Evaluating Exchange Rate Regimes: a Natural Experiment?

Amol
Ashoka University

Constantino Hevia
Universidad Torcuato Di Tella

Juan Pablo Nicolini
FRB Minneapolis and Universidad Torcuato Di Tella

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Introduction

- We revisit the question of the **optimal exchange rate policy** in Small Open Economies (SOE).
- Old question: Friedman (1953) *"The case for flexible exchange rates"*:
  - Prices are sticky.
  - Let the exchange rate do the adjustment.
  - Spain and Portugal 2009-12.
- "Fear of Floating" in practice. Calvo and Reinhart (2002).

Introduction

- Want a model with realistic real exchange rate behavior.
- Focus on role of primary commodities in SOE.
- Primary commodity prices (PCP)
  - are particularly volatile and persistent
  - correlate with relevant variables (RER, output).
  - exogenous in SOE.
- Very simple model reproduces salient features of data.

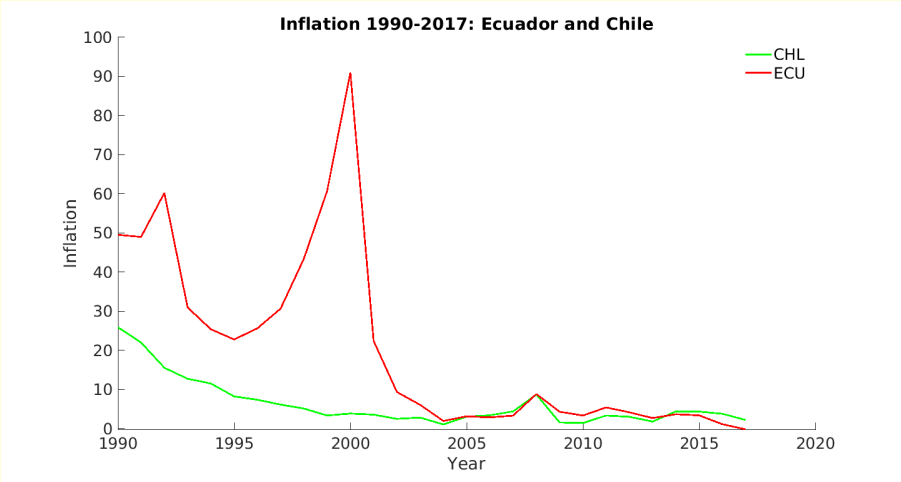
Introduction

- Study the interaction of
  - shocks to the terms of trade (PCP).
  - frictions in the setting of **both** prices and wages
- If only one friction, the nominal exchange rate movements fixes it.
- One example with rigid wages: Schmitt-Grohé and Uribe (2016).

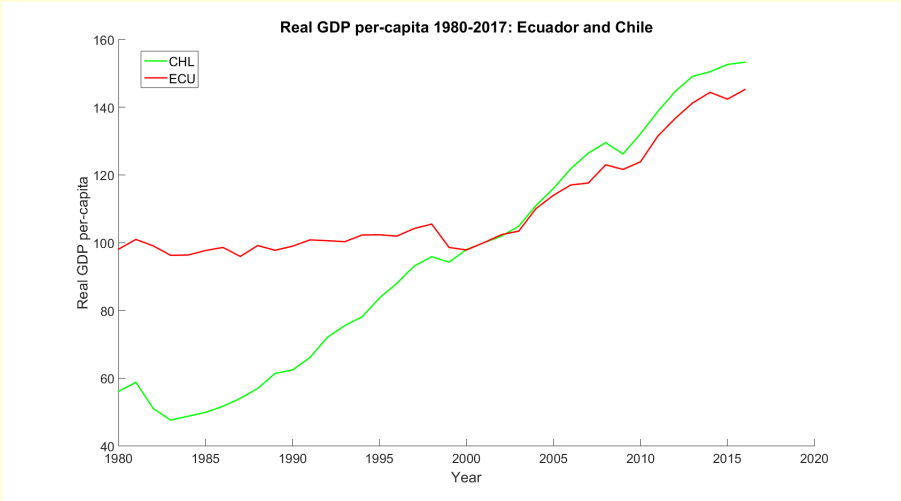
Introduction

- We use two paradigmatic examples.
  - Chile “floats” since 2001.
  - Ecuador “hard peg” also since 2001.
- In both countries exports of PC around 20% of GDP (over 80% copper in Chile and almost 50% oil in Ecuador).
- Almost a natural experiment?

Inflation in Chile and Ecuador



GDP per capita in Chile and Ecuador



Introduction

- We use Chilean data (floater) to calibrate the model.
- Simple NK model with Calvo-type frictions in prices and wages.
- Augmented with:
  - A sector that produces an exportable primary commodity.
  - Exogenous shocks to PC prices, and TFP.

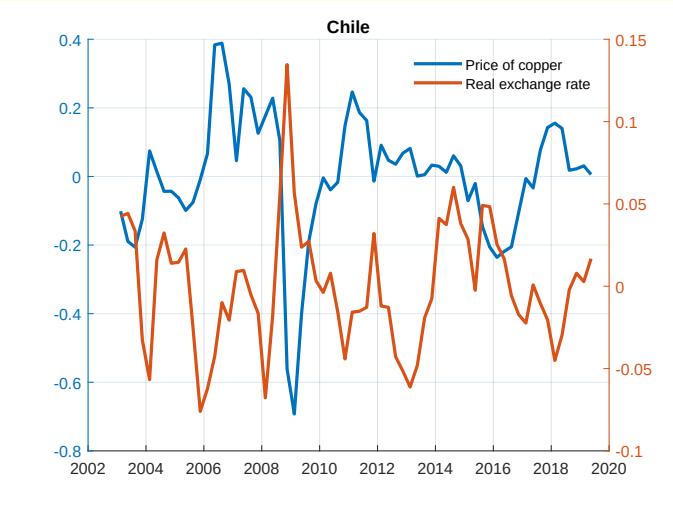
Introduction

- The model replicates key moments in the data.
- Some degree of “fear of floating” is optimal.
- The right amount of “fear” depends much on details.
- Fully floating dominates a hard peg, with welfare gain around 0.03 percentage points of lifetime consumption.
- The model ignores lack of commitment and assumes that the price level can be perfectly targeted.

Plan

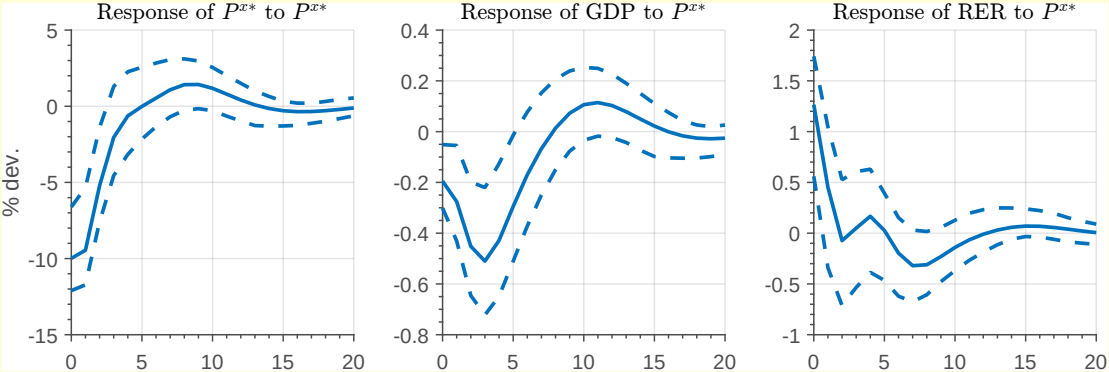
- Data for Chile.
- Model.
- Calibration and Simulations.
- Welfare Analysis.
- Data for Ecuador

Chile and copper



Note: Quarterly data. HP-filtered with a smoothing parameter of 1600. Correlation is -0.6.

Impulse response to negative shock to the price of copper



Note: VAR with price of copper in constant USD, real GDP, and real exchange rate. VAR identified using exogeneity of price of copper. Data are hp-filtered.

Model with flexible prices and financial autarky

- Labor only economy.
- Produces
  - a **traded** primary commodity using labor and an endowment (oil, land)
  - a **nontraded** final good using labor, the locally produced commodity and an imported input
- Preferences

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t) - h(n_t + l_t) \right]$$

- n_t is labor allocated to the final non-traded
- l_t is labor allocated to the primary commodity.

Final good technology

$$y_t = Z_t \left(n_t\right)^{\eta_1} \left(x_t\right)^{\eta_2} \left(m_t\right)^{\eta_3}$$

Thus

$$P_t = k \frac{1}{Z_t} \left(W_t\right)^{\eta_1} \left(P_t^x\right)^{\eta_2} \left(P_t^m\right)^{\eta_3}$$

Commodity sector

$$X_t = A_t \left(E\right)^{\phi} \left(l_t\right)^{(1-\phi)}$$

so

$$W_t = (1-\phi) P_t^x A_t \left(\frac{E}{l_t}\right)^{\phi}$$

Replacing on the price level

$$P_t = k' \frac{A_t^{\eta_1}}{Z_t} \left(\frac{E}{l_t}\right)^{\phi\eta_1} \left(P_t^x\right)^{\eta_1+\eta_2} \left(P_t^m\right)^{\eta_3}$$

- Law of one price

$$\begin{aligned} P_t^x &= S_t P_t^{x*} \\ P_t^m &= S_t P_t^{m*} \end{aligned}$$

- Then,

$$P_t = k' \frac{A_t^{\eta_1}}{Z_t} \left(\frac{E}{I_t} \right)^{\phi \eta_1} \left(S_t P_t^{x*} \right)^{\eta_1 + \eta_2} \left(S_t P_t^{m*} \right)^{\eta_3}$$

- or

$$P_t = P_t^{USA} S_t \left[k' \frac{A_t^{\eta_1}}{Z_t} \left(\frac{E}{I_t} \right)^{\phi \eta_1} \left(\frac{P_t^{x*}}{P_t^{USA}} \right)^{\eta_1 + \eta_2} \left(\frac{P_t^{m*}}{P_t^{USA}} \right)^{\eta_3} \right]$$

- If we let ζ_t be the real exchange rate:

$$\zeta_t = \frac{P_t^{USA} S_t}{P_t} = \frac{1}{MC_t^*}$$

where

$$MC_t^* = \left[k' \frac{A_t^{\eta_1}}{Z_t} \left(\frac{E}{I_t} \right)^{\phi\eta_1} \left(\frac{P_t^{x*}}{P_t^{USA}} \right)^{\eta_1+\eta_2} \left(\frac{P_t^{m*}}{P_t^{USA}} \right)^{\eta_3} \right]$$

is the marginal cost in constant USD.

Quantitative Model

- Add Calvo frictions in prices and wages.
- Accumulation of foreign liabilities:

$$\frac{D_{t+1}}{1+r_t} - D_t + P_t^{x*}\left(X_t - x_t\right) - P_t^{z*} z_t = 0.$$

Numerical experiments

- We abstract from implementation.
- Monetary policy can set a nominal variable.
- Given the frictions, natural policy to considers trades-off P_t vs W_t.
- Will consider a policy that trades off P_t versus S_t
  - Chile targets nominal prices: inflation targeting.
  - Ecuador: dollarization equivalent to a fixed exchange rate regime.

“Fear of floating” policy

- Recall that

$$P_t = \frac{\theta_p}{\theta_p - 1} S_t MC_t^*$$

- Policy of the form

$$\log\left(\frac{S_{t+1}}{S_t}\right) = -\nu \log\left(\frac{MC_{t+1}^*}{MC_t^*}\right).$$

- $\nu = 0$ is a peg.
- $\nu = 1$ is pure inflation targeting.
- $0 < \nu < 1$ is “fear of floating”.

Calibration

- Preferences of the form

$$U(C_t, L_t) = \frac{C_t^{1-\gamma} - 1}{1-\gamma} - \varphi \frac{\left(\bar{L} - L_t\right)^{1+\psi}}{1+\psi}.$$

- Elasticity of labor supply: $\psi = 3$.
- Fraction of the workforce in commodity sector is 5%.
- Share parameters in final goods: $\eta_1 = 0.03$, $\eta_2 = 0.24$, $\eta_3 = 0.73$.
- Commodity production: elasticity of substitution $\omega = 0.15$.
- Process for commodity prices P_t^{x*}. Volatility = 0.14, persistence = 0.97.
- Price stickiness parameters:
  - $\alpha^p = 0.5$
  - $\alpha^w = 0.75$

Baseline parameters

Parameter	Description	Value
β	Discount factor (utility, annualized)	0.96
γ	Risk aversion (utility)	2
ψ	Exponent leisure (utility)	3
ω	Elasticity of substitution in commodity technology	0.15
ρ	Share of labor in commodities technology	0.10
η_1	Share of home commodity in final goods	0.03
η_2	Share of foreign commodity in final goods	0.24
η_3	Share of labor in final goods	0.73
α^p	Calvo parameter prices	0.50
α_w	Calvo parameter wages	0.75
θ_p	Elasticity of subst. intermediate varieties	6
θ^w	Elasticity of subst. labor varieties	6
ρ_x	Coefficient on lagged value home commodity price	0.97
σ_x	Standard deviation shock to home commodity price	0.14

Moments Chile and Inflation targeting

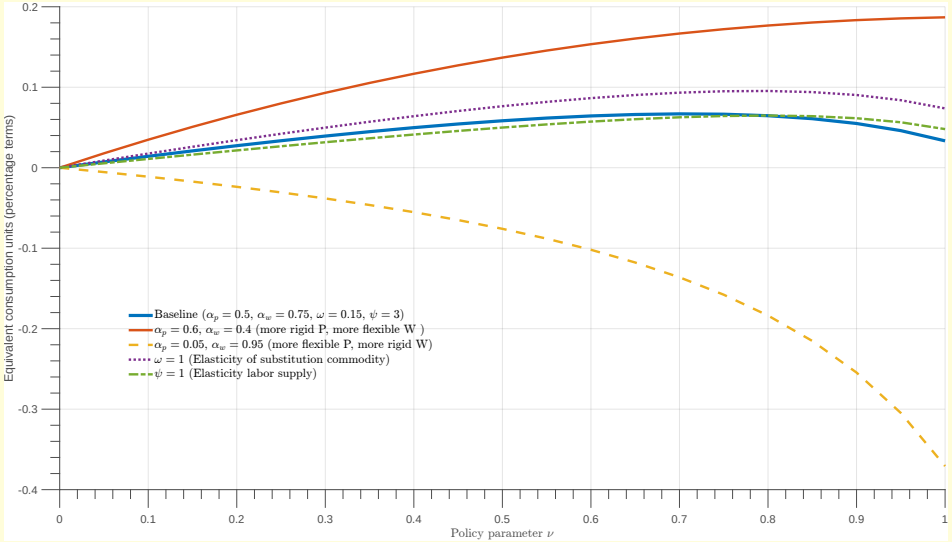
	Chile	Model
std(GDP)	1.6	1.6
std(p^{x*})	18.4	18.4
std(RER)	5.5	6.8
corr(RER,p^{x*})	-0.75	-0.83
corr(RER,GDP)	-0.46	0.20
corr(GDP,p^{x*})	0.56	0.29

Data and model are HP-filtered with a smoothing parameter of 1600.

Welfare analysis

- Compute the welfare gain relative to a peg by moving the “fear of floating” parameter ν.
- Simulate model with all shocks
- Baseline economy
- Economies with different degrees of price stickiness and elasticities.

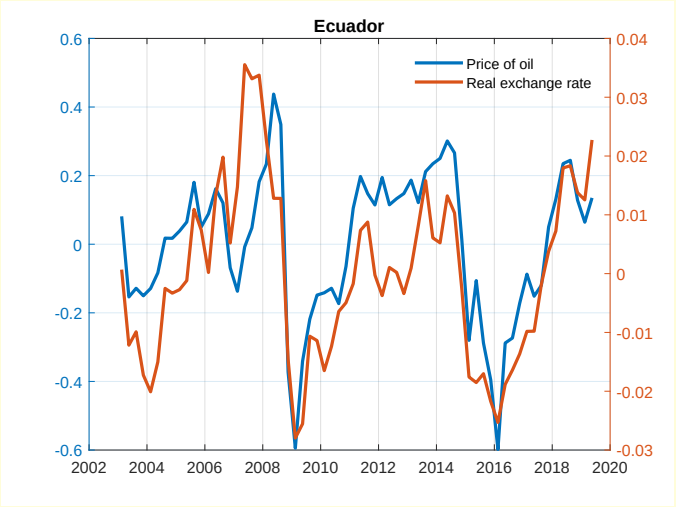
Welfare gain over hard peg ($\nu = 0$)



Welfare analysis

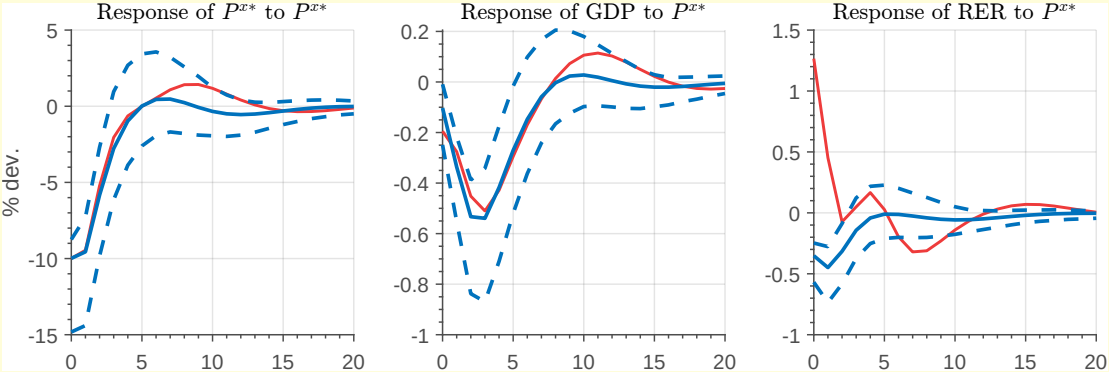
- Some degree of “fear of floating” is optimal.
- The exact amount is sensitive to details.
- Pure inflation targeting dominates a peg unless wages are extremely rigid.

Ecuador



Note: Quarterly data. HP-filtered with a smoothing parameter of 1600. Correlation is 0.9 for multi and 0.76 for bilateral

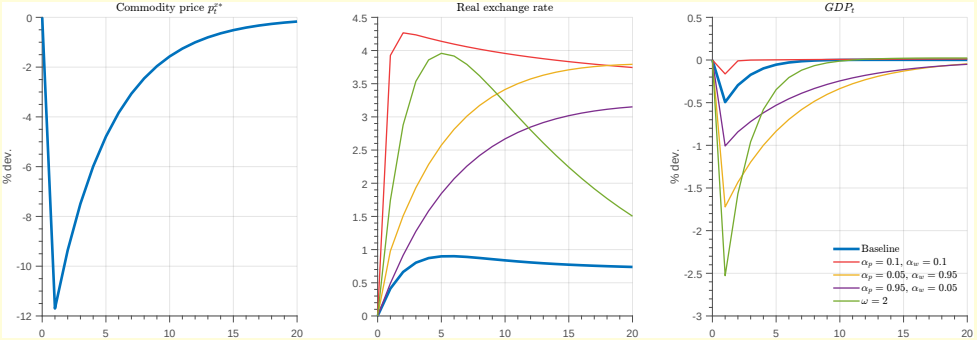
Ecuador: impulse response to negative oil price shock



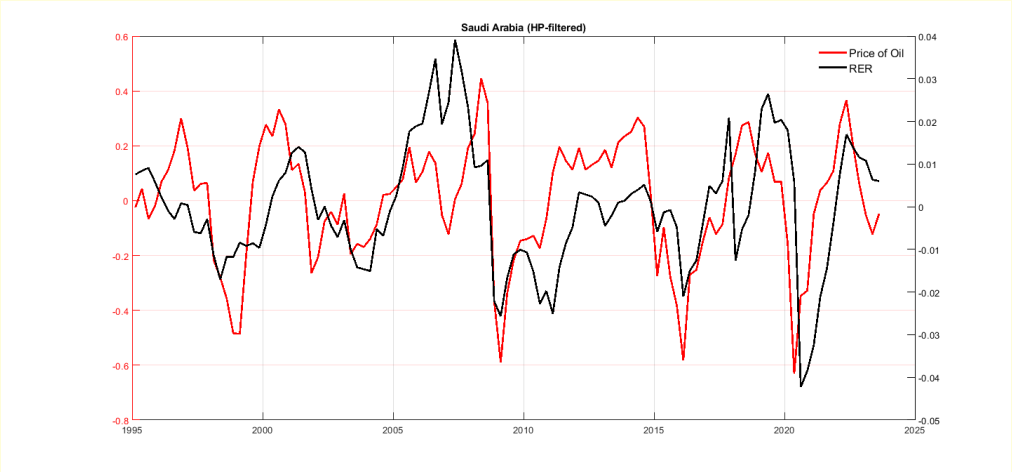
Note: VAR with oil price in constant USD, real GDP, and real exchange rate. VAR identified using exogeneity of oil price. Data is hp-filterd. In red, Chile's impulse response.

Price and wage stickiness don’t do the job!

- Impulse response under a peg for different degrees of stickiness.

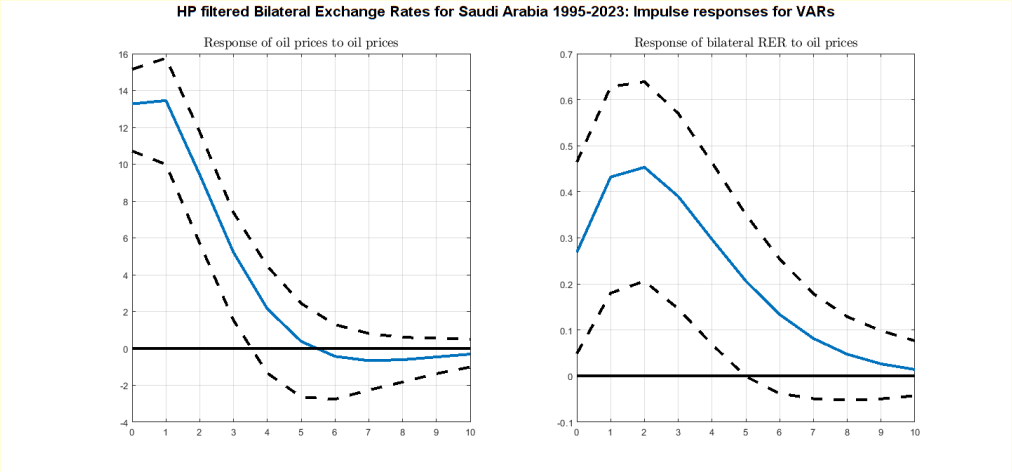


Other Peg: Saudi Arabia and oil



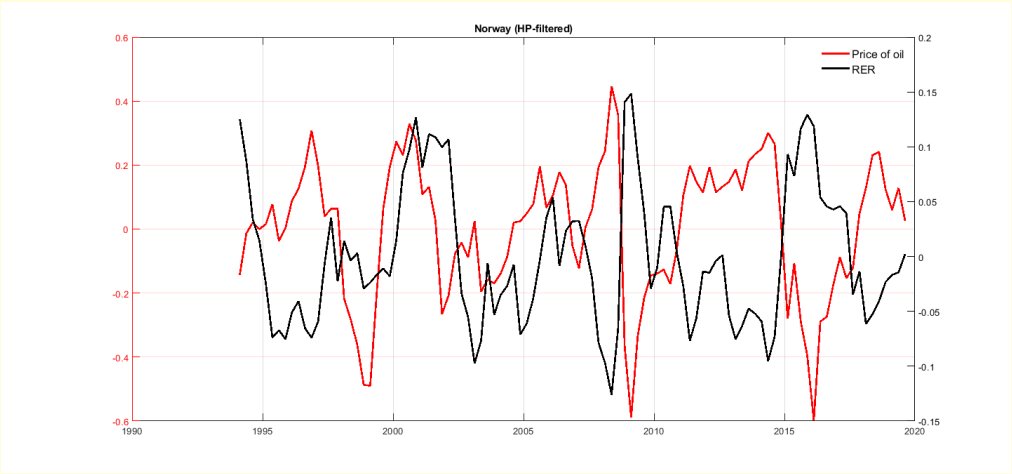
Note: Quarterly data. HP-filtered with a smoothing parameter of 1600. Correlation is 0.46.

Impulse response to positive shock to the price of oil



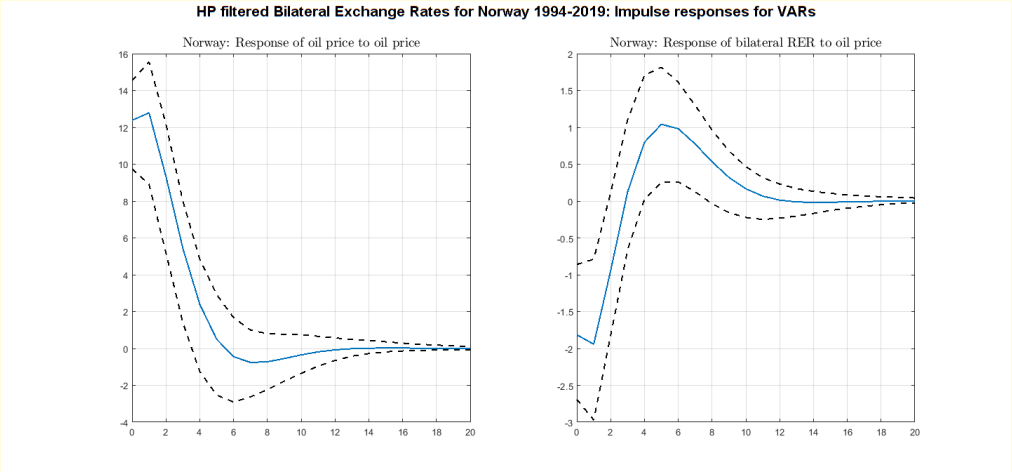
Note: VAR with price of oil in constant USD, and real exchange rate. VAR identified using exogeneity of price of oil. Data are hp-filtered.

Other floater: Norway and oil



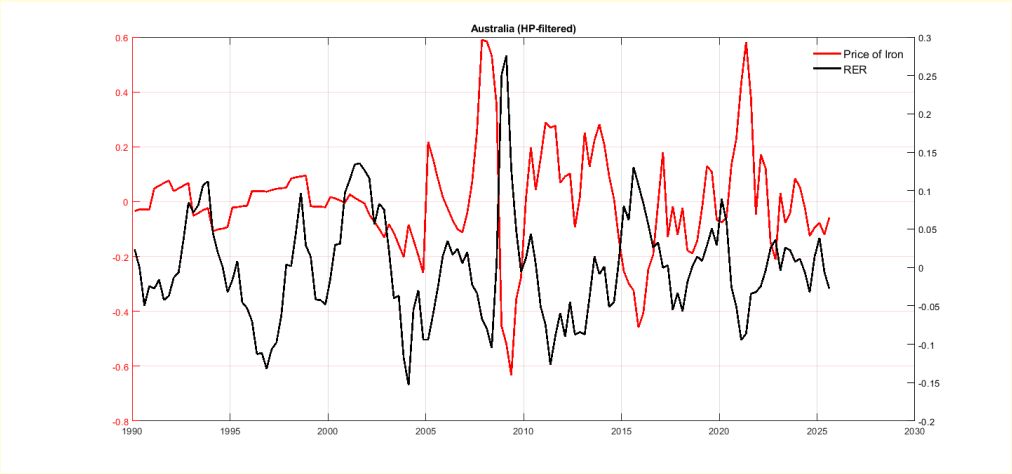
Note: Quarterly data. HP-filtered with a smoothing parameter of 1600. Correlation is -0.5.

Impulse response to positive shock to the price of oil



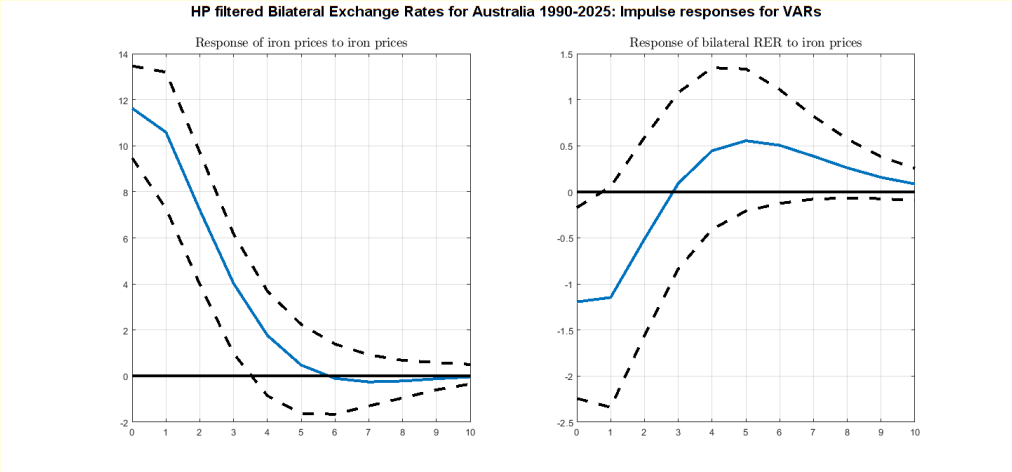
Note: VAR with price of oil in constant USD, and real exchange rate. VAR identified using exogeneity of price of oil. Data are hp-filtered.

What about Australia and iron?



Note: Quarterly data. HP-filtered with a smoothing parameter of 1600. Correlation is -0.5.

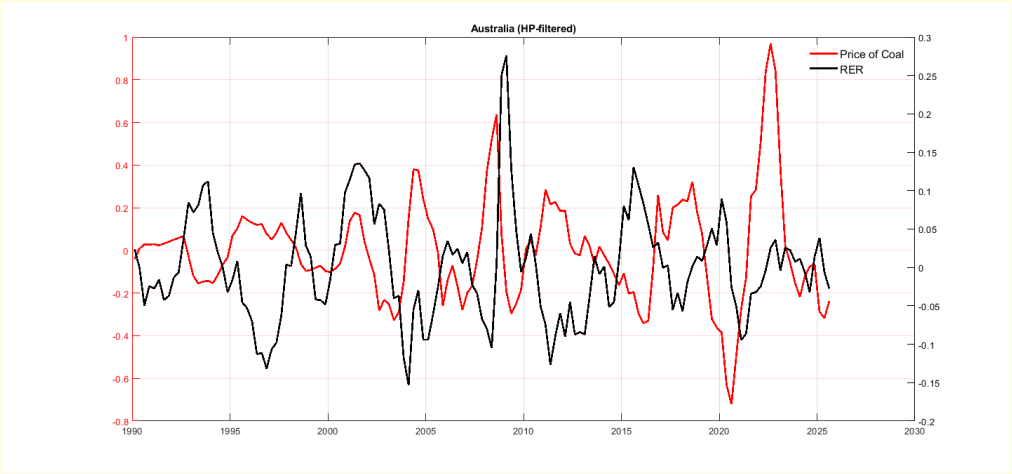
Impulse response to positive shock to the price of iron



Note: VAR with price of iron in constant USD, and real exchange rate. VAR identified using exogeneity of price of iron. Data are hp-filtered.

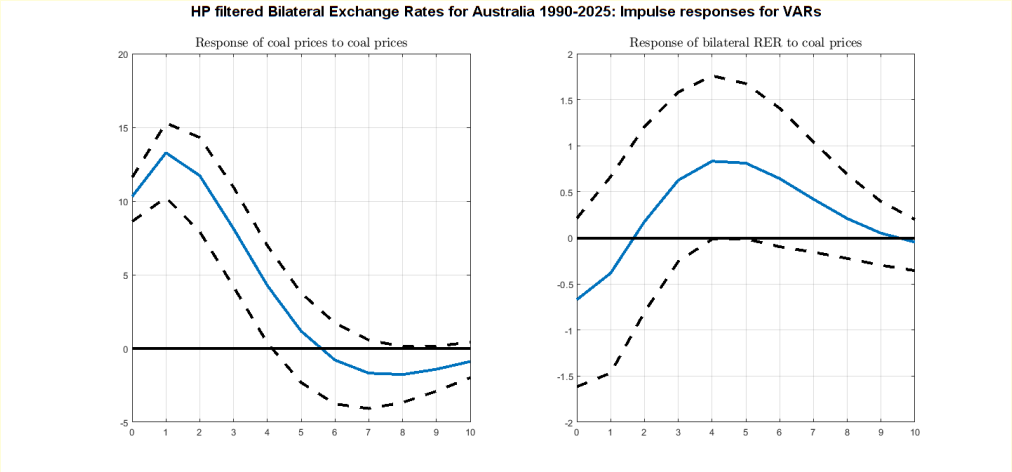
THANKS!

Australia and coal



Note: Quarterly data. HP-filtered with a smoothing parameter of 1600. Correlation is 0.32.

Impulse response to positive shock to the price of coal



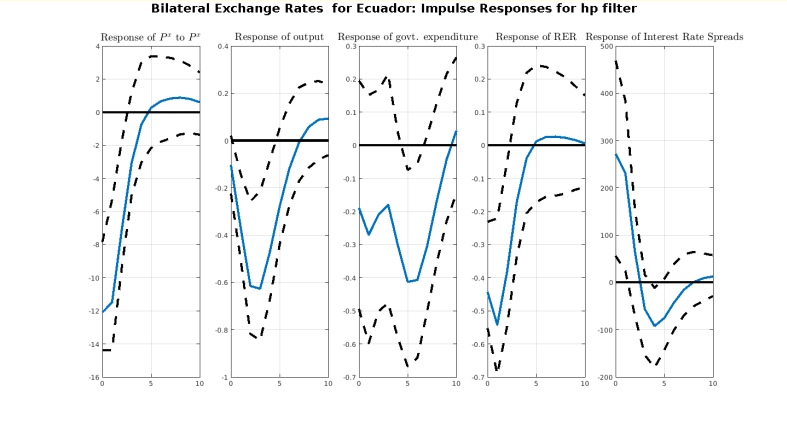
Note: VAR with price of coal in constant USD, and real exchange rate. VAR identified using exogeneity of price of iron. Data are hp-filtered.

Moments Ecuador and fixed exchange rate

	Ecuador	Model (only p^{x*})
std(p^{x*})	21.5	21.4
std(GDP)	1.8	3.1
std(RER)	1.5	6.4
corr(RER,p^{x*})	0.76	-0.74
corr(RER,GDP)	0.30	-0.26
corr(GDP,p^{x*})	0.47	0.83

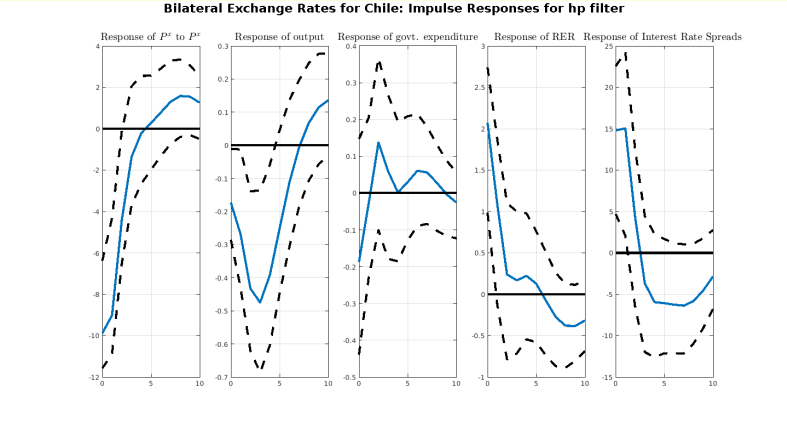
Data and model are HP-filtered with a smoothing parameter of 1600.

Ecuador: impulse response to negative oil price shock



Note: VAR with oil price in constant USD, real GDP, real exchange rate, government expenditures, and soverign spread. VAR identified using exogeneity of oil price. Data is hp-filtered.

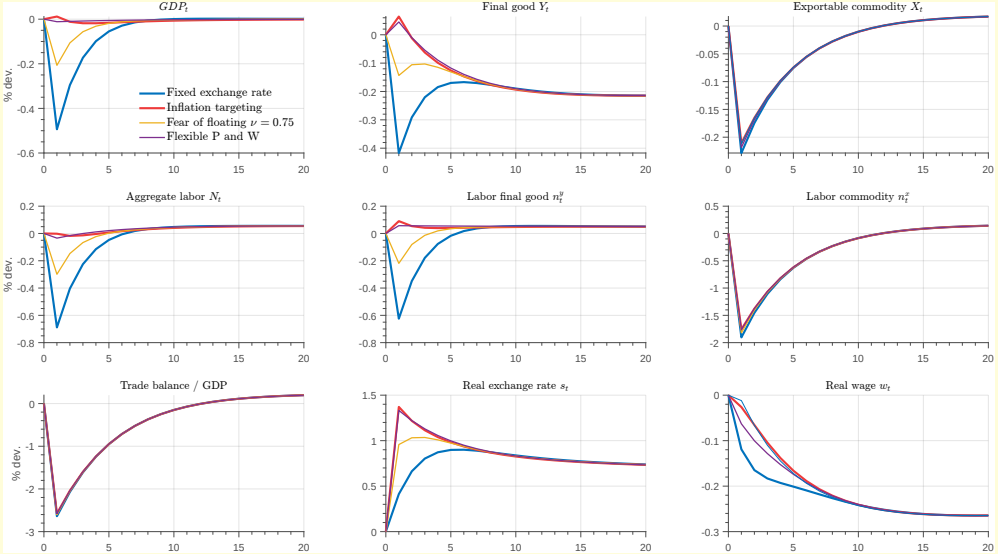
Chile: impulse response to negative copper price shock



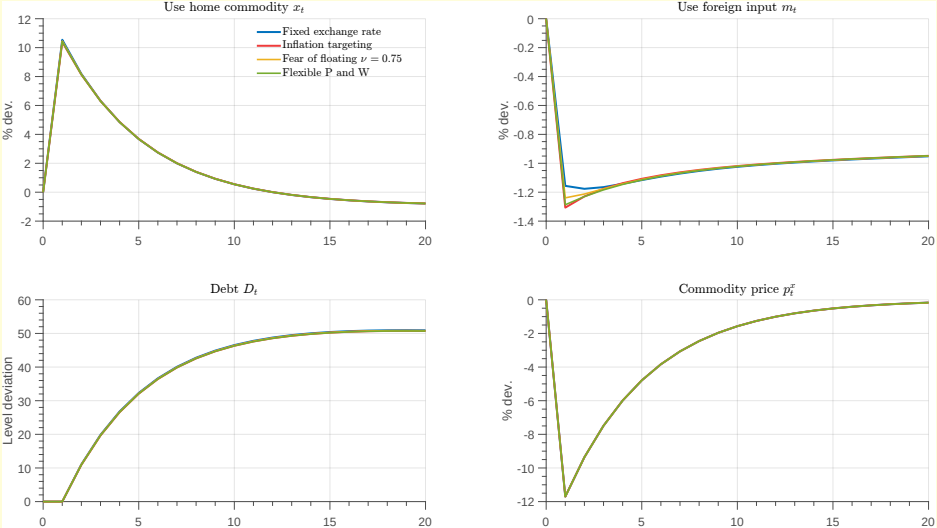
Note: VAR with copper price in constant USD, real GDP, real exchange rate, government expenditures, and soverign spread. VAR identified using exogeneity of oil price. Data is hp-filtered.

APPENDIX

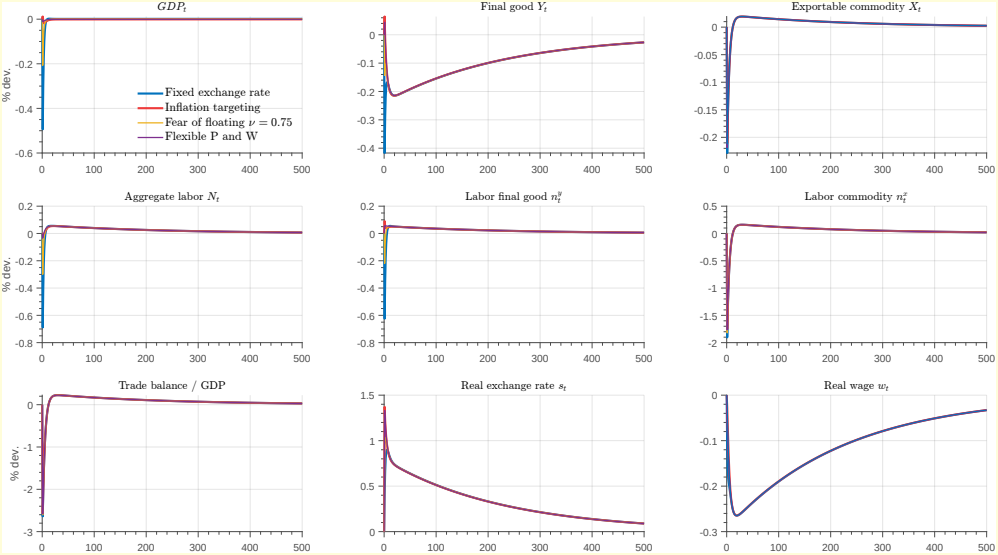
Impulse responses inflation targeting



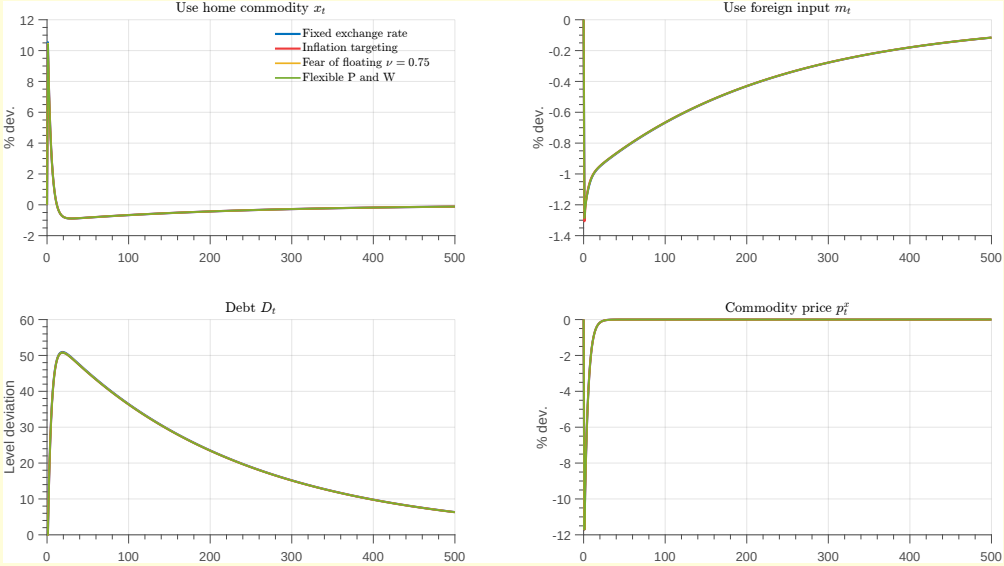
Impulse responses inflation targeting



Impulse responses inflation targeting (long horizon)



Impulse responses inflation targeting (long horizon)



Moments Chile and Inflation targeting

	Chile	Model	Only p^{x*}	No A^x	No A^y
std(RER)	5.5	6.8	5.7	6.7	6.5
std(GDP)	1.6	1.6	0.8	1.6	1.1
std(p^{x*})	18.4	18.4	18.4	18.4	18.4
corr(RER,p^{x*})	-0.75	-0.83	-0.97	-0.82	-0.85
corr(RER,GDP)	-0.46	0.20	-0.40	0.20	0.03
corr(GDP,p^{x*})	0.56	0.29	0.61	0.32	0.43

Data and model are HP-filtered with a smoothing parameter of 1600.

Model moments small sample distributions