Dollar Dominance and the Transmission of Monetary Policy

Michael McLeay[1] Silvana Tenreyro[2]

[1]Bank of England [2]London School of Economics

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The Question

Can monetary policy help stabilise the economy in a world of dollar dominance?

Outline

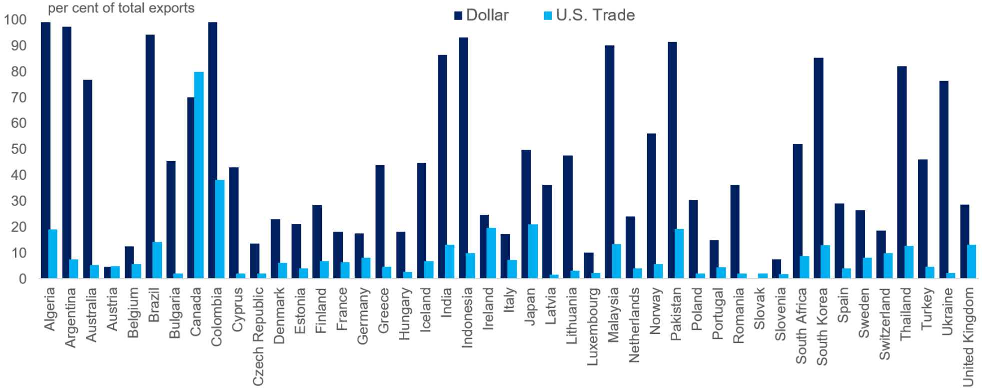
1. Background
2. Empirical Observations
3. Model
4. Simulations
5. Empirical Test
6. Takeaways

Background

Background

1. A large share of international trade transactions is invoiced in dollars
2. New dominant currency pricing (DCP) paradigm has emerged, shifting policy views
   - Makes exports unresponsive to exchange rate changes
   - Reduces the value of flexible exchange rates as automatic stabilisers
   - Limits the gains from independent monetary policy
3. Key DCP assumptions: 1) exporters have monopoly power; 2) prices are sticky in dollars. But:
   - Dollar dominance is more prevalent in homogeneous-good markets in which prices are flexible
     - Many developing and EM producers are price takers. They export commodities or fairly homogeneous products with limited market power. Even if there is market power, prices tend to be flexible; e.g., commodity prices are quoted in US dollars, but prices are flexible
     - Advanced-economy producers often face very elastic demands in global markets too

Background - Dollar invoicing dominates trade



Source: Gopinath (2016) and IMF

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Background - Shift in policy views

- *"Exchange rate flexibility may need to be supported with other policies...exchange rate changes have muted effects on the trade balance in the short term, including because of the limited response of export volumes."*
  IMF (2019)

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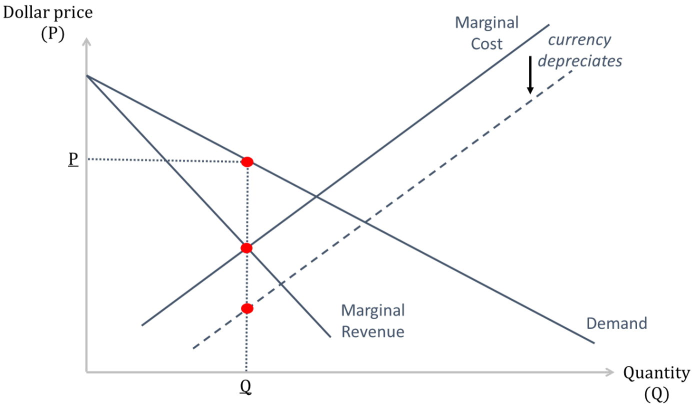
Dollar dominance in trade: monopolist with sticky price

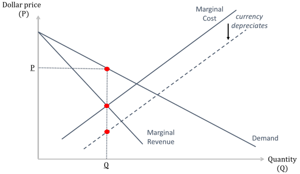
Depreciation with sticky dollar prices: monopolist



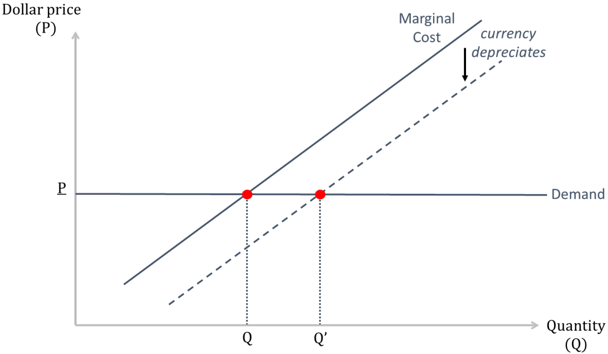
- With sticky dollar prices, export quantities do not change

Dollar dominance in trade: commodity producer

MONOPOLIST



Depreciation for a commodity exporter: price taker

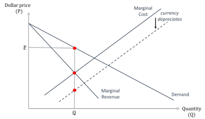


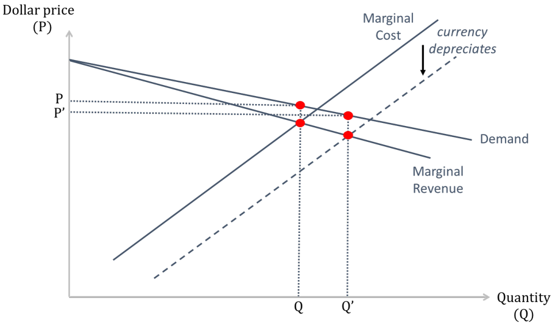
- Dollar commodity prices do not change, but export quantities increase

Dollar dominance: the producer in competitive markets

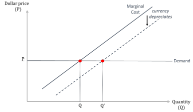
Depreciation with elastic demand

Monopolist





Price taker



- 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)

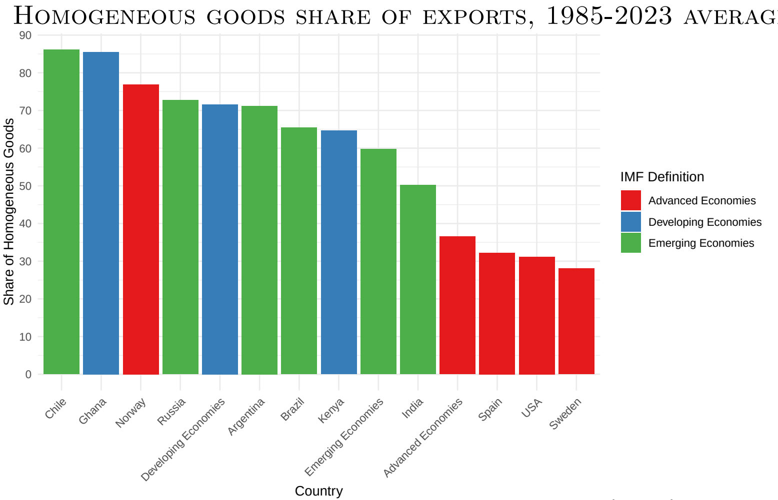
- With monopolists and sticky USD prices, an ER depreciation does not affect export prices or quantities. Monetary policy has a small effect.
- With commodity (or commodity-like) producers and flexible USD prices, an ER depreciation does not affect export prices but causes a large increase in export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

Some remarks

- Most trade is invoiced in a few currencies: dominant currency literature has pushed the frontier in the field.
- But using dominant currency for pricing/invoicing does not need to entail sticky prices or monopoly power.
  - Empirical evidence suggests the opposite: the more competitive the market, the more likely a producer would invoice in a dominant currency. (E.g., commodities).
- Very different implications for monetary-policy effectiveness and the role of exchange rates as automatic stabilisers.

Empirical Observations

Fact 1 - Homogeneous products have a large export share



Source: UN Comtrade, Rauch classification (1999)

- Homogeneous goods (sold in competitive markets, categorised by Rauch (1999).

Fact 2 - Homogeneous goods tend to have flexible prices

- Bils and Klenow (2004); Nakamura and Steinsson (2008)...

- Gopinath and Rigobon (2008): median monthly price durations
  - Homogeneous goods (organised): 1.2 months
  - Homogeneous goods (reference): 3.3 months
  - Differentiated goods: 14.2 months

Fact 3 - Invoicing in vehicle currency is more prevalent in homogeneous-good sectors

- McKinnon (1979) and many others: producers with lower market power in homogeneous good markets will tend to price in foreign currencies, as they would stick very closely to the competitive prices in those markets. Bachetta-and-van Wincoop model formalises the idea.

- Goldberg and Tille (2008) using microdata on Canadian imports, show dollar pricing more likely for exporters that are
  - selling homogeneous goods
  - intensive in commodity inputs
  - have low market share.

Fact 3 - Invoicing in vehicle currency is more prevalent in homogeneous-good sectors

Share of exports invoiced in USD

	(1)	(2)	(3)	Averages
Export share of	0.717***	0.752***	0.766***	0.830***
homogeneous goods	(0.0325)	(0.0333)	(0.0497)	(0.239)
Constant	16.11***	14.50***	22.04***	15.57
	(1.671)	(1.697)	(2.372)	(13.34)
Year FE	No	Yes	Yes	NA
Weighted by GDP	No	No	Yes	Yes
Observations	1,170	1,170	1,170	100
R-squared	0.294	0.331	0.340	0.363

Robust Standard errors in parentheses.

**** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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Model

Model summary

- Setting with dominant, dollar currency pricing, in line with DCP literature
  - Focus on small open economy version of the model
  - Financial markets are incomplete

- Production and competition:
  - Imported intermediates used in production
  - Allows for a flexible market structure that permits intra-sector international competition, and heterogeneity in the degree of price stickiness
  - **Low (standard)** substitution across different goods/sectors.
  - But international competition $\rightarrow$ **higher** substitution across different varieties of the same good/sector

- Wage and price-setting
  - Sticky wages (Calvo).
  - Nests PCP, DCP and flexible prices (makes invoicing currency irrelevant)

Open economy setup and exchange rate

- Home (H) is small open economy.
- Trades goods and assets with other countries.
  - Rest of the world dynamics are assumed exogenous.
  - Includes US and also third countries where exports may be priced in dollars.
- $\mathcal{E}_{\$H}$ – price of a dollar in home currency
  - $\mathcal{E}_{\$H} \uparrow \implies$ depreciation of home currency against the dollar.
- $\mathcal{E}_{jH}$ – price of third currency j in home currency.

Household preferences

- Households in H maximise expected lifetime utility

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_{H,t}^{1-\sigma_c}}{1-\sigma_c} - \frac{N_{H,t}^{1+\varphi}}{1+\varphi} \right)$$

- Consumption basket is a CES aggregate of goods:

$$C_{H,t} \equiv \left(\int_0^1 C_{H,t}(g)^{\frac{\sigma-1}{\sigma}} dg \right)^{\frac{\sigma}{\sigma-1}}$$

- Each good is CES aggregate of home and foreign varieties $\omega \in \Omega_j$, for $j = H, R$.

$$C_{H,t}(g) \equiv \left(\sum_j \left(\frac{\gamma_{jH}^g}{|\Omega_j^g|} \right)^{\frac{1}{\eta_g}} \int_{\omega \in \Omega_j^g} C_{jH,t}^g(\omega)^{\frac{\eta_g - 1}{\eta_g}} d\omega \right)^{\frac{\eta_g}{\eta_g - 1}},$$

  - γ_{jH}^g governs relative size of economy and home bias, with $\gamma_{HH}^g = 1 - \gamma_{RH}^g$.
  - σ is elasticity of substitution across goods/sectors.
  - η is elasticity of substitution across varieties/countries.

Budget constraint and asset market

- Home household budget constraint for each differentiated labour type h

$$P_{H,t}C_{H,t} + \mathcal{E}_{\$H,t}(1 + i^{\$}_{H,t-1})B^{\$}_{H,t} + B_{H,t} =$$
$$W_{H,t}(h)N_{H,t}(h) + \Pi_{H,t} + \mathcal{E}_{\$H,t}B^{\$}_{H,t+1} + \sum_{s\in S} Q_{H,t+1}(s)B_{H,t+1}(s),$$

  - $\Pi_{H,t}$ are lump-sum profits.
  - $B_{H,t}$ full set of domestic state-contingent debt.
  - $B^{\$}_{H,t}$ USD risk-free debt - no risk sharing across countries.

- Euler equations imply UIP condition:

$$(1 + i_{H,t}) = (1 + i^{\$}_{H,t})\mathbb{E}_t\left(\frac{\mathcal{E}_{\$H,t+1}}{\mathcal{E}_{\$H,t}}\right)$$

Production with intermediates

- For each variety, identical Cobb-Douglas production function using labor and domestic and imported intermediates (X_t), with aggregate productivity A_t

$$Y^g_{H,t}(\omega) = A^g_{H,t}(L^g_{H,t}(\omega))^{1-\alpha}(X^g_{H,t}(\omega))^{\alpha}\left[(L^g_{H,t})^{1-\alpha}(X^g_{H,t})^{\alpha}\right]^{\nu_g-1} \tag{1}$$

$\nu_g - 1 \leq 1$ (decreasing or constant returns to scale at the industry level)

- Intermediate inputs aggregated in the same way as consumption varieties, which gives demand from country i for each home variety:

$$Y^g_{Hi,t}(\omega) = \frac{\gamma^g_{Hi}}{|\Omega^g_H|}\left(\frac{P^g_{Hi,t}(\omega)}{P_{i,t}(g)}\right)^{-\eta^g}\left(\frac{P_{i,t}(g)}{P_{i,t}}\right)^{-\sigma}(C_{i,t}+X_{i,t})\,, \tag{2}$$

Wage setting

- Each producer uses a CES bundle of differentiated labour inputs.

$$N_{H,t} = \left(\int_0^1 N_{H,t}(h)^{\frac{\vartheta-1}{\vartheta}} dh \right)^{\frac{\vartheta}{\vartheta-1}}$$

- Optimal hiring condition for each type

$$N_{H,t}(h) = \left(\frac{W_{H,t}(h)}{W_{H,t}} \right)^{-\vartheta} N_{H,t}$$

- Wage setting subject to Calvo (1983) friction

Price setting

- We compare flexible prices, to Calvo sticky price setting DCP or PCP.
  - Export and import prices are either set in dollars or in the producer currency.
- For sticky-price firms that cannot adjust, depreciation ($\mathcal{E}_{\$H,t} \uparrow$) increases profits.
- With flexible prices, or for firms that adjust dollar prices, prices fall and exports increase.

Monetary policy

- Close the model with a simple inflation targeting Taylor rule with smoothing

$$i_{H,t} - i^* = \rho(i_{H,t-1} - i^*) + (1-\rho)\phi\pi_{H,t} + \nu_{H,t}$$

- $\nu_{H,t}$ is a monetary policy shock in the home economy

Market clearing

- For each product variety
- For labour

Simulations

Calibration

- Reduce to three types of goods
  - Homogeneous (sorry for H) only exported
  - Differentiated Nontradable N
  - Differentiated Imported M

- Home country consumes N and M and exports all homegeneous goods

$$C_{H,t} = \left(\kappa_M C_{H,t}(g_M)^{\frac{\sigma-1}{\sigma}} + (1-\kappa_M) C_{N,t}(g_N)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{3}$$

- Our calibration sets $\eta_{g_H} >> \eta_{g_M} = \eta_{g_N} = \sigma$, which means that demand for each variety of non-tradables reduces to:

$$Y_{H,t}(\omega)^{g_N} = Y_{HH,t}^{g_N}(\omega) = \frac{1}{|\Omega_H^{g_N}|} \left(\frac{P_{HH,t}^{g_N}(\omega)}{P_{H,t}} \right)^{-\sigma} (C_{H,t} + X_{H,t}), \tag{4}$$

Calibration II

- Demand from the US for each variety is

$$Y^{g_H}_{HU,t}(\omega) \approx \frac{1}{|\Omega^{g_H}_H|}\left(\frac{P^{\$,g_H}_{HU,t}(\omega)}{P^{\$}_{U,t}(g_H)}\right)^{-\eta_{g_H}} \gamma^{g_H}_{HU}\left(C_{U,t}+X_{U,t}\right), \tag{5}$$

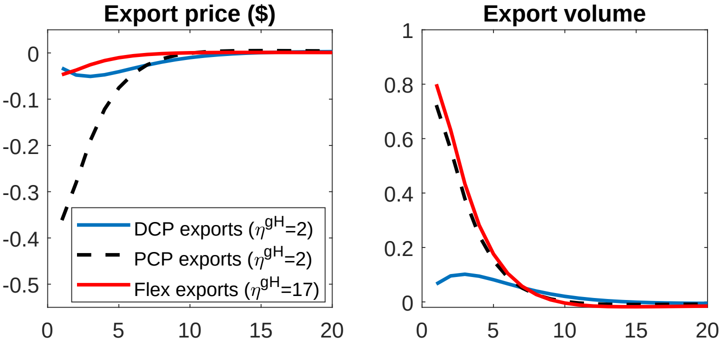
- with an analogous demand from the rest of the world.

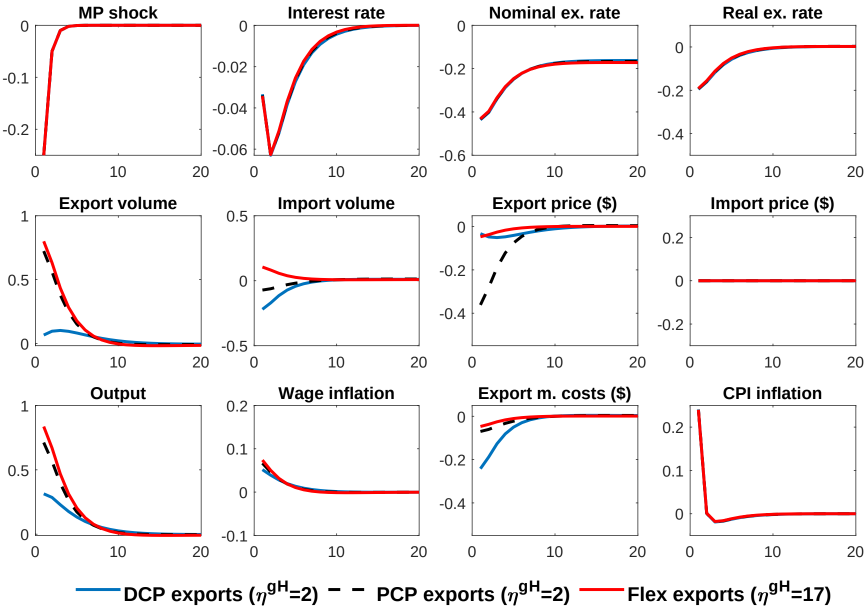
Calibration III

Parameter	Description	Value
	Household preferences	
β	Discount factor	0.99
σ_c	Risk aversion	2
φ	Frisch elasticity	2
ϑ	Labour demand elasticity	4
	Demand	
σ	Cross-product elasticity	2
κ_M	Import/tradable share in home consumption	0.5
η^{g_N}	Non-tradable cross-variety elasticity	2
η^{g_H}	Home export cross-variety elasticity	17
η^{g_M}	Imported good cross-variety elasticity	2
$\gamma_{HH}^{g_N}$	Home consumption of non-tradables	1
$\gamma_{HH}^{g_H}$	Home consumption of home exports	0
$\gamma_{UH}^{g_M}$	Share of US in home imports	0.5
$\gamma_{RH}^{g_M}$	Share of ROW in home imports	0.5
	Supply	
α	Intermediate share	2/3
ν^{g_N}	Non-tradable returns to scale	1
ν^{g_H}	Home export returns to scale	0.8
A^{g_N}, A^{g_H}	Productivity	1
δ_w	Wage rigidity	0.75
$\delta_p^{g_N}$	Non-tradable good price rigidity	0.75
$\delta_p^{g_H}$	Home export price rigidity	0
$\delta_p^{g_M}$	Imported good price rigidity	0.75
	Monetary policy	
ρ	Taylor rule smoothing	0.4
ϕ_π	Taylor rule inflation weight	1.5

Home monetary loosening and depreciation

Figure: Export responses to a home monetary policy shock under different models




MP shock
Interest rate
Nominal ex. rate
Real ex. rate
Export volume
Import volume
Export price ($)
Import price ($)
Output
Wage inflation
Export m. costs ($)
CPI inflation
DCP exports (η^{gH}=2)
PCP exports (η^{gH}=2)
Flex exports (η^{gH}=17)

Home monetary policy loosening, model comparison

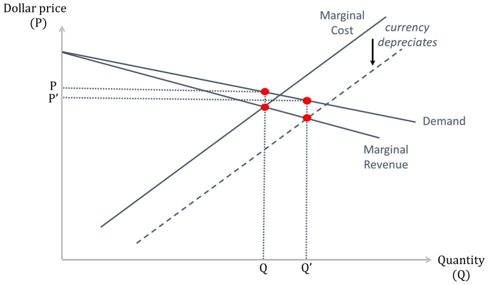
Table: Year 1 average responses to exogenous 1pp cut in interest rates

	Sticky producer prices, differentiated exports ($\delta_p^{gH} = 0.75, \eta^{gH} = 2$)	**Sticky dollar prices, differentiated exports ($\delta_p^{gH} = 0.75, \eta^{gH} = 2$)**	**Flexible prices, homogeneous exports ($\delta_p^{gH} = 0, \eta^{gH} = 17$)**
Dollar exchange rate (% depr.)	0.36	0.36	0.36
Annual CPI inflation (end year 1, %)	0.21	0.21	0.21
Output (%)	0.48	0.25	0.52
Dollar export price (%)	-0.24	-0.05	-0.03
Export volume (%)	0.48	0.09	0.54

- Our model generates a large response in export volumes, but 'pass-through' to dollar export prices is limited.
- Restores the quantity properties of PCP with the price properties of DCP

Intuition - prices

Depreciation with elastic demand



- If $\hat{p}_R^g$ is the price charged in the rest of the world, and prices are fully fixed/flexible, then:
  - Under dollar pricing: $\Delta\hat{p}_R^g = -\Delta\mathcal{E}_{\$R} = 0$
  - Under producer pricing: $\Delta\hat{p}_R^g = -\Delta\mathcal{E}_{\$H}$
  - Under flexible pricing: $\Delta\hat{p}_R^g = -\Delta\mathcal{E}_{\$H} + \Delta\hat{mc}_H$

- Under dollar pricing, prices are unchanged.
- Under flexible prices, producer adjusts prices to reflect lower dollar costs.
- But domestic marginal costs rise as exports increase, so pass-through to prices is limited.

Other Calibrated Exercises in the Paper

- Paper studies role of supply constraints
  - Decreasing returns to scale reduce price adjustment (more price stickiness in equilibrium)
  - In reality, there is a mix of dollar pricing and PCP in exporters

- Some exporters adjust prices more frequently than others; some face more or less elastic demand curves.

- Paper works out case in which a fraction of exporters invoice in dollar and the rest do PCP.
  - Goods priced in dollars have higher elasticity and price flexibility
  - Goods priced in domestic currency have low elasticity and price rigidity
  - Similar results for exports as in baseline. Intuition, if exporters use PCP for differentiated goods and dollar for homogeneous goods, exports would always respond

Empirical Test

Assumptions and testable hypotheses

	DCP (Gopinath et al, 2020)	Our model
Exporters' market power	High/inelastic	Low/elastic
Prices	Sticky	Flexible
Low export-price pass-through	✔	✔
Large export quantity response	✗	✔

The test so far: pass through

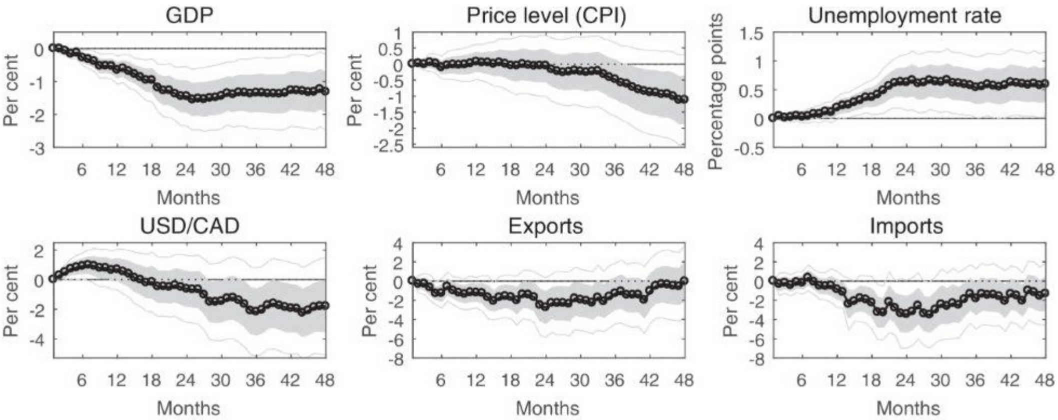
- ER changes have small effect on export prices in USD. Implies stickiness!
- But for commodity producers with flexible prices, an ER depreciation does not change export prices either. Lack of pass-through does not imply stickiness.
  - Pass-through into prices cannot help distinguish the two models
  - Price pass-through cannot inform about monetary policy efficacy

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 monetary policy tightening that appreciates currency.

Export quantities - monetary policy shock (Canada)

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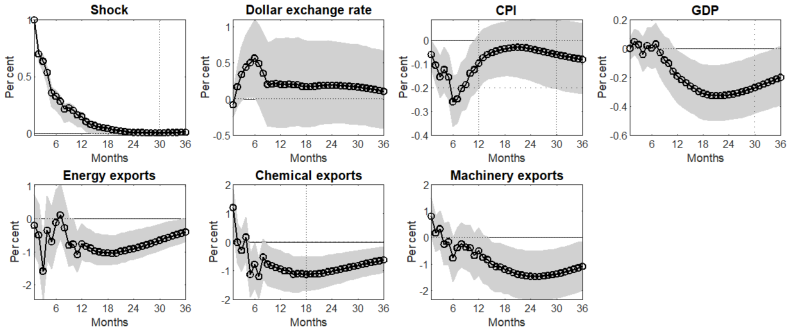
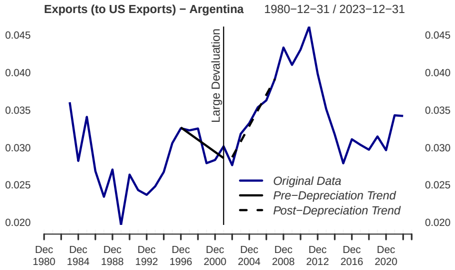
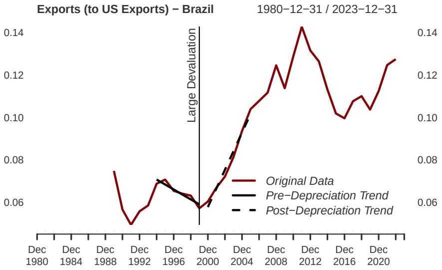
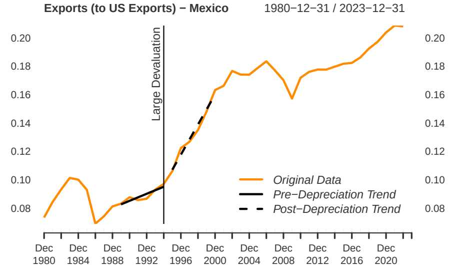


- Cumulated shocks from Champagne and Sekkel (2018), VAR (1981-2015).
- Export volumes fall across sectors.

Exports and large devaluations







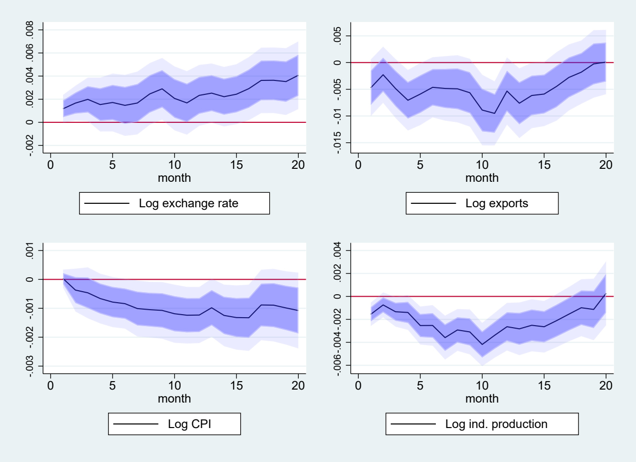
EMERGING/DEVELOPING ECONOMY MONETARY POLICY SHOCKS

- 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 (μ_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

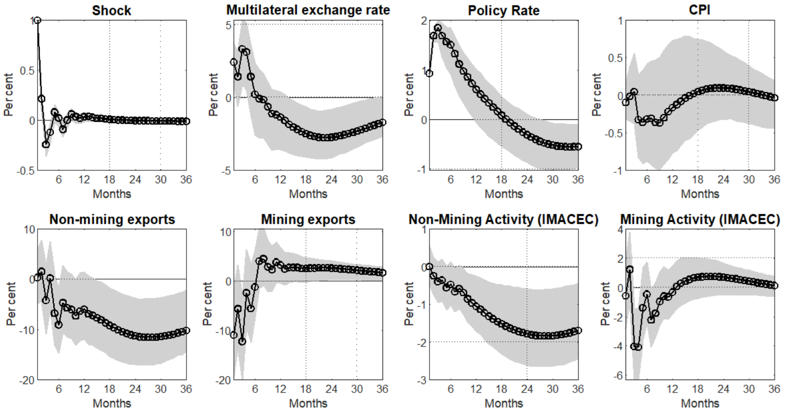
Effect of a monetary tightening shock



- Dollar export values fall in response to tightening that induces appreciation.
- If prices also adjust, Δ values might be a lower bound to quantity response.
- Responses comparable to Canada

Export quantities - monetary policy shock (Chile)

Impulse response to a Chilean monetary policy shock



- Shocks from Brandao-Marques et al. (2020), ordered first in a recursive VAR.
- Export volumes fall quickly for copper, more gradually for other exports.

Takeaways

Takeaways

- Policy conclusions from DCP models rely on two premises: monopoly power and sticky dollar prices in export markets. But: USD is more likely to be used in competitive markets, where prices tend to be flexible
- This paper presents a more general framework: greater global competition and price flexibility for some goods; monopoly power and rigidity for others.
  - Model can better connect with the micro evidence on price flexibility
- As in DCP, in our model pass-through of exchange rates to prices is limited, but the response of export quantities can be large. Quantity effects are similar to PCP model

Conclusions

- Monetary policy can be effective when vehicle currencies are used in export markets
- Exchange rates can act as automatic stabilisers
- Consistent with evidence from large devaluations and identified MP shocks. Time to revisit policy advice?