Commodity price shocks and macroeconomic dynamics

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Introduction

- Two thirds of developing countries count as commodity-dependent
- These countries are typically price takers
- Commodity prices are notoriously volatile
- As a result, commodity prices are often regarded as key drivers of business cycles in these countries

Some data

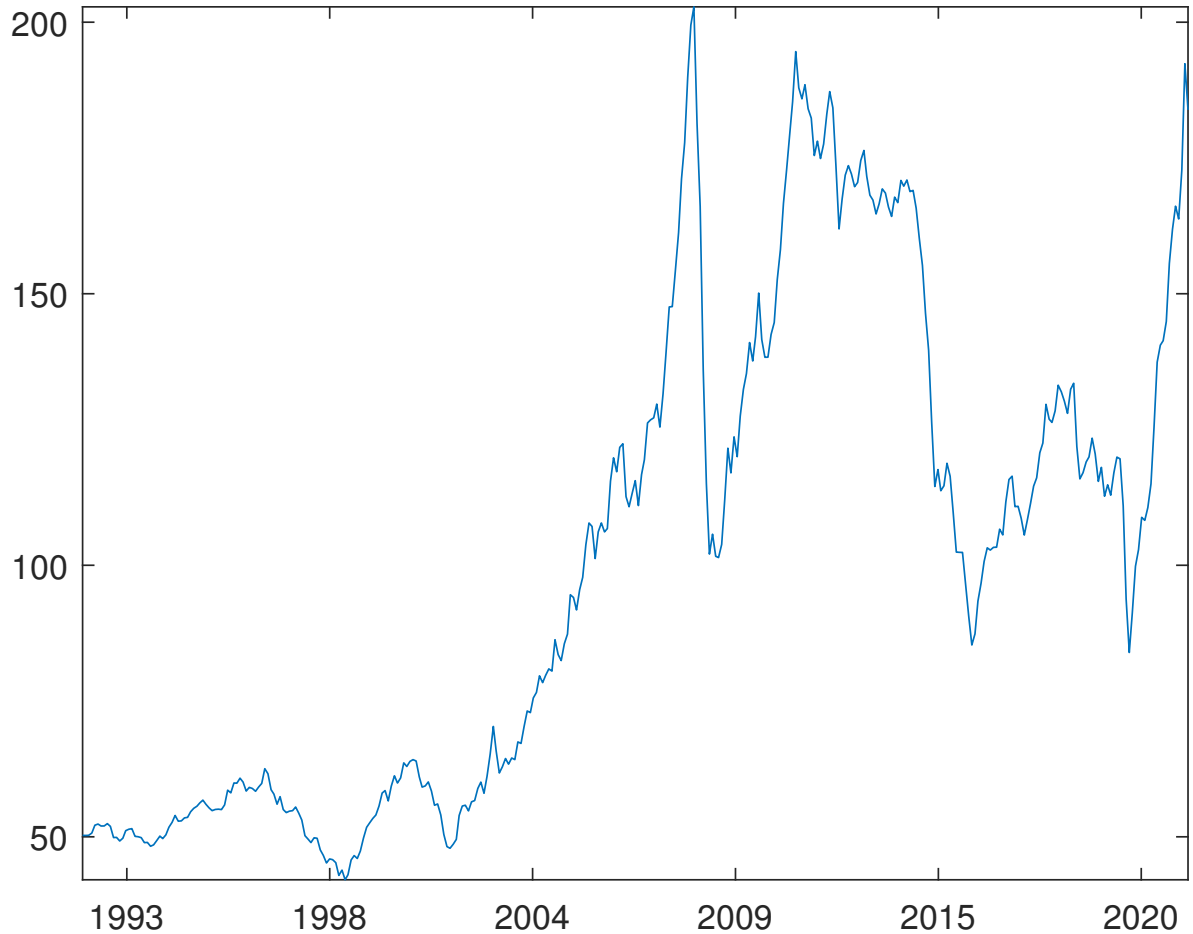


Figure: Raw commodity price series, 2016 = 100.

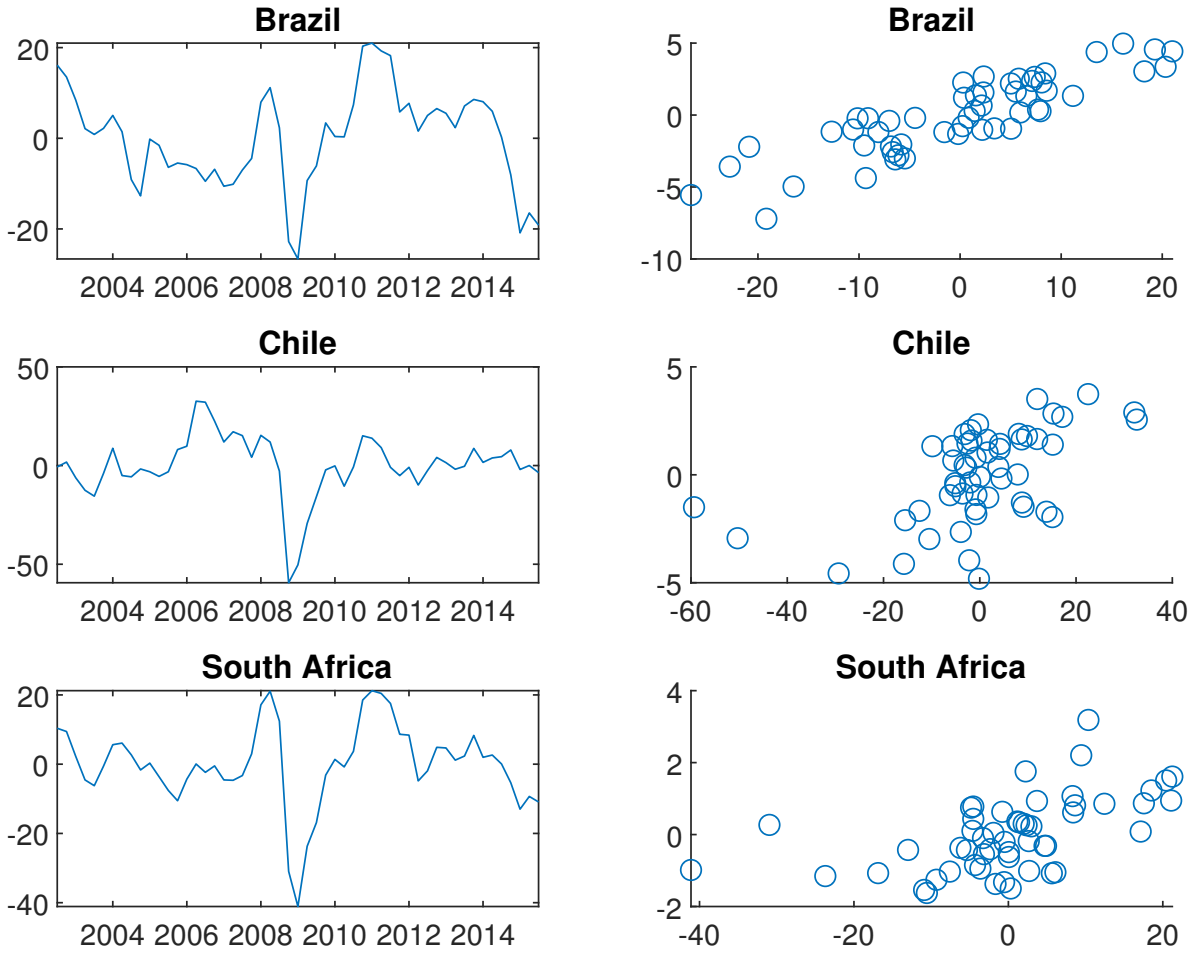


Figure: De-trended commodity prices and output

There is a growing literature on the role of commodity prices in developing countries that export these goods

We shed new light on this topic by focusing on

- the impact on nominal variables
- unemployment dynamics
- the role of monetary policy

The bulk of the literature has not considered all three aspects simultaneously

What are the effects of commodity price shocks and what explains the mechanism?

Our approach

We estimate a panel SVAR(2) to determine empirically the effects of a shock to commodity prices on a range of variables

We use a DSGE model in order to understand the mechanism through which the shock is transmitted across the economy

We set parameters to match the impulse responses (IRFs) implied by the DSGE model to those from the PSVAR

Time series evidence

We estimate

$$x_t = Ax_{t-1} + \Pi\epsilon_t \tag{1}$$

where

$$x_t = \begin{bmatrix} p^*_{2,t} \\ y_t \\ \pi_t \\ rer_t \\ ue_t \\ nx_t \\ R_t \end{bmatrix} \tag{2}$$

and impose

$$p^*_{2,t} = \rho_{2,1}p^*_{2,t-1} + \rho_{2,2}p^*_{2,t-2} + \pi_1\epsilon_{p2,t} \tag{3}$$

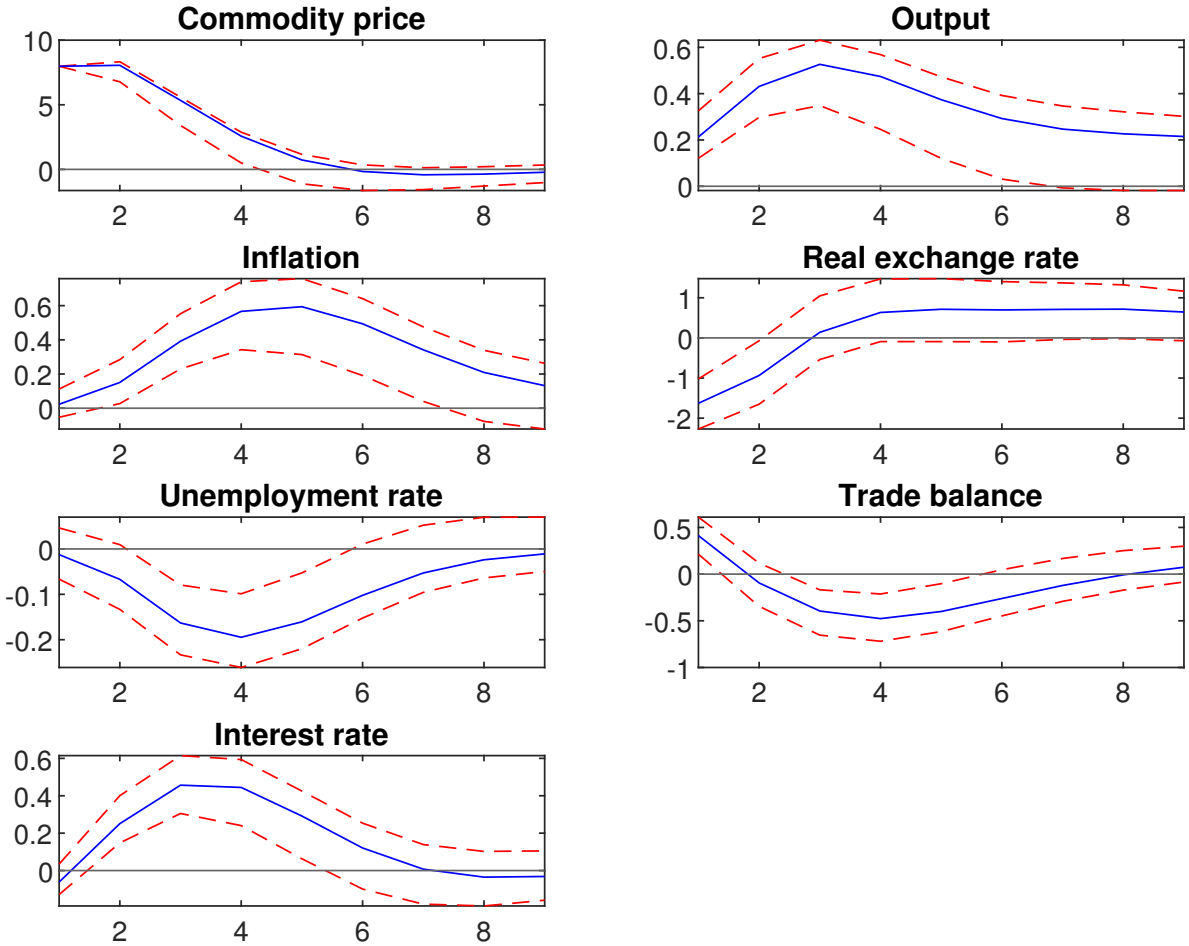


Figure: Impulse responses to one standard deviation commodity price shock (Brazil, Chile and South Africa, $2001Q3 - 2015Q3$)

Key features of model

Standard small open economy NK model extended to include

- Search and matching frictions in the labour market (Nash bargaining and hiring costs)
- Nominal frictions in the goods market
- Small open economy with a commodity sector (not imported; these are either exported or used as inputs)
- Imperfect exchange rate pass through; monopolistic competition in the retail sector

Key features of the model II

- Commodities enter the production function of the domestic wholesale sector
- The interest rate spread is sensitive to commodity prices
- Monetary policy responds to commodity prices (procyclically)

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho_r} \left[\left(\frac{\Pi_t}{\Pi}\right)^{\phi_\pi} \left(\frac{1+u_t}{1+u_{t-1}}\right)^{-\phi_u} \left(\frac{p^*_{2,t}}{p^*_2}\right)^{\phi_p}\right]^{(1-\rho_r)} \tag{4}$$

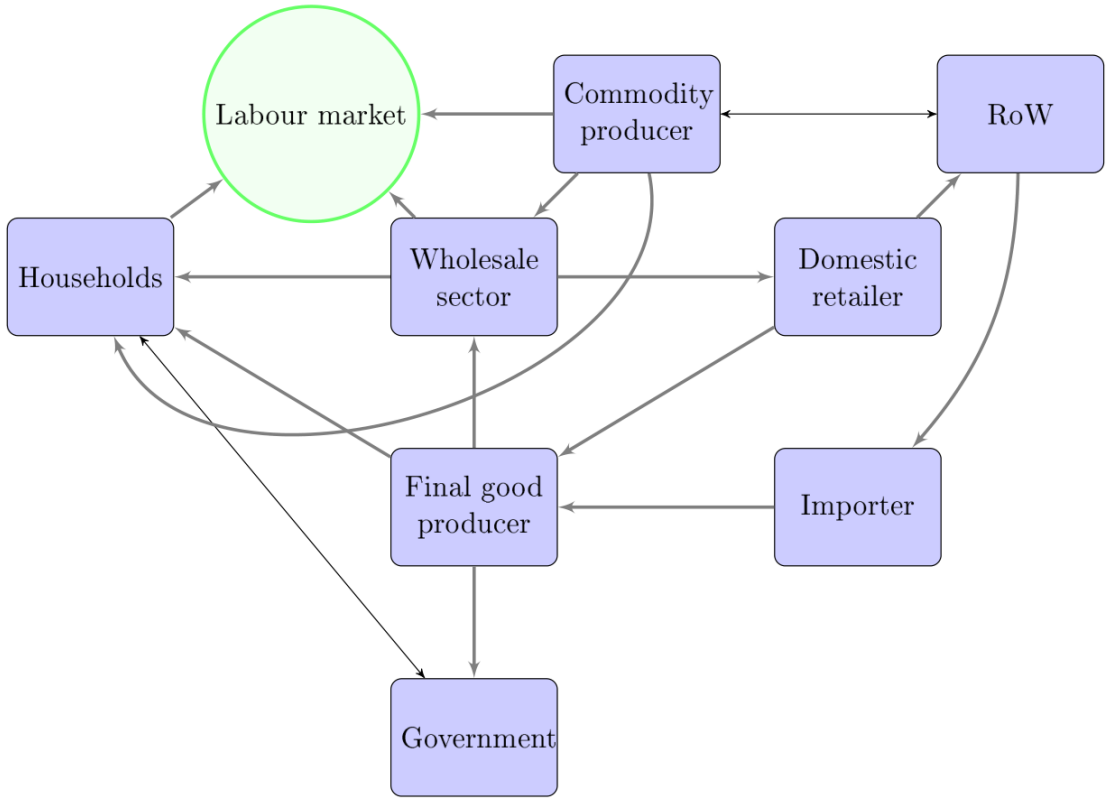


Figure: Main features of model

Reconciling the model to the SVAR

Previously estimated impulse responses are stacked in vector G

Model-implied impulse responses are stacked in vector $G(\Theta^c, \Theta^e)$

Ω represents the variance-covariance matrix of the impulse response functions

We place more weight on the IRFs that are more precisely estimated

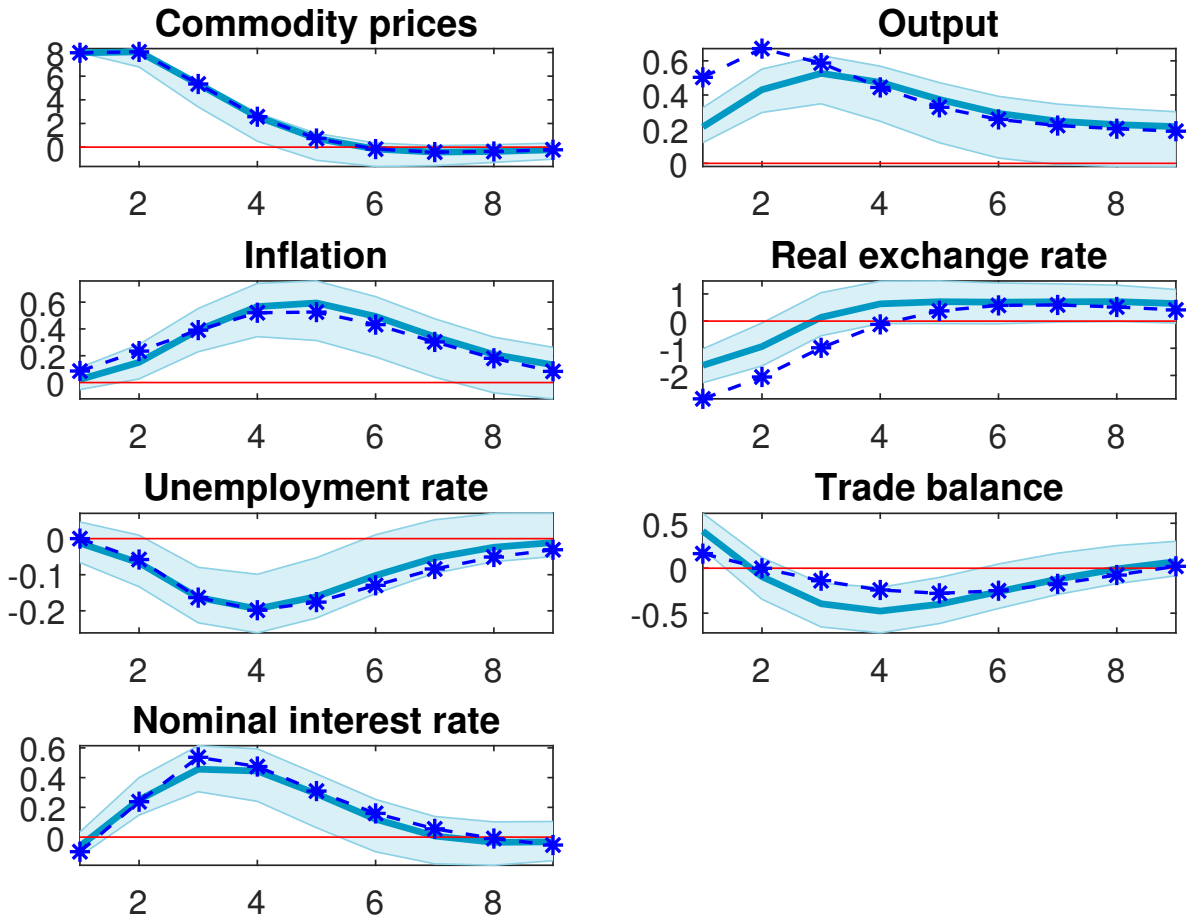
$$\hat{\Theta}^e = argmin_{\Theta^e}[G - G(\Theta^c, \Theta^e)]'\Omega^{-1}[G - G(\Theta^c, \Theta^e)]. \quad (5)$$

Parameter	Description	Value	s.e.
	Estimated parameters		
ρ_R	Interest rate rule persistence	0.09	0.01
ϕ_π	Interest rate rule (inflation)	1.05	0.01
ϕ_{p_2}	Interest rate rule (p_2^*)	-0.02	0.00
ϕ_y	Interest rate rule (unemployment)	0.58	0.01
ζ	Inflation indexation (retail)	0.77	0.00
ζ_f	Indexation (imports)	0.90	0.02
ϕ_1	Investment adjustment costs (wholesale)	3.29	0.07
ϕ_2	Investment adjustment costs (commodity)	0.17	0.00
$\xi_{p2,t}$	Sensitivity of spread to p_2	-0.19	0.00
χ	Int. rate premium elasticity	0.15	0.01

Reconciling the model to the SVAR

Parameter	Description	Value	s.e.
	Estimated parameters		
h	Habits	0.66	0.08
ρ	Job separation rate	0.12	0.00
γ	Household bargaining weight	0.35	0.01
ω	Calvo parameter (retail)	0.88	0.00
ω_f	Calvo parameter (imports)	0.95	0.00

Results


Commodity prices
Output
Inflation
Real exchange rate
Unemployment rate
Trade balance
Nominal interest rate

Inspecting the mechanism

For the model to explain the data all key features are essential

- The model suggests symptoms of the Dutch disease but its magnitude is ameliorated by monetary policy
- The commodity price shock raises the costs of producing domestic wholesale good, making it inflationary
- Without the decline in the interest rate spread, the real exchange rate response would be too small, making the shock highly expansionary

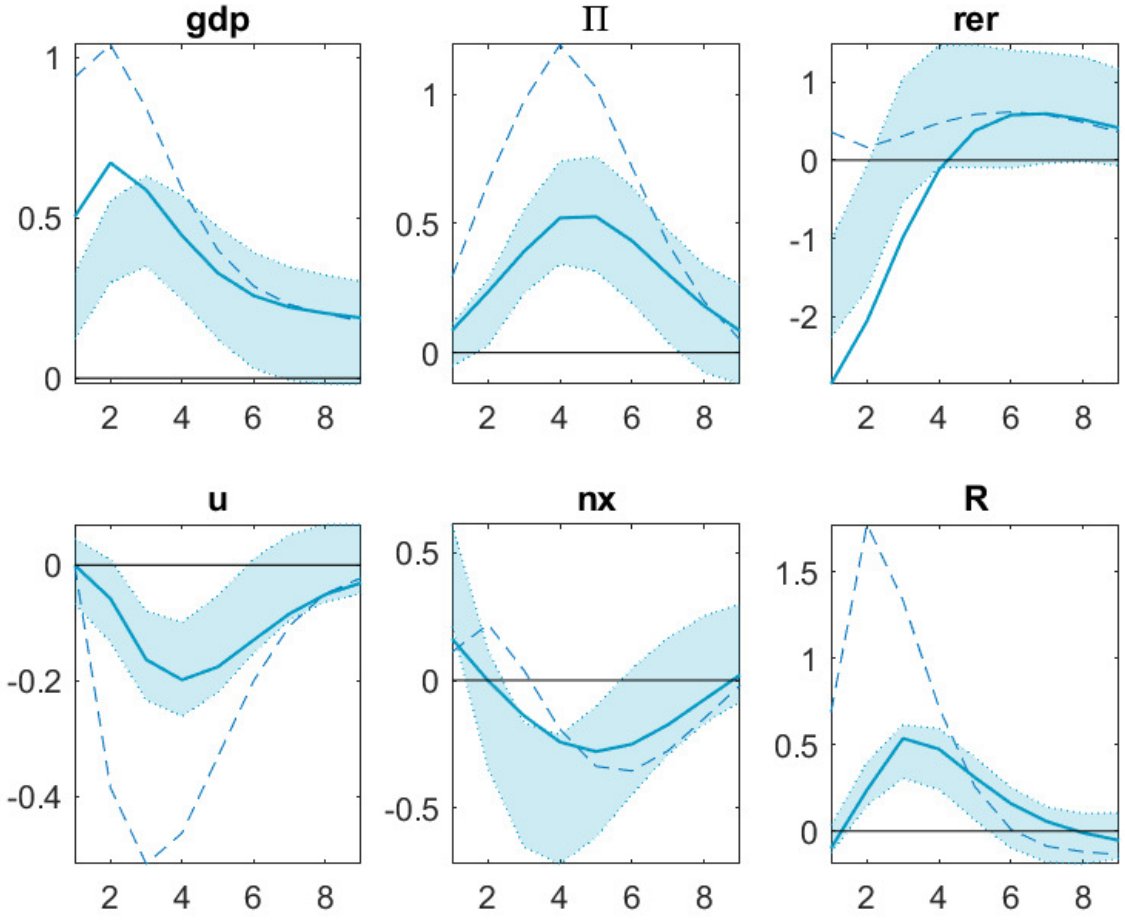


Figure: Shock to commodity prices for different values of $\xi_{p,2}$

$$\tilde{R}_t^* = R_t^* e^{-\chi rer_{t-1} \frac{b_{t-1}^*}{\bar{g}dp}} \left(\frac{p_{2,t}}{\bar{p}_2} \right)^{\xi_{p,2}} \tag{6}$$

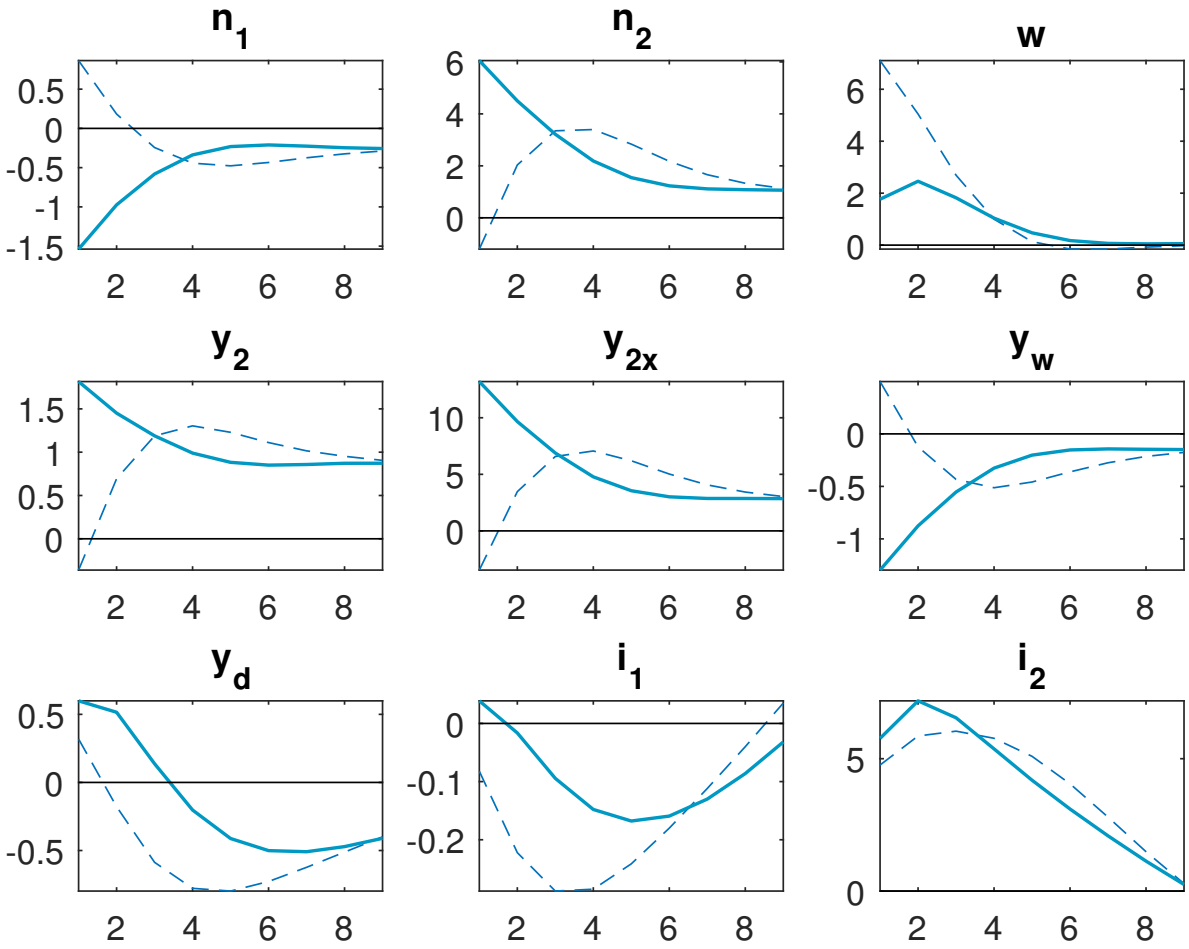
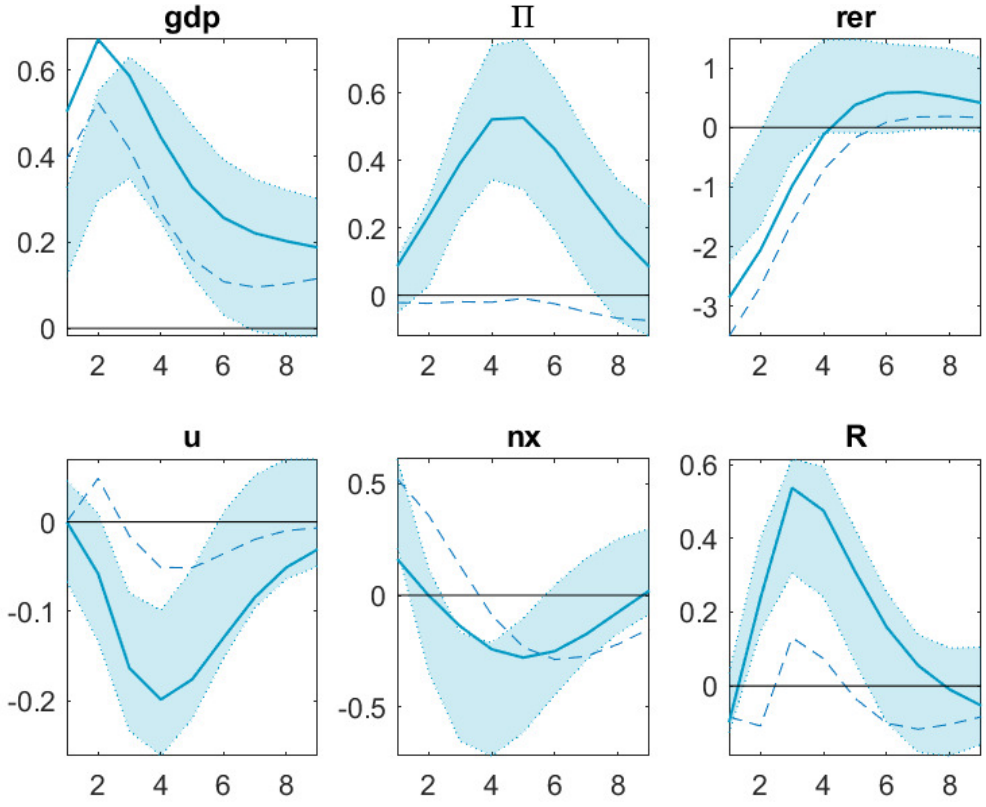


Figure: Effects of commodity price shock for different values of $\xi_{p,2}$ (benchmark and zero)



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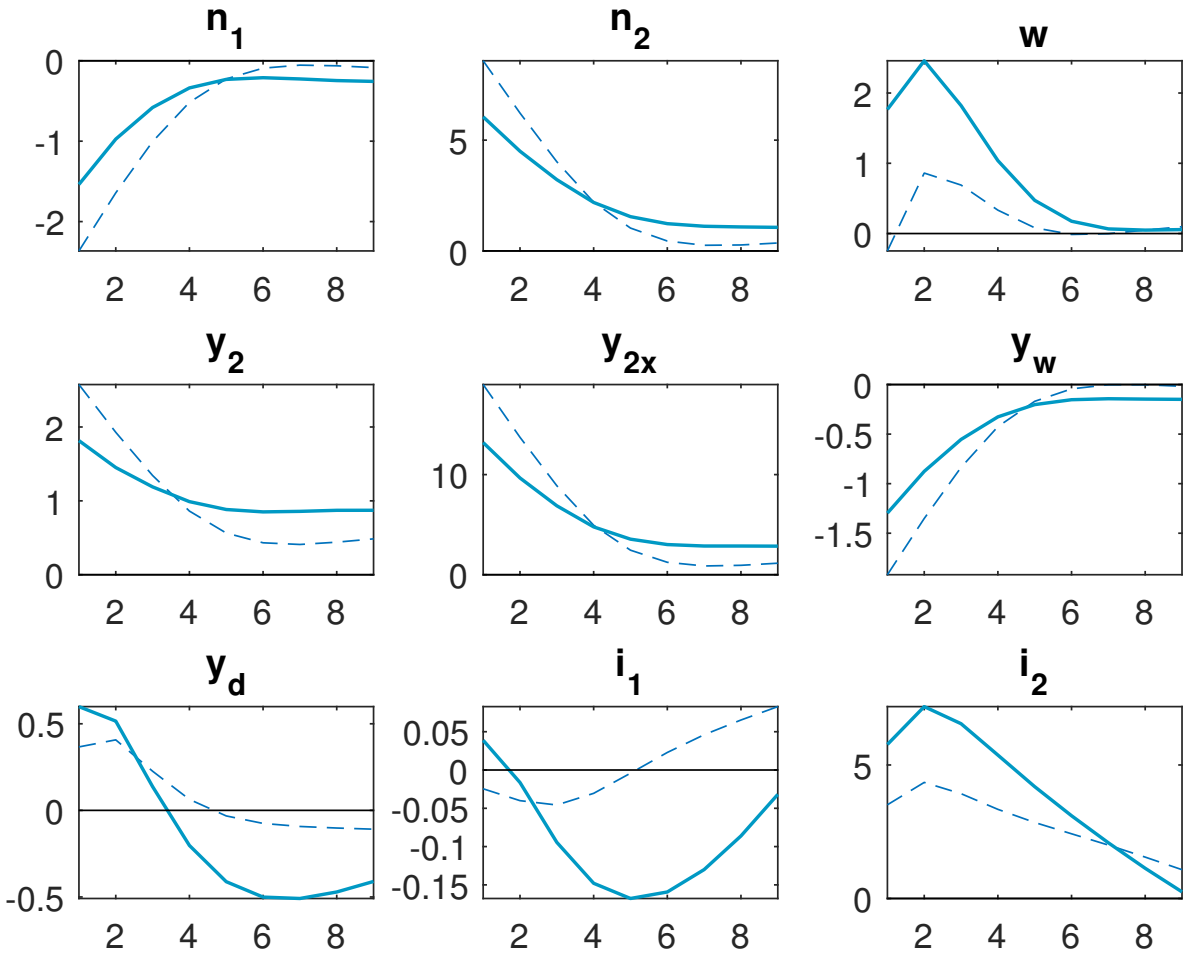

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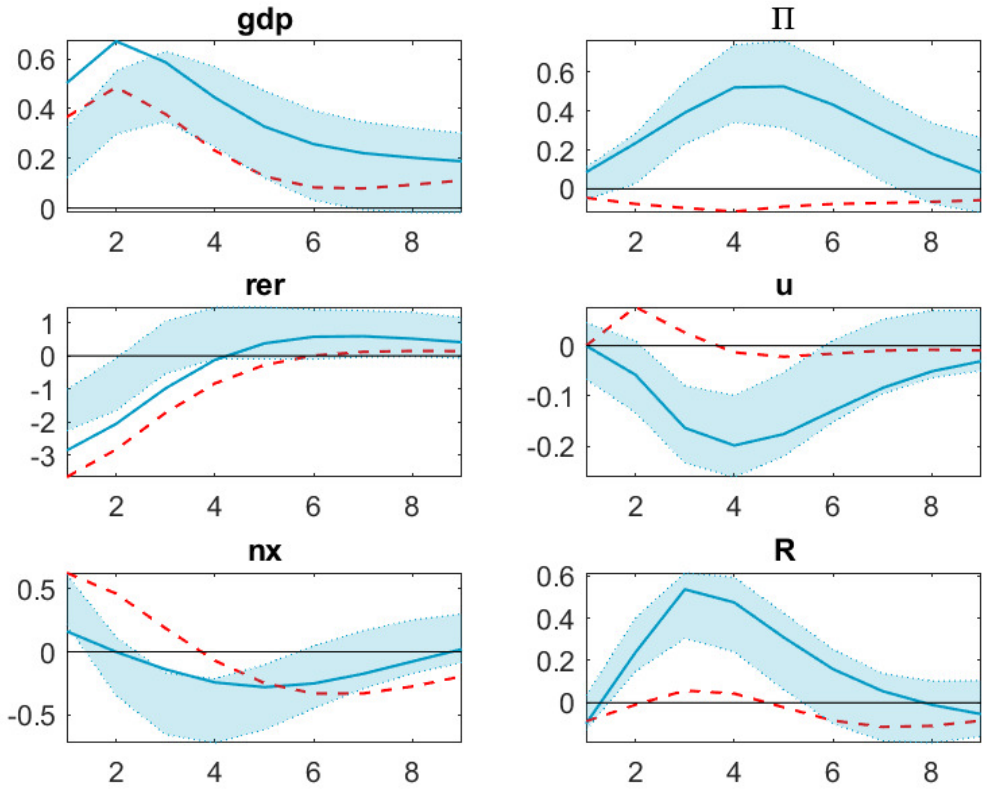
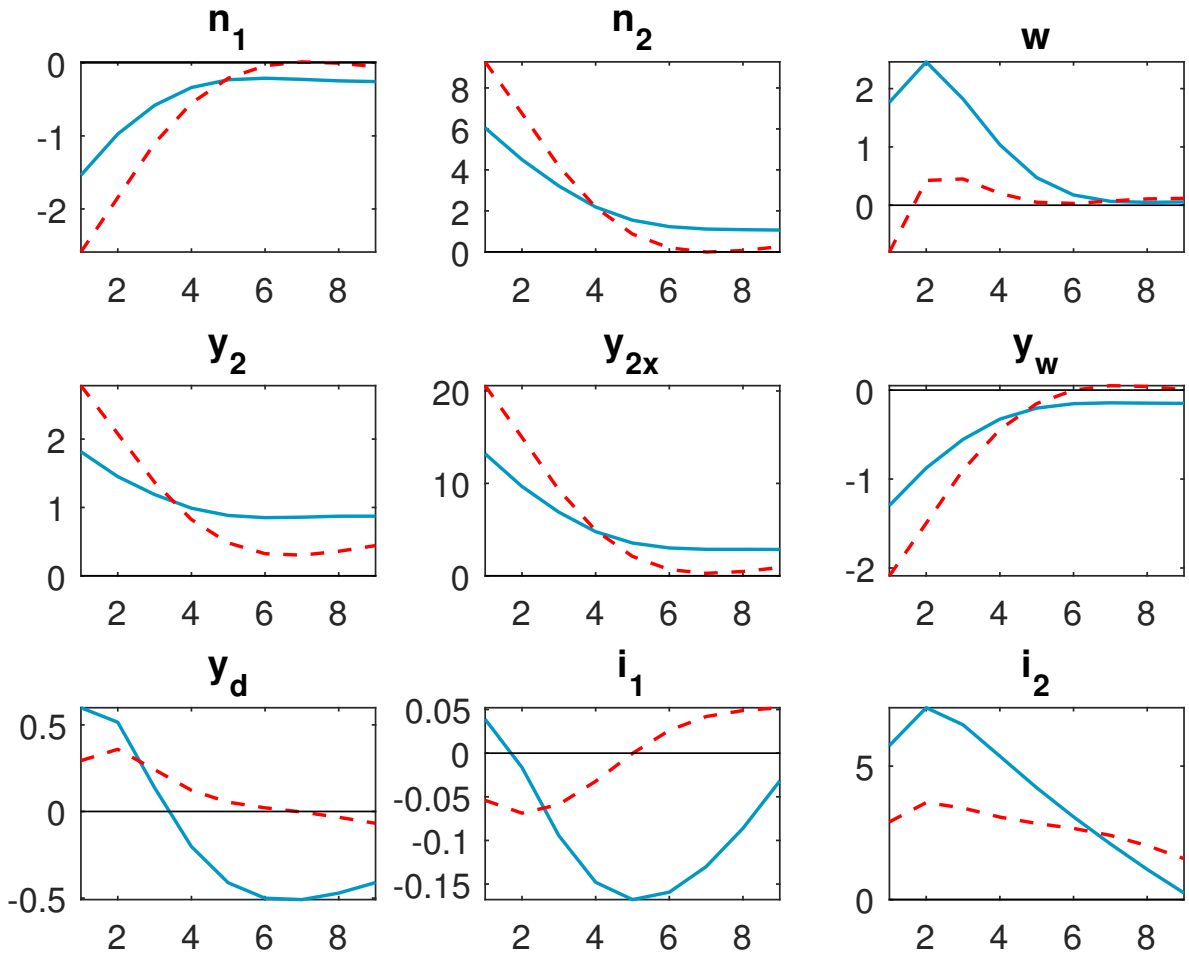


Figure: Effects of commodity price shock with a Taylor rule

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{\bar{R}}\right)^{0.7} \left[\left(\frac{\Pi_t}{\bar{\Pi}}\right)^{1.5} \left(\frac{gdp_t}{gdp}\right)^{0.125}\right]^{0.3} \tag{8}$$



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Conclusion I

Our DSGE model can explain the mechanics behind the impulse response functions to a commodity price shock

We include both labour market and nominal variables

We show that a DSGE model with S&M frictions in the labour market as well as nominal rigidities can explain the key dynamics of the estimated IRFs

Conclusion II

Excluding the latter omits an important channel

Magnitude of the Dutch disease is a policy choice: monetary policy is expansionary following a commodity price shock in order to limit the contraction in the domestic production sector