Use of Dynare Software for DSGE modelling

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Outline

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Model

- Extended version of Aliyev & Bobkova (2014)
- Characteristics of both models:
  - External habit formation in the utility function
  - Wage and price rigidity
  - Capital adjustment costs
- Main differences
  - More detail household heterogeneity
    - Three HHs groups
  - Income effect in the consumption equation
    - Without non-ricardian HHs specification
    - Important for government shock or foreign demand shock
  - Intermediate-inputs
    - Introduced into PF, import and export
    - Intermediate-inputs complement other inputs

Data transformation

- Data on model-entry side:
  - To define parameters for calibrated model
  - To define priors for estimated model
  - To define size of shocks or their prior value for conditional forecasts or as input for shock decomposition.
- Output values from model:
  - For model evaluation, compared to data
  - Sometimes subject to transformation to obtain absolute or relative values
  - Forecast
- The link between data and model might be weaker for calibrated rather than estimated models as no observation equations are necessary for model simulations.

Data transformation

- Seasonally adjusted data with X-13 ARIMA are subject to transformation into growth rates and then demeaned to obtain data compatible with observed variables. The final values are multiplied by 100 for easier interpretation in percentages. (See Pfeifer, 2017)
- The transformation of data appears as

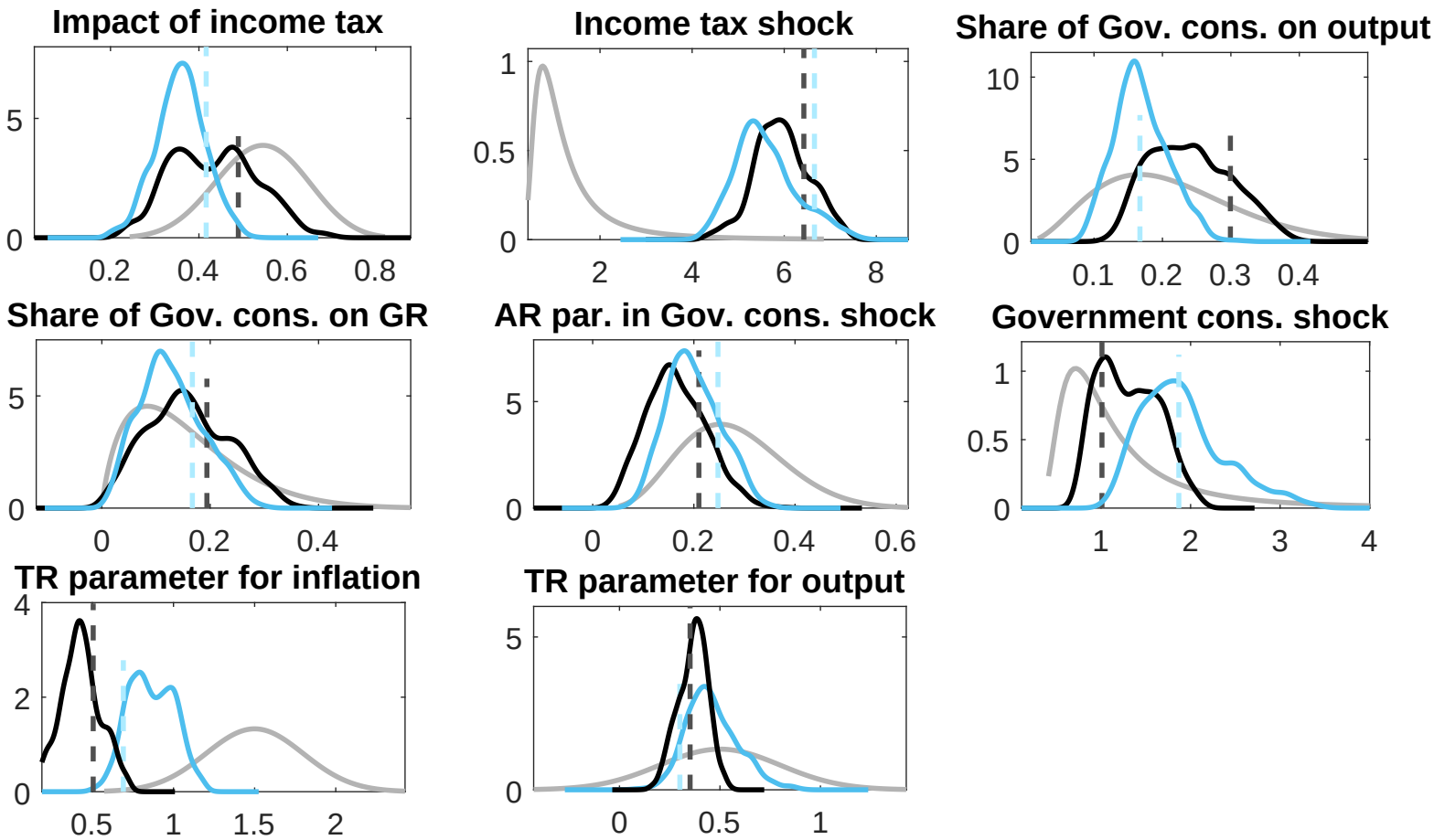
$$X_t^{mobs} = \left(log \frac{X_t}{X_{t-1}} - \bar{X}_t^{obs} \right) * 100$$

Bayesian estimation

- Bayesian estimation combines prior information about a parameter value with the evolution of data.
- Mostly used algorithm is the MH-MCMC, this algorithm decides if a new parameter value given the likelihood defined by Kalman filter should be accepted.
- For our model we use two MCMC sequences with 100 000 draws. The acceptance ratio is below 0.24.

$$p(\Omega/y_t) = \frac{p(y_T/\Omega)p(\Omega)}{p(y_T)}$$

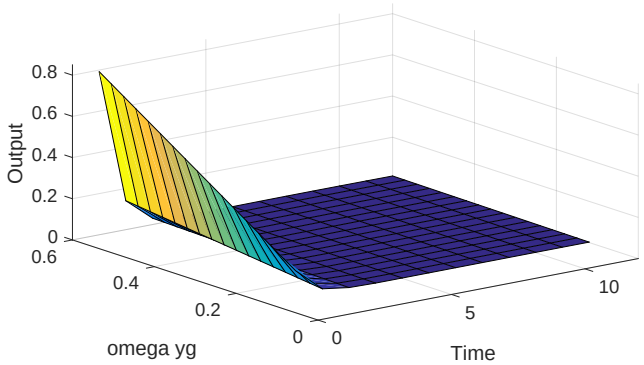
Prior & Posterior probability



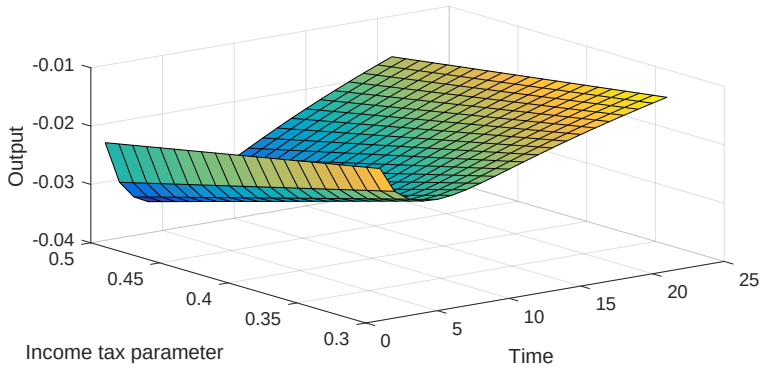
Sensitivity analysis

Parameters - posterior mean			
	Period including crisis	Period without crisis	Diff. in %
Government consumption shock	1.31	1.90	-31.29
Impact of gov. con. on output	0.24	0.17	42.70
Impact of gov. con. on government revenue	0.16	0.13	24.02
Income tax shock	5.95	5.59	6.32
impact of income tax on economy	0.43	0.36	21.14
TR parameter for inflation	0.43	0.86	-50.58
TR parameter for output	0.37	0.46	-20.33
Interest rate shock	0.24	0.26	-7.36

Output variation with Gov. cons. parameter

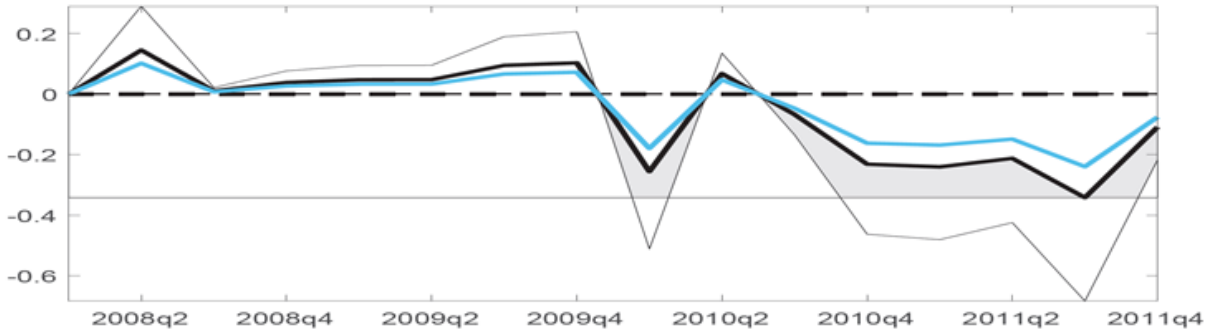


Output variation with income tax parameter



Conditional forecast

Impact of government consumption shock on output

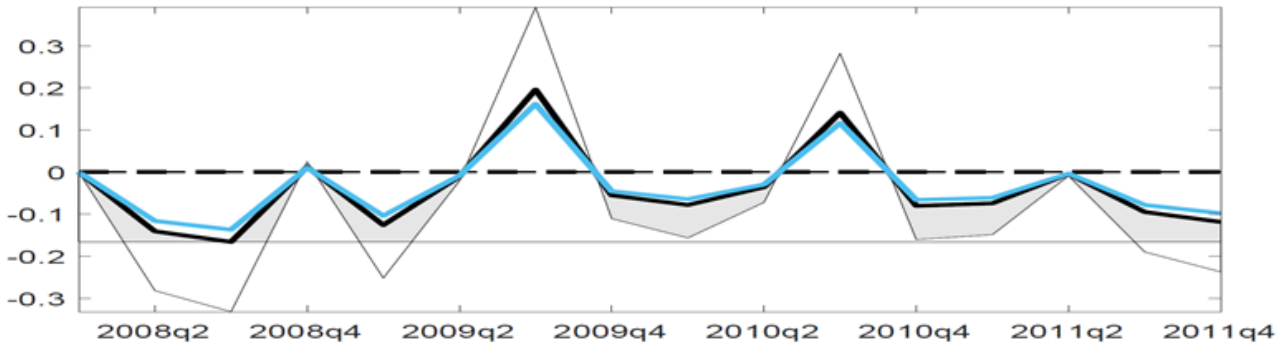


Output vs government consumption variable in data

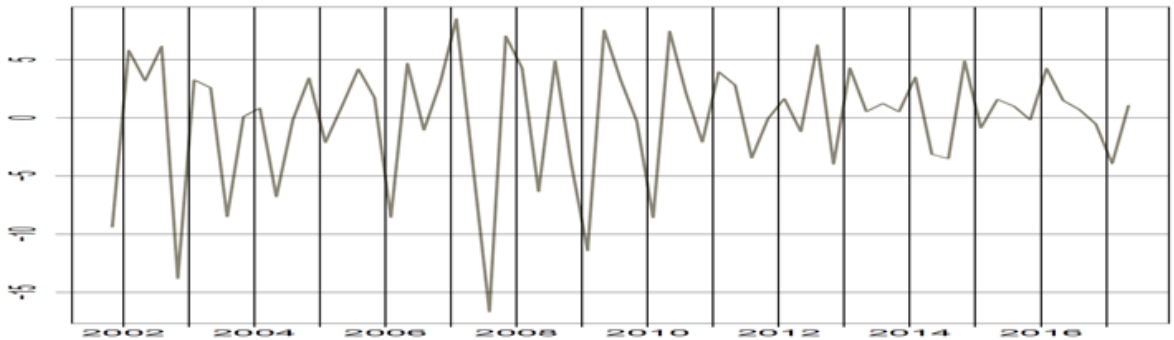
Source: Authors' creation, data from the Ministry of Finance.

Conditional forecast

Impact of income tax shock

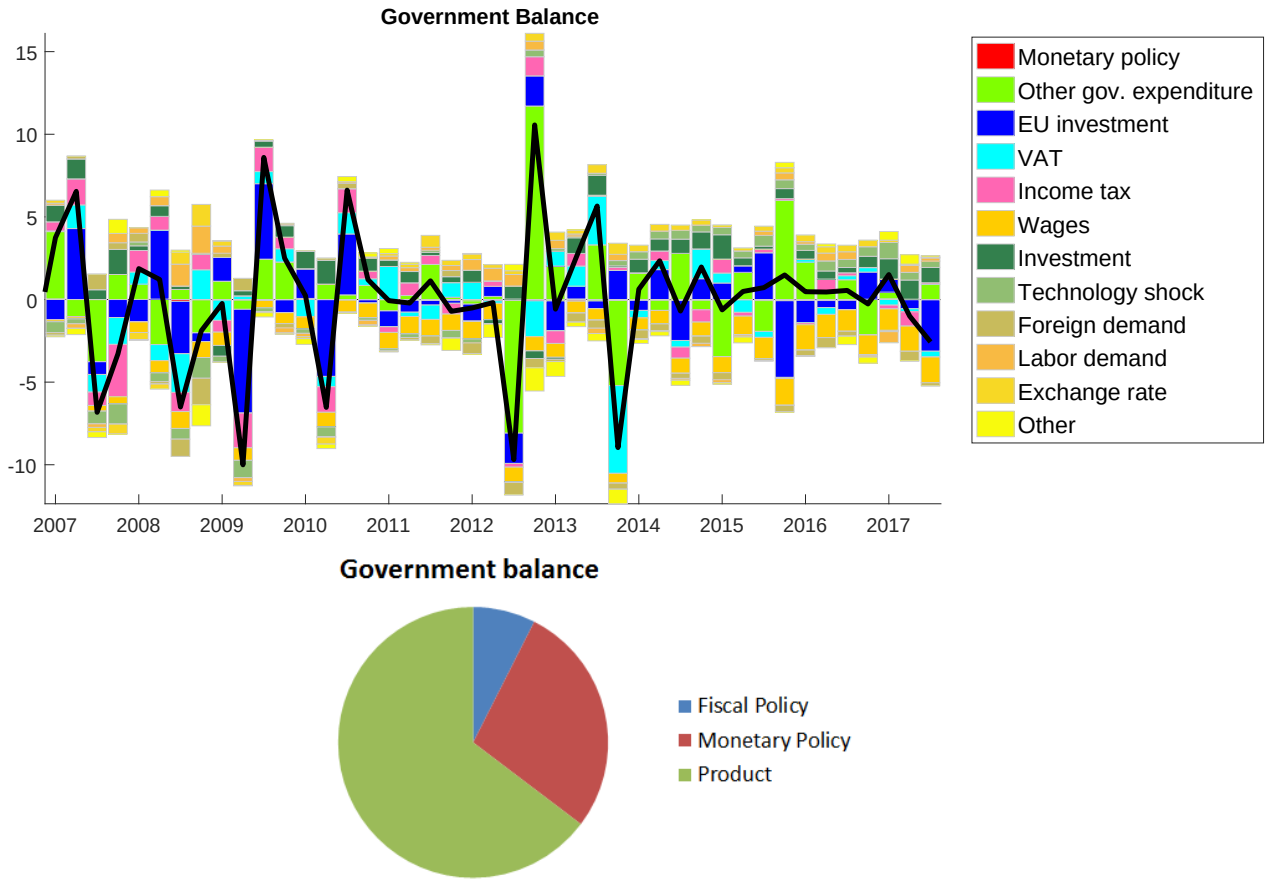


Dynamic of income tax in data



Source: Authors' creation, data from the Ministry of Finance.

Shock decomposition



Source: Authors' creation, data from the Ministry of Finance.

Dynare - shortcomings

- Difficulty to write a Matlab code into a Dynare script
  - Possible to write it at the bottom of the script to create a plot
  - Or to write it in the beginning of the script to call on steady-state values or parameters
- Entering exogenous values for a variable
- Combining deterministic and stochastic shocks
- Identification of shock contributions to variables from a shock-decomposition output and subsequent transformation of quarterly data to annual
- Black-box search for the steady-state of non-linear models as well as their subsequent estimation and interpretation
- gEcon package as an alternative?

Thank you for your attention...

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