A Model of U.S. Monetary Policy and the Global Financial Cycle

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Motivation

- U.S. MP has large effects on risky asset prices in rest of world.
  Rey (15), Mueller-Tahbaz-Salehi-Vedolin (17),
  Albagli-Ceballos-Claro-Romero (19), Gilchrist-Yue-Zakrajsek (19),
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  Kalemli-Ozcan (20), Miranda-Agrippino-Rey (20), Boehm-Kroner (25), ...
- No GE model explaining global risk pricing effects of U.S. MP.
- Such a framework needed to understand
  - why U.S. MP is special;
  - implications for macro spillovers;
  - if these spillovers might change in future.

What we do

Related literature

Propose model of U.S. monetary transmission in open-economy NK with global intermediaries that price risky assets globally.

- When intermediaries are short dollar, dollar appreciation upon U.S. MP tightening erodes net worth, raises global price of risk.
- Quantitative relevance of mechanism:
  - FX, yield curve resp. to U.S. MP line up with avg excess returns.
  - intermediaries indeed short dollar if portfolio mean-var. efficient.
  - spillovers through risk pricing matter for real outcomes.
- Potential future with higher dollar interest rates:
  - $\Rightarrow$ lower intermediary dollar funding, so smaller U.S. MP spillovers.
  - can arise from lower dollar demand, consistent with 2025 data.

Overview of model

Model details

- *n*-country NK model in which:
  - households supply labor and consume local, imported goods;
  - firms set sticky prices in each destination market (“LCP”);
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$$E_t(\text{profits})_{t+1} - \frac{\gamma}{(\text{wealth})_t} Var_t(\text{profits})_{t+1}.$$

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$\Rightarrow$ Global macro model w/ currency, bond risk premia. Many uses.

The key mechanism in this paper

Analytical results

- $E_{j,t} \equiv j$ currency per dollar,
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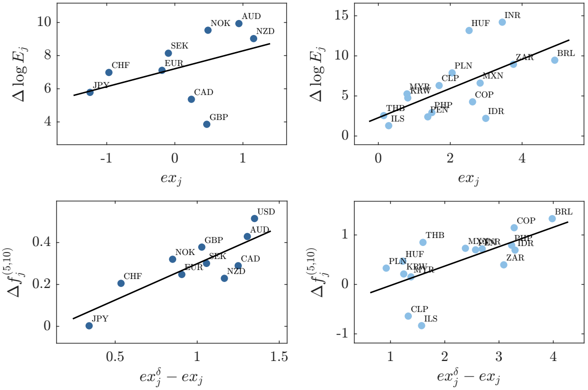
- Similar mechanism applies to risk premia on long-term bonds.

Asset price responses to U.S. tightening in data

- Given 1*pp* Bauer-Swanson (23) surprise increase in 2*y* U.S. yield:



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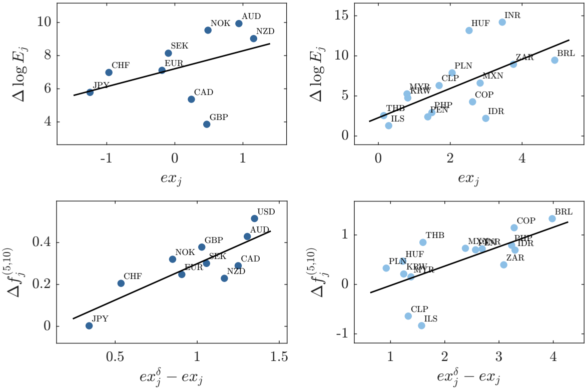

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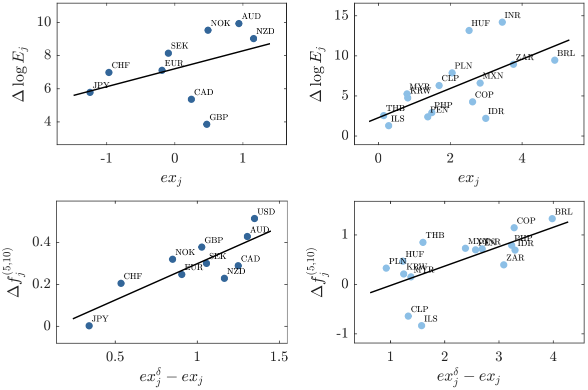

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- Dollar has low interest rate *relative to risk*, complementing CIP-based "dollar convenience" (Jiang-Krishnamurthy-Lustig (21)).
- Structure of portfolio robust to base currency; using IBOR yields; excluding long bonds; sample period. ▸ Details

Asset price responses to U.S. tightening in model

▸ Estimation

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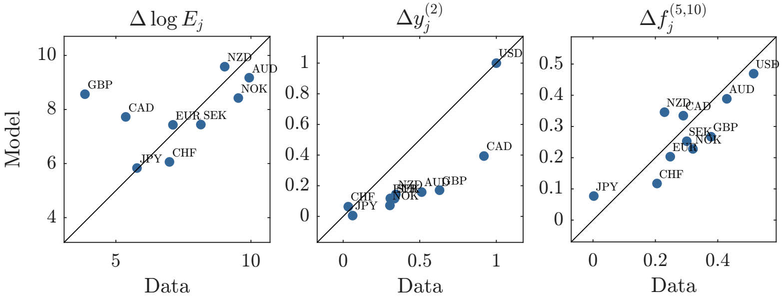

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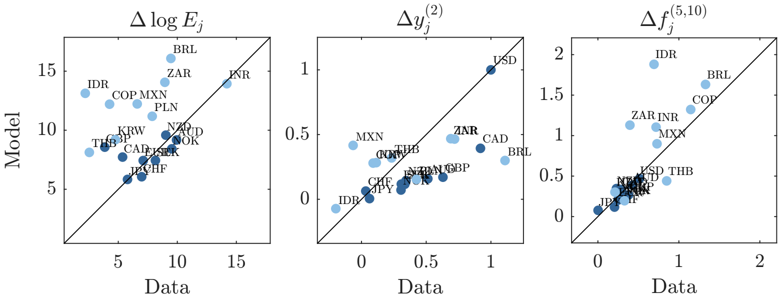
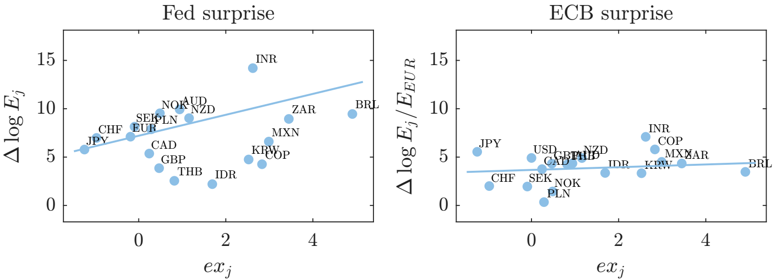


- Implied leverage ≈ 30. EM "misses" may be FX intervention (Albagli-Ceballos-Claro-Romero (19, 24)) or mis-measurement.

- Responses to Fed vs. ECB surprises (from Altavilla et al (2019)):



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The specialness of U.S. MP

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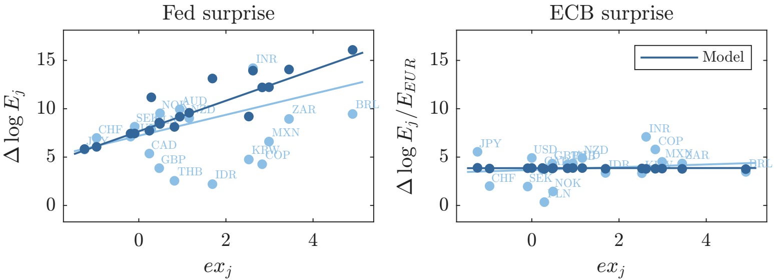
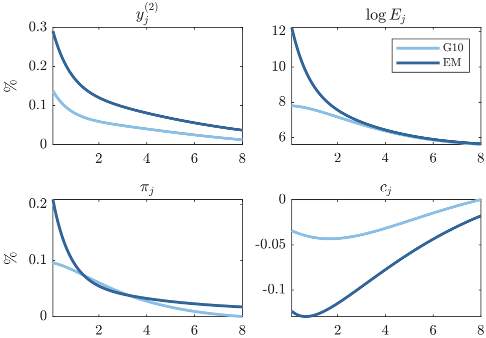


- Unlike Fed surprises, x-section doesn't line up with avg returns.
- Model explains this (untargeted!), given dollar funding.

Real and policy implications

Details

- Effects on risk pricing $\Rightarrow$ "sudden stop" in EMs vs. G10:



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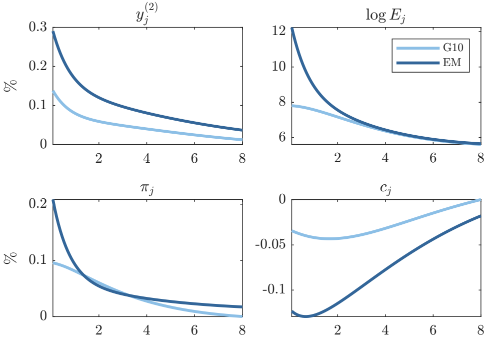

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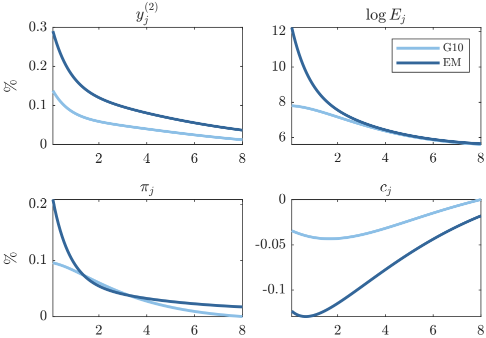

- Inflation vs. consumption. Can mitigate via FX intervention. à la Farhi-Werning (12), Bianchi-Lorenzoni (22), Corsetti-Dedola-Leduc (23),...
- Here conjecture distinct gains from coordination: countries do not internalize effect of broad dollar on intermediary wealth.

What might the future hold? ▸ Details

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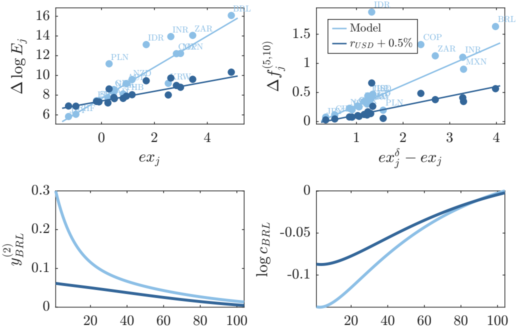
- Model implies weaker U.S. monetary spillovers, because mean-variance efficient portfolio features smaller dollar funding:



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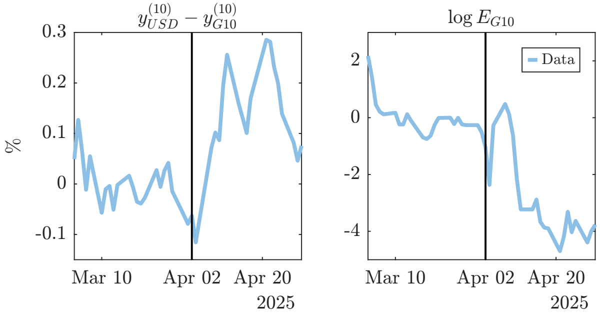

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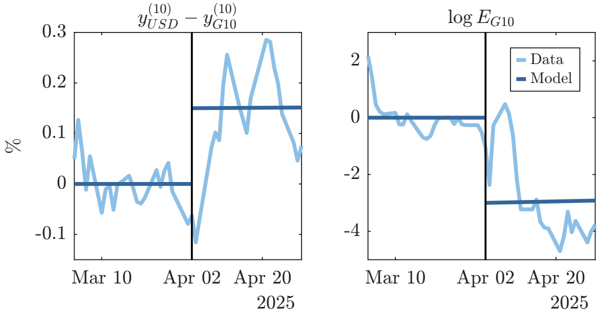

- Can match with decline in foreign ownership of dollar bonds equal to 3.1% of annual U.S. output (half-life $\approx$ 3 years).

Demand for dollar-denominated assets (2/2)

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	persistence (ann.)			
wealth/ GDP	0.85	0.90	0.95	0.9999
0.1%	-2.3%	-2.1%	-1.8%	-1.6%
0.2%	-3.0%	-2.6%	-2.3%	-2.0%
0.3%	-4.5%	-3.9%	-3.3%	-2.7%
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- vs. foreign-owned Treasuries (debt, assets): 25% (50%, 200%).
- *News* of future rebalancing is what matters for asset prices.

Conclusion

Extended canonical NKOE w/ global intermediaries pricing risk.

- When intermediaries are short dollar, U.S. MP tightening erodes net worth and raises global price of risk.
- Consistent w/ FX, yield responses. Matters for real spillovers.
- Dampened w/ higher dollar rates, as from lower dollar demand.

APPENDIX

Related literature

Back

- Exchange rates and balance sheet effects in open economies.
  Bruno-Shin (15), Miranda-Agrippino-Rey (20), Jiang-Krishnamurthy-Lustig (24).
  Aghion-Bacchetta-Banerjee (07), Gertler-Gilchrist-Natalucci (07),...
  Here: GE; imperfect asset substitutability from risk.

- Int'l capital flows and risk premia in segmented markets.
  Gabaix-Maggiori (15), Itskhoki-Mukhin (21), Kekre-Lenel (24).
  Gourinchas-Ray-Vayanos (22), Greenwood-Hanson-Sunderam-Stein (23).
  Here: multiple risky assets in GE; endog. risk-bearing capacity.

- Risk premium effects of MP in closed economy.
  Hanson-Stein (15), Hanson-Lucca-Wright (21).
  Bianchi-Lettau-Ludvigson (21),Bauer-Pflueger-Sunderam (24),Bianchi-Ludvigson-Ma (24).
  Pflueger-Rinaldi (22), Kekre-Lenel (22), Kekre-Lenel-Mainardi (25).
  Here: open economy; wealth reval'n explains why U.S. MP special.

Model (1/3)

Back

- Representative household in each country j:
  - separable utility in consumption (IES ψ) and labor supply.
  - CES consumption over goods from each country (elast. σ).
  - asset markets are only difference from standard NKOE models.
    - in each currency k, agents trade short bond paying $i_{k,t}$ at $t+1$, consol at price $P^{\delta}_{k,t}$ and paying $1, \delta, \delta^2, \ldots$ from $t+1$ onwards.
    - households frictionlessly trade local currency short bond;
    - households have exog. positions in foreign short bonds, consols:

$$B_{jk,t} = P_{k,t}\bar{b}_{jk}, \ \ \forall k \neq j,$$
$$B^{\delta}_{jk,t} = P_{k,t}\bar{b}^{\delta}_{jk}, \ \ \forall k.$$

can easily generalize as “demand shifters”, w/ adj. costs.

Model (2/3)

▸ Back

- Intermediaries trade all bonds and facilitate int'l capital flows:
  - rep. intermediary at t has wealth $W_{m,t}$ (in dollars) and trades in all bonds to maximize

$$E_t \Pi_{m,t+1} - \frac{\gamma}{W_{m,t}} Var_t \Pi_{m,t+1},$$

    where $\Pi_{m,t+1}$ is dollar value of intermediary's portfolio at $t+1$.
  - share ξ exit at $t+1$, rebate wealth to U.S. households.
  - new intermediaries endowed w/ $P_{1,t+1}\omega_m$ from U.S. households.

  ⇒ wealth of rep. intermediary evolves as

$$W_{m,t+1} = \xi P_{1,t+1}\omega_m + (1-\xi)\Pi_{m,t+1}.$$

- Assuming profits rebated to U.S. households is not important; objective denominated in dollars *can* be important.

Model (3/3)

Back

- Continuum of firms in each j owned by domestic households:
  - produce variety with linear technology in labor.
  - face price adjustment costs in each destination (LCP).
- Taylor (93) rules: inertia ρ_i, inflation coeff. ϕ_π, U.S. shock $\nu_{i1,t}$.
  - later consider foreign policies that target exchange rate, FXI.
- Market clearing: labor, goods, one-period bonds, consols.
- Defn's: $q_{j,t} \equiv E_{j,t} P_{1,t} / P_{j,t}$,

$$ex_{j,t+1} \equiv \frac{E_{j,t}}{E_{j,t+1}}(1 + i_{j,t}) - (1 + i_{1,t}),$$

$$ex^{\delta}_{j,t+1} \equiv \frac{E_{j,t}}{E_{j,t+1}} \frac{1+\delta P^{\delta}_{j,t+1}}{P^{\delta}_{j,t}} - (1 + i_{1,t}).$$

Solution approach

Back

- First-order approx. around SS with $\gamma\sigma^2_{shocks} \to \Gamma$ as $\sigma_{shocks} \to 0$ (Itskhoki-Mukhin (21), Borovicka-Hansen-Sargent (23), KL (24)).

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- In SS,

$$ex_j = \frac{\Gamma}{w_m}\left[\sum_{k=2}^{n} Cov(ex_{j,+1}, ex_{k,+1})q_k^{-1}b_{mk} + \sum_{k=1}^{n} Cov(ex_{j,+1}, ex^{\delta}_{k,+1})q_k^{-1}b^{\delta}_{mk}\right],$$

where $w_{m,t} \equiv W_{m,t}/P_{1,t}$, $b_{mk,t} \equiv B_{mk,t}/P_{k,t}$, $b^{\delta}_{mk,t} \equiv B^{\delta}_{mk,t}/P_{k,t}$, and

$$E_t\hat{ex}_{j,t+1} = -ex_j\hat{w}_{m,t} + \frac{\Gamma}{w_m}\sum_{k=2}^{n} Cov(ex_{j,+1}, ex_{k,+1})q_k^{-1}\hat{b}_{mk,t} + \dots$$

and analogously for ex^{δ}_j, $E_t\hat{ex}^{\delta}_{j,t+1}$.

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and analogously for ex^{δ}_j, $E_t \hat{ex}^{\delta}_{j,t+1}$.

$\Rightarrow$ *Cov*'s summarize role of other shocks in propagation of $\nu_{i1,t}$. We treat these as parameters and discipline directly with data.

Effects of U.S. monetary shock on exchange rates

Back

- Consider fully sticky prices, small $\{ex_j, b_{jk}, \Gamma/w_m\}$, $\{b^{\delta}_{jk} = 0\}$.
- **Prop:** given U.S. monetary tightening $d\nu_{i1,t}$,

$$\hat{E}_{j,t} = \hat{q}_{j,t} = \Bigg(\left[\beta^{-1} - \rho_{i1}\right]^{-1} \left[1 + (\beta^{-1} - 1)(1 - \rho_{i1})^{-1}\psi\right]$$

$$+ \left[\beta^{-1} - \rho_{i1}\right]^{-1} \left[1 + (\beta^{-1} - 1)(1 - \rho_{i1})^{-1}\psi\right] \beta \frac{1 - \xi}{\xi} \frac{\sum_{k=2} q_k^{-1} b_{mk}}{w_m} ex_j$$

$$+ \left[\beta^{-1} - \rho_{i1}\right]^{-2} \left[\beta^{-1} - 1\right]^{-1} [\psi - 1] \frac{\Gamma}{w_m} Cov\left(ex_{j,+1}, \sum_{k=2}^{n} \eta_{1k} ex_{k,+1}\right) \Bigg) d\nu_{1,t}.$$

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- Absent change in risk pricing, foreign depreciation.
- Arbitrarily large as $\beta \to 1$, $\rho_{i1} \to 1$ (à la Engel-West (05)).
- Does not depend on trade w/ U.S. b/c of fully sticky prices.

Effects of U.S. monetary shock on exchange rates

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- Dollar appreciation reduces wealth if $\sum_{k=2}^{n} q_k^{-1} b_{mk} > 0$.
- Raises risk premium ($\Rightarrow$ bigger depreciation) if $ex_j > 0$.
- Magnified as ξ falls, since risk premium persistently rises.

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- If $\psi < 1$, U.S. inflows $\Rightarrow$ intermediary holds less foreign bonds.
- Currencies w/ high “dollar beta” fall in risk and appreciate.

$\Rightarrow$ “Dollar beta” (Verdelhan (18)) is exposure to U.S. inflows in GE.

Effects of U.S. monetary shock on consol prices

Back

- **Prop:** given U.S. monetary tightening $d\nu_{i1,t}$,

$$\hat{P}^{\delta}_{j,t} = \Bigg(-\left[1-\delta\beta\rho_{i1}\right]^{-1} 1\{j=1\}$$

$$-\left[\beta^{-1}-\rho_{i1}\right]^{-1}\left[1+(\beta^{-1}-1)(1-\rho_{i1})^{-1}\psi\right]\frac{1-\xi}{1-\delta(1-\xi)}\frac{\sum_{k=2} q_k^{-1} b_{mk}}{w_m}\left(ex_j^{\delta}-ex_j\right)$$

$$-\left[\beta^{-1}-\rho_{i1}\right]^{-1}\left[\beta^{-1}-\delta\rho_{i1}\right]^{-1}\left[\psi-1\right]\frac{\Gamma}{w_m} Cov\left(ex^{\delta}_{j,+1}-ex_{j,+1}, \sum_{k=2}^{n}\eta_{1k}\,ex_{k,+1}\right)\Bigg) d\nu_{1,t}.$$

Taking stock, and quantitative approach

Back

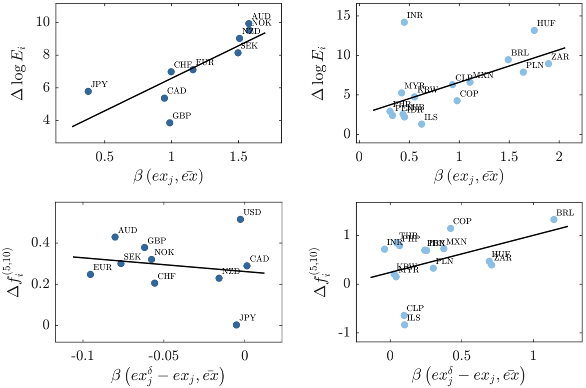
- U.S. monetary policy affects global risk pricing through
  1. revaluation of intermediary wealth $\Rightarrow$ change in price of risk;
  2. capital flows $\Rightarrow$ change in quantity of risk ("portfolio balance").
- #2 depends on *Cov*'s and (standard) preference parameters.
- #1 depends on *ex*'s, $\frac{\sum_{k=2}^{n} q_k^{-1} b_{mk}}{w_m}$, and ξ.
  - recall portfolios solve (in matrix notation) $\boldsymbol{ex} = \frac{\Gamma}{w_m} \boldsymbol{C}(\boldsymbol{q}^{-1}\boldsymbol{b_m})$.

$\Rightarrow$ $\frac{1}{w_m}(\boldsymbol{q}^{-1}\boldsymbol{b_m}) = \frac{1}{\Gamma}\boldsymbol{C}^{-1}\boldsymbol{ex}$.

$\Rightarrow$ estimated $\boldsymbol{C}$ and $\boldsymbol{ex}$ pins down currency exposure.
then we estimate Γ, ξ to match asset price effects of U.S. MP.

Asset price responses to U.S. tightening in data

▸ Back



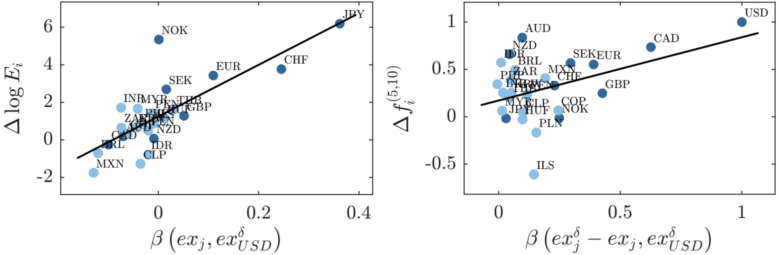
- Currencies covarying more with broad dollar depreciate by *more*.

$\Rightarrow$ Portfolio balance not dominant (assuming U.S. inflows).

- But consistent w/ comovements induced by MP being "typical".

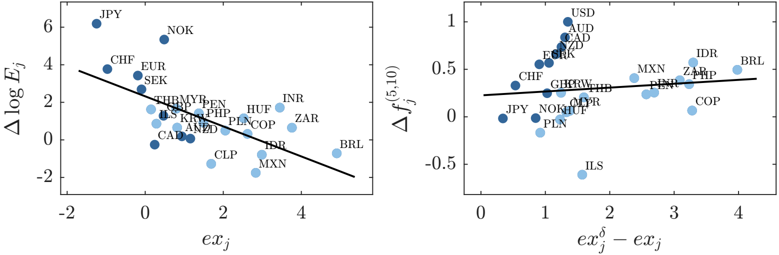
Asset price responses to U.S. QT in data

▸ Back



Asset price responses to U.S. QT in data

▸ Back



Mean-variance efficient portfolios (1/3)

Back

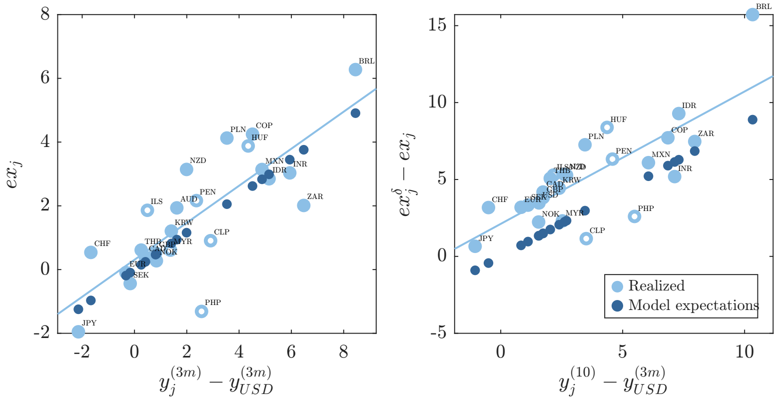
- Daily data on G10 + EM yield curves, exchange rates, 91-24.

	CHF, EUR, JPY	Other non-U.S. G10	EM
Avg 3m interest rate diff. (ann.)	-1.4%	0.9%	4.0%
Avg 3m excess return (ann.)	-0.5%	1.0%	2.7%
Daily s.d. of log exchange rate (ann.)	10.1%	11.0%	10.8%

- Estimate $\boldsymbol{ex}$ using fitted value from x-sectional reg. of avg. excess returns on interest rate diff. and slope of yield curve.
- Estimate $\boldsymbol{C}$ using cov's of daily changes in log exchange rates and 10-year bond prices, aggregated to quarter.

Mean-variance efficient portfolios (2/3)

Back



Mean-variance efficient portfolios (3/3)

Back

- Resulting mean-variance efficient portfolio shares:

	CHF, EUR, JPY	Other non-U.S. G10	EM	Sum
$\Gamma = 1$	-2.1	-2.7	9.2	4.5
$\Gamma = 1$, JPY-based investor	-2.1	-2.7	9.2	4.5
$\Gamma = 0.1$	-20.5	-27.1	92.2	44.6
$\Gamma = 0.1$, JPY-based investor	-29.5	-27.1	92.2	35.6
$\Gamma = 1$, G10 IBOR yields	-3.2	-0.7	6.3	2.5
$\Gamma = 1$, no 10-year bonds	-0.7	-3.1	9.7	5.9
$\Gamma = 1$, 2008-2024	-3.9	-2.5	9.9	3.5

Why not measure portfolios directly? ▸ Back

- Growing literature measuring international portfolios.
  Maggiori-Neiman-Schreger (20), Koijen-Yogo (22), Du-Fontana-Jakubik-Koijen-Shin (23), Hacioglu-Ostry-Rey-Rousset Planat-Stavrakeva-Tang (24), Rey-Stavrakeva (24), Dao-Gourinchas-Itskhoki (25), ...
- But even using administrative data:
  - how to measure exposure given (opaque) trading in derivatives?
  - who are the "intermediaries"? (i.e., who enforces no arbitrage?)
- Solving for optimal portfolios can be useful complementary tool.
  Downside: potential instability. Robustness ongoing.

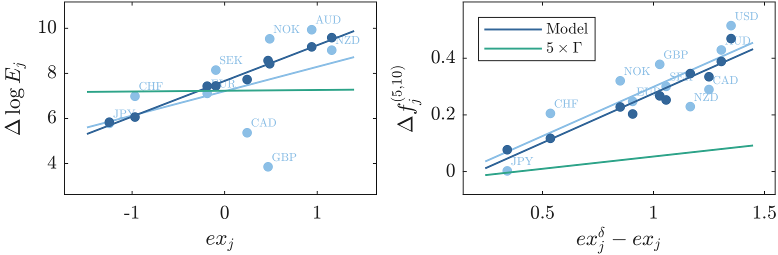
Model parameterization

Back

- Externally set parameters:
  - $\psi = 0.5$, $\sigma = 1.5$, Calvo-equiv. 5 qtrs, $\xi \approx$ half-life 2 qtrs.
- Calibrated parameters without reference to U.S. MP shocks:
  - discount factors and $\{\bar{b}^{\delta}_{1j}\}$ matching ***ex***;
  - $\{\bar{b}_{1j}, \bar{b}_{jk}, \bar{b}^{\delta}_{jk}\} = 0 \;\; \forall j > 1$ for now (intend to match NFAs);
  - $\boldsymbol{C}$ directly taken from data;
  - tastes in CES aggregators matching trade shares (IMF DOTS).
- $\{\Gamma, \xi, \rho_{i1}\}$ estimated on high-freq. G10 responses to U.S. MP:
  - project $\Delta y^{(2)}_{j,t}$, $\Delta f^{(5,10)}_{j,t}$, $\Delta \log E_{j,t}$ on Bauer-Swanson (22) surp.
  - responses which follow scaled to correspond to $\Delta y^{(2)}_{USD,t} = 1pp$.
- ω_m estimated on high-freq. U.S. response to QE1.

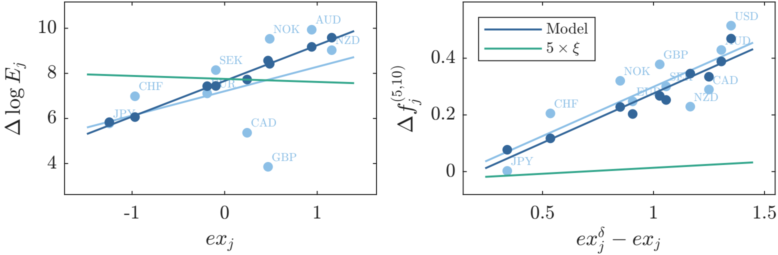
Identification of Γ

Back



Identification of ξ

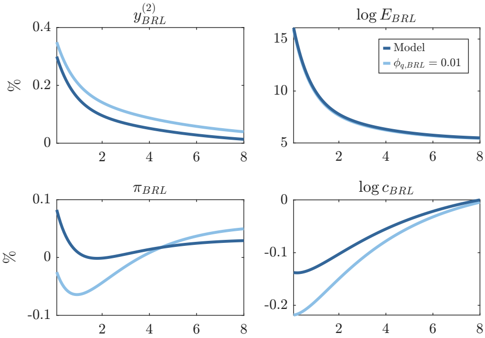
Back



Role of exchange rate targeting

Back

- Add $+\phi_{q,j}(\log q_{j,t} - \log q_j)$ to monetary policy rule.

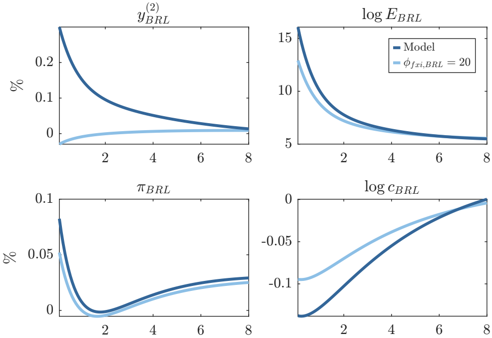


- $\phi_{q,BRL} > 0$ dampens depreciation but worsens real contraction.

Role of FXI

▸ Back

- New FXI rule: $\bar{b}_{j1,t} = -\phi_{fxi,j}(\log q_{j,t} - \log q_j)$.



- $\phi_{fxi,BRL} > 0$ dampens depreciation and lowers domestic yields.

A future with higher dollar interest rates

Back

- Going forward, dollar rates may rise (fiscal, dollar demand, ...).
- Mean-variance efficiency implies shift away from dollar funding:

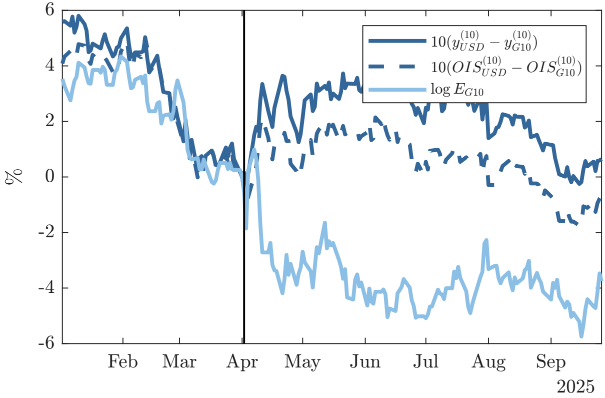
	CHF, EUR, JPY	Other non-U.S. G10	EM	Sum
$\Gamma = 1$	-2.1	-2.7	9.2	4.5
$\Gamma = 1$, 0.5*pp* higher dollar rate	-2.9	-3.0	6.7	0.8

- Recall Δ risk pricing from U.S. MP depends on $\frac{\sum_{k=2}^{n} q_k^{-1} b_{mk}}{w_m} ex_j$.

$\Rightarrow$ Dampened with smaller leverage in non-dollar bonds.

Asset prices through 2025

Back



Disciplining price impact of flows

▸ Back

- Recall

$$E_t \hat{ex}_{j,t+1} = \frac{\Gamma}{w_m} \sum_{k=2}^{n} Cov(ex_{j,+1}, ex_{k,+1}) q_k^{-1} \hat{b}_{mk,t} + \dots$$

$\Rightarrow$ given other targets, w_m controls price impact per dollar flow.

- We discipline endowment ω_m to match effect of U.S. QE1:
  - $\approx$ 6.5% of ann. GDP worth of 10-year Treasuries purchased.
  - simulate equivalent $\bar{b}^{\delta}_{11,t}$ innovation in model with half-life $\approx$ 3 years, and estimate ω_m to match $\Delta f^{(5,10)}_{USD,t} = -1.2\%$.

Impulse responses to foreign flows

Back