

Software support for economic research at CNB

Modern tools for financial analysis and modeling

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Outline

- 1 Supporting prediction process
- 2 Solving, simulating and estimation of DSGE models
- 3 Examples from prediction process

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Introduction

- Monetary policy of CNB:
 - Inflation targeting regime
 - Delay in policy transmission
 - Prediction of economic development
- Prediction:
 - Model
 - Expert judgement

Prediction process I

Data + Model + Expert judgment = Prediction

- Data:
 - Various sources
 - Database creation: loading from external databases, merging databases
 - Time series operations: seasonal adjustment, transformations
- Model:
 - Define a rational expectation model
 - Solve and estimate model
 - Simulate

Prediction process II

- Expert judgement:
 - Include expected shocks: impact of news, legislative changes
 - Compare scenarios

Software requirements I

- Users:
 - Developers
 - Model operators
 - Decision makers
- Requirements:
 - User friendly interface
 - Availability of special functions
 - Implementation of changes in models
 - Sensitivity tests
 - Automation of repetitive tasks

Software requirements II

- Output:
 - Tables: Call \LaTeX to create tables
 - Databases: Final output is MS Excel
 - Inflation report: MS Word document

Software options I

- Ready to use programs:
 - Specific data structures
 - Black box computation
 - Impossibility of customization or implementing changes in algorithms
- Programming languages:
 - Lack of specialized libraries
 - Requirement of skilled users
 - Time consuming development process

Software options II

- Matlab:
 - High-level language
 - Numerical computation algorithms
 - Easy to implement new algorithms: Toolboxes
 - Data visualization and analysis

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DSGE toolboxes

Toolboxes for DSGE models simulation:

- IRIS
 - Developed by CNB staff
 - Designed specially for CNB's prediction process
- Dynare
 - Developed by O. Kamenik and M. Juillard
 - Designed to solve and estimate theoretical models

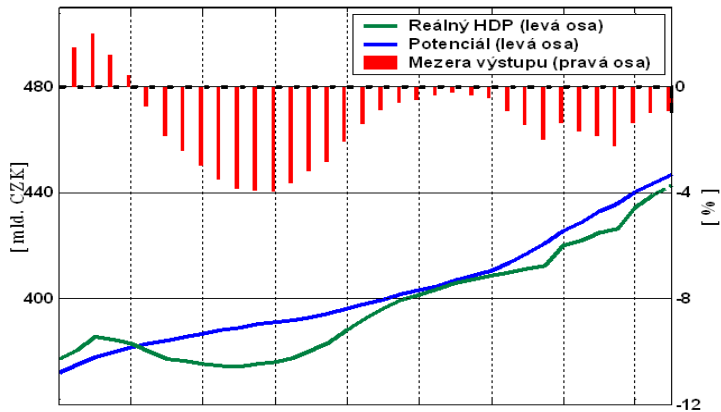
IRIS I

IRIS toolbox:

- CNB's toolbox
- Database functions: underlying format CSV
- Time series function: plotting and transformations
- Solution of linear DSGE models
- Inclusion of expert information in form of shocks
- Simulation: constrained vs. unconstrained

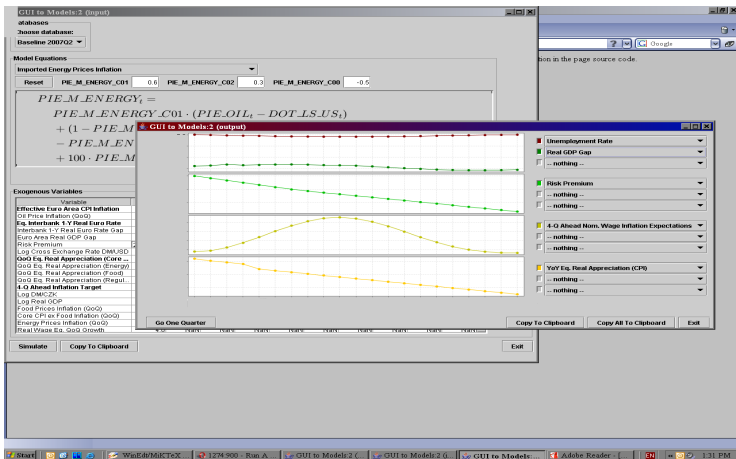
IRIS II

- Special types of figures:



IRIS III

- GUI interface: Java



Dynare

Dynare:

- Free alternative to internal/commercial toolboxes
- Up to second order approximation
- Bayesian and Maximum-Likelihood estimation
- No database functions
- Dynare++: cubic and higher order of approximation

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Examples I

- L^AT_EX:
 - Creating reports

April 2007 Forecast Round
Baseline - ER included taxes

		2005:1	2005:2	2005:3	2005:4	2006:1	2006:2	2006:3	2006:4	2007:1	2007:2	2007:3	2007:4	2008:1	2008:2
CPI Inflation															
CPI	level	98.4	98.9	99.6	100.5	101.2	101.9	102.6	102.0	102.5	103.1	103.9	104.5	105.7	106.1
	% pa q-o-q	1.0	2.0	2.6	3.3	3.0	2.6	2.7	-2.4	3.8	2.4	3.1	2.2	4.5	4.5
	% pa y-o-y	1.6	1.5	1.8	2.3	2.8	2.9	2.9	1.5	1.5	1.5	1.9	2.9	3.1	3.1
Wage Inflation															
Nominal Wage	level	56.0	56.8	57.6	58.5	59.5	60.5	61.6	62.6	63.7	64.8	65.9	66.9	68.0	68.6
	% pa q-o-q	5.3	5.7	5.6	6.3	6.4	6.8	6.9	6.9	6.9	6.5	6.3	6.2	6.5	6.5
	% pa y-o-y	5.6	5.7	5.5	5.7	6.0	6.3	6.6	6.8	6.9	6.8	6.6	6.5	6.4	6.4
Nominal Interest Rates															
3-Month Interbank Rate	% pa	2.3	1.8	1.8	2.1	2.1	2.1	2.4	2.6	2.6	2.6	2.7	2.9	2.9	2.9
Policy Neutral Rate	% pa	3.5	3.4	3.5	2.1	2.1	1.9	1.8	2.6	3.0	3.2	3.4	3.5	3.2	3.2
Policy Misalignment	pp	-0.2	-0.5	-0.3	0.8	0.4	0.6	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0
1-Year Interbank Rate	% pa	2.4	1.9	1.9	2.4	2.3	2.5	2.8	3.0	2.8	2.7	2.9	3.0	3.1	3.1
Newly-Issued Bank Loans	% pa	5.9	5.6	5.2	5.4	5.5	5.6	5.8	6.0	6.1	5.8	6.0	6.2	6.3	6.3
Euro 1-Year Interbank Rate	% pa	2.3	2.2	2.2	2.6	3.0	3.3	3.6	3.9	4.1	4.1	4.1	4.0	4.0	4.0
Nominal Exchange Rates															
CZK/EUR	level	30.0	30.1	29.7	29.3	28.6	28.4	28.3	28.0	28.0	28.0	28.0	28.1	28.1	28.1
	% pa q-o-q	-14.3	1.5	-6.0	-5.1	-9.5	-3.0	-0.8	-4.0	-0.1	-0.5	0.6	0.3	-0.0	-
	% pa y-o-y	-8.7	-5.9	-6.0	-5.9	-4.7	-5.8	-4.5	-4.3	-2.0	-1.4	-1.0	0.1	0.1	-
CZK/EUR Risk Premium	% of Exchng Rate	3.9	3.8	3.7	3.5	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.6
CZK/USD	level	22.9	23.9	24.3	24.7	23.8	22.6	22.2	21.8	21.4	21.2	21.3	21.3	21.4	21.4
	% pa q-o-q	-18.8	18.2	6.2	5.7	-14.1	-20.2	-6.3	-8.3	-6.9	-3.2	1.0	1.1	1.2	-
	% pa y-o-y	-12.9	-10.0	-6.0	2.6	3.9	-5.6	-8.5	-11.7	-10.1	-6.0	-4.3	-2.0	0.0	-
USD/EUR	%	131.1	125.8	122.1	118.8	120.2	125.7	127.4	128.8	131.0	131.9	131.8	131.5	131.1	131.1

- ActiveX:
 - To ease repetitive tasks

Examples III

- Exporting figures to MS Powerpoint

The screenshot shows a MATLAB Editor window with the following code:

```

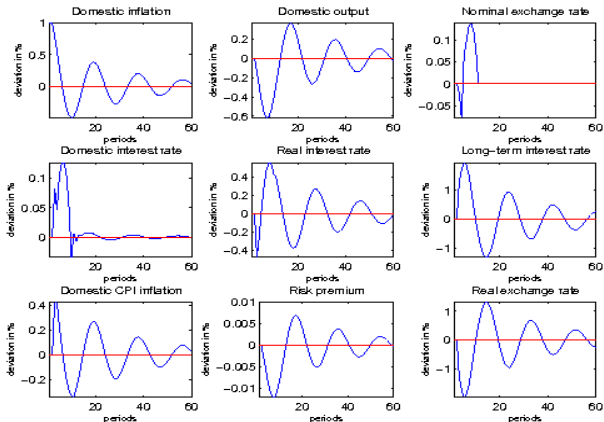
280 error(' ');
281 end
282 end
283 osa = [osa(1) osa(2)];
284 switch osa
285     case '1'
286         g(1) = graph;
287         graph_style;
288     case {'2','3'}
289         disp('Zadav');
290         g(1) = graph;
291         graph_style;
292     end
293 end
294 % ylim([1 5]);
295 saveppt('test.ppt');
296 end
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The PowerPoint slide titled "Struktura inflace" displays a line graph showing inflation rates for four categories: Obchodovatelné - potravin, nápoje, tabák (red line); Obchodovatelné - ostatní bez PH (blue line); Neobchodovatelné - regulované (black line); and Neobchodovatelné - ostatní (orange line). The graph shows significant fluctuations, with a notable peak in the regulated non-tradable category around 2008. To the right of the graph, a bulleted list explains that the structure of inflation is influenced by changes in prices of goods and services, and that in recent times, food prices have risen and then fallen, and that the CPI is being revised.

Examples IV

- Exporting graphics: Impulse responses



Use of Matlab in CNB:

- Forecasting
- Research
- Econometrics
- Testing of risk evaluation models