Computational Finance with MATLAB

MathWorks Computational Finance Team
Challenges in Financial Analysis

- Volatile markets
  - Ever-changing needs

- Lack of computing power
  - Large data, large models

- Increased transparency
  - More auditing and regulation
  - More sharing with colleagues
Who uses MATLAB in Financial Services?

- The top 15 asset-management companies
- The top 10 U.S. commercial banks
- 11 of the top 15 hedge funds
- The reserve banks of all OECD member countries
- The top 3 credit rating agencies
MATLAB Application Areas in Finance

- Investment Management
- Risk Analysis
- Insurance
- Economics/Econometrics
- Trading
- Pricing & Valuation

More details & user stories at mathworks.com/financial-services
Credit Risk Analysis

- Assess the Credit Value-at-Risk of a bond portfolio
  - 1311 different obligors
  - 12 different industries
  - Maturities in 1 to 4 years

- Compute credit ratings
- Model credit transitions
- Simulate credit events & analyze portfolio losses
## Challenges Faced During Model Development

<table>
<thead>
<tr>
<th>Traditional Approach</th>
<th>Challenge</th>
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<td>Off-the-shelf software</td>
<td>Inability to customize</td>
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<td>In-house development with traditional languages</td>
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Computational Finance Workflow

Access
- Files
- Databases
- Datafeeds

Research and Quantify
- Data Analysis & Visualization
- Financial Modeling
- Application Development

Share
- Reporting
- Applications
- Production

Automate
- Files
- Databases
- Datafeeds
Connect to Data from Various Sources

- Excel spreadsheets and flat files
- ODBC or JDBC compliant databases
- Data feeds including Bloomberg, Reuters, Factset®, eSignal® and others
- Web services (SOAP)
Leverage Built-in Functions to Save Time

Mathematics
- Regression (Linear, Non-Linear)
- Curve Fitting
- Probability Distributions, RNG
- Clustering
- Multivariate & Factor Analysis
- Predictive Modeling, AI
- Optimization, Parameter Estimation

Financial Modeling
- Portfolio Optimization & Analysis
- Derivative Pricing & Hedging
- Yield Curve Modeling
- Monte Carlo Simulation
- Risk Quantification
- ARMA/GARCH Analysis
CalPERS Analyzes Currency Market Dynamics to Identify Intraday Trading Opportunities

Challenge
Develop an intraday trading model for currency markets

Solution
Use MATLAB and companion toolboxes to quantify market dynamics by analyzing millions of rows of historical market data

Results
- Development time reduced by months
- Profitable market dynamic identified
- Market insight gained

“My expertise is in finance, not programming. To perform sophisticated analysis on vast amounts of data, I needed software that was easy to use and included many of the functions I needed. With MATLAB I can do everything in one environment, and that is a real benefit.”

Omid Rezania
CalPERS

Link to user story
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# MATLAB Solutions

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<td>Inability to customize</td>
<td><strong>Flexible modeling</strong></td>
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<td>▪ Complete development environment</td>
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<td>Lack of transparency</td>
<td><strong>White-box modeling</strong></td>
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<td>▪ Viewable-source functions</td>
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<td>Subpar computational speeds</td>
<td><strong>Powerful computation engine</strong></td>
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<td>▪ Run fast Monte-Carlo simulations</td>
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<td>Long development time</td>
<td><strong>Quick prototyping</strong></td>
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<td>▪ Focus on modeling not programming</td>
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<td>Inefficiencies in Integration</td>
<td><strong>Easy to Integrate &amp; Deploy</strong></td>
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<td>▪ Point-and-click workflow</td>
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Finance Application Examples

- Economic Modeling & Forecasting
- Cash-flow Hedging & Scenario Analysis
- Credit Value-at-Risk

More focused webinars available at mathworks.com/recordedwebinars
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Share
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- Production

Spreadsheet Link EX
- Database
- Datafeed

Fixed Income
- Financial Derivatives
- Econometrics

Financial
- Statistics
- Optimization

MATLAB
- Parallel Computing
- MATLAB Distributed Computing Server

MATLAB Compiler
- Report Generator
- Builder EX
- Builder NE
- Builder JA
Support and Community
Training

- Three ways to get training
  - Public training
    - Offered throughout the world
    - Schedule and course information at www.mathworks.in/training
  - Onsite training
    - Bring training to your site, with course customization available
  - Web-based training
    - Instructor-led e-learning
    - Train at work or at home, with flexible dates and times

- Example course topics
  - Introductory and intermediate training on MATLAB, Simulink, Stateflow, and Real-Time Workshop
  - Specialized courses in control design, signal processing, parallel computing, code generation, communications, financial analysis, and other areas
Technical Support

Resources

- Over 100 support engineers
  - All with MS degrees (EE, ME, CS)
  - Local support in North America, Europe, and Asia
- Comprehensive, product-specific Web support resources

High customer satisfaction

- 95% of calls answered within three minutes
- 70% of issues resolved within 24 hours
- 80% of customers surveyed rate satisfaction at 80-100%

www.mathworks.in/support