

The Geoeconomics of Oil Trade: Evidence from EU-Russia Market Disruptions

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Motivation

- ▶ discussion about EU energy imports from Russia after invasion of Ukraine
- ▶ debate focuses on gas, but embargo is on oil
- ▶ oil twice as important in terms of primary energy consumption
- ▶ in fact oil most important primary energy source (40% of total energy use in EU)

This paper

- ▶ macroeconomic effects of demand/supply shifts in EU-RU oil trade
- ▶ two-country Bayesian panel SVAR with
 1. traditional, theory-consistent static sign restrictions
 2. narrative sign restrictions
 3. elasticity restrictions
- ▶ identify
 1. Urals import demand shock
 2. Russian oil supply shocks
 3. other structural oil market shocks

Main findings

- ▶ Urals import shocks and oil supply shocks affect output in EU country and Russia similarly
- ▶ no region has efficient sanction lever
- ▶ structural scenario analyses

Scenario	output EU (country)	output RU	Urals price
import stop EU country	-3%	-1%	-5%
delivery stop RU	-2%	-1%	+3%
import stop EU	-10%	-10%	-40%

Empirical model

- ▶ reduced form Bayesian panel VAR for $i = 1, \dots, N$ countries and $t = 1, \dots, T$ months

$$y_{it} = C_i + \sum_{l=1}^{12} A_l y_{it-l} + \sum_{m=1}^M B_m \sum_{j \neq i} y_{jt} + D X_t + u_{it} \quad (1)$$

with $E(u_{it} u'_{it}) = \Sigma$, $E(u_{it} u'_{jt}) = 0$, $i \neq j$ and

$$y_{it} = \begin{bmatrix} \log(\text{oil production Russia}) \\ \log(\text{industrial production Russia}) \\ \text{arsinh}(\text{oil production} + \text{other oil imports EU}_i) \\ \log(\text{industrial production EU}_i) \\ \text{arsinh}(\text{oil imports from Russia of EU}_i) \\ \log(\text{real Urals price}) \end{bmatrix} \quad (2)$$

Structural model

- ▶ Structural VAR:

$$A_0 y_{it} = C_i + \sum_{l=1}^p A_l y_{i,t-l} + \sum_{m=1}^M B_m \sum_{j \neq i} y_{jt} + D x_t + \epsilon_{it} \quad (3)$$

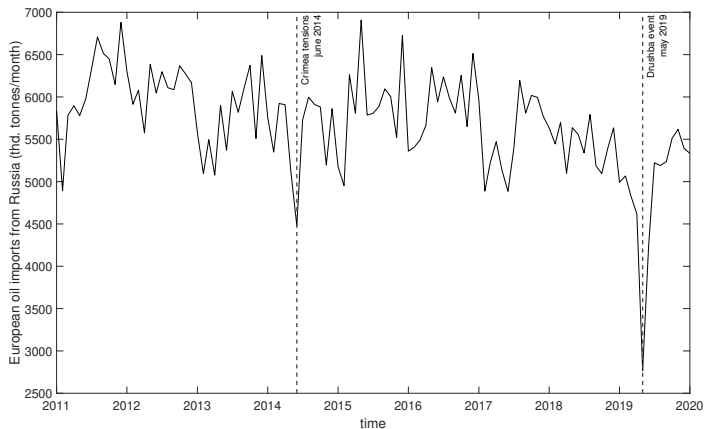
- ▶ ϵ_{it} white noise with diagonal unit covariance matrix
- ▶ Identification of A_0 using
 1. theory-consistent traditional static sign restrictions
 2. narrative sign restrictions (type I and type II)
 3. magnitude restrictions on oil supply elasticity

Identification 1: traditional static sign restrictions

Shocks	Urals Import Demand Shock	RU Oil Supply Shock	Aggregate Demand Shock	Oil Specific Demand Shock
Variable				
Oil production RU	-	-	-	+
Industrial production RU	-	-	-	-
EU _i Oil imports from non-RU	+	+	-	+
Industrial production EU _i	-	-	-	-
EU _i Oil imports from RU	-	-	-	*
Urals price	-	+	-	*

- ▶ Urals import demand shock equals trade cost shock that drives wedge between consumer and producer price Urals-Brent-Spread

Identification 2: narrative sign restrictions



No.	Narrative	Date	Shock	Variable	Sign	Contribution
1	Crimea annexation	2014M6	ϵ^U	EU oil imports	-	Largest
2	Druzhba contamination	2019M5	ϵ^S	EU oil imports	-	Largest

Identification 3: elasticity restrictions

- ▶ oil supply very inelastic
- ▶ restrict oil supply elasticity to $(0, 0.4)$

Results

Responses to Urals import demand shock

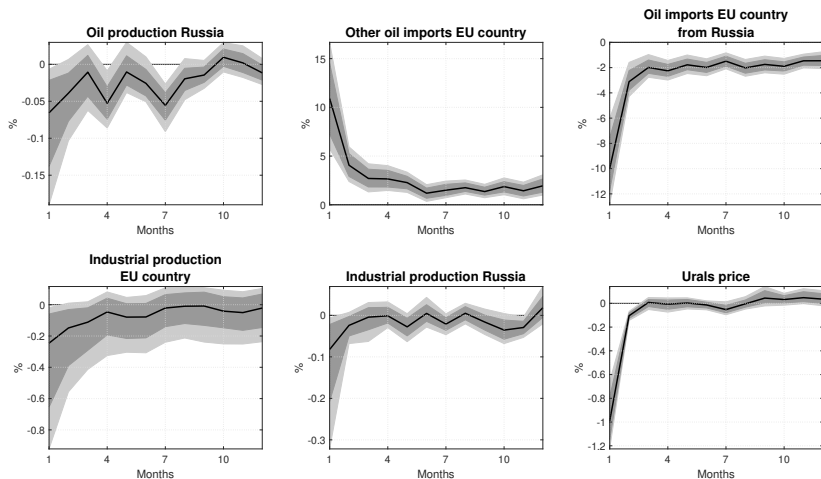


Figure: Scaled to match 10% decrease in oil imports from Russia. Median estimate and 68 and 90% credible sets based on 500 draws.

Responses to oil supply shock

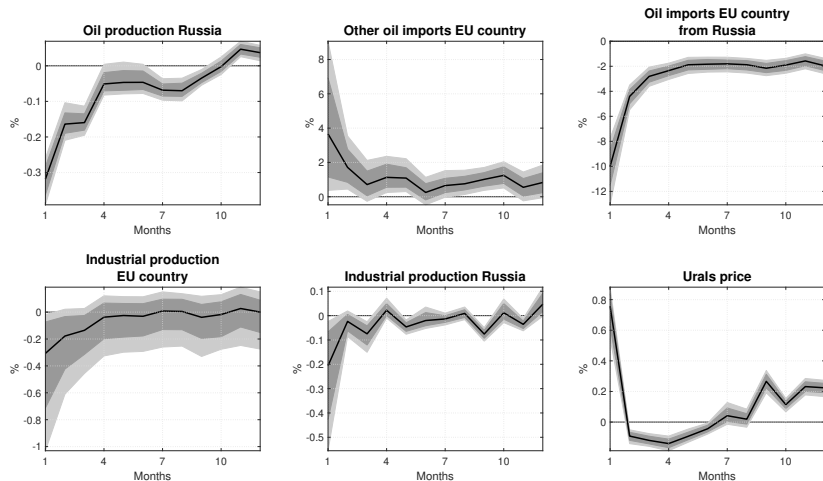


Figure: Scaled to match 10% decrease in oil imports from Russia. Median estimate and 68 and 90% credible sets based on 500 draws.

Differential response industrial production RU – EU

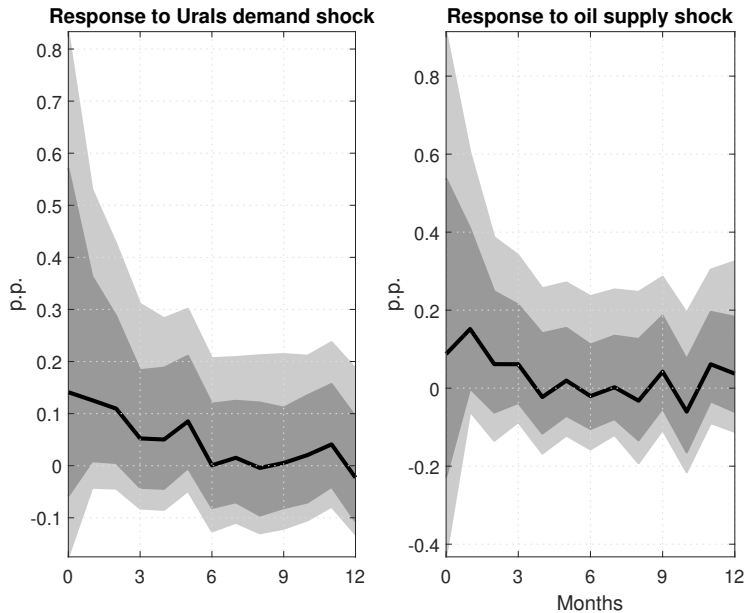


Figure: Difference between response of IP in Russia and IP in EU:

Structural scenario analysis

- ▶ Urals imports $\rightarrow 0$ over 12 months
- ▶ scenario starts in February 22
- ▶ 3 scenarios:
 1. EU country import stop (uncoordinated embargo)
 2. EU import stop (coordinated embargo)
 3. Russian delivery stop

Scenario 1: EU country oil import stop

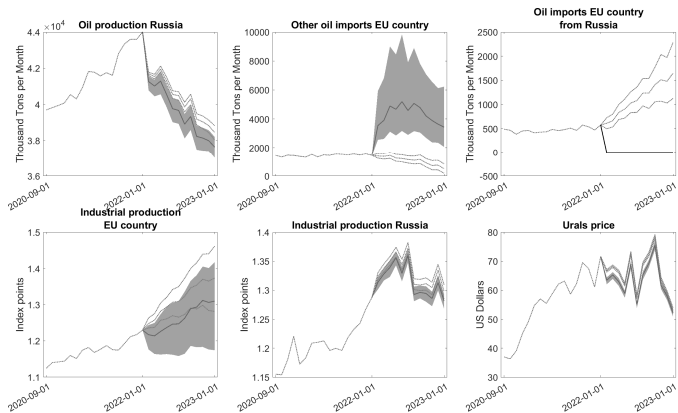


Figure: Unconditional forecast (dotted line) and scenario 1 (solid line). Median estimate and 68 and 90% credible set.

Scenario 1: Effects of uncoordinated embargo

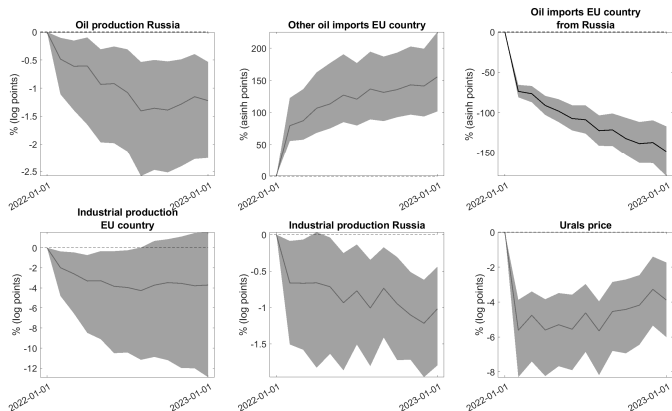


Figure: Difference between scenario 1 and forecast. Median estimate and 68 and 90% credible set.

Scenario 2: full EU embargo

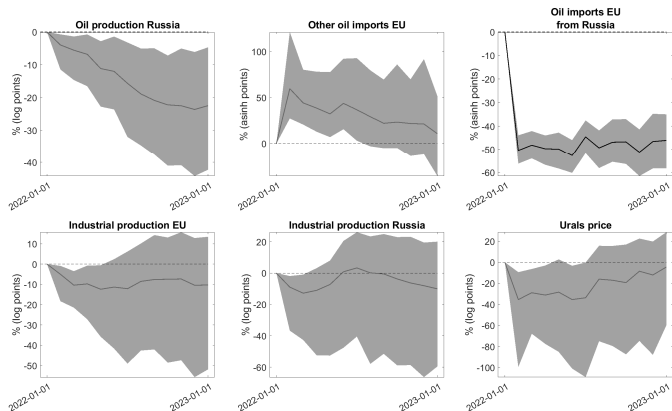


Figure: Difference between scenario 3 and forecast. Median estimate and 68 and 90% credible set.

Scenario 3: Effects of Russian delivery stop

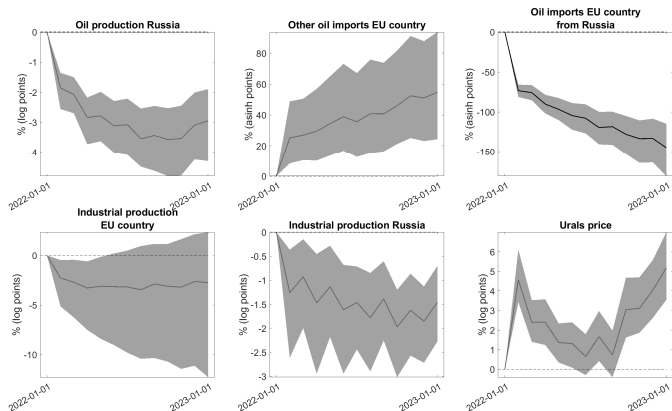


Figure: Difference between scenario 2 and forecast. Median estimate and 68 and 90% credible set.

Effects on RU oil revenues and EU (country) inflation

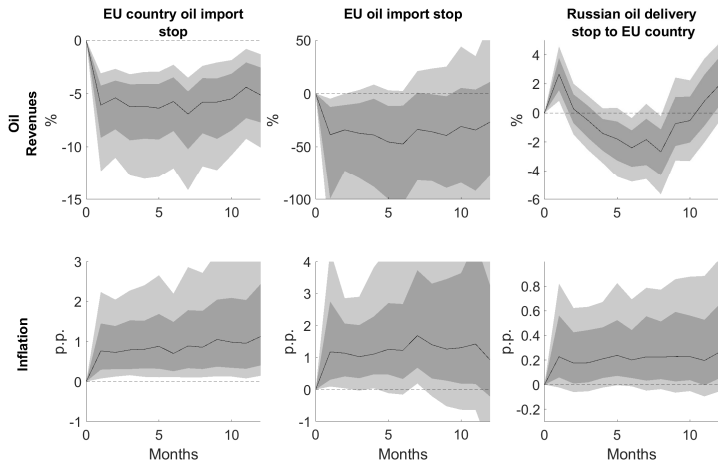


Figure: Difference between respective scenario and forecast. Median estimate and 68 and 90% credible set.

Sensitivity

- ▶ Mean group estimation **PMGE**
- ▶ Robust prior structural parameters **Robust**
- ▶ Lag length **6 lags**
- ▶ No linear trend **No trend**
- ▶ Only sign restrictions **SRs**
- ▶ No arsinh **No arsinh**
- ▶ benchmark price forecast against Urals-Brent-Spread **benchmark**

Conclusions

- ▶ demand/supply shifts in EU-RU oil trade have macroeconomically relevant effects
- ▶ both regions affected similarly
- ▶ restrictions on oil trade effective but not efficient instrument

Appendix

Data

- ▶ monthly data 2009M01-2022M01
- ▶ 20 EU countries that import Russian crude oil
- ▶ Data Sources:
 - ▶ Oil production: U.S. Energy Information Administration (EIA)
 - ▶ Oil imports: Eurostat
 - ▶ Industrial production: IMF/FRED
 - ▶ Urals price (fob) and exchange rates: Macrobond

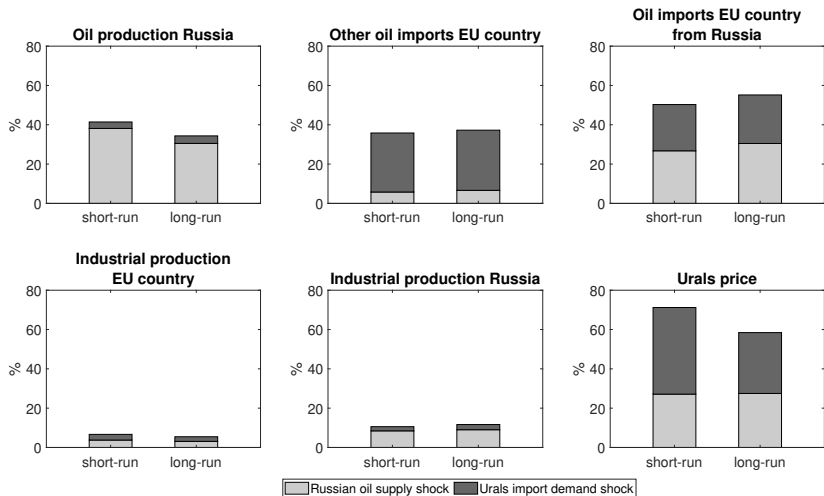
Related literature

- ▶ empirical literature on global oil markets (Kilian 2009, Kilian and Murphy 2014)
- ▶ methodology: SVAR identification and structural forecasting (Antolin-Diaz and Rubio-Ramirez 2018, Antolin-Diaz et al 2021)
- ▶ literature on geoeconomics: sanctions (Felbermayr et. al 2020, Ahn and Ludema 2020)

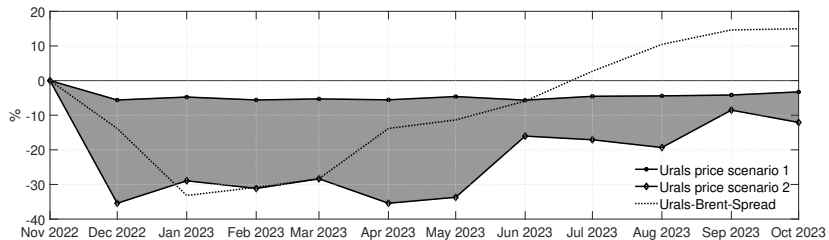
Exogenous variables

- ▶ Year fixed effects
- ▶ Linear trend
- ▶ Calendar fixed effects
- ▶ lockdown dummies
- ▶ Global oil market variables of Kilian (2009, AER): global oil production, real oil price, global economic activity
- ▶ Real exchange rates (RUB-USD, EUR-USD)
- ▶ Real Brent price

Forecast error variance decomposition

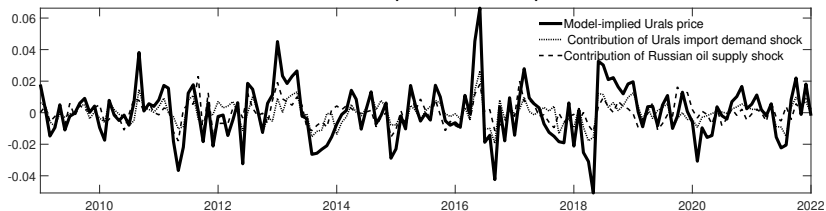


Urals Price benchmark [back](#)

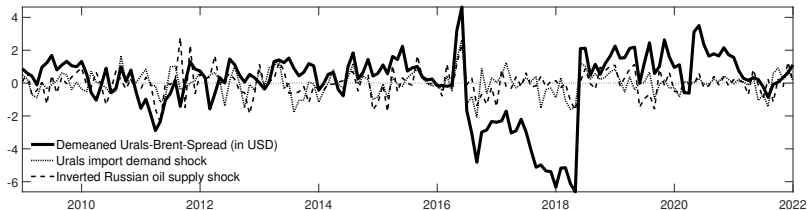


Shocks against Urals-Brent-Spread

Historical decomposition of the Urals price

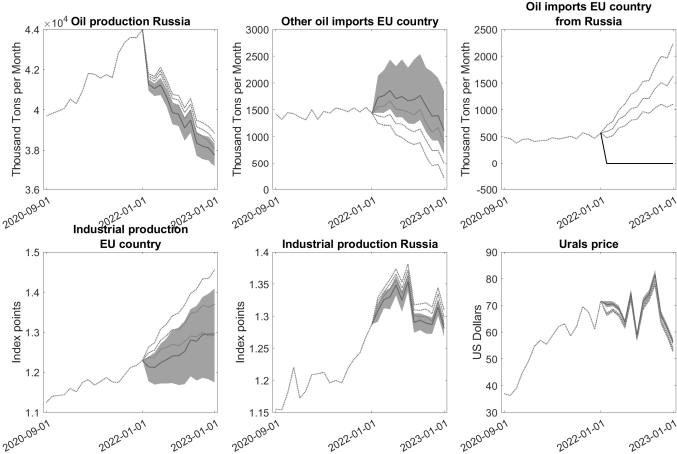


Urals import demand shock, Russian oil supply shock and Urals-Brent-Spread



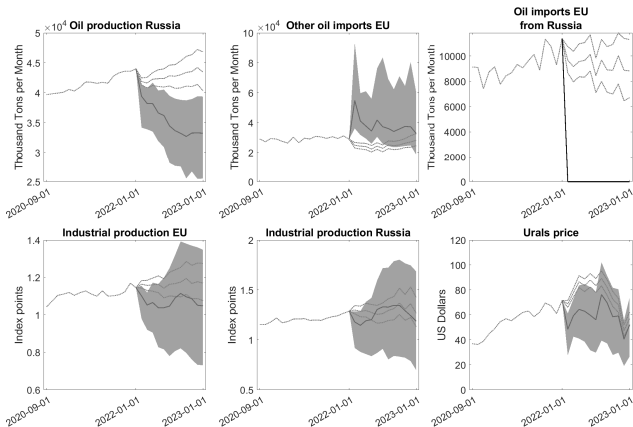
Results: Structural Scenario Analysis - RU oil delivery stop

back

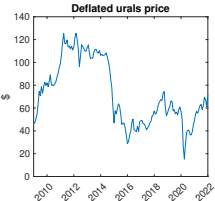
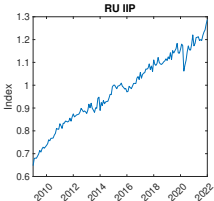
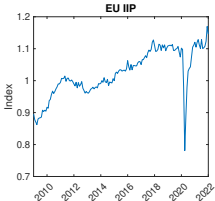
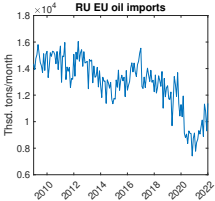
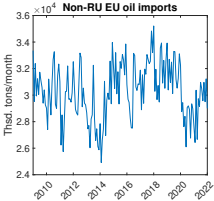
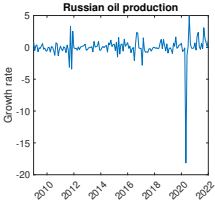


Results: Structural Scenario Analysis - EU aggregated

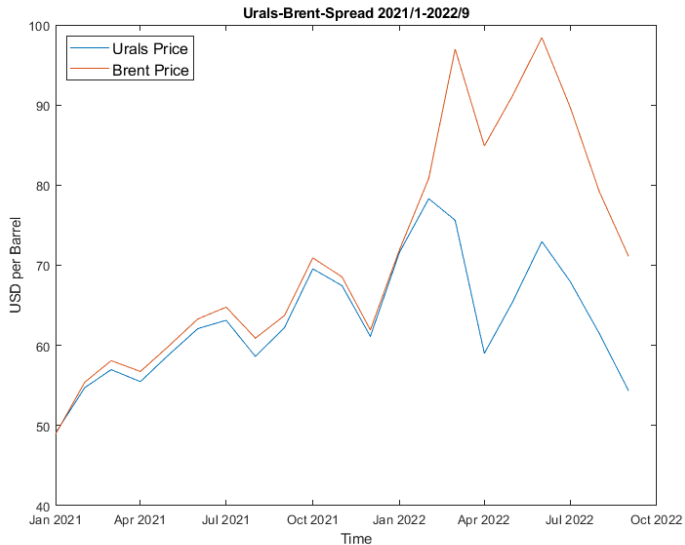
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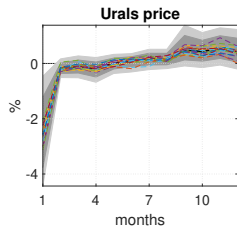
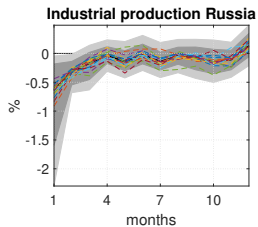
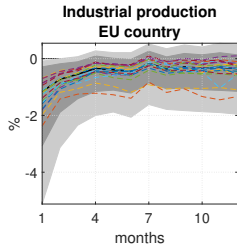
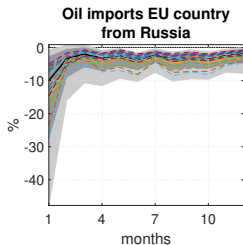
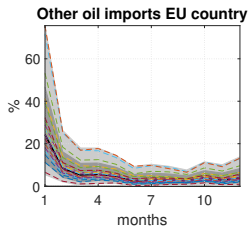
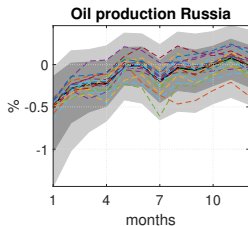
Dependent variables back



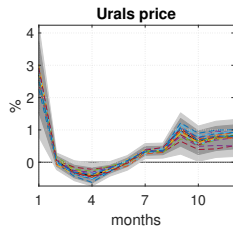
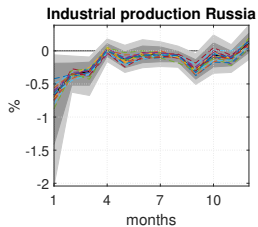
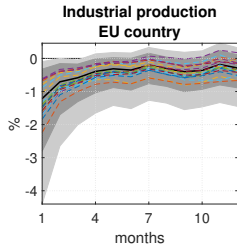
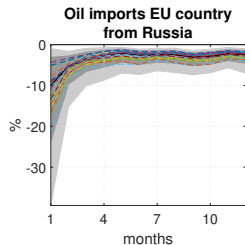
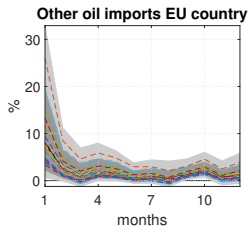
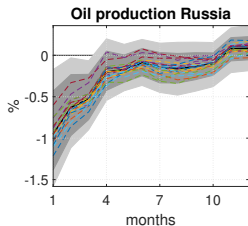
Urals-Brent-Spread (real prices) [Back](#)



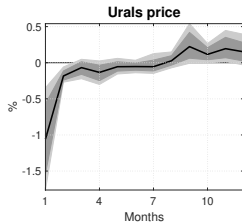
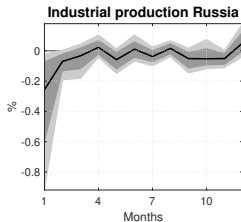
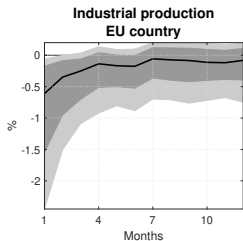
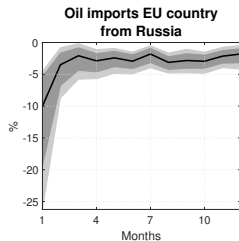
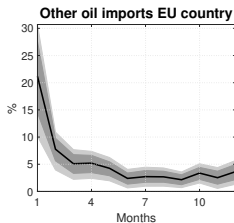
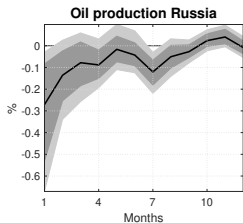
Sensitivity: PMGE Urals demand shock [back](#)



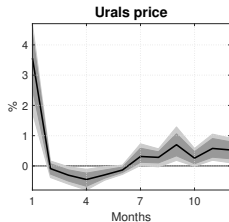
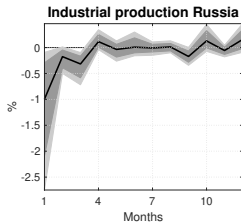
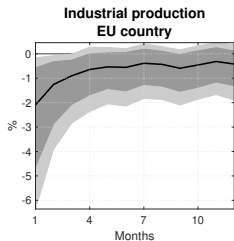
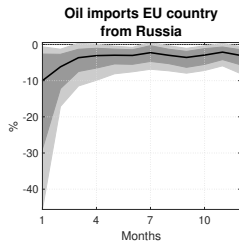
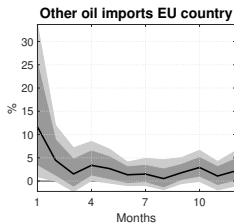
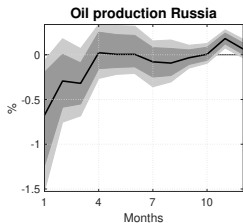
Sensitivity: PMGE oil supply shock shock [back](#)



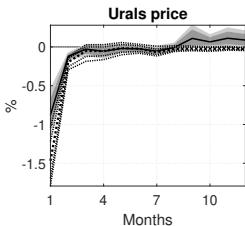
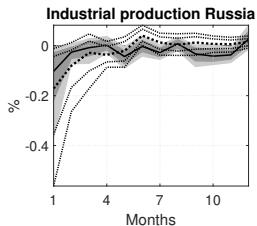
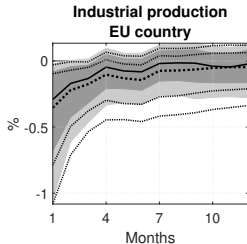
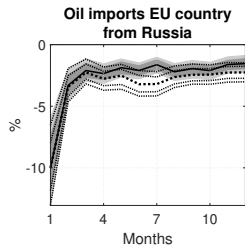
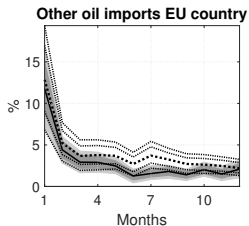
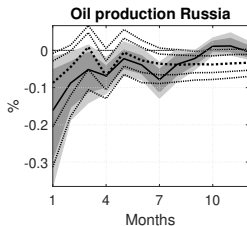
Sensitivity: Robust prior Urals demand shock [back](#)



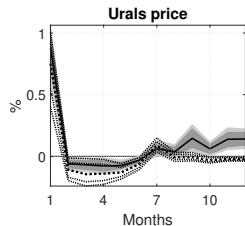
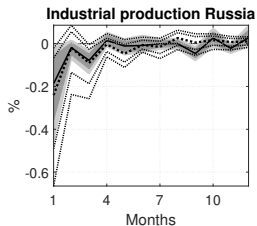
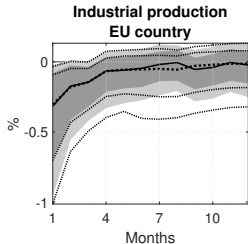
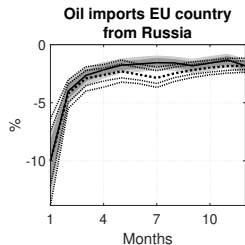
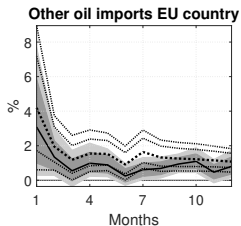
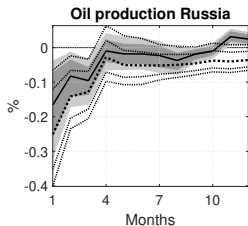
Sensitivity: Robust prior oil supply shock [back](#)



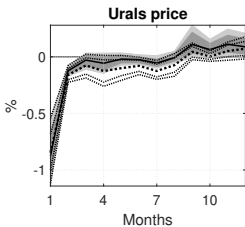
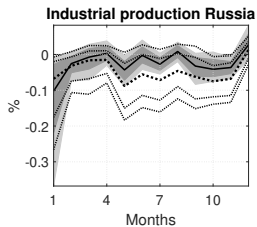
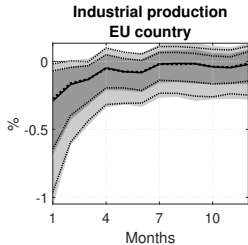
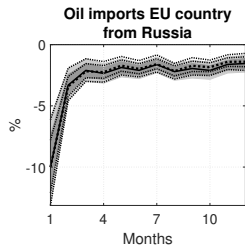
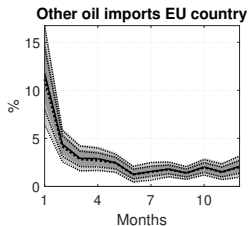
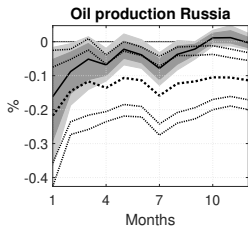
Sensitivity: 6 lags Urals demand shock [back](#)



Sensitivity: 6 lags oil supply shock [back](#)

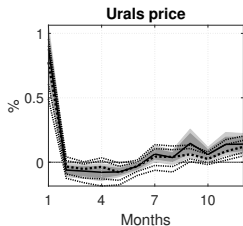
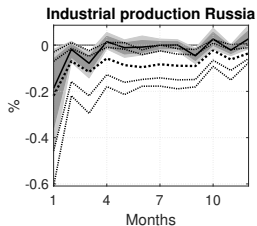
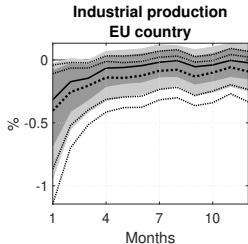
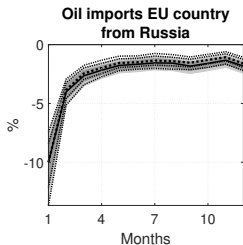
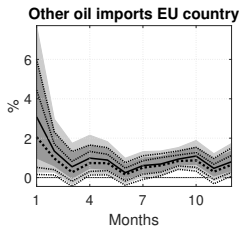
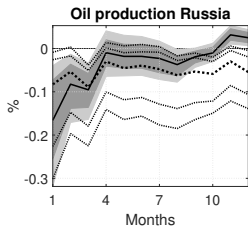


Sensitivity: No trend Urals demand shock [back](#)

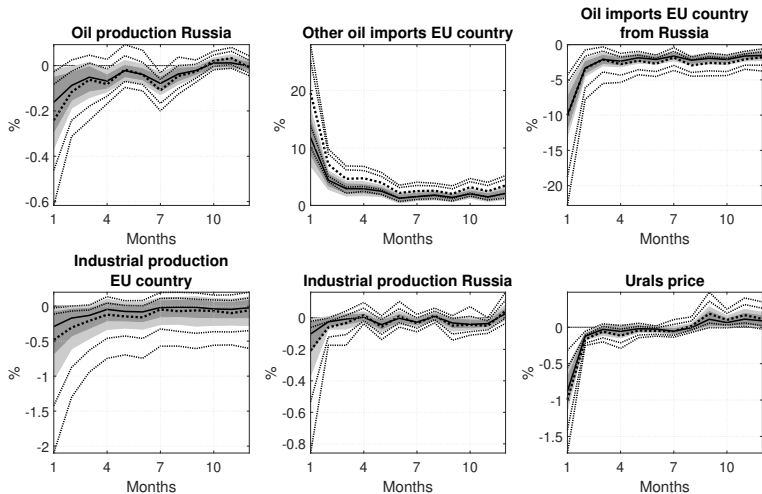


Sensitivity: No trend oil supply shock

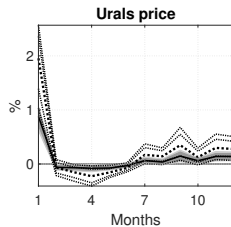
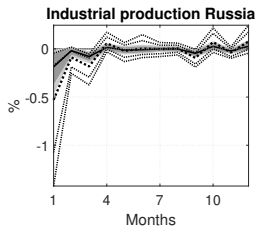
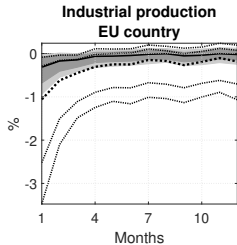
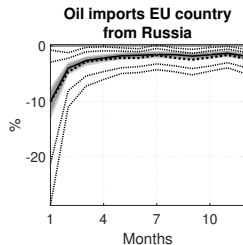
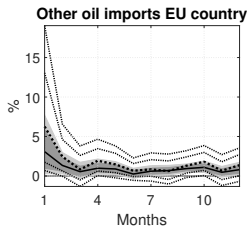
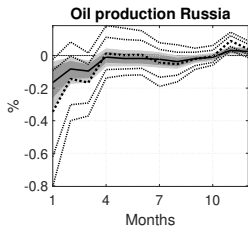
back



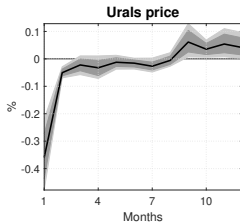
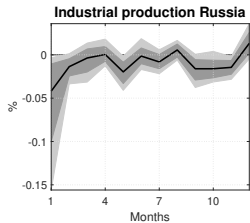
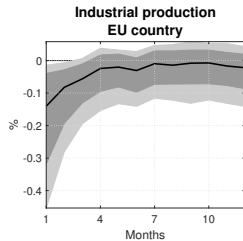
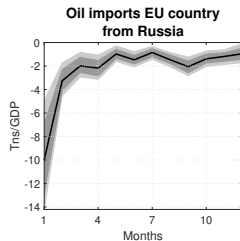
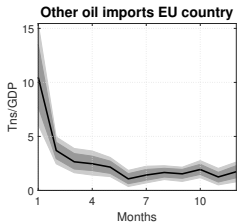
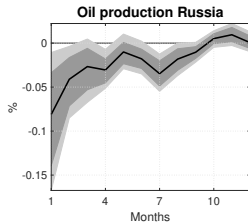
Sensitivity: Only sign restrictions Urals demand shock [back](#)



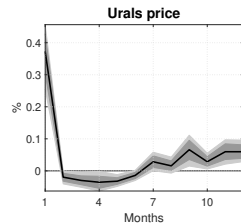
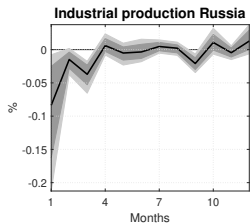
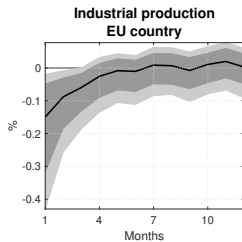
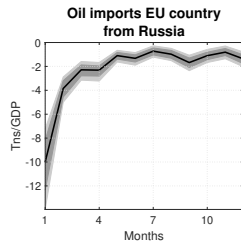
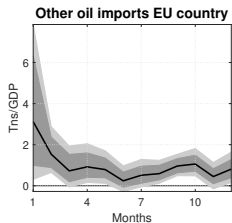
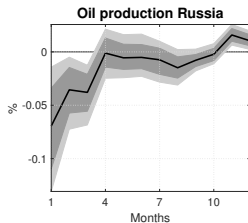
Sensitivity: Only sign restrictions oil supply shock [back](#)



Sensitivity: No arsinh Urals demand shock [back](#)



Sensitivity: No arsinh oil supply shock [back](#)



Sensitivity: No arsinh structural scenario analysis [back](#)

