

Macroeconomic modeling in the NBU

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Contents

1. General overview
2. The QPM
 - main equations
 - parameters
3. Forecasting with the QPM
 - filtration
 - regular exercise
 - pseudo-real-time
4. Conclusions and perspective developments
5. Additional slides
 - impulse response functions
 - shock decompositions



General Overview

Changing environment for our modeling and forecasting team

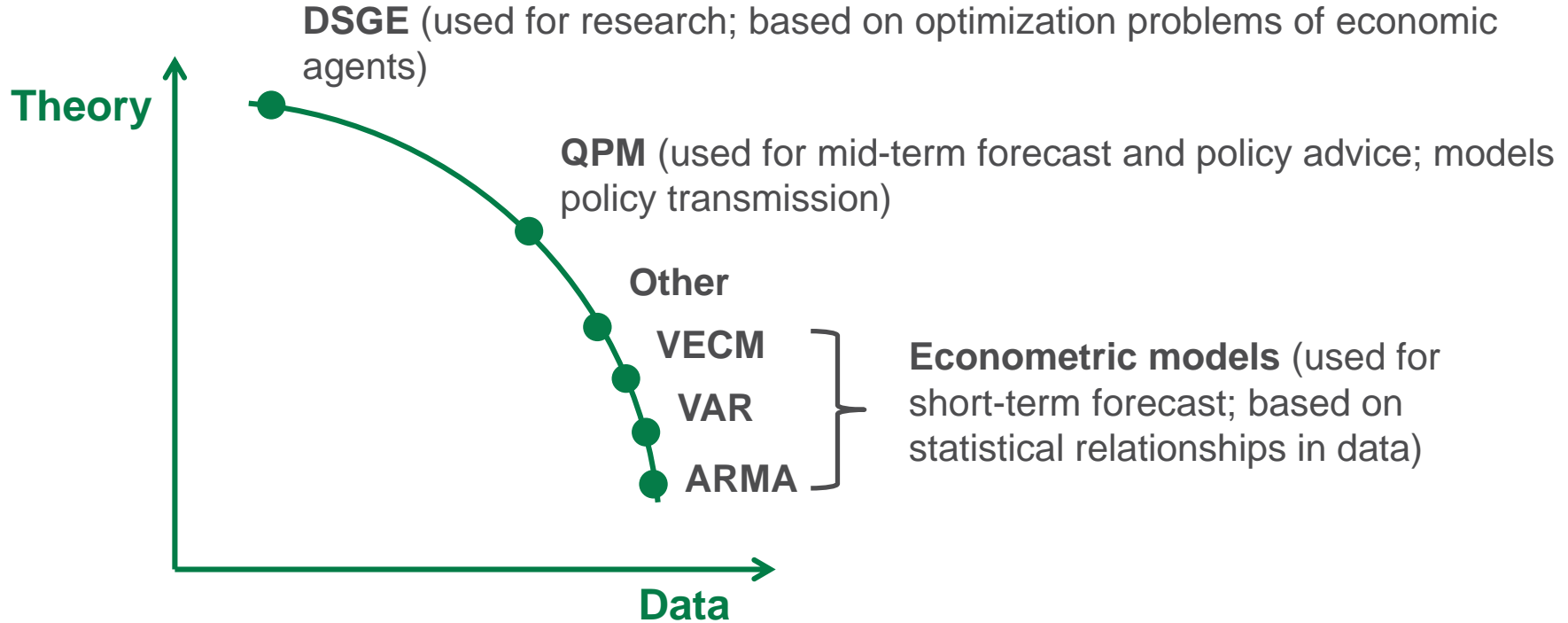
❑ 2001-2013 **Silent mode**

- Lack of interest in forecasts
- No involvement into forecasting process by the Board
- Requests for some analysis of individual events effects

❑ 2014-Today **Active mode**

- Major interest in forecasts and policy simulations
- Focus on achieving targets
- The Board is involved into forecasting; interest in details
- Regular public communications of forecasts and policy decisions

Models in Forecasting and Policy Analysis System: Examples



Models for forecasting

- **Nowcast and Near-term forecast models**
 - A suite of models for GDP nowcasting (current quarter)
 - A suite of models for short-term inflation components forecasting (1-7 months)
 - Web-scraping for inflation nowcasting
 - Unemployment and wages nowcasting

- **Economy stance models**
 - Equilibrium (trend) REER

- **Core model**
 - Quarterly Projection Model (QPM)

- **Satellite models**
 - Small scale QPM to assess the role of FX interventions

Why we need QPM

- ❑ Medium-term forecasting
 - monetary transmission mechanism
 - alternative simulations

- ❑ Part of the Forecasting and Policy Analysis System (FPAS)
 - allows inputs from satellite models and expert judgments
 - organizational framework

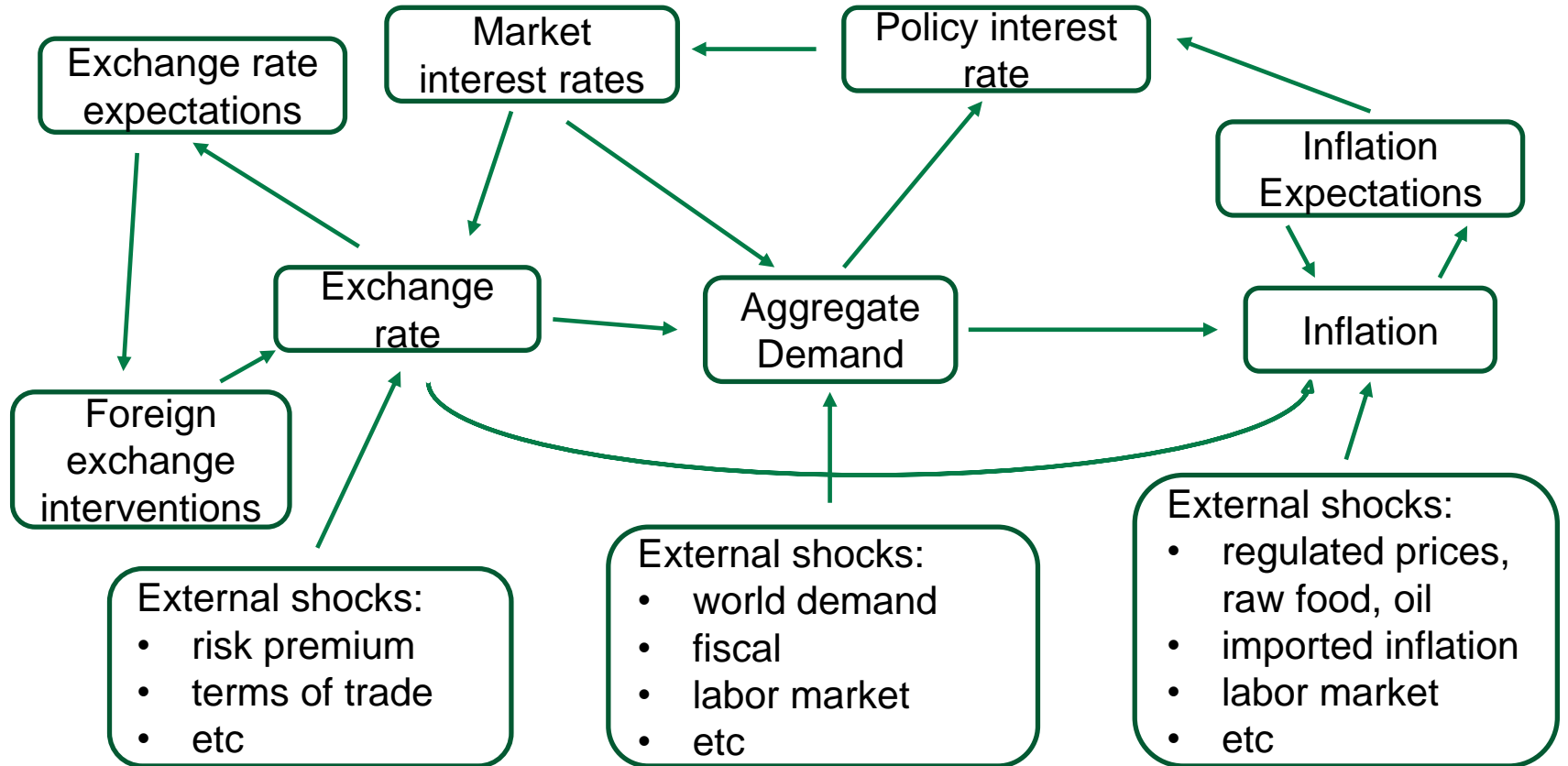


The QPM

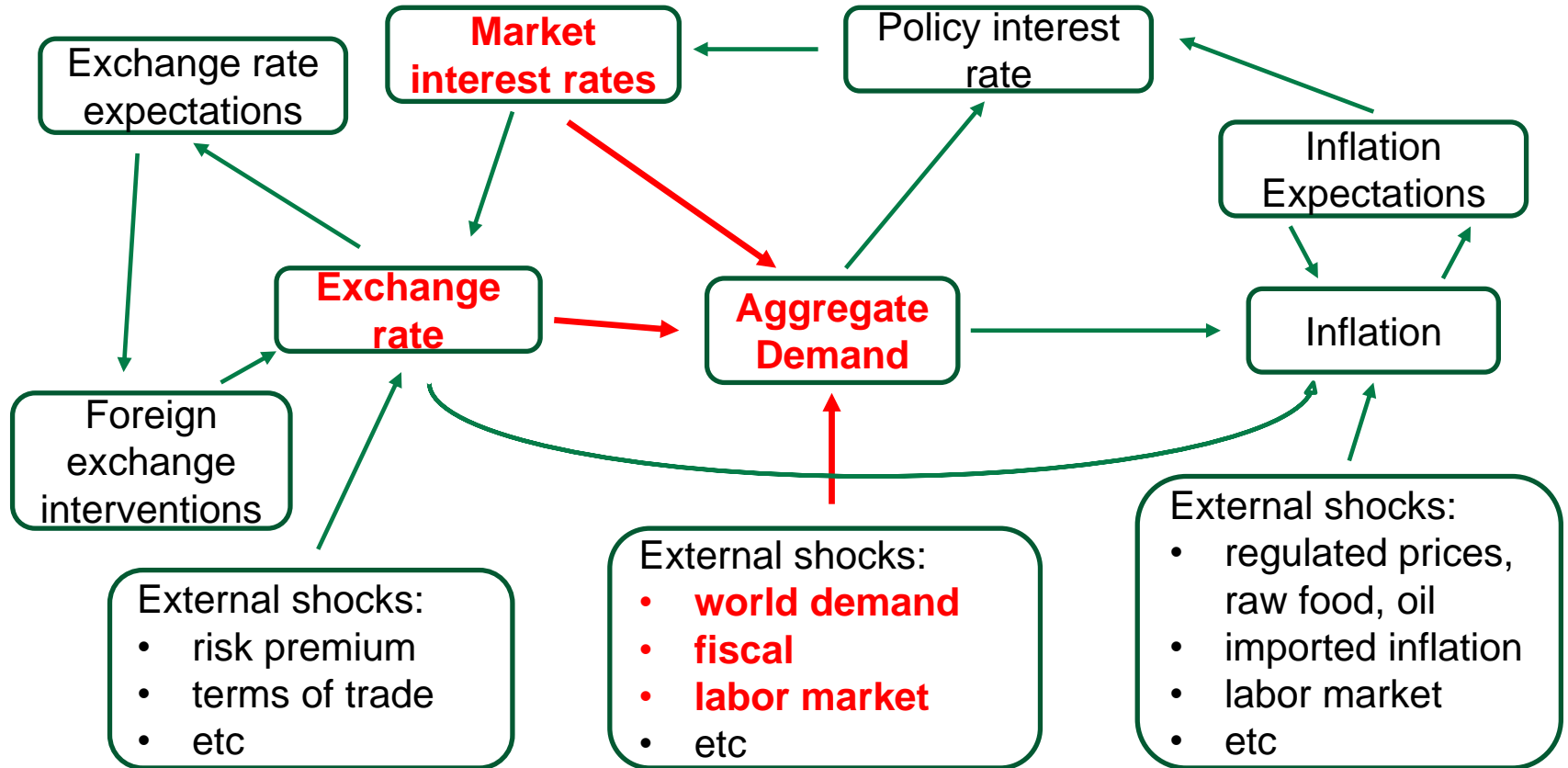
NBU's Quarterly Projection Model (QPM)

- ❑ Small open-economy New-Keynesian with specific extensions
- ❑ Model in “gaps”
 - measures trend variables and explains deviations
- ❑ Similar models are used by many other central banks
 - Amarasekara et al. (2018), Beneš et al. (2017)
- ❑ Describes monetary policy transmission mechanism
 - variables actively respond to shocks in the short run
 - shocks dissipate in the long run

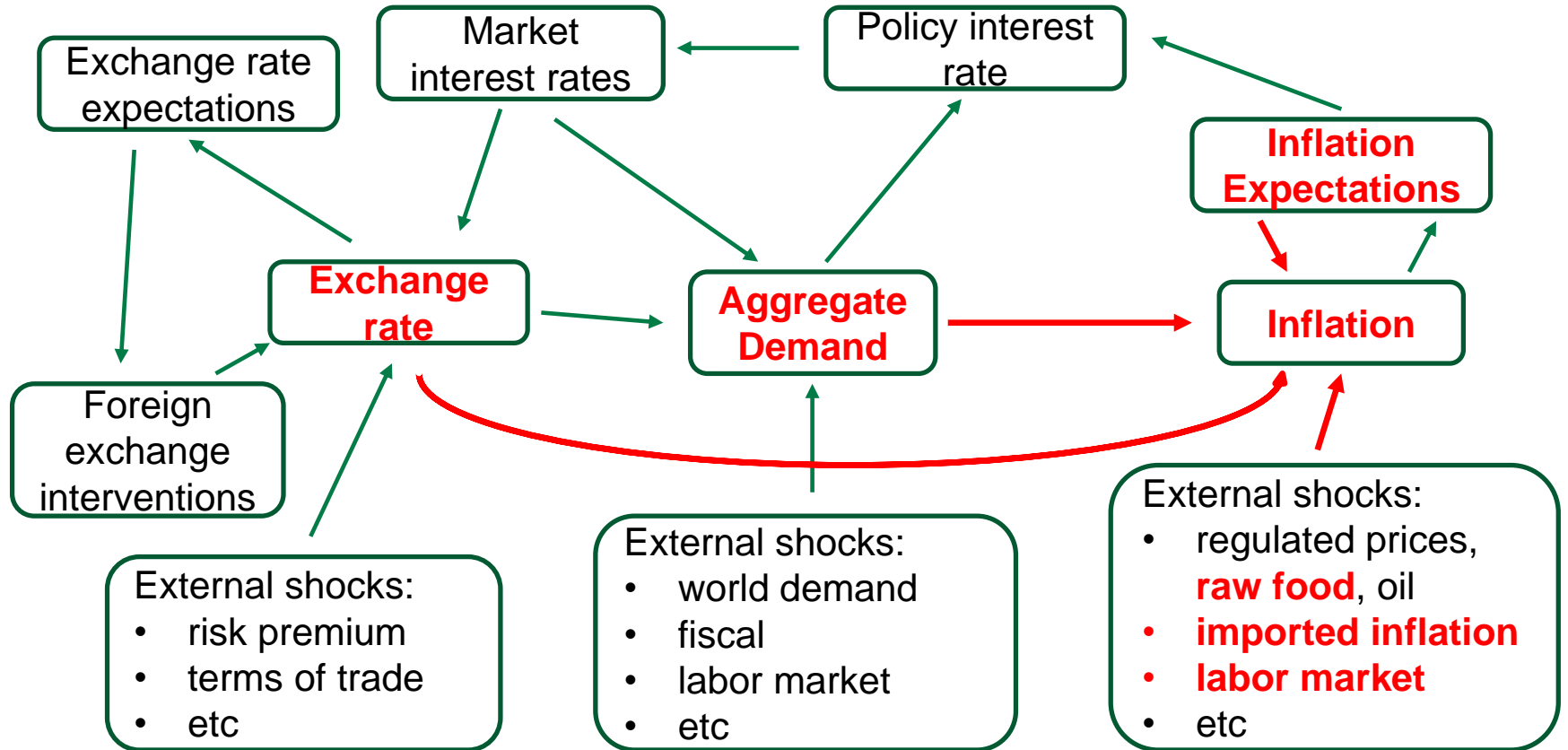
Transmission mechanism



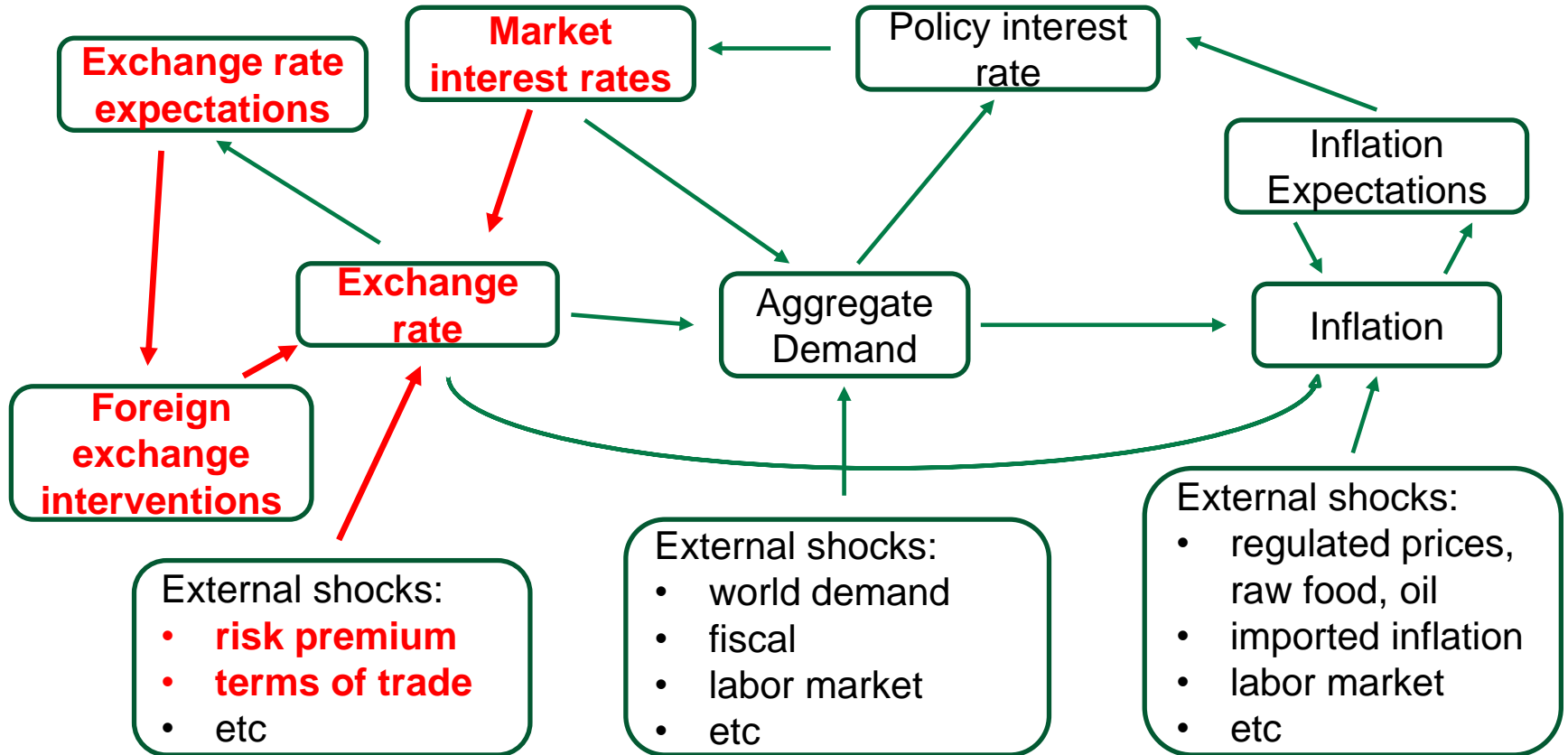
Main Channels: Aggregate demand



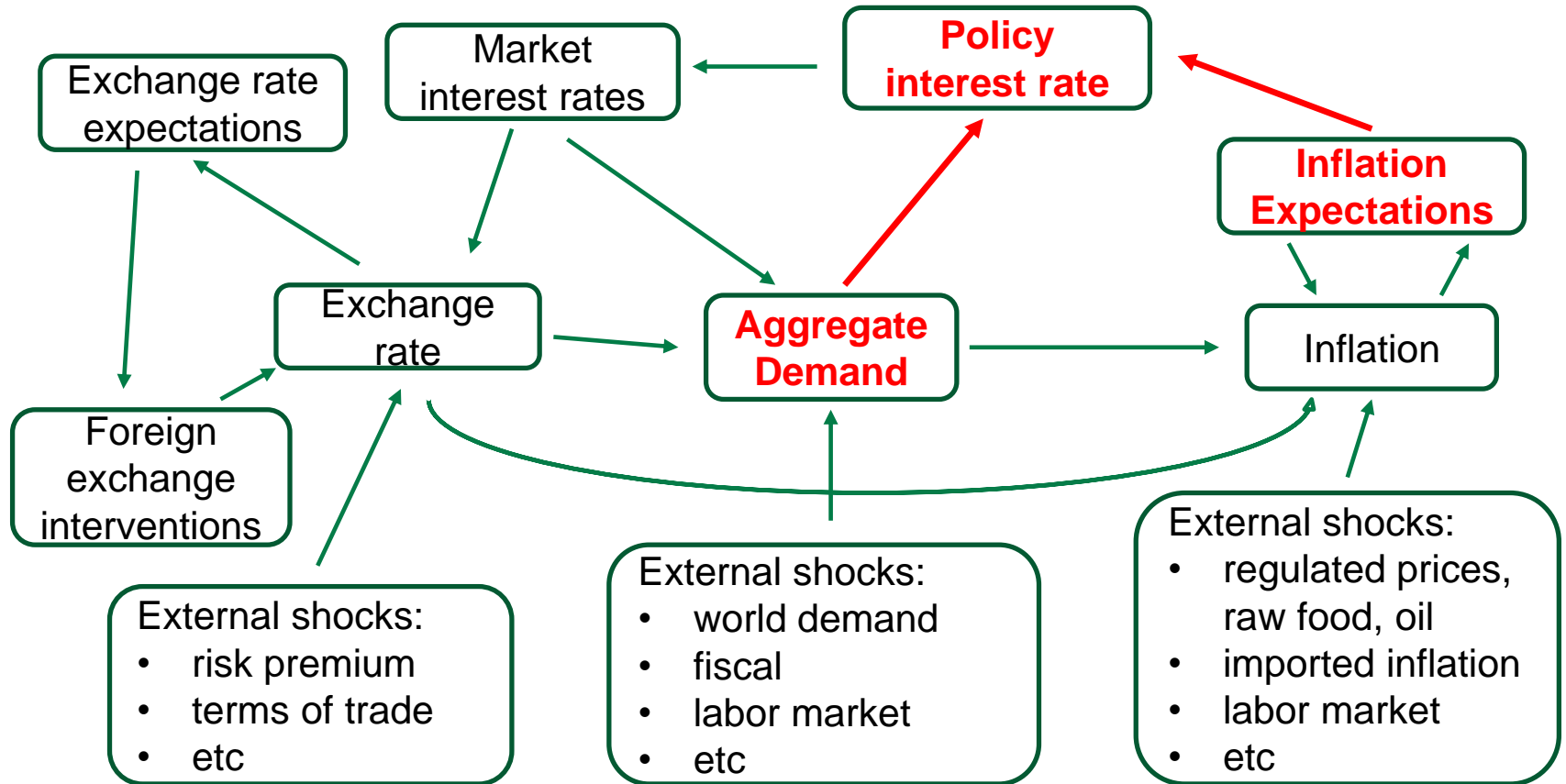
Main Channels: Inflation



Main Channels: Exchange rate



Main Channels: Policy interest rate



QPM's external sector

- Foreign sector (autoregressive, white noise, random walk)
 - trade partners' output, inflation and bilateral exchange rates
 - foreign nominal short-term and real neutral interest rates
 - commodity terms of trade, food price index
 - sovereign risk premium
 - fiscal impulse
 - domestic harvest

Parameters

“It is better to be roughly right than precisely wrong.”

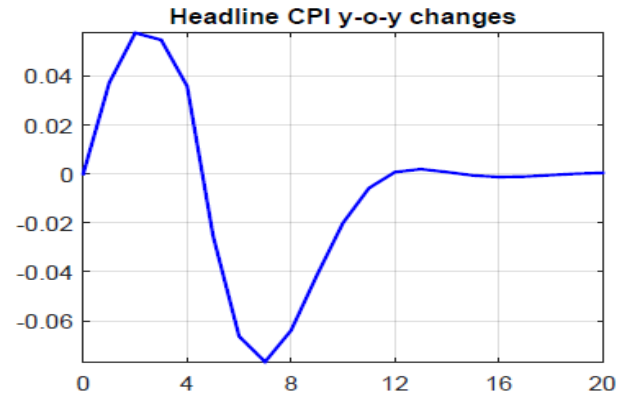
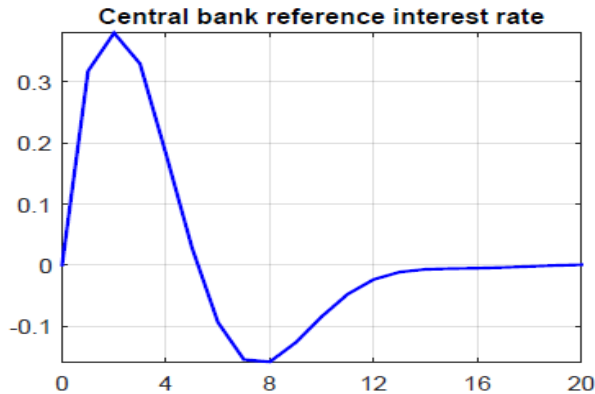
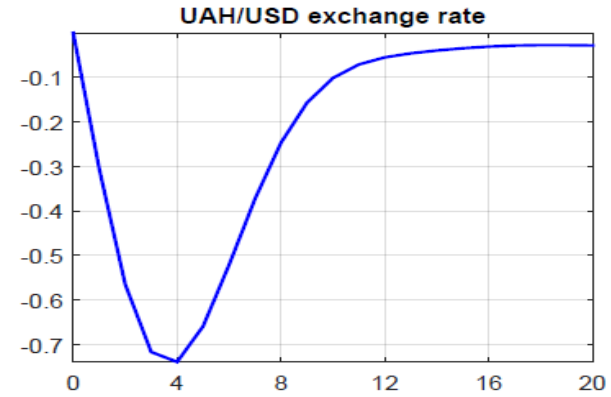
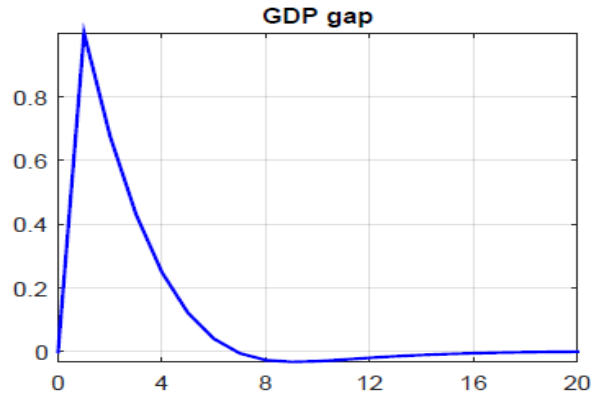
— **John Maynard Keynes**

- About 150 parameters in the model (coefficients, shock variations, steady states)
- Full model estimation is highly problematic (lack of data, numerous unknowns, nonlinearities, endogeneity)

Remedies:

- Estimations from satellite studies
- Calibration based on the literature
- Bayesian estimation of separate parameters

Impulse Response Functions: Positive Demand Shock



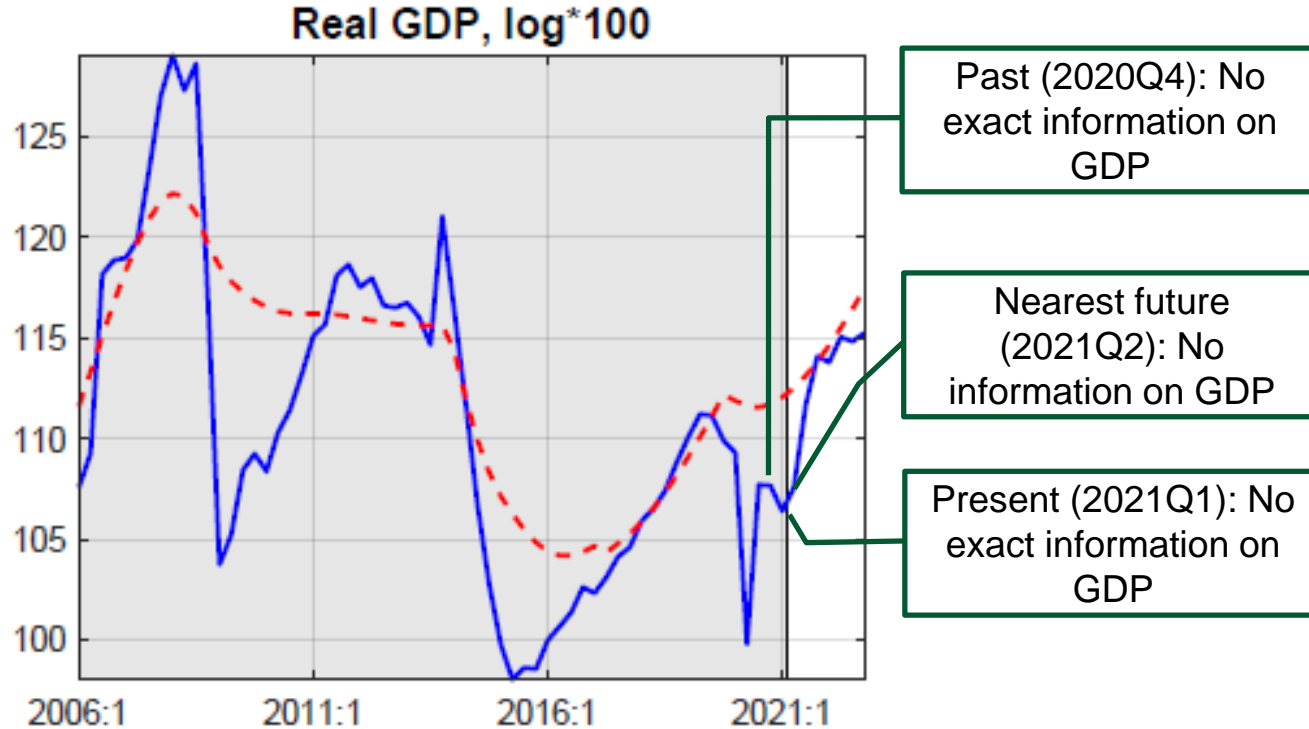


Forecasting with the Model

Regular forecasting exercise

1. Project exogenous variables (outside the model)
 - foreign sector, administratively regulated prices
2. Filter variables into unobservable trends and gaps
3. Exogenise some domestic variables over particular horizons
 - short-term forecasts
 - conditional scenarios
 - add-factors
4. Discuss at an expert panel
5. Reiterate until consensus

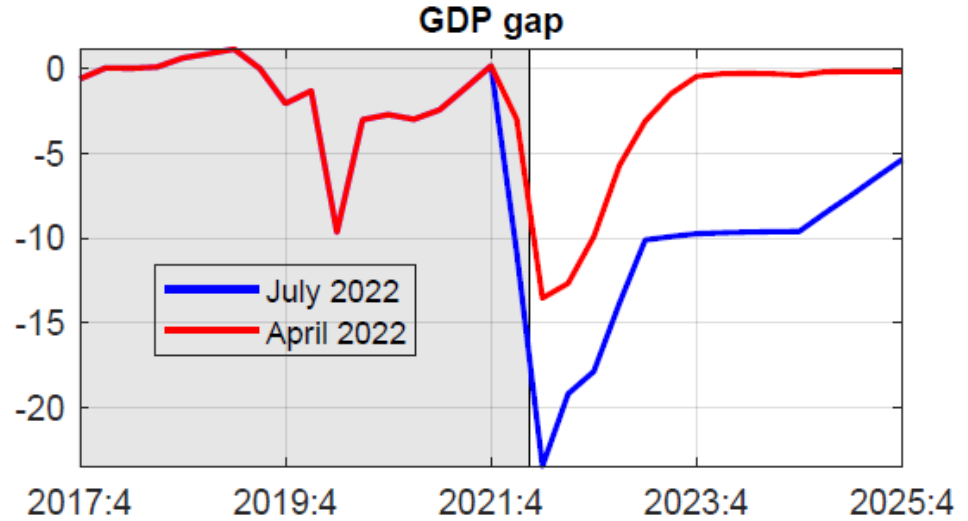
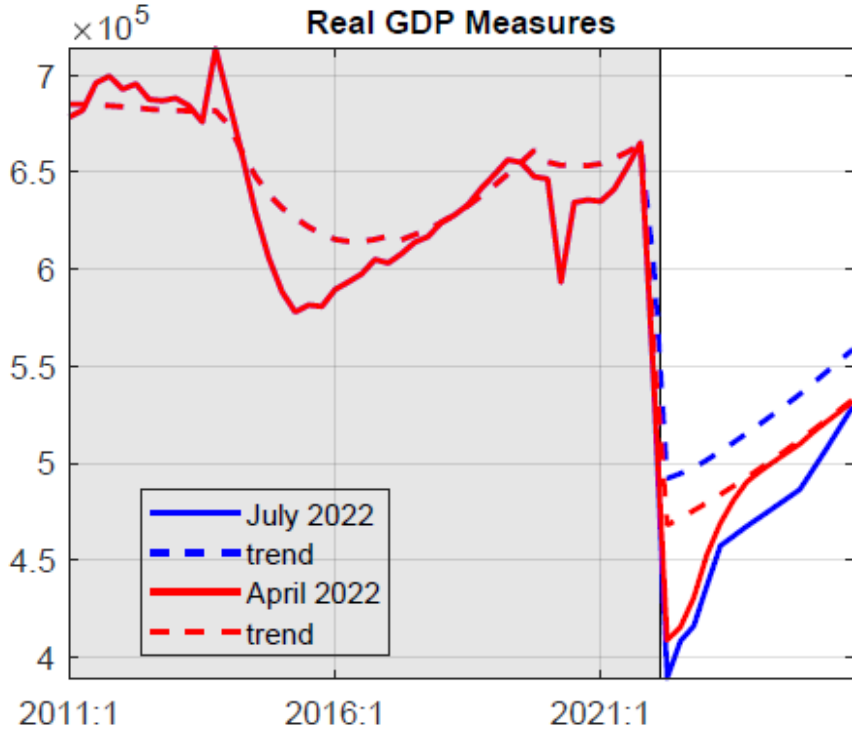
Exogenous judgments



Lets help the model:

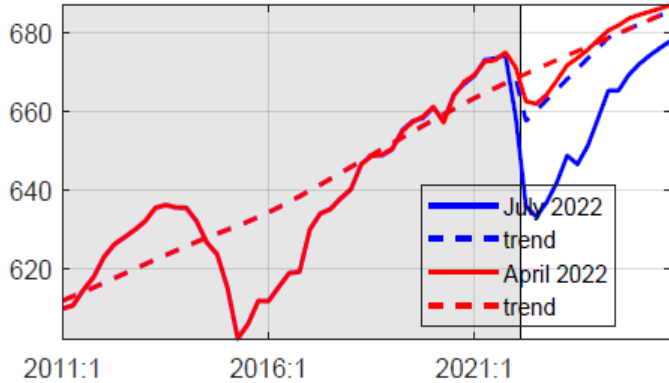
- Nowcasting
- Nearcasting
- Assumptions

QPM Filtration (1) GDP vs Trend

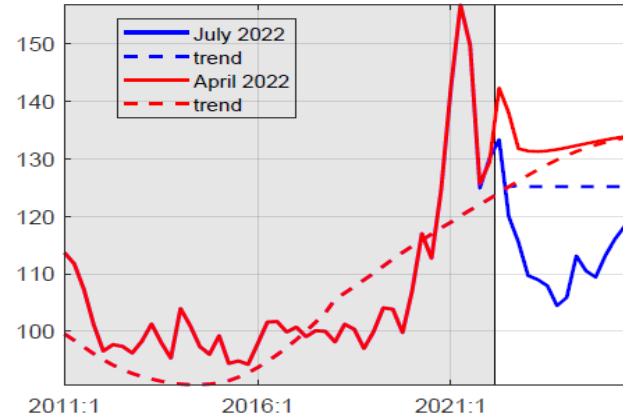


QPM Filtration (2) Real Indicators vs Trends

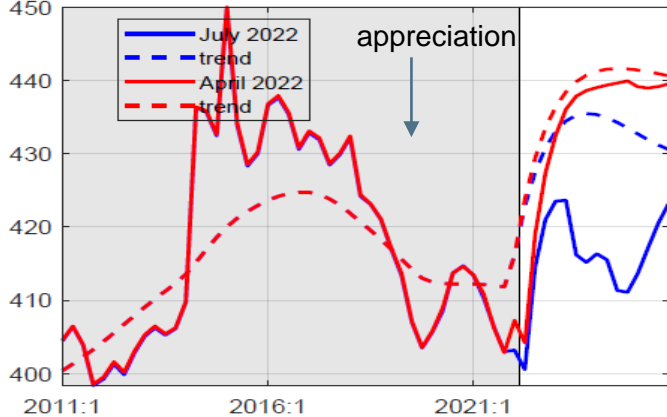
Real Wage Levels



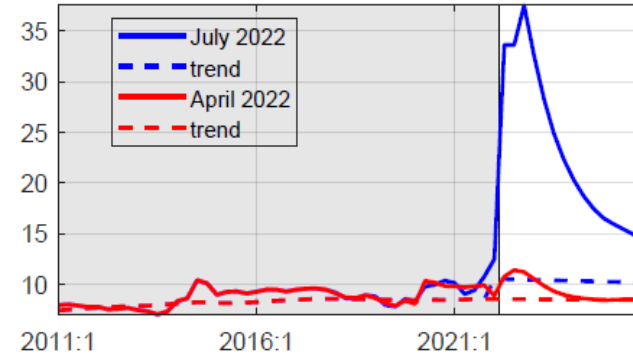
Terms of Trade



REER

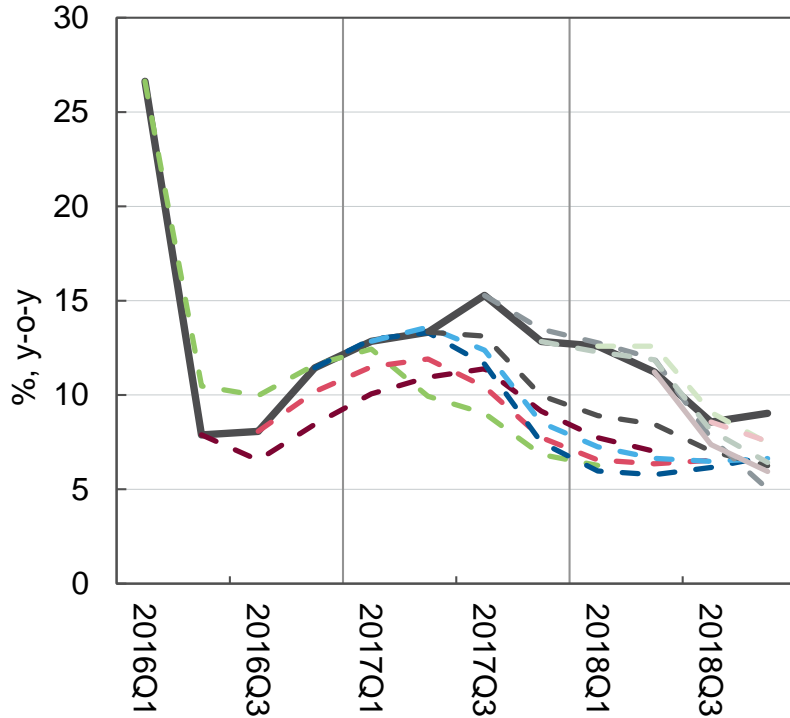


Unemployment

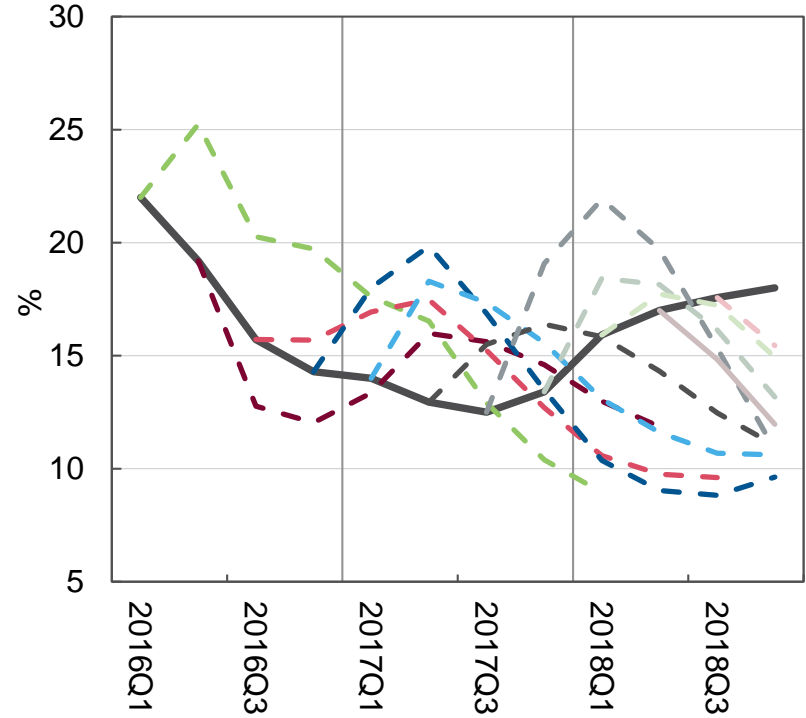


Pseudo-real-time forecasting (1) Inflation and Policy rate

Consumer inflation

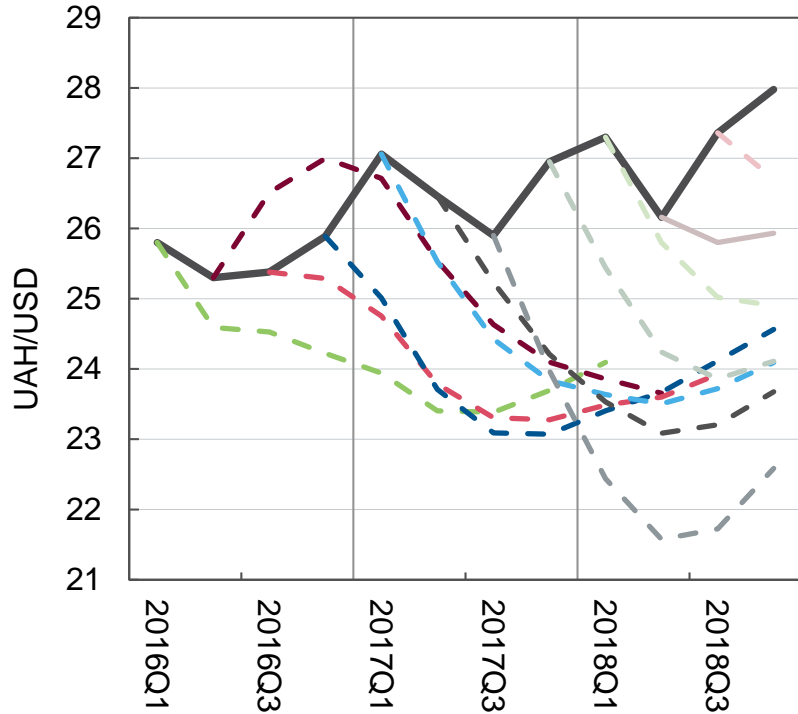


Policy interest rate

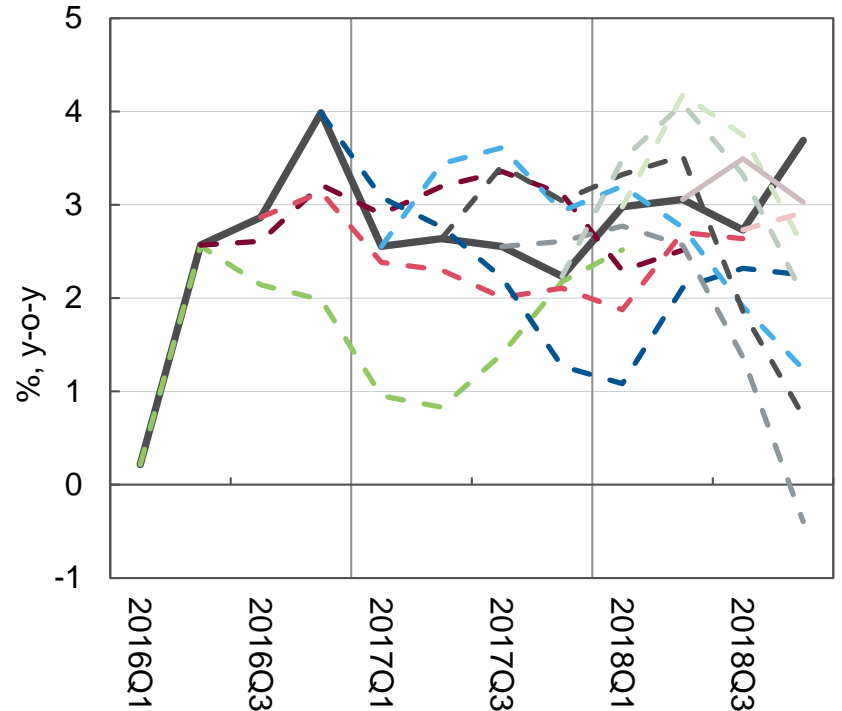


Pseudo-real-time forecasting (2) Exchange rate and Output

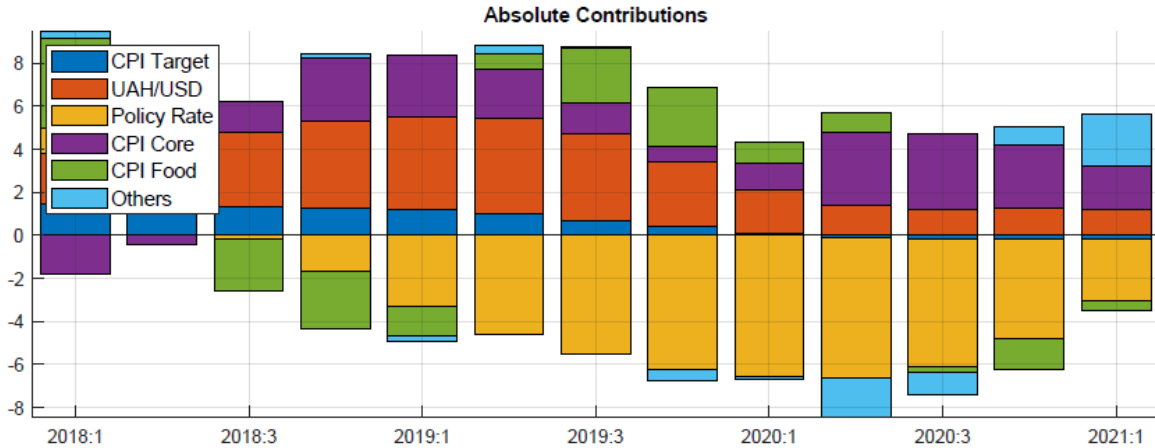
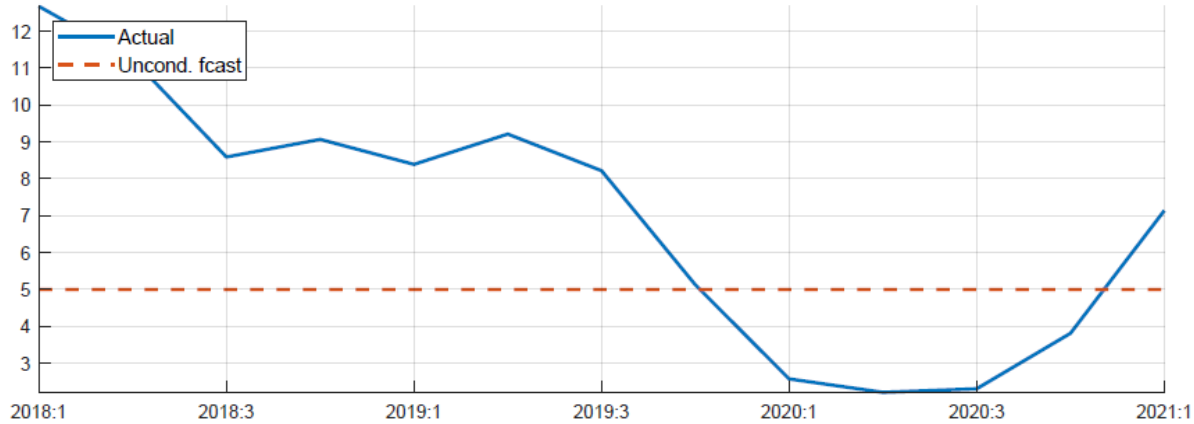
Nominal exchange rate



Real GDP growth



Shock Decompositions (1) Headline Inflation, % y-o-y





Conclusions and perspective developments

Conclusions and perspective developments

- ❑ The QPM is an essential tool for monetary policy decisions and analyses
- ❑ The model is good for forecasting and can benefit from external judgments
- ❑ Historical simulations help assess past policy decisions
- ❑ Perspective developments
 - external assessment of trends and steady states
 - new empirical findings and Bayesian estimation to support calibration
 - reassessment of forecasting performance with more data and sophisticated benchmarks
 - satellite QPM-type models to account for FX interventions and endogenous policy credibility

References and further reading

- ❑ Amarasekara, C., Anand, R., Ehelepola, K., Ekanayake, H., Jayawickrema, V., Jegajeevan, S., ... & Plotnikov, S. (2018). An Open Economy Quarterly Projection Model for Sri Lanka. International Monetary Fund.
- ❑ Beneš J., Clinton K., George A., Gupta P., John J., Kamenik O., Laxton D., Mitra P., Nadhanael G.V., Portillo R., Wang H., Zhang F. (2017). Quarterly Projection Model for India: Key Elements and Properties. IMF Working Papers, No. 17/33.
- ❑ Békési, L., Köber, C., Kucsera, H., Várnai, T., & Világi, B. (2016). The macroeconomic forecasting model of the MNB (No. 2016/4). MNB Working Papers.
- ❑ Djukic, M., Momcilovic, J., & Trajcev, L. (2010). Medium-term projection model of the National Bank of Serbia (No. 17).
- ❑ Grui, A., Lepushynskiy, V., & Nikolaychuk, S. (2018). A Neutral Real Interest Rate in the Case of a Small Open Economy: Application to Ukraine. Visnyk of the National Bank of Ukraine, (243), 4-20.
- ❑ Grui, A., & Vdovychenko, A. (2019) Quarterly Projection Model for Ukraine. NBU Working Papers, No. 3/2019
- ❑ Grui, A. (2020). Uncovered interest parity with foreign exchange interventions under exchange rate peg and inflation targeting: The case of Ukraine (No. 14-2020). Economics Section, The Graduate Institute of International Studies.
- ❑ Монетарна політика з точки зору економіста Національного банку України, voxukraine.org, October 13, 2020

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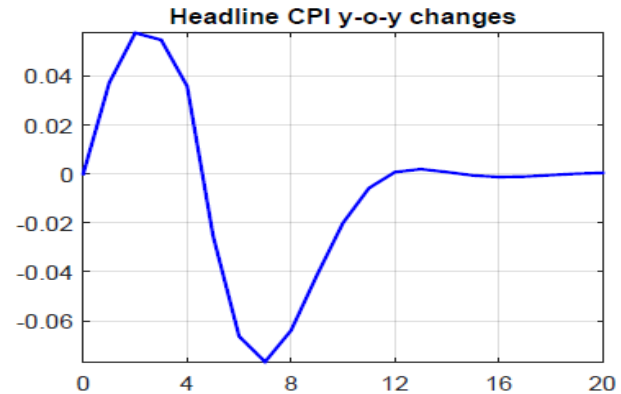
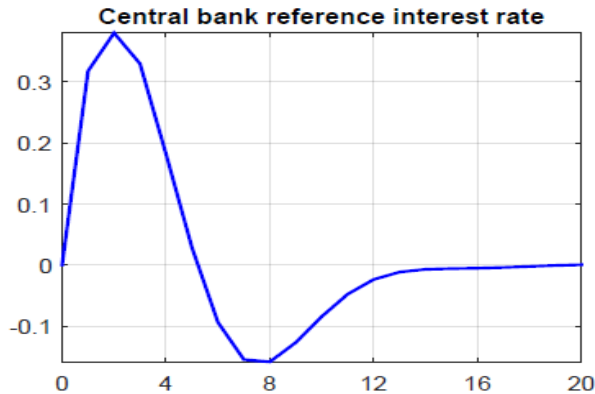
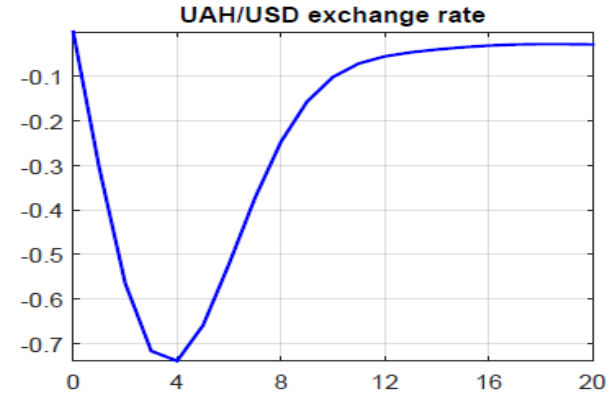
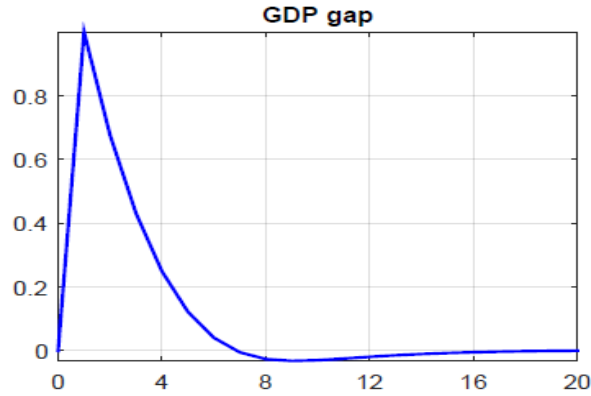


Additional Slides

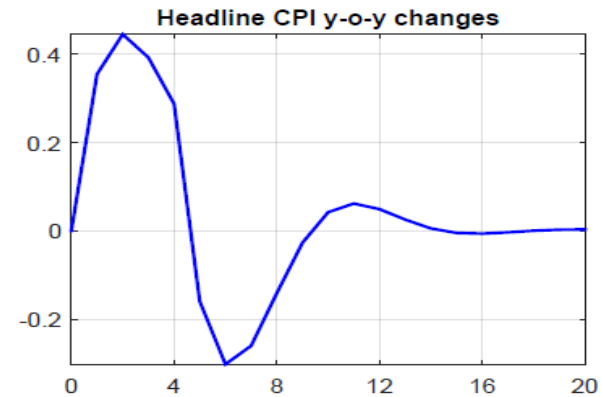
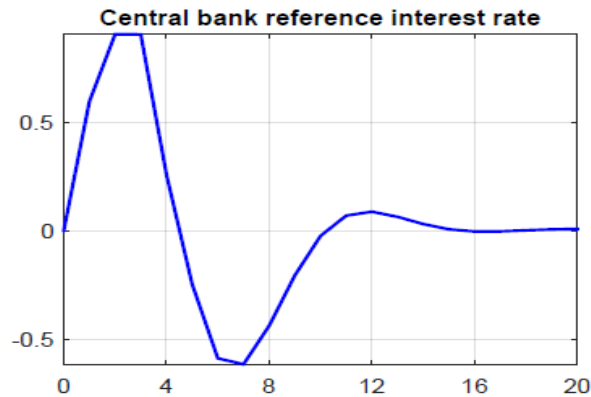
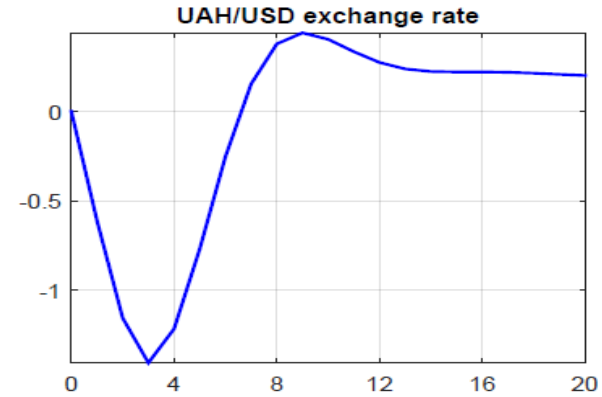
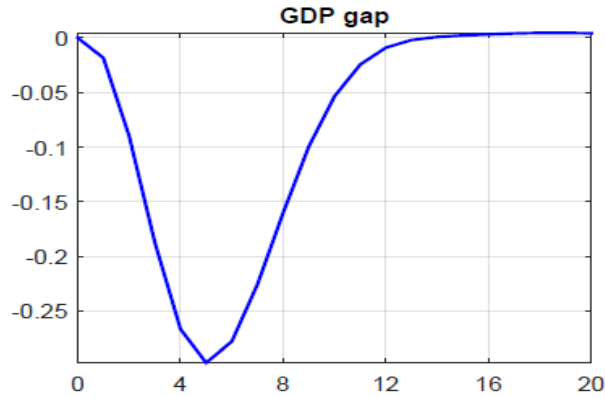


Impulse Response Functions

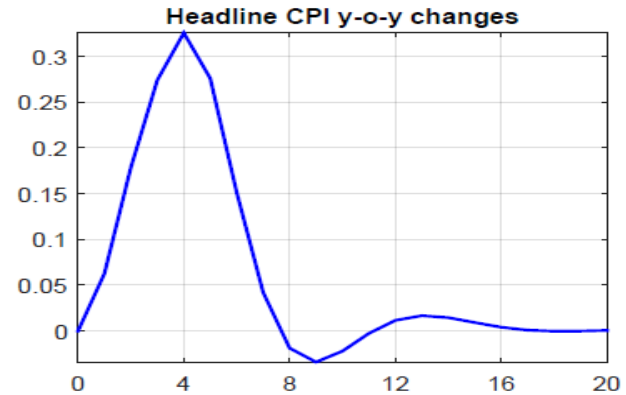
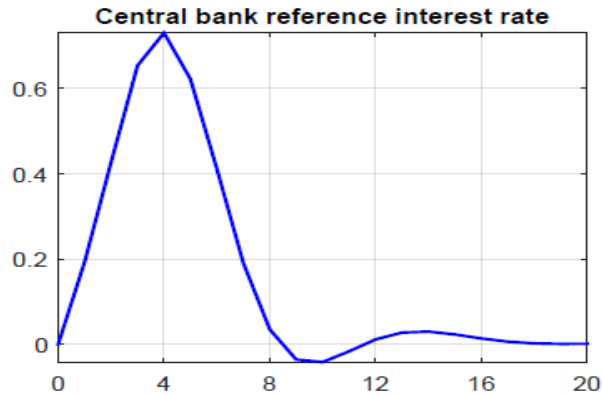
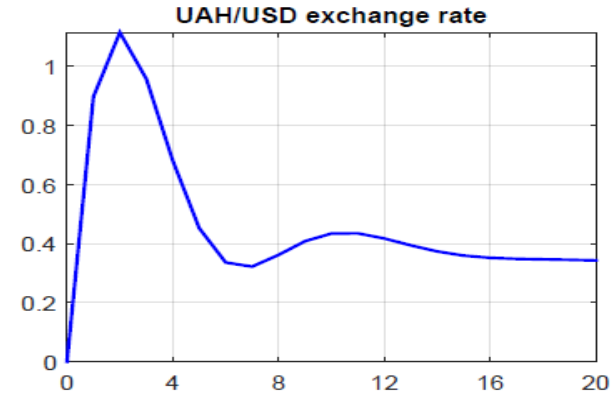
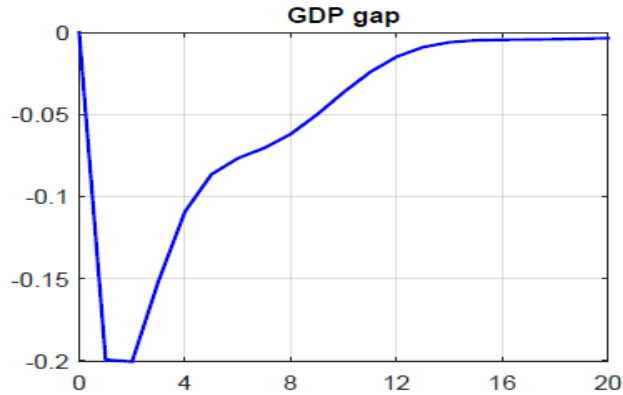
Impulse Response Functions (1) Positive Demand Shock



Impulse Response Functions (2) Negative Supply Shock

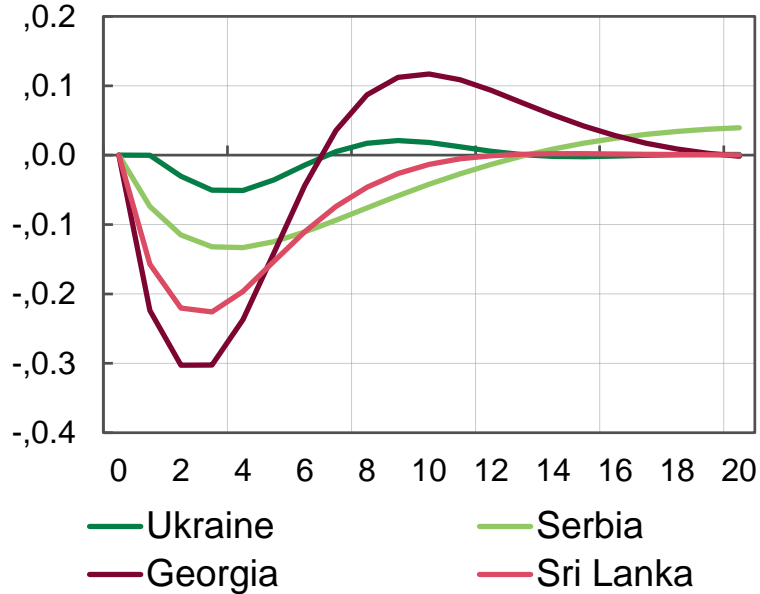


Impulse Response Functions (3) Negative Risk Premium Shock

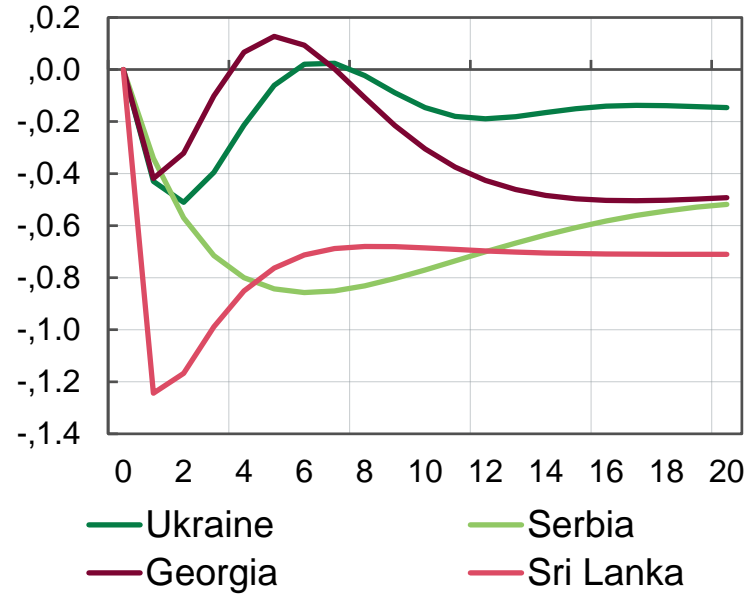


IRFs (4) Monetary Policy Shock Comparison

Output gap



Nominal exchange rate

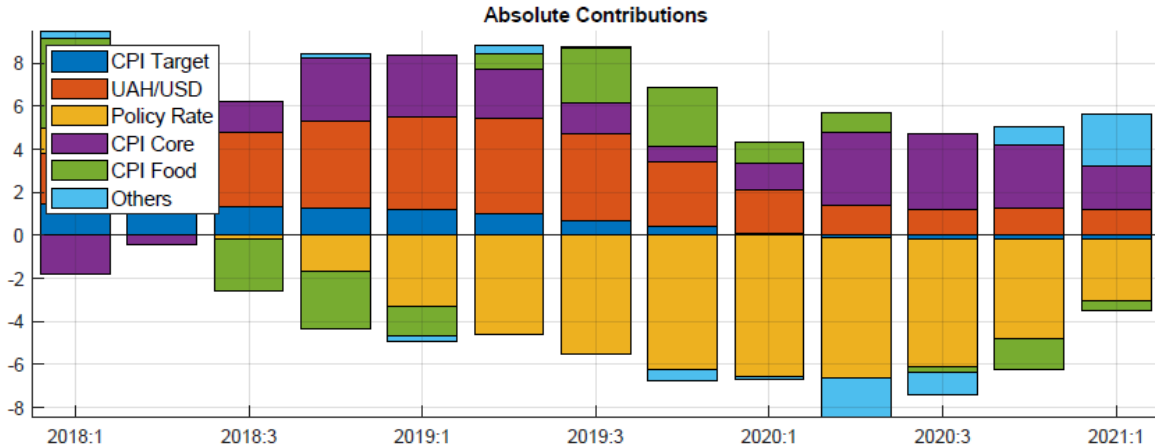
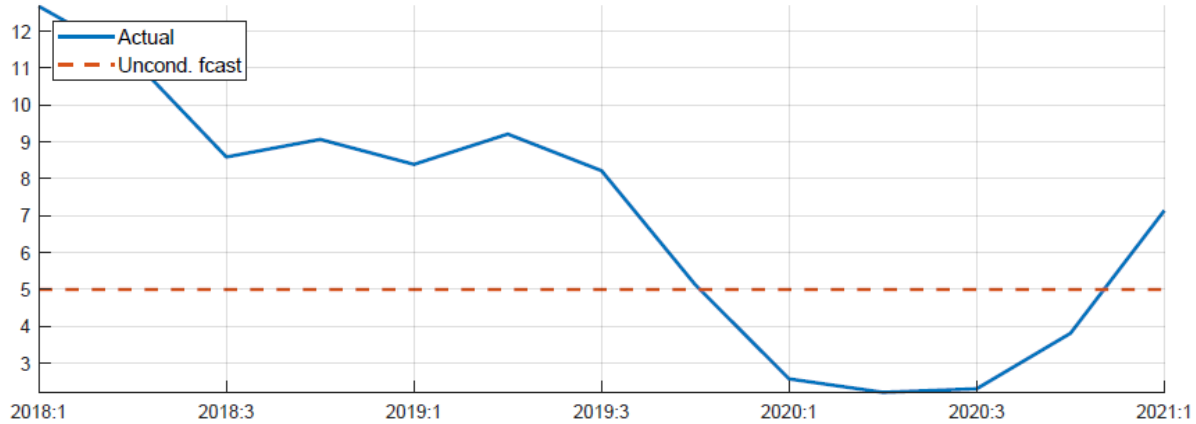


- Central Bank of Sri Lanka – Amarasekara et al. (2018)
- National Bank of Serbia – Dukic et al. (2010)
- Central Bank of Hungary – Bekesi et al. (2016)

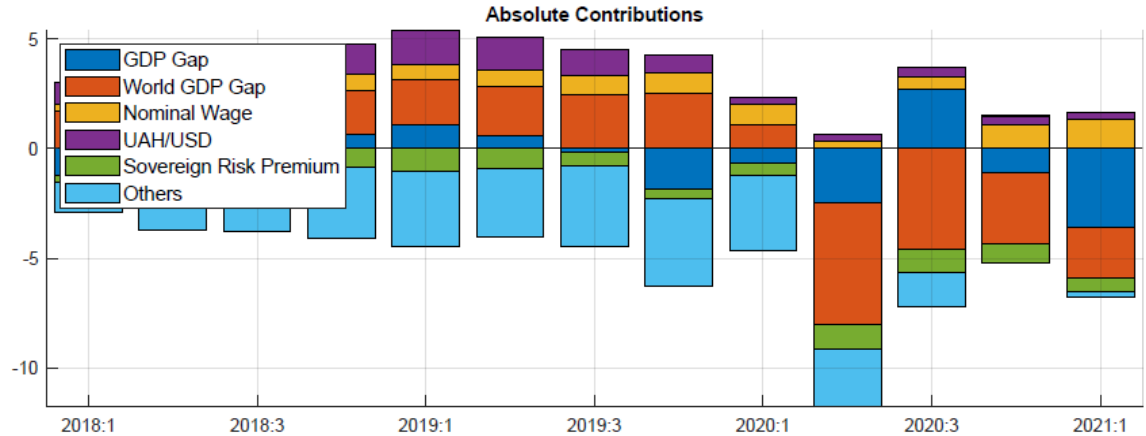
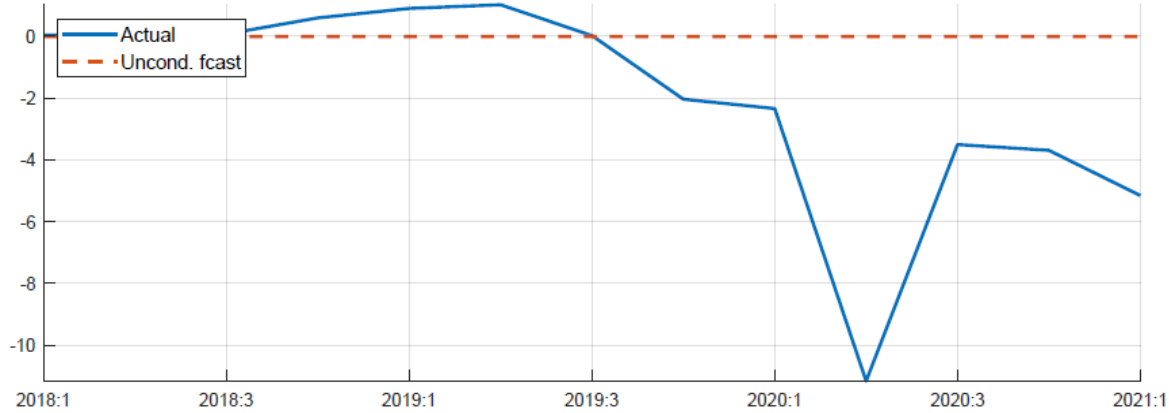


Shock Decompositions

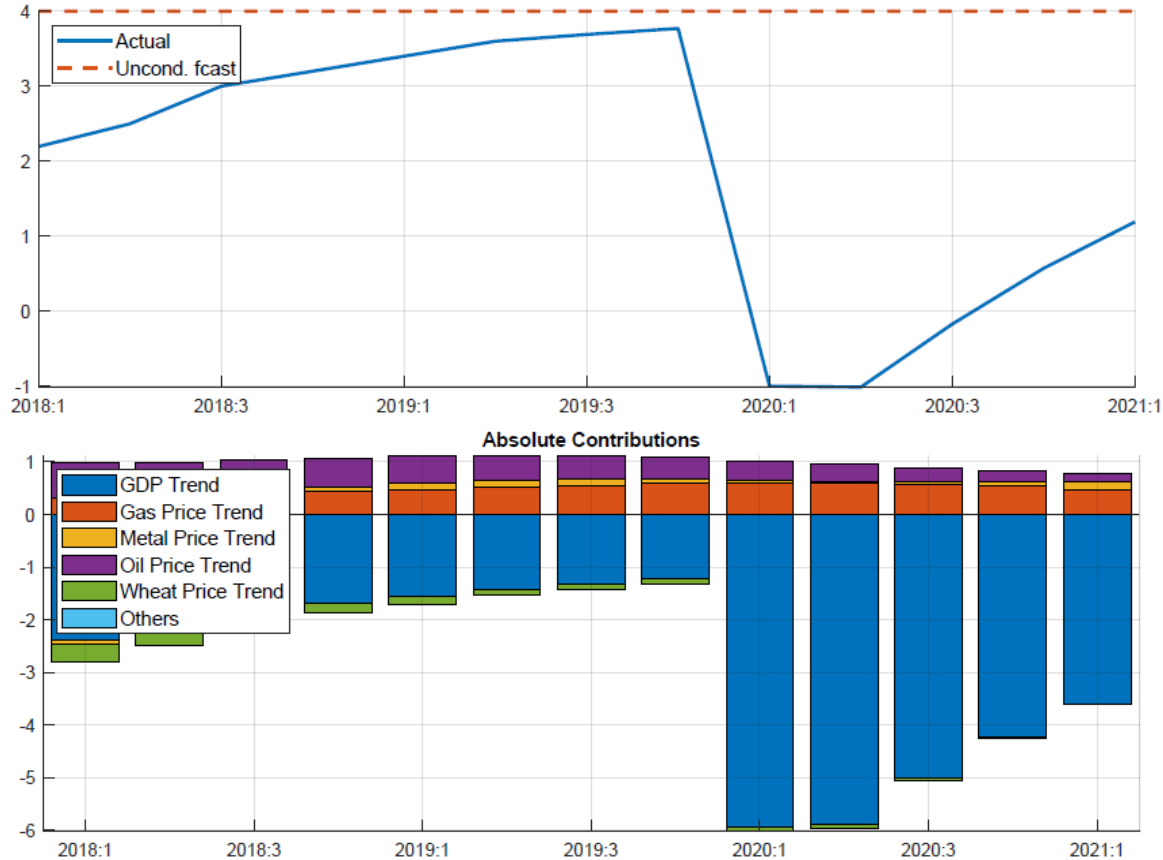
Shock Decompositions (1) Headline Inflation, % y-o-y



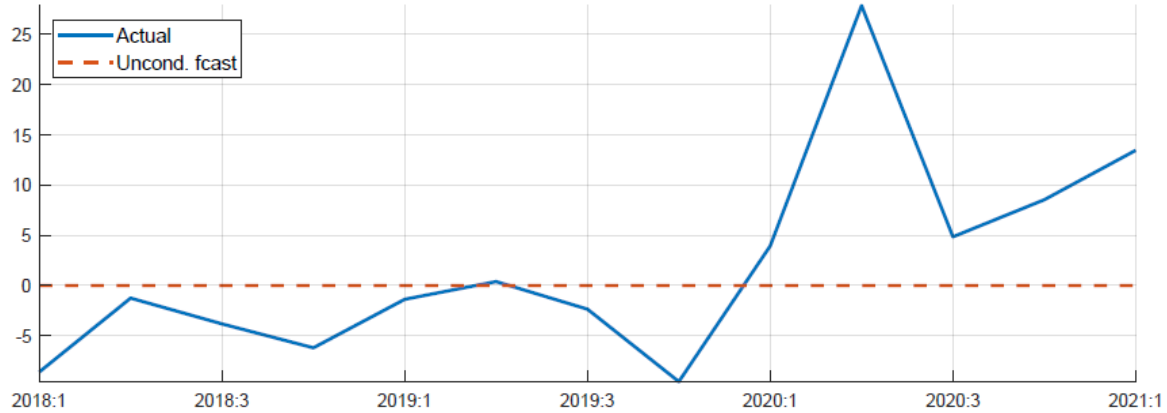
Shock Decompositions (2) GDP Gap, %



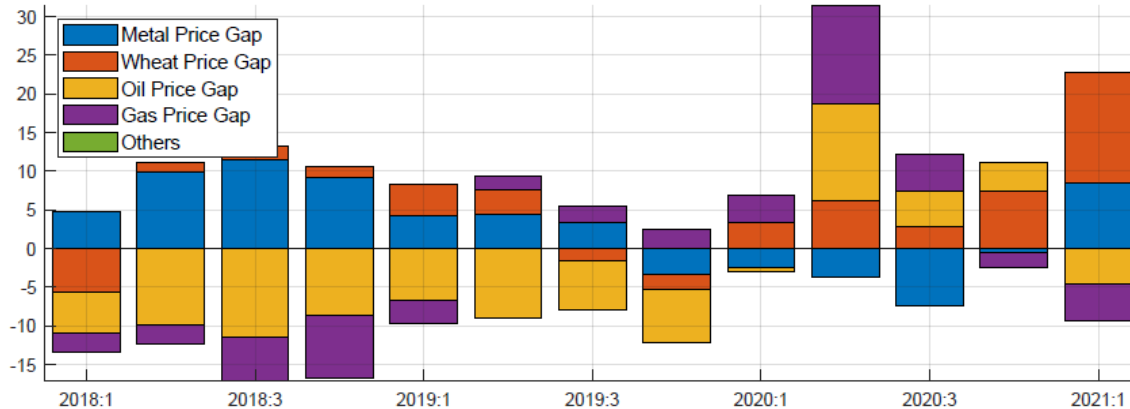
Shock Decompositions (3) GDP Trend growth, % q-o-q ann.



Shock Decompositions (4) Terms of Trade Gap, %



Absolute Contributions



Shock Decompositions (5) REER gap, %

