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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3 Examples from prediction process

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
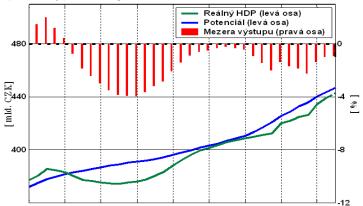 - Designed to solve and estimate theoretical models

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
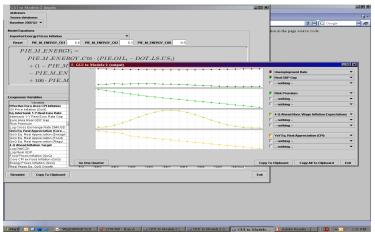- Simulation: constrained vs. unconstrained

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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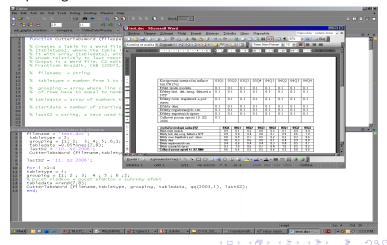
Examples I

- LaTeX:
  - Creating reports

April 2007 Forecast Round
Baseline - ER included taxes

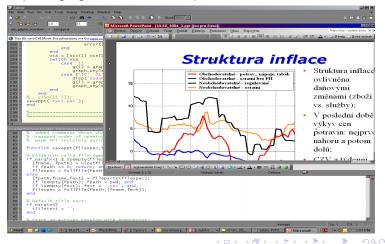|		2005:1	2005:2	2005:3	2005:4	2006:1	2006:2	2006:3	2006:4	2007:1	2007:2	2007:3	2007:4	2008:1	200
CPI Inflation															
CPI	level	98.4	98.9	99.6	100.5	101.2	101.9	102.6	102.0	102.5	103.1	103.9	104.5	105.7	10
	% pa q-o-q	1.0	2.0	2.6	3.3	3.0	2.6	2.7	-2.4	3.8	2.4	3.1	2.2	4.5	
	% pa y-o-y	1.6	1.5	1.8	2.3	2.8	2.9	2.9	1.5	1.5	1.5	1.9	2.9	3.1	
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	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	
	% 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	
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	
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	
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	
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	
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	
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	
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	2
	% 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	
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	2
	% 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	13

- ActiveX:
  - To ease repetitive tasks

Examples II

- Exporting tables to MS Word

Examples III

- Exporting figures to MS Powerpoint

Examples IV

- Exporting graphics: Impulse responses

Use of Matlab in CNB:

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