

# COMMODITY PRICE SHOCKS AND MONETARY POLICY

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Material based on:

“Commodity shocks with diverse impacts” by Drechsel, McLeay, Tenreyro and Turri (2024)

“Dollar dominance and the export channel of monetary policy transmission” by McLeay and Tenreyro (2023)

The views in these papers do not represent those of the BoE

## BACKGROUND

- ▶ Swings in commodity prices a material source of fluctuations in activity and inflation
- ▶ Concern that those swings might become even more frequent or virulent
  - ▶ Geopolitical fragmentation
  - ▶ Climate-related events
- ▶ Other policies need to be put in place to tackle real impact of commodity price swings
- ▶ Monetary policy should address any residual impact not tackled by other policies

## TWO QUESTIONS

1. How does the inflation targeting framework, supported with flexible exchange rate, fare in an environment subject to commodity price swings?

### Perspectives of

- ▶ Advanced economies that are commodity exporters
- ▶ Emerging and developing economies that are commodity exporters
- ▶ Advanced economies that are commodity importers
- ▶ Emerging and developing economies that are commodity importers

2. Is monetary policy effective in a world of **dollar dominance**?

# ANSWERS TO QUESTIONS

1. How does the inflation targeting framework, supported with flexible exchange rate, fare in an environment subject to commodity price swings?
  - ▶ For commodity exporters, IT with flexible exchange clearly dominates over a peg
  - ▶ For EME/DE commodity importers, some (tenuous) advantage in stabilising ER
2. Is monetary policy effective in a world of **dollar dominance**?
  - ▶ Yes. Monetary policy is effective when vehicle currencies are used

QUESTION 1: HOW DOES INFLATION TARGETING, COUPLED WITH FLEXIBLE ER, FARE IN THE FACE OF COMMODITY PRICE SHOCKS?

## MODEL SUMMARY: STARTING POINT

- ▶ Small open economy New Keynesian setting building on Gali and Monacelli (2005), Svensson (2000), Obstfeld and Rogoff (1995) and many others
  - ▶ Forward looking households maximise their utility over consumption and leisure choices as well as asset holdings, subject to their budget constraints
  - ▶ Firms optimise profits, given technology
  - ▶ There is monopolistic competition in the domestic good sector and prices are sticky

## MODEL SUMMARY: COMMODITIES AND FINANCIAL MARKETS

- ▶ Commodities are traded in globally competitive markets. Prices are flexible.
- ▶ Commodities enter the import and/or export baskets (Hevia and Nicolini, 2003)
- ▶ They are used in consumption or as an input in production (e.g., Guerrieri, Marcussen, Reichlin and Tenreyro, 2023)
- ▶ Imperfect global financial markets (different from Gali-Monacelli's perfect risk sharing)
- ▶ Critically, risk premium in international financial markets may be affected by commodity prices
  - ▶ Captures pro-cyclicality of credit - e.g., when soy prices increase, Argentina can borrow at better terms (Drechsel and Tenreyro, 2018)

# COMMODITY PRICES AND ARGENTINE REAL SPREADS

- ▶ Simple correlation: -0.78
- ▶ Range of semi-elasticities from regressions using different measures and various controls: -0.23 to -0.31. [Regression table](#)
- ▶ Evidence for other countries, e.g. Bastourre et al (2012)



# LINEARIZED MODEL

## Households.

$$\begin{aligned}
 \hat{c}_{h,t} &= \alpha \hat{\tau}_t + \hat{c}_t \\
 \hat{c}_{f,t} &= (\alpha - 1) \hat{\tau}_t + \hat{c}_t \\
 \hat{c}_{h,t}^* &= \hat{\tau}_t - \alpha_{\tilde{c}} \hat{p}_{\tilde{c},t}^* + \hat{c}_t^* \\
 \hat{c}_{nc,t} &= \hat{p}_{f,t} - \hat{p}_{nc,t} + \hat{c}_{f,t} \\
 \hat{c}_{\tilde{c},t} &= \hat{p}_{f,t} - \hat{p}_{\tilde{c},t} + \hat{c}_{f,t} \\
 \varphi \hat{n}_t + \hat{c}_t &= \hat{w}_t - \hat{p}_t \\
 \hat{c}_t &= -(i_t - \mathbb{E}_t \hat{\pi}_{t+1}) + \mathbb{E}_t \hat{c}_{t+1} \\
 i_t - \mathbb{E}_t \hat{\pi}_{t+1} &= i_t^* - \mathbb{E}_t \hat{\pi}_{t+1}^* + \mathbb{E}_t \hat{s}_{t+1} - \hat{s}_t + \hat{\phi}_t \\
 \hat{\phi}_t &= \phi_{\tilde{c}} \hat{p}_{\tilde{c},t} - \phi_c \hat{p}_{c,t} - \phi_B \hat{b}_t \\
 \beta \hat{b}_t - \hat{b}_{t-1} &= \frac{s_{m,ss}}{\nu} (\hat{y}_{c,t} + \hat{p}_{c,t}^*) + s_{c^*,ss} \hat{c}_t^* + \\
 &\quad - \mu (\hat{x}_{\tilde{c},t} + \hat{p}_{\tilde{c},t}^*) - \frac{\alpha s_{c,ss}}{1 - \alpha} (\hat{c}_{f,t} + \alpha_{\tilde{c}} \hat{p}_{\tilde{c},t}^*)
 \end{aligned}$$

## Prices and resource constraint.

$$\begin{aligned}
 \hat{p}_t &= \alpha \hat{p}_{f,t} + (1 - \alpha) \hat{p}_{h,t} \\
 \hat{p}_{f,t} &= \alpha_{\tilde{c}} \hat{p}_{\tilde{c},t} + (1 - \alpha_{\tilde{c}}) \hat{p}_{nc,t} \\
 \hat{\tau}_t &= \hat{p}_{f,t} - \hat{p}_{h,t} \\
 \hat{s}_t &= (1 - \alpha) \hat{\tau}_t - \alpha_{\tilde{c}} \hat{p}_{\tilde{c},t}^* \\
 \Delta \hat{e}_t &= \Delta \hat{s}_t + \hat{\pi}_t - \hat{\pi}_{f,t}^* \\
 \hat{y}_{h,t} &= s_{c,ss} \hat{c}_{h,t} + s_{c^*,ss} \hat{c}_{h,t}^* + s_{m,ss} \hat{m}_{h,t}
 \end{aligned}$$

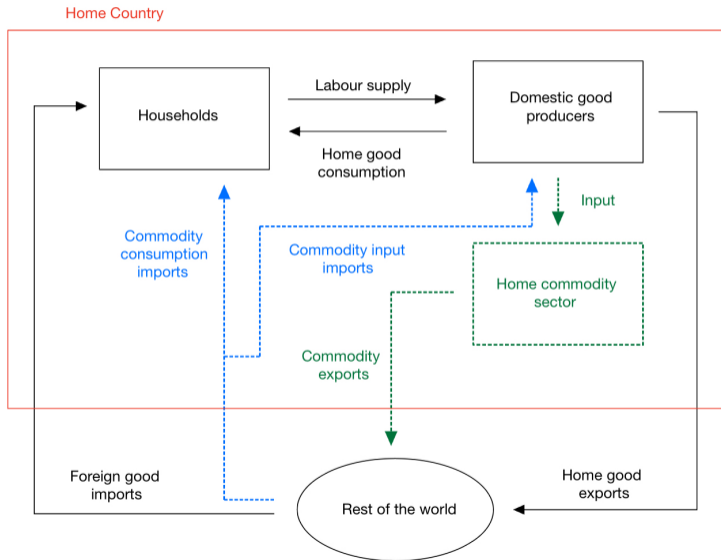
## Domestic goods sector.

$$\begin{aligned}
 \hat{y}_{h,t} &= \hat{a}_{h,t} + (1 - \mu) \hat{n}_t + \mu \hat{x}_{\tilde{c},t} \\
 \hat{\pi}_{h,t} &= \beta \mathbb{E}_t \hat{\pi}_{h,t+1} + \kappa \hat{m}_t \\
 \hat{m}_t &= (1 - \mu) (\hat{w}_t - \hat{p}_t) + \mu (\hat{p}_{\tilde{c},t}^* + \hat{s}_t) + \alpha \hat{\tau}_t - \hat{a}_{h,t} \\
 \hat{x}_{\tilde{c},t} &= \hat{n}_t + (\hat{w}_t - \hat{p}_t) - (\hat{p}_{\tilde{c},t}^* + \hat{s}_t)
 \end{aligned}$$

## Commodity export sector.

$$\begin{aligned}
 \hat{y}_{c,t} &= \hat{a}_{c,t} + \nu \hat{m}_{h,t} \\
 (1 - \nu) \hat{m}_{h,t} &= \hat{p}_{c,t}^* + \alpha \hat{\tau}_t + \hat{s}_t + \hat{a}_{c,t}
 \end{aligned}$$

# PRODUCTIVE STRUCTURE OF THE ECONOMY



# TYPES OF ECONOMIES

Risk premium  
sensitivity to foreign  
bond holdings and  
commodity prices



High

Low

Commodity importer

Commodity exporter

Emerging economy commodity importer	Emerging economy commodity exporter
Advanced economy commodity importer	Advanced economy commodity exporter

# POLICY FRAMEWORKS

1. Fixed exchange rate regime
2. Flexible exchange rate regime. Taylor rules:
  - ▶ Weight on CPI inflation
  - ▶ Weight on Domestic Price Inflation

Compare outcomes with efficient allocation (from a “national” social planner perspective. Future: global social planner)

## CHANNELS REFLECTED IN THE TRADE BALANCE

The linearised trade balance can be written as

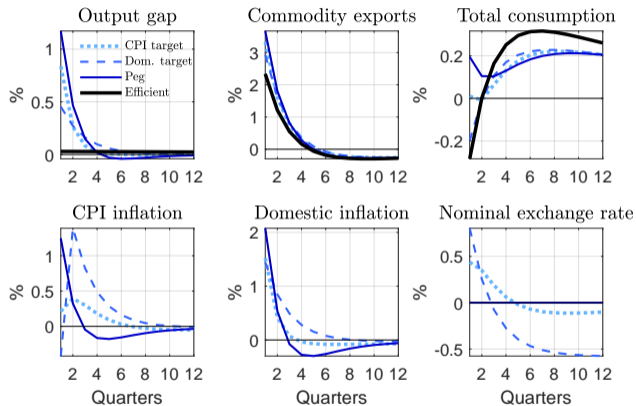
$$\hat{t}b_t = \frac{s_{m,ss}}{\nu} \underbrace{(\hat{p}_{c,t}^*)}_1 + \underbrace{(\hat{y}_{c,t})}_2 + s_{c^*,ss} \hat{c}_t^* - \mu (\hat{x}_{\tilde{c},t} + \underbrace{\hat{p}_{\tilde{c},t}^*}_3) - \frac{\alpha s_{c,ss}}{1-\alpha} (\underbrace{\hat{c}_{f,t}}_5 + \underbrace{\alpha_{\tilde{c}} \hat{p}_{\tilde{c},t}^*}_4),$$

1. For an exporter, increase in  $\hat{p}_{c,t}^*$  leads to **windfall income channel**.
2. Expansion in output ( $\hat{y}_{c,t}$ ) until (upward sloping) marginal cost equals the new, higher price, via an **export supply channel**.
3. For an importer a rise in  $\hat{p}_{\tilde{c},t}^*$  makes production more costly via a **domestic production channel**.
4. The same import basket becomes more costly, by  $\alpha_{\tilde{c}} \hat{p}_{\tilde{c},t}^*$ , worsening the trade balance - a **direct consumption channel**.
5. A **risk premium channel**

# CALIBRATION

Parameter	Description	Value	Calibration target/source
$1 - \alpha$	Home bias	0.6	Gali and Monacelli (2005)
$\phi$	Inverse Frisch elasticity	3	Gali and Monacelli (2005)
$\beta$	Discount factor	0.996	Steady state interest rate $\approx 1.5\%$
$1 - \theta$	Price re-set probability	0.25	Standard value for Calvo pricing
$\epsilon$	Elasticity of substitution	6	Gives markup of 20%
$\nu$	Returns of scale in comm. prod.	0.6	Gives $s_{m,ss} = 0.4$

# ADVANCED ECONOMY COMM. EXPORTER - EXPORT PRICE SHOCK



- ▶ Peg amplifies boom; output gap is too high compared to efficient allocation
- ▶ Efficient allocation would call for bigger appreciation
- ▶ Inflation-based Taylor rules dominate peg

# ADVANCED ECONOMY COMM. EXPORTER - EXPORT PRICE SHOCK

IMPLIED STANDARD DEVIATIONS ACROSS POLICIES

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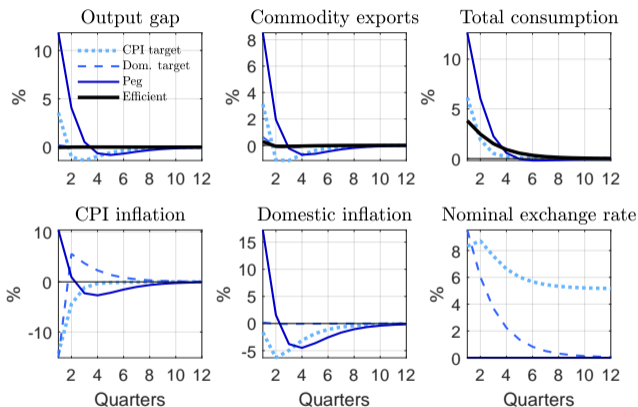
	<b>CPI inf. target</b>	<b>Dom. inf. target</b>	<b>Nominal peg</b>
CPI inflation	0.15	0.44	0.33
Domestic inflation	0.40	0.44	0.56
Efficient output gap	0.86	0.52	1.25

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# EME/DE COMMODITY EXPORTER - EXPORT PRICE SHOCK



- ▶ Fall in risk premium exacerbates the consumption boom and makes it more difficult to stabilise the economy
- ▶ Peg is by far the worst option, leading to enormous boom and domestic inflation overshoot.

# EME/DE COMMODITY EXPORTER - EXPORT PRICE SHOCK

IMPLIED STANDARD DEVIATIONS ACROSS POLICIES

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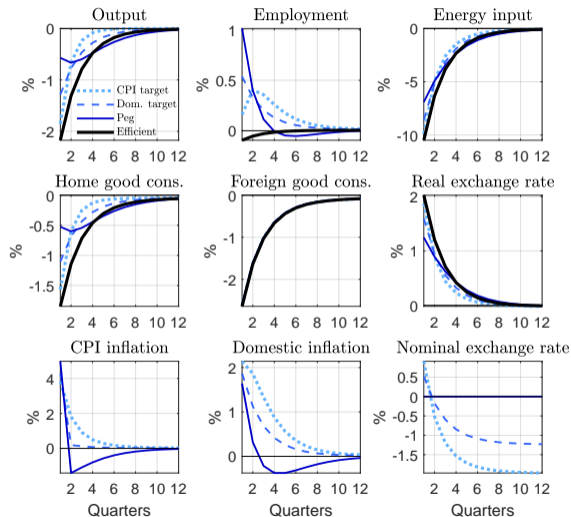
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	<b>CPI inf. target</b>	<b>Dom. inf. target</b>	<b>Nominal peg</b>
CPI inflation	3.75	4.20	2.84
Domestic inflation	2.26	0.09	4.73
Efficient output gap	4.16	0.23	12.54

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# ADVANCED ECONOMY COMM. IMPORTER - IMPORT PRICE SHOCK



- ▶ Efficient allocation implies little change in employment, lower imports and output
- ▶ All rules are a bit loose relative to efficient allocation
- ▶ No big difference across policies. Increasing weight on Taylor rule (domestic IT) should get closer to the efficient allocation

# ADVANCED ECONOMY COMM. IMPORTER - IMPORT PRICE SHOCK

IMPLIED STANDARD DEVIATIONS ACROSS POLICIES

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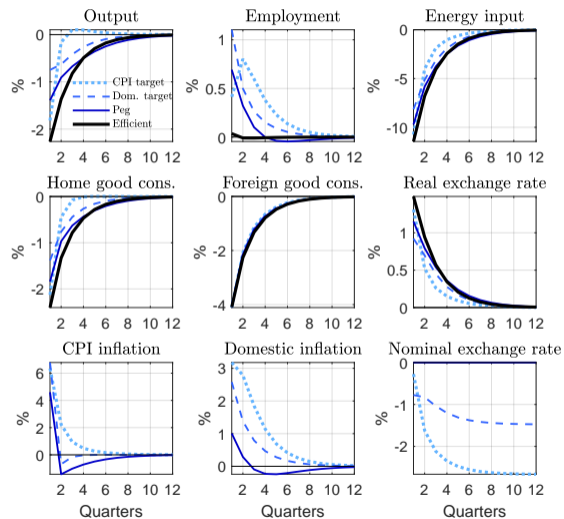
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	<b>CPI inf. target</b>	<b>Dom. inf. target</b>	<b>Nominal peg</b>
CPI inflation	1.09	1.07	1.35
Domestic inflation	0.83	0.59	0.46
Efficient output gap	1.07	1.14	1.78

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# EME/DE COMMODITY IMPORTER - IMPORT PRICE SHOCK



- ▶ Peg does better than Taylor rules at stabilising inflation
- ▶ Risk premium increases less under the peg
- ▶ Even with extreme Taylor coefficients, peg still stabilises domestic inflation better than CPI rule.

# EME/DE COMMODITY IMPORTER - ENERGY IMPORT PRICE SHOCK

IMPLIED STANDARD DEVIATIONS ACROSS POLICIES

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	<b>CPI inf. target</b>	<b>Dom. inf. target</b>	<b>Nominal peg</b>
CPI inflation	1.70	1.71	1.26
Domestic inflation	1.21	0.77	0.29
Efficient output gap	1.75	1.76	1.00

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## ANSWER TO QUESTION 1

- ▶ Some form of IT performs better than pegs in response to commodity shocks under 3 of the 4 model configurations.
  - ▶ For AE commodity *exporters*, pegs create more volatility in inflation and output.
  - ▶ For EME/DE commodity *exporters*, volatility is amplified by an endogenous loosening of financial conditions, made worse by the peg. Domestic IT achieves a better balance.
  - ▶ For AE commodity *importers*, there is a smaller difference between the various policies.
  - ▶ For EME/DE commodity *importers*, there are some more distinct advantages to the exchange rate peg. A rise in the risk premium leads to a more depreciated currency under inflation targeting rules, which the peg prevents. By doing so, the peg is able to limit the volatility in both domestic and CPI inflation, relative to Taylor rules targeting those variables

## NEXT STEPS

- ▶ Individually, despite different exposure to commodity price shocks, “national” social planners want to appreciate.
- ▶ Not feasible globally
  - ▶ In equilibrium, more of the adjustment happens via global interest rates
  - ▶ To explore: policy coordination
  - ▶ In the context of the war in Ukraine, perhaps currencies could have appreciated vis-a-vis the USD given that the US is self-sufficient in gas. But another large development blurring the picture: US fiscal stimulus.
- ▶ Two big omissions: lags and inertia from wage catch-up effects.



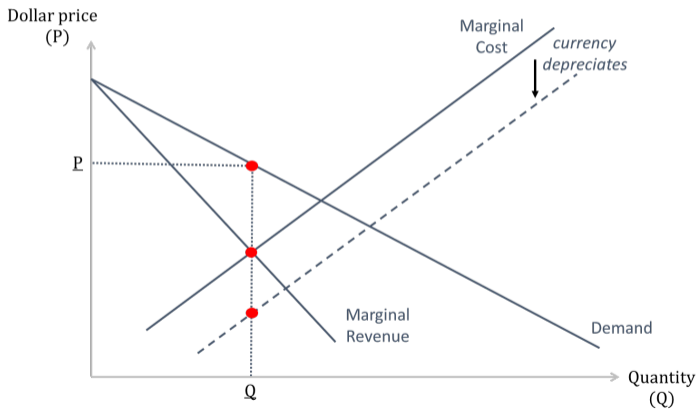
QUESTION 2: IS MONETARY POLICY EFFECTIVE IN A  
WORLD OF **dollar dominance**? (CAN FLEXIBLE  
EXCHANGE RATES ACT AS AUTOMATIC STABILISERS?)

## RECENT CHALLENGES TO THE VALUE OF ER FLEXIBILITY

1. Most international trade is invoiced in a few currencies. Large US dollar role
2. New dominant currency pricing (DCP) paradigm shifting policy views
  - ▶ Makes exports unresponsive to exchange rates
  - ▶ Reduces the value of flexible exchange rates as automatic stabilisers
  - ▶ Limits the gains from independent monetary policy
3. DCP assumptions: 1) exporters have monopoly power; 2) prices are sticky in dollars. But:
  - ▶ Many developing and EM producers are price takers. They export commodities or similar products with limited market power
  - ▶ Even if there is market power, prices tend to be flexible
    - ▶ commodity prices are quoted in US dollars, but prices are flexible
  - ▶ Advanced-economy producers often face very elastic demands in global markets too

# DOLLAR DOMINANCE IN TRADE: THE MONOPOLIST WITH STICKY PRICE

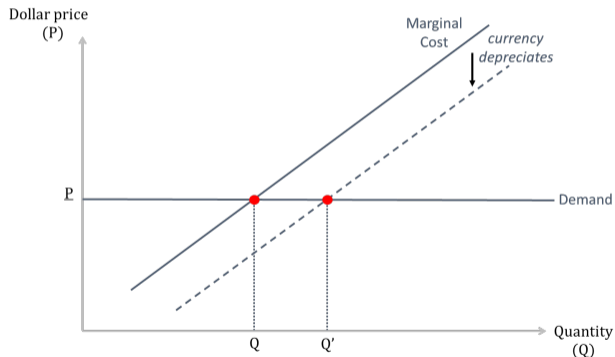
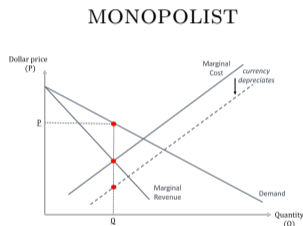
## DEPRECIATION WITH STICKY DOLLAR PRICES: MONOPOLIST



- ▶ With sticky dollar prices, export quantities do not change

# DOLLAR DOMINANCE IN TRADE: THE COMMODITY PRODUCER

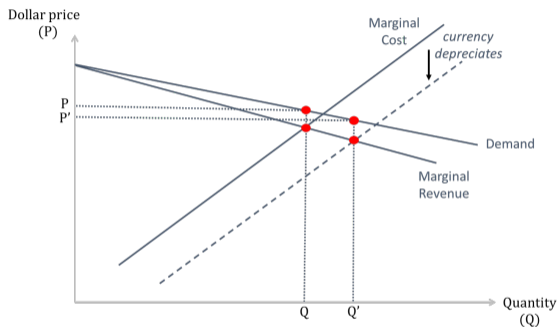
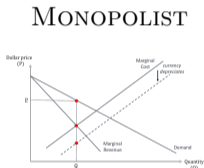
## DEPRECIATION FOR A COMMODITY EXPORTER: PRICE TAKER



- ▶ Dollar commodity prices do not change, but export quantities increase

# DOLLAR DOMINANCE: THE PRODUCER IN COMPETITIVE MARKETS

## DEPRECIATION WITH ELASTIC DEMAND



- ▶ For a producer facing an elastic demand, flexible prices may appear sticky in equilibrium
- ▶ Export quantities increase a lot, as for the commodity exporter

## IMPLICATIONS FOR MONETARY POLICY (THE ER CHANNEL)

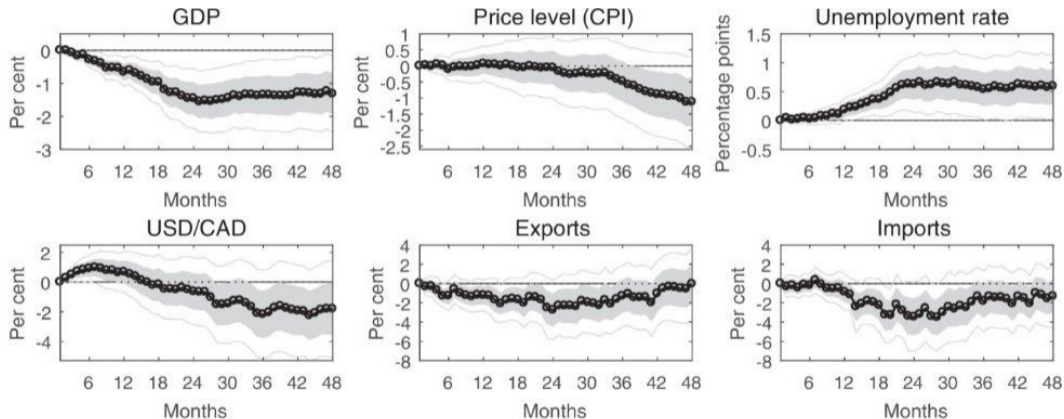
- ▶ With monopolists and sticky USD prices, an ER depreciation does not affect export prices or quantities. Monetary policy has a small effect.
- ▶ With commodity (or commodity-like) producers and flexible USD prices, an ER depreciation does not affect export prices either, but causes a large increase in export quantities. Monetary policy has a large effect.
  - ▶ Effect depends on supply capacity.

## THE IDEAL TEST: EXPORT QUANTITIES (AND OUTPUT)

- ▶ Use identified monetary policy shocks to examine movements in exchange rates orthogonal to other determinants of export volumes or activity.
  - ▶ (ER depreciations do not happen exogenously; identification is the key challenge)

# EXPORT QUANTITIES - MONETARY POLICY SHOCK (CANADA)

## IMPULSE RESPONSE TO A CANADIAN MONETARY POLICY SHOCK



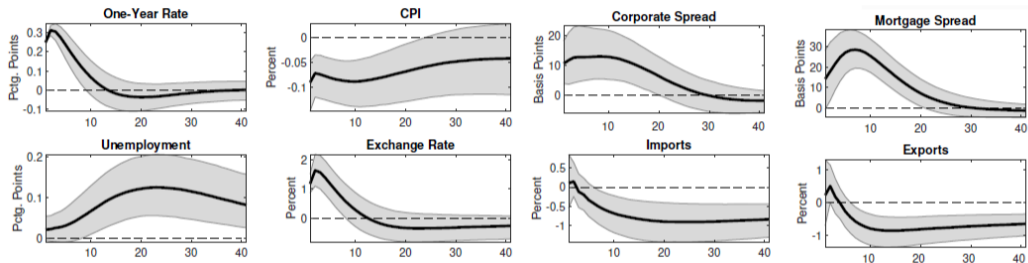
Source: Champagne and Sekkel (2018)

- ▶ Export volumes fall in response to a monetary policy tightening that leads to an initial exchange-rate appreciation.



# EXPORT QUANTITIES - MONETARY POLICY SHOCK (UK)

## IMPULSE RESPONSE TO A UK MONETARY POLICY SHOCK



Source: Cesa-Bianchi et al. (2020)

- ▶ Export volumes (and import volumes) fall in response to a monetary policy tightening that leads to a persistent exchange-rate appreciation.

# EMERGING/DEVELOPING ECONOMY MONETARY POLICY SHOCKS

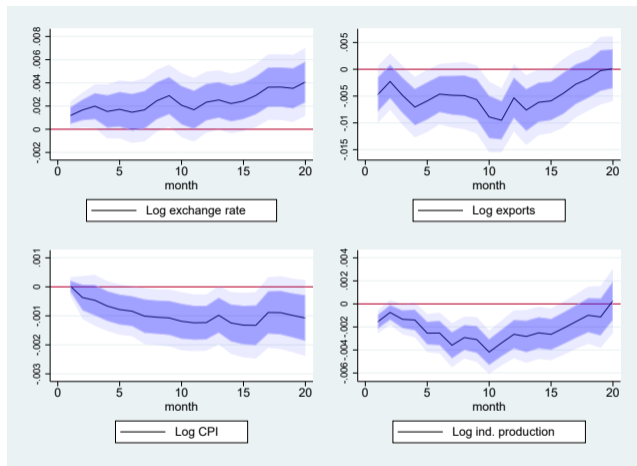
- ▶ Panel of 38 emerging and developing economies from Brandao-Marques et al. (2020).
- ▶ They identify monetary policy shocks as residuals ( $\hat{\epsilon}_{i,t}$ ) to estimated Taylor Rule:

- ▶ 
$$\Delta i_{i,t} = \phi_{\pi^f} E_t \pi_i^f + \phi_{y^f} E_t y_i^f + \sum_{j=1}^2 \phi_{\pi} \pi_{i,t-j} + \sum_{j=1}^2 \phi_y \Delta y_{i,t-j} + \sum_{j=1}^2 \phi_e \Delta NEER_{i,t-j} + \sum_{j=1}^2 \phi_i i_{i,t-j} + \epsilon_{i,t}$$

- ▶ We estimate effects on macro variable ( $y_{i,t+h}$ ) at each time horizon ( $h$ ) using local projections with country fixed-effects ( $\mu_i^h$ ):

- ▶  $y_{i,t+h} = \mu_i^h + \sum_{j=0}^2 \gamma_j^h \hat{\epsilon}_{i,t-j} + \delta_0^h \Delta NEER_{i,t} * \hat{\epsilon}_{i,t} + \sum_{j=0}^2 \beta_j^h * controls_{i,t-j} + \omega_{i,t}^h$
  - ▶ Effect assuming simultaneous 1s.d. exchange-rate change is  $\gamma_0^h + sd(NEER) * \delta_0^h$ .
  - ▶ Also interact responses with other country characteristics.

# EFFECT OF A MONETARY TIGHTENING SHOCK



- ▶ Dollar export values fall in response to tightening that induces appreciation.
- ▶ If prices also adjust,  $\Delta$  values might be a lower bound to quantity response.

## ANSWER TO QUESTION 2

- ▶ Using a dominant currency to invoice transactions does not mean prices are sticky in dollars.
  - ▶ Empirical evidence suggests the opposite: the more competitive the market, the more likely a producer would invoice in a dominant currency. (E.g., commodities).
- ▶ Lack of pass-through from exchange rates to prices does not mean prices are sticky: it might simply reflect the interplay between (elastic) demands and/or upward sloping cost curves
- ▶ Flexible exchange rates can help stabilise the economy under dollar dominance
  - ▶ Key is to have some underlying nominal rigidities in wages or domestic production costs (in the producer currency)

## OUTSIDE OF THE MODEL

- ▶ Other policies (besides monetary) to tackle climate and geopolitical shocks
- ▶ Need for a “real-side” policy strategy to prevent, mitigate and cope with geopolitical or climate related shocks
  1. Investment on technological diversification, focused on low substitutability inputs or technologies ([Koren and Tenreyro, 2010](#))
  2. Deeper trade integration with low geopolitical-risk countries to lower exposure to domestic shocks to specific suppliers/buyers, reducing volatility ([Caselli, Koren, Lisicky, and Tenreyro, 2020](#))
  3. Inventory base to prepare for shortages in critical inputs (energy, water, etc.)

# CONCLUSIONS

1. How does the inflation targeting framework, supported with flexible exchange rate, fare in an environment subject to commodity price swings?
  - ▶ For commodity exporters, IT with flexible exchange clearly dominates over a peg
  - ▶ For EME/DE commodity importers, some advantage in stabilising ER
2. Is monetary policy effective in a world of **dollar dominance**?
  - ▶ Yes. Relatively larger price rigidity in the domestic sector means depreciations boost activity

# COMMODITY PRICES AND ARGENTINE REAL SPREADS

LHS variable	(1)	(2)	(3)	(4)	(5)
	Real spread (based on World Bank measure)				
Commodity price	-0.278*** (0.073)	-0.233*** (0.065)	-0.307*** (0.080)	-0.313*** (0.077)	-0.260*** (0.070)
Output growth		-0.668** (0.236)			-0.664** (0.235)
Trade balance			-0.273 (0.306)		0.231 (0.508)
Debt-to-GDP ratio				-0.058 (0.046)	-0.087 (0.079)
Constant	0.049** (0.017)	0.054*** (0.015)	0.055*** (0.019)	0.086** (0.034)	0.105** (0.044)
Observations	22	22	22	22	22
R-squared	0.423	0.594	0.446	0.468	0.640

Standard errors in parentheses  
 \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$