



Oprogramowanie
Naukowo-Techniczne
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Dystrybutor oprogramowania MathWorks, Inc. w Polsce



MATLAB

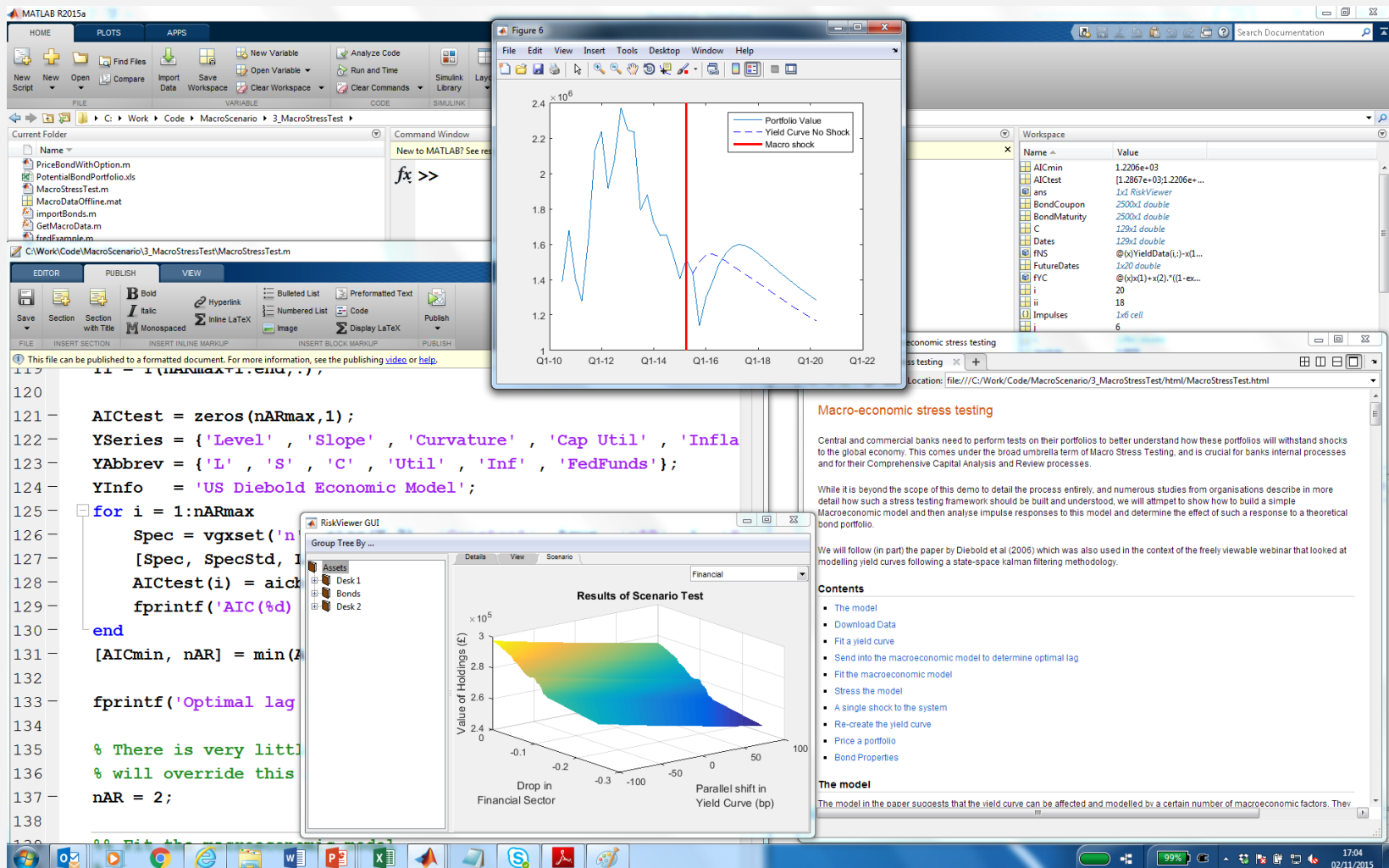
Accelerating Model Development in Finance

Remigiusz Lipiec

15.09.2017 ERFIN Workshop Warszawa



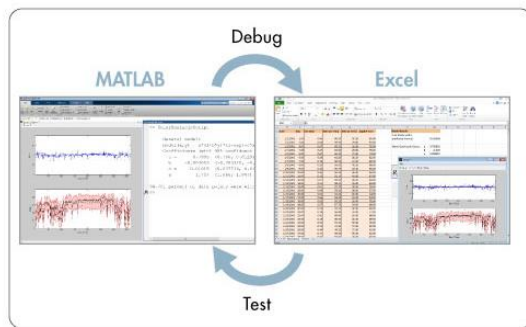
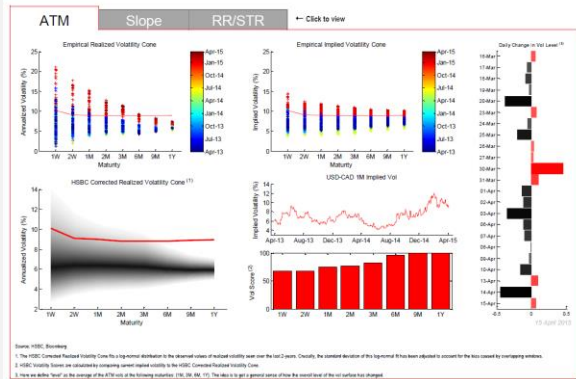
What is MATLAB?: Rapid, Assured Model Development





What is MATLAB?: Easy to Implement and Scale

USD-CAD



Portfolio Management Home Asset Allocation

Asset Allocation Parameters

Asset Classes
ASSET CLASSES AND LIMITS

Asset Class	Allowable Limits	Initial Allocation	Asset Class Statistics		
Include	Min	Max	Return	Std Dev	99% VaR
<input checked="" type="checkbox"/> US Large Cap	10	100	5.00	21.37	44.84
<input checked="" type="checkbox"/> US Small Cap	10	100	4.11	1.80	45.66
<input checked="" type="checkbox"/> US Corp. Bond	10	100	4.98	5.49	7.81
<input checked="" type="checkbox"/> US HY Bond		100	11.76	23.35	42.16
<input checked="" type="checkbox"/> EAFE Equity		100	7.80	24.82	50.00
<input checked="" type="checkbox"/> EM Equity		100	21.24	34.36	58.70
<input checked="" type="checkbox"/> US Treasury		100	8.11	11.49	18.60
<input checked="" type="checkbox"/> US REIT		100	14.99	35.17	67.15
<input checked="" type="checkbox"/> US Commodity		100	7.64	20.75	40.27

RISK-FREE ASSET

☐ Include risk-free (cash) asset

Annual risk-free cash rate: 2 %

Minimum allocation: %

Maximum allocation: %

RISK PROXY

☒ Standard Deviation

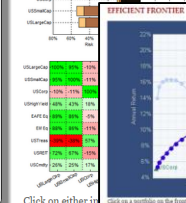
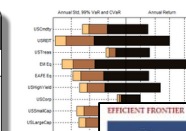
☐ CVaR at: 99 % confidence

TURN

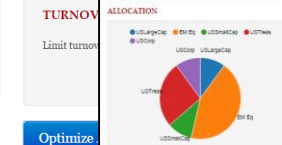
Limit turnover

Optimize

Asset Class Statistics STATISTIC VISUALS

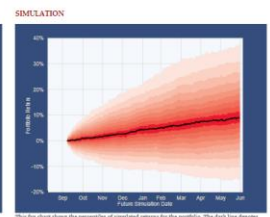


Portfolio Composition & Metrics



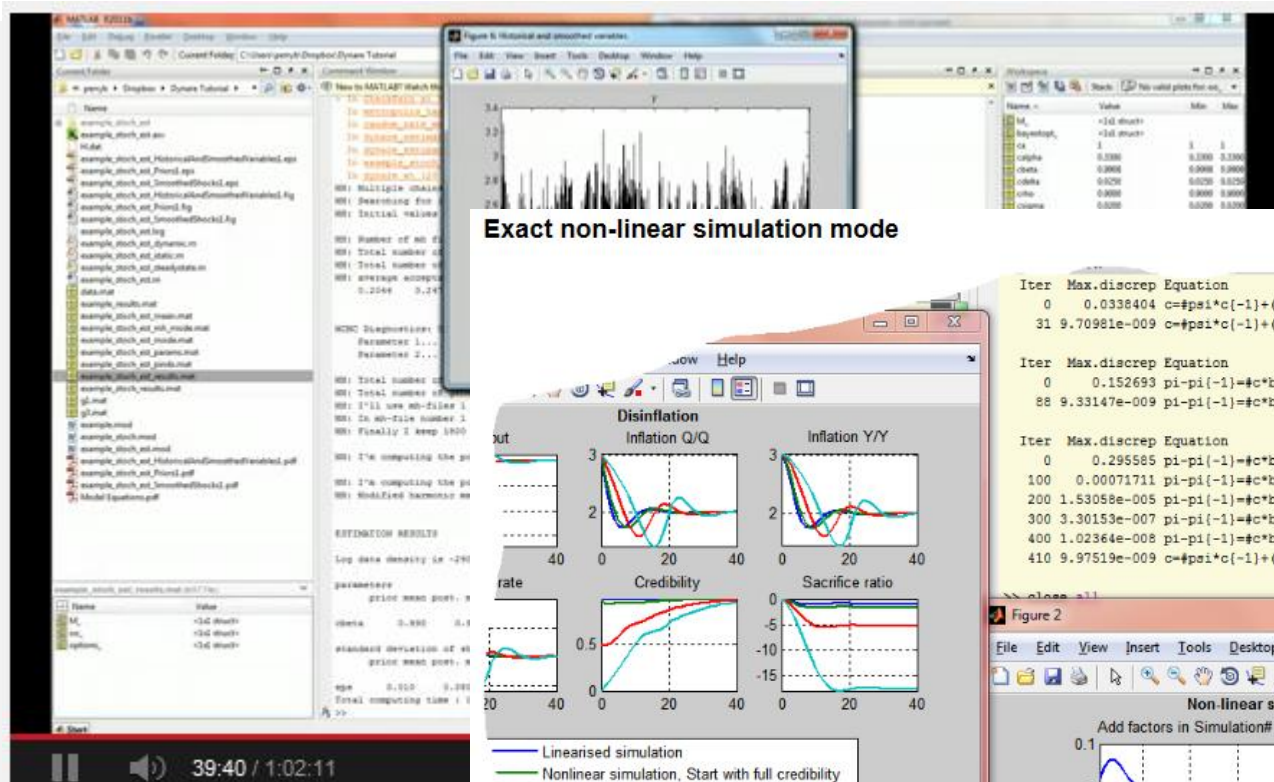
Metric	Value
Expected Return	62.34%
Expected Std. Deviation	27.85%
Expected Sharpe Ratio	0.70
Single period 99% VaR	2.25%
Single period 99% CVaR	4.25%
Minimum Asset Deviation	0.27%
Minimum Asset Deviation	4.54%

Portfolio Performance & Simulation





MATLAB Use Across Central Banks



Exact non-linear simulation mode

Dynare 3



Anders

Warne

YADA

YADA is program for conducting Bayesian estimation and evaluation of Dynamic Stochastic General Equilibrium (DSGE) and Vector Autoregressive (VAR) models. It is developed by the New Area-Wide Model (NAWM) team at the Monetary Policy Research Division (formerly the Econometric Modelling Division) within the Directorate General Research of the **European Central Bank** (ECB). Unlike other DSGE estimation applications, such as **Dynare**, YADA is a GUI-based program.

YADA is distributed with **six examples** that allow you to start playing with DSGE models directly. The examples are given by the models studied by:

1. An, S. and Schorfheide, F. (2007), "Bayesian Analysis of DSGE Models", *Econometric Reviews*, 26, 113-172.



MATLAB Use Across Central Banks

Forecasting GDP with a Dynamic Factor Model

Challenge

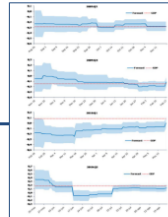
Estimate and forecast GDP in the very short term

Solution

Use MATLAB to build a dynamic factor model that estimates a common factor underlying 31 economic indicators

Results

- Virtually real-time forecasting enabled
- Updates and recalculations completed in minutes
- Business-cyclical turning points for a 20-year period accurately identified



MATLAB plot showing temporal aggregation of the common factor (red) and GDP (blue) from 1990 to 2010.

"MATLAB was a natural choice for this work because much of the processing requires matrix operations."

Enrique M. Quilis
Spanish Ministry of Economy and Finance

Macroeconomic Modeling and Inflation Rate Forecasting at the Reserve Bank of New Zealand

Challenge

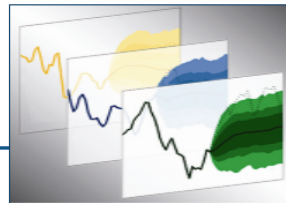
Support New Zealand monetary policy with a theoretically well-founded model

Solution

Use MATLAB to analyze and forecast macroeconomic variables, and communicate results to stakeholders

Results

- Entire workflow completed in a single environment
- Code shared with other central banks and financial institutions
- Technical rigor of macroeconomic forecasting increased



Sample fancharts produced by RBNZ's macroeconomic model.

"With all RBNZ models now implemented in MATLAB, the RBNZ has a common platform for evaluating the economy and making informed decisions."

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Monetary policy in Norway

Inflation

- Models for monetary policy analysis and forecasting

Models for monetary policy analysis (NEMO)

Models for short-term forecasting (SAM)

Interest rates

Monetary policy meetings

Exchange rates

Foreign exchange purchases for the GPF

Foreign exchange transactions

Foreign exchange reserves

Liquidity management

Government debt

Swap arrangement

Historical monetary statistics for Norway

Models for monetary policy analysis and forecasting

The forecasting and monetary policy analysis system
A number of analytical tools are used in forecasting and monetary policy analysis.

[The system in more detail](#)

Models for monetary policy analysis (NEMO)
NEMO ("Norwegian Economy Model") was developed by Norges Bank and is a macro model for forecasting and monetary policy analysis. The model is based on international research and model development over the past 20 years and has many features in common with similar models in other central banks.

[More about NEMO](#)

Models for short-term forecasting (SAM)
Norges Bank's short-term forecasts are based on a number of statistical and econometric models and judgment. A broad information set about the economic situation is part of the analysis. No single model can provide a complete description of reality. Different models have different properties. Theory and experience show that a weighted average of different model-based forecasts is often more accurate than forecasts provided by individual models. Norges Bank has therefore developed a system, SAM (System for Averaging Models), for averaging forecasts for inflation and mainland GDP provided by different models.

[More about SAM and updated figures](#)

Other models for forecasting and analysis
A number of smaller models are also used to a varying extent for forecasting and analysis. These models are partly used as cross-checks of forecasts provided by other models and partly for analysing specific conditions.

[More about other models](#)

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Parallel Sequential Monte Carlo for Efficient Density Combination: The DeCo Matlab toolbox

Roberto Casarin
University of Venice

Stefano Grassi
CREATES

Francesco Ravazzolo
Norges Bank and BI

Herman K. van Dijk
Erasmus University Rotterdam
VU University Amsterdam and TI

Esobe, Norges Bank, August 2013

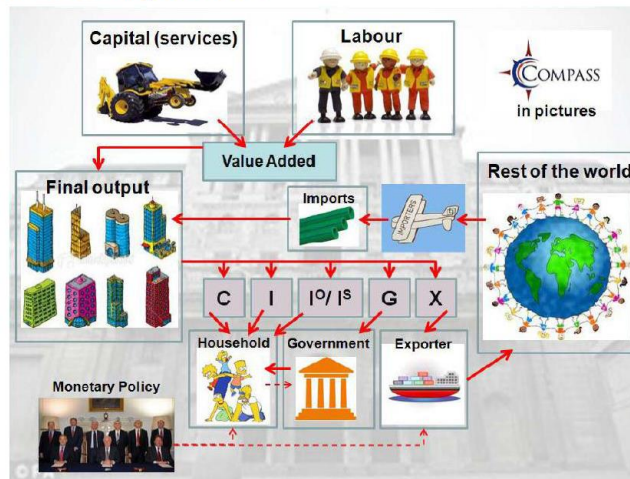


BANK OF ENGLAND

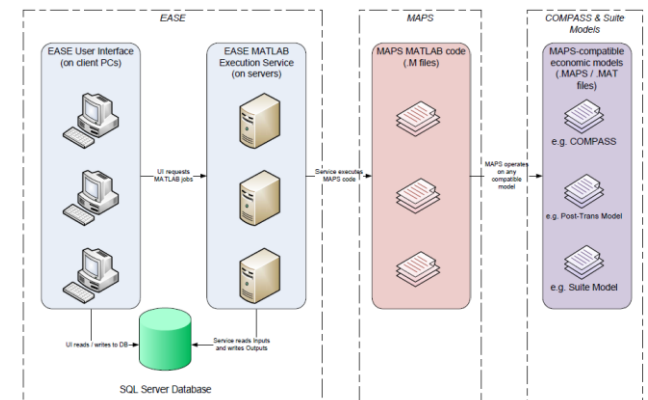
The Bank of England's forecasting platform

Macroeconomic forecasting at Bank of England

COMPASS in pictures



MAPS/EASE architecture



Matt Waldron

24 June 2014



BANK OF ENGLAND

Matt Waldron, Model Development Team

Why MATLAB?

- MATLAB is the leading software used by economists in universities
- Core level of MATLAB proficiency in the Bank
 - Lowers maintenance cost/risk
- A lot of the functionality is based around linear matrix algebra
- Developing new code is fast
 - Policymakers often want results very quickly
- Toolboxes are generally of a high quality
- Flexibility in mixing procedural and object-oriented design



The State Space Model in Matlab version 2

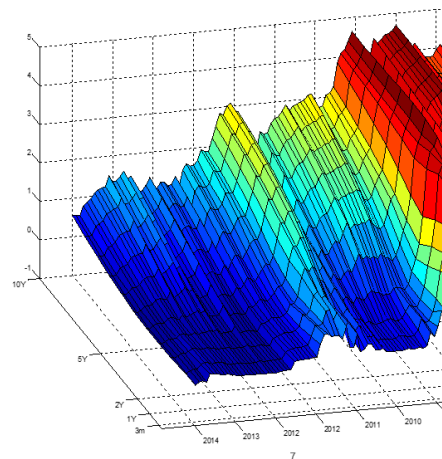
Estimating and Simulating yield curves using the Dynamic Nelson-Siegel framework

Outline

- 1 The State-Space Module in the Econometric Toolbox
- 2 Dynamic Nelson-Siegel characterisation of the yield curve
- 3 Including exogenous variables, constants and breaks in parameters
- 4 Estimation and Results
- 5 Generate simulated yield curve surfaces

Dynamic Nelson-Siegel characterisation of the yield curve

- The state space description of the Nelson-Siegel model include dynamics for the underlying factors and yield curves observed at time interval (t)
- Consequently, the model can describe the yield curve surface as shown below



Including exogenous variables, constants and breaks in parameters

- The `ssm` module requires four matrices to be specified (A,B,C,D)
- So,
 - How do we integrate exogenous variables in the dynamic evolution of the yield curve?
 - What about a constant in the evolution of the yield curve factors?
 - What if we want VARMA dynamics for the factors?

Observation equation: $y_t = C_t \cdot x_t + D_t \cdot e_t$ $y_t(\tau) = H \cdot \beta_t + e_t$

State equation: $x_t = A_t \cdot x_{t-1} + B_t \cdot u_t$ $\beta_t = m + F \cdot \gamma_{t-1} + Q \cdot M_t + W \cdot z_{t-1} + z_t$



ECB



Stephane DEES
Output and Demand Division
Directorate Economic Developments
with input from L.V. Smith (University of York)

What is a GVAR model?

- The GVAR approach developed in Pesaran et al. (2003) has been extended to study the international linkages of the euro area in Dees et al. (2007).
- A GVAR model combines country level models into a global system, where all variables are all endogenous and directly linked to one another
- The individual blocks can be any type of units, such as regional housing markets.
- The GVAR is a suitable tool for policy analysis, as it provides a framework for the quantitative analysis of the relative importance of different shocks and channels of transmission mechanisms.

The GVAR Toolbox

MATLABDAY@ECB2014
29 October 2014

- Recent presentation at MathWorks [New York Conference](#)

Modeling Macroeconomics in MATLAB

Jaromír Beneš
International
MATLAB Conference
May 2015

Macroeconomic Modeling

- Narrow view
- Broad policy
 - Minimize
 - Limit distribution
- Key elements
 - Tail-risk
 - Feedback
 - Possibilities
- Models to

Macroeconomic Modeling

Design macro

- Slow-burn
- Unlikely year

Communication

- Consider policy

Macroeconomic Modeling

Real

- Relative (DSGE)
- Monetary
- Optimal finite (horizon)
- Mixed

IRIS Toolbox

60+ classes, 30+ packages, 2,300+ functions
www.iris-toolbox.com

Structural modeling (DSGE)

MV time series analysis

Time series and database management

Reporting Documentation



Thank You

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