techniques for interest rate modeling.

Based on his experience as an advisor, investment banker, and most recently a derivatives

derivative products or taxable interest rate swap products to hedge risk. In part, the models project cash flow by multiplying matrices of interest rates and outstanding bond amounts.

To make it easier for analysts to adopt, Orr used Excel as the primary link to MATLAB. Integration was simplified using MATLAB integration tools. Orr developed a template in Excel that analysts use to specify model inputs, including the bond portfolio, constraints, volatility parameters, and correlations between interest rate parameters. The group then used Spreadsheet Link™ EX to submit data entered in the Microsoft Excel spreadsheet to the MATLAB models and quickly return the MATLAB results to the spreadsheet.

Using Optimization Toolbox™, the team developed algorithms to structure new derivatives that minimize risk given a cost constraint or minimize cost given a risk constraint. To calculate the volatility factors in the model, they used Statistics Toolbox™.

Working with MathWorks Consulting, the group used Econometrics Toolbox™ to implement a method for calibrating the interest rate models using historical data.

After developing and testing the models, Orr used MATLAB Compiler™ and MATLAB Builder™ NE for Microsoft .NET framework to create a standalone version of the application, which will be deployed to hundreds of financial analysts' desktops. This application also includes a GUI, accessible via Excel, that enables the analysts to visualize results using error bar plots and three-dimensional surface plots.

Currently, the team is developing a Web services-based version of the analytical tools

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Because MATLAB enables us to build and distribute applications to analysts that are accessible from Excel, we are quickly bringing to market products that are adopted and deployed by investment banks.

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Peter Orr, Intuitive Analytics

using MATLAB Builder NE that will be centrally managed, further simplifying deployment, upgrades, and licensing. A major Wall Street bank is in the process of rolling out the tools.

THE RESULTS

▪ **Development productivity increased by 90%.** “As a start-up company, we compete effectively with much larger organizations because we can quickly build solutions with MathWorks tools,” says Orr. “I estimate that we can develop 90% faster with MathWorks tools than we could with C/C++ or Visual Basic.”

▪ **Deployment simplified.** “With MathWorks tools, analysts can still use Excel but leverage more efficient and powerful algorithms, models, and simulations that would be impossible to implement in spreadsheets alone,” explains Orr. “MATLAB Builder NE gives us a huge advantage in moving from prototyping, testing, to deploying our applications because we avoid the enormous cost of rewriting everything in C/C++.”

▪ **Visual environment created.** “With MATLAB visualization and interactive plots, we provide our users with a quantitative and intuitive understanding of what is going on, even though they may not fully understand the underlying mathematics,” says Orr.

To learn more about Intuitive Analytics, visit www.intuitive-analytics.com

APPLICATION AREAS

- Financial modeling and analysis
- Algorithm development
- Application development and deployment

PRODUCTS USED

- MATLAB®
- MATLAB Builder™ NE
- Optimization Toolbox™
- Statistics Toolbox™
- Econometrics Toolbox™
- Spreadsheet Link™ EX
- Microsoft® Excel®

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