Introduction
oooooo

Economic model
oooo

Results
ooooooooooo

Conclusions and policy
oooo

Extra
oooooo

Unveiling inflation: Oil Shocks, Supply Chain Pressure, and Expectations Post-COVID

Knut Are Aastveit[1,2]   **Hilde C. Bjørnland**[2,1]   Jamie L. Cross[3]
Helene O. Kalstad[2]

[1]Norges Bank

[2]BI Norwegian Business School

[3]Melbourne Business School

Financial Markets Workshop: Energy Markets and the World Economy, 14 March 2024

Motivation

- Following low inflation levels prior to the COVID-19 pandemic, global inflation rates have increased dramatically over the past years

- The rapid increase has raised questions about the underlying drivers of the inflationary pressure. Two main hypothesis:

    - Following COVID-19 and Russian invasion of Ukraine, oil prices have rapidly escalated, pushing up other commodity prices and inflation.

    - Supply chain pressures, brought about by the pandemic-induced disruptions, transportation bottlenecks, and labour shortages, have disrupted the traditional flow of goods and services, and thereby exerted inflationary pressures on economies.

        - See for instance Benigno, di Giovanni, Groen and Noble (2022) and Celasun, Hansen, Mineshima, Spector and Zhou (2022))

Inflation expectations and the price of oil

- Monetary policy: anchoring inflation expectations is necessary for achieving stable prices

- Expected and actual inflation are sensitive to oil price shocks Bernanke, Gertler and Watson (1997), Hooker (2002), Harris et al. (2009)

- Two mechanisms for oil price pass-through to actual inflation
  1. Direct cost channel
  2. Indirect expectations channel

- Empirical strength of indirect channel is debated
  1. Coibion and Gorodnichenko (2015), Aastveit, Bjørnland and Cross (2023)
 2. Blanchard and Gali (2007), Blanchard and Riggi (2013) and Wong (2015)

Introduction
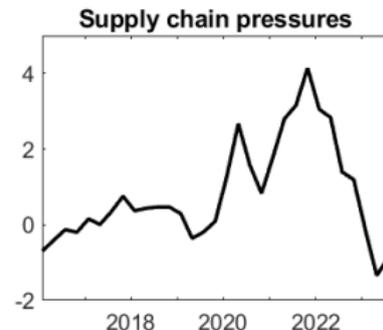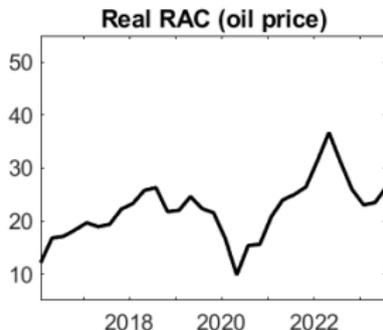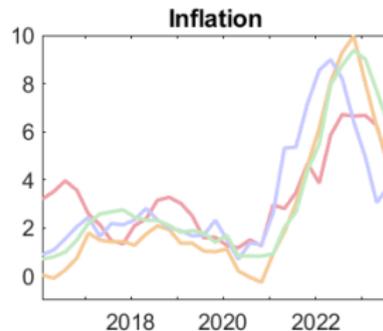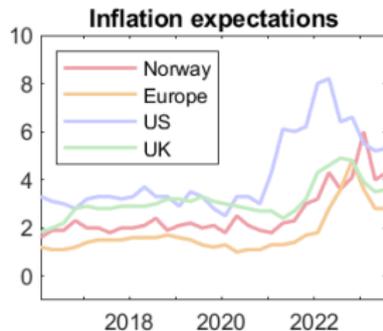
What we ask

① How important are global shocks for driving inflation in the US, Euro Area, the UK and Norway?

- Various oil market shocks

- Global supply chains

- Separate between global demand and global supply shocks

② Does oil prices matter specifically for the recent hike in inflation?

③ What is the role played by inflation expectations in amplifying the effects of these shocks on inflation?

What we do

- We specify a Bayesian SVAR with global oil market variables, global supply chains and domestic inflation and inflation expectations

  - Extend the models of Baumeister and Hamilton (2019) and Aastveit, Bjørnland and Cross (2023)

- Study the pass-through and the importance of various global shocks for fluctuations in inflation and inflation expectations

- Use counterfactuals to

  - Analyze the role of expected inflation in transmitting these shocks to inflation across countries.

Introduction
ooooo●   Economic model
          oooo   Results
                      ooooooooooo   Conclusions and policy
                                     oooo   Extra
                                                 oooooo

What we find

- Both oil market shocks and supply chain pressures have been prominent drivers of the recent inflation surge

- In particular, economic activity shocks and oil consumption demand shocks, together with global supply chain shocks have contributed

- In a counterfactual exercise, we demonstrate that if oil prices had remained constant since the first quarter of 2021, actual inflation would have been 3-5 pp. lower than what was observed.

  - This effect is most pronounced in the EURO Area and the UK

- We show that inflation expectations is an important channel in the pass-through, in particular for global supply chain shocks

Introduction
oooooo

Economic model
●ooo

Results
ooooooooooo

Conclusions and policy
oooo

Extra
oooooo

Model and identification

Introduction
000000

Economic model
0●00

Results
00000000000

Conclusions and policy
0000

Extra
000000

Data

- Quarterly data for US, Euro Area, Norway and UK, 2002Q3-2023Q1

- Global oil market variables:

  1. Percentage change in global crude oil production (q_t)
  2. Percentage change in global real economic activity (y_t)
  3. percentage change in the global real price of oil (p_t)
  4. Observable change in above-ground crude oil inventories as a percent of the previous month's world production (i_t)

- Local block:

  1. Annualized inflation (π_t)
  2. Inflation expectations one year ahead (π_t^e)

- Global supply chain pressure index ($GSCPI_t$) by NYFED

Introduction
000000

Economic model
0000

Results
00000000000

Conclusions and policy
0000

Extra
000000

Economic Model

Model the interplay between global oil market fluctuations, supply chain variations, and their effects on expected and actual inflation, aiding in policymaking and forecasting.

- **Oil Market Block:** Examines the interaction between oil supply, global real economic activity, oil demand and inventory changes.

- **Inflation Block:** Differentiating between expected and actual inflation rates, and incorporates the influence of oil market shocks and supply chain pressures.

- **Global Supply Chain Block:** Focuses on the Global Supply Chain Pressure and its relation to the oil market and inflation.

Identification

The model employs a structural vector autoregression (SVAR), estimated with Bayesian techniques; Baumeister and Hamilton (2019) and Aastveit, Bjørnland and Cross (2023)

1. *Oil Supply Shock:* Decreases oil production and increases oil prices on impact.

2. *Economic Activity Shock:* Boosts oil production, industrial production, and oil prices on impact.

3. *Consumption Demand Shock:* Raises oil production and prices on impact.

4. *Inventory Demand Shock:* Increases oil stocks and prices on impact.

Additionally, we consider a *Supply Chain Pressure Shock* that elevates the GSCPI on impact.

1. How important are global shocks for driving inflation?

Introduction
oooooo

Economic model
oooo

Results
oo●ooooooooo

Conclusions and policy
oooo

Extra
oooooo

Effect of oil market shocks on inflation - US
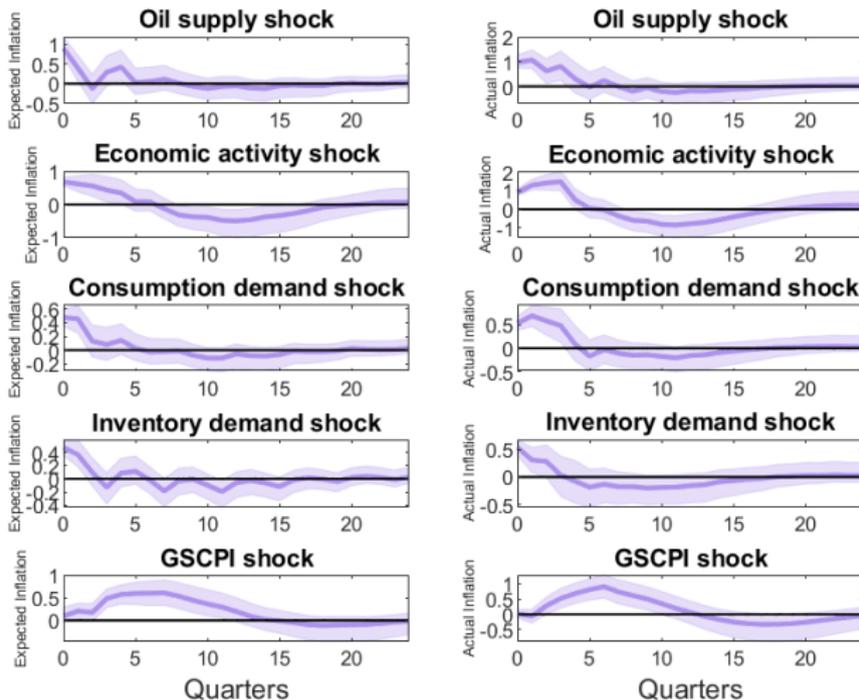
Effect of oil market shocks on inflation - Europe
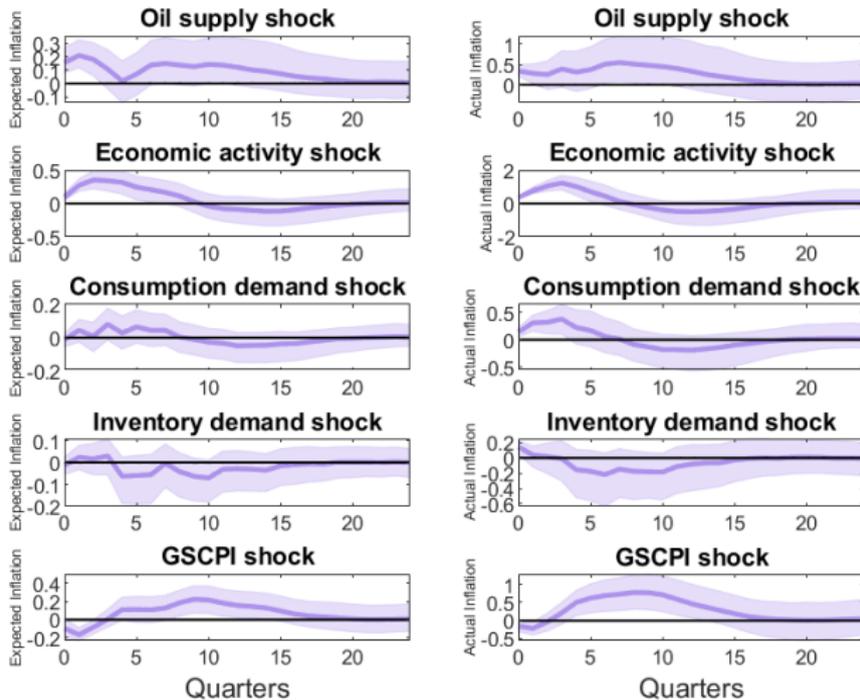
Historical decomposition of inflation
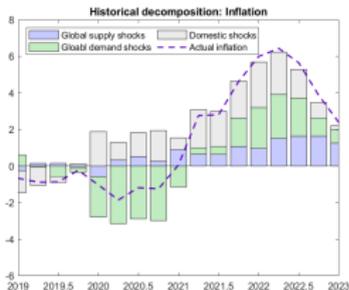

Figure: US
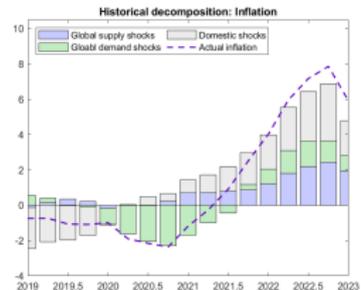
Figure: Europe
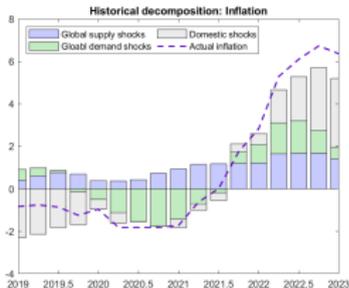
Figure: UK
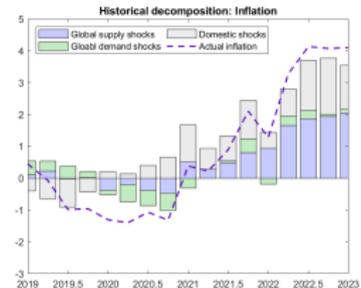
Figure: Norway

2. Does oil prices matter specifically for the recent hike in inflation?

A counterfactual exercise

- We perform a counterfactual exercise, holding the real price of oil constant through 2021Q1-2023Q3

  - Reconstruct IRFs holding the real price of oil constant at each impulse horizon, using a combination of the structural shocks

  - The counterfactual data series are then simulated using the counterfactual shocks in addition to the realized inflation shocks

- Any deviation between actual inflation and the counterfactual can be attributed to the indirect effect of inflation pass-through during this period

Counterfactual for inflation when holding oil price flat
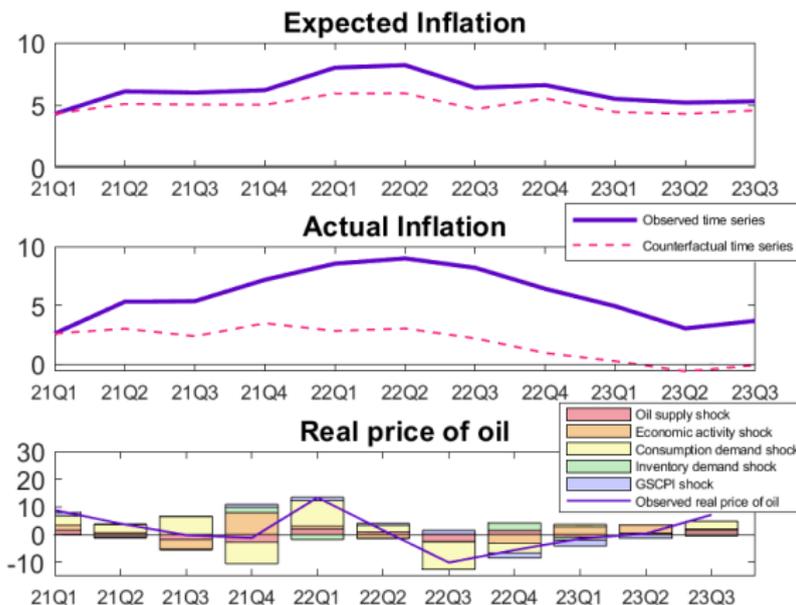
Figure: US

Counterfactual for inflation when holding oil price flat
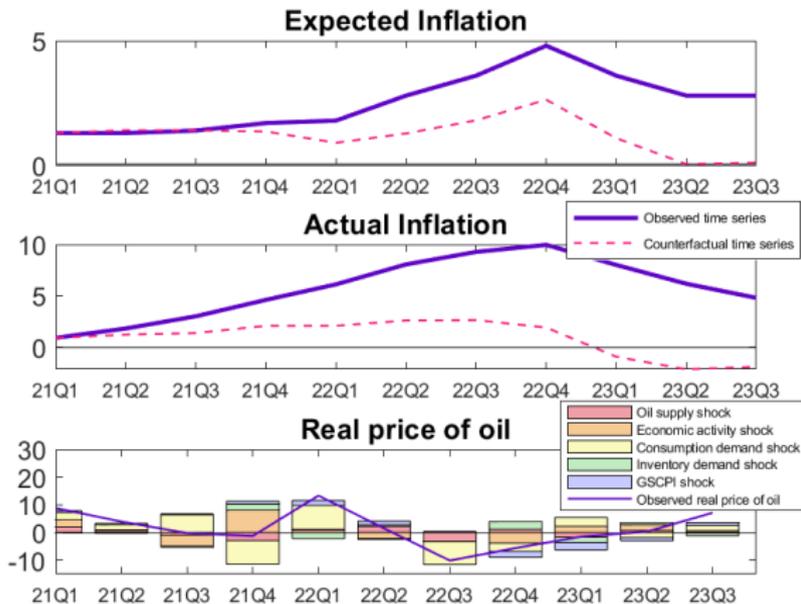
Figure: EU

Introduction
000000

Economic model
0000

Results
0000000000●00

Conclusions and policy
0000

Extra
000000

3. What is the role played by inflation expectations in amplifying the effects of global shocks on inflation?

Counterfactuals

- Consider a counterfactual in which inflation expectations are held constant during the impulse response analysis.

- This has the effect of isolating any increased inflation associated with shocks affecting the real oil price and global supply chain.

- Any observed difference between the inflationary effects in the actual and counterfactual impulse response functions must consequently be due to a propagation by inflation expectations.

The role of inflation expectations

Introduction
oooooo

Economic model
oooo

Results
ooooooooooo

Conclusions and policy
●ooo

Extra
oooooo
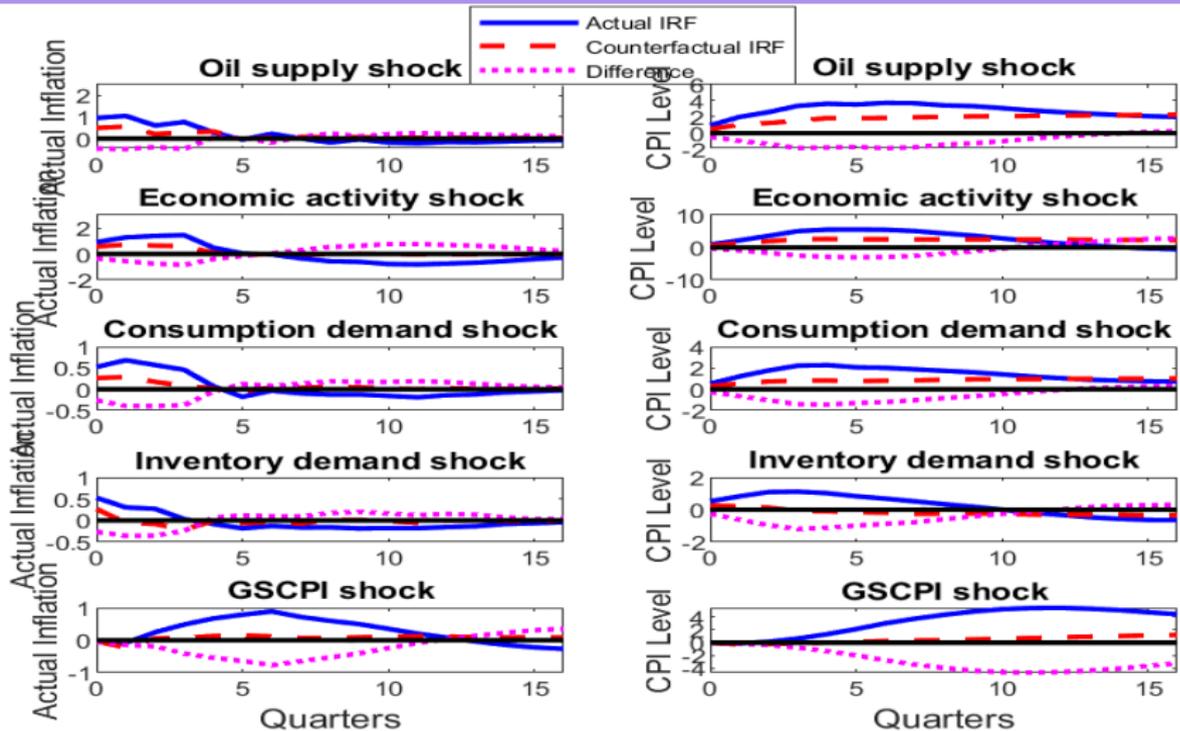
Conclusions and policy implications

Conclusions and policy implications I

Question: How important are global shocks for driving inflation?

1. Both global supply- and demand side factors have contributed significantly to the recent inflation surge in the four economies

2. US inflation has been the most impacted by demand side factors of the four countries.

3. From the counterfactual exercise, we find that inflation would have been 2-5 pp. lower than the current high inflation rates if oil prices had remained at the low levels in 2021Q1.

Conclusions and policy implications II

Question: What is the role played by inflation expectations in amplifying the effects of global shocks on inflation?

1. Holding inflation expectations constant after various shocks will, on average, reduce the CPI level by 1- 4 percent over the next three years

2. The largest impacts stems (by far) from GSPCI shocks.

3. Hence, inflation expectations are an important channel in the pass-through of real oil price and global supply chain increases into realized inflation.

4. Important for central banks to control inflation expectations

Thank you!

Extra material

SVAR Model

Oil market block

$$q_t = c_1 + \alpha_{qp}p_t + \mathbf{b}_1^{'}\mathbf{x}_{t-1} + u_{1t}^* \tag{1}$$

$$y_t = c_2 + \alpha_{yp}p_t + \mathbf{b}_2^{'}\mathbf{x}_{t-1} + u_{2t}^* \tag{2}$$

$$q_t = c_3 + \beta_{qp}p_t + \beta_{qy}y_t + i_t^* + \mathbf{b}_3^{'}\mathbf{x}_{t-1} + u_{3t}^* \tag{3}$$

$$i_t^* = c_4 + \psi_1^* q_t + \psi_2^* y_t + \psi_3^* p_t + \mathbf{b}_4^{'}\mathbf{x}_{t-1} + u_{4t}^* \tag{4}$$

$$i_t = \chi i_t^* + e_t \tag{5}$$

Inflation block

$$\pi_t^e = c_5 + \lambda_{\pi^e,q}q_t + \lambda_{\pi^e,y}y_t + \lambda_{\pi^e,p}p_t + \lambda_{\pi^e,\pi}\pi_t + \lambda_{\pi^e,GSCPI}\,GSCPI_t + \mathbf{b_5'x_{t-1}} + u_{5t} \tag{6}$$

$$\pi_t = c_6 + \gamma_{\pi,q}q_t + \gamma_{\pi,y}y_t + \gamma_{\pi,p}p_t + \gamma_{\pi,\pi^e}\pi_t^e + \gamma_{\pi,GSCPI}\,GSCPI_t + \mathbf{b_6'x_{t-1}} + u_{6t} \tag{7}$$

Global supply chain

$$GSCPI_t = c_7 + \delta_{GSC,q}q_t + \delta_{GSC,y}y_t + \delta_{GSC,p}p_t + \delta_{GSC,\pi^e}\pi_t^e + \delta_{GSC,\pi}\pi_t + \mathbf{b_7 x_{t-1}} + u_{7t} \tag{8}$$

Identification: Priors for oil market block (Baumeister and Hamilton, 2019)

| Parameter	Meaning	Location	Scale	Degrees of freedom	Skew	Sign restriction
Priors affecting contemporaneous coefficients **A**						
				Student t distribution		
α_{qp}	Oil supply elasticity	0.1	0.2	3	—	$\alpha_{qp} > 0$
α_{yp}	Effect of p on economic activity	−0.05	0.1	3	—	$\alpha_{yp} < 0$
β_{qy}	Income elasticity of oil demand	0.7	0.2	3	—	$\beta_{qy} > 0$
β_{qp}	Oil demand elasticity	−0.1	0.2	3	—	$\beta_{qp} < 0$
ψ_1	Effect of q on oil inventories	0	0.5	3	—	none
ψ_3	Effect of p on oil inventories	0	0.5	3	—	none

Identification: Priors for inflation block (Aastveit et al., 2023)

Parameter	Definition	Location	Scale	Degrees of freedom	Sign restriction
$\lambda_{\pi^e q}$	Effect of oil production on inflation expectations	-0.01	10	3	negative
$\lambda_{\pi^e y}$	Effect of real economic output on inflation expectations	0.01	10	3	positive
$\lambda_{\pi^e p}$	Effect of real price of oil on inflation expectations	0.02	1	3	positive
$\lambda_{\pi^e \pi}$	Effect of actual inflation on inflation expectations	0.55	1	3	positive
$\gamma_{\pi q}$	Effect of oil production on actual inflation	-0.01	10	3	negative
$\gamma_{\pi y}$	Effect of real economic activity on actual inflation	0.25	1	3	positive
$\gamma_{\pi p}$	Effect of real price of oil on actual inflation	0.04	1	3	positive
$\gamma_{\pi \pi^e}$	Effect of inflation expectations on actual inflation	1	1	3	positive

Priors and posteriors - Oil block
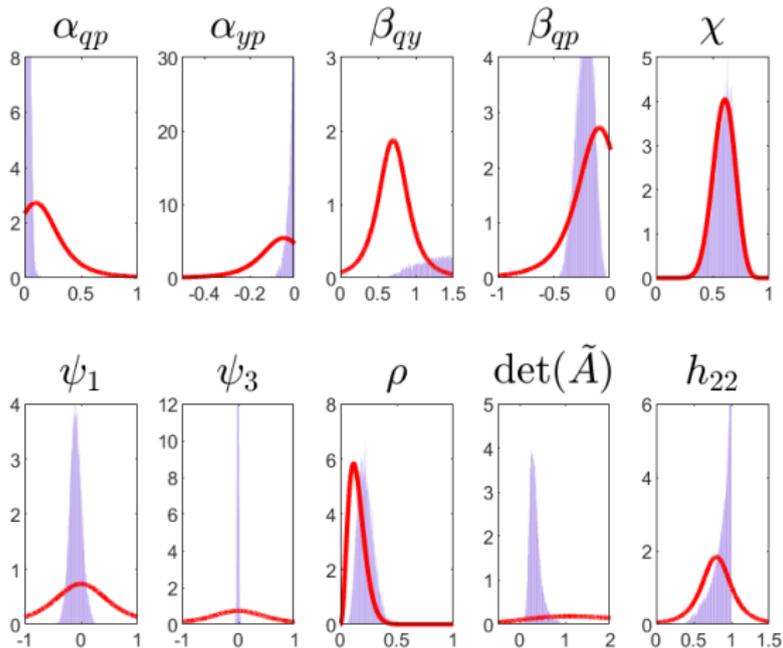
Priors and posteriors - Inflation and global supply chains