New Economics of Exchange Rate Adjustment: The Known Unknowns

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The ‘Known Knowns’ and the ‘Known Unknowns’

‘As we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know’ Donald Rumsfeld, Feb. 2002 (but also John Keats, Thomas Schelling...)

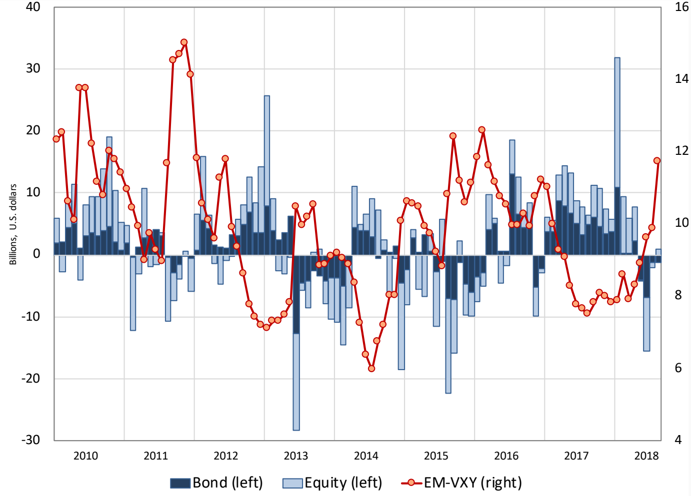
Known Unknowns in the Economics of Exchange Rate Adjustment

A very partial and idiosyncratic list:

1. The Transmission of Monetary Policy.
2. Why the dollar appreciates in bad times, and the search for a 'financial determination' of exchange rates.
3. Safe Asset Scarcity and Exchange Rate Adjustment: how elastic is the exchange rate?
4. Global Trade: Invoicing or FX Borrowing?

Transmission, Spillovers, Dilemma/Trilemma

Emerging Fund Flows & Global Risk



Left: Flows to EME-dedicated bond and equity funds; Right: JP Morgan's EM-VXY. Source: WEO (2018).

A Simple Example

Two countries EM (home) and U.S. (*):

$$Y = A + NX \quad (1)$$

$$A = -cR - fE + \xi \quad (2)$$

$$NX = a(Y^* - Y) + bE \quad (3)$$

$$E = d(R^* - R) + \chi(R^*) \quad (4)$$

$$Y^* = A^* = -cR^* + \xi^* \quad (5)$$

- ξ and ξ^* are aggregate demand shocks (fiscal...);
- $f > 0$ captures financial spillovers : an appreciation is expansionary. $f = 0$ is the Mundell-Fleming case.
- (4) is a UIP condition. $\chi(R^*) = gR^* + \chi$ is a risk-premium shock, possibly correlated with R^*. global financial cycle.
- US is 'large' so $NX^* = 0$.

A Simple Example

Solve the model to obtain:

$$(1+a)Y = (\xi + a\xi^*) + (b-f)\chi + ((b-f)(d+g) - ac)R^* + ((f-b)d - c)R$$

$$\frac{\partial Y}{\partial R^*} = \frac{(bd-ac) - f(d+g) + bg}{1+a} \equiv \phi_{R^*}$$

$$\frac{\partial Y}{\partial \chi} = \frac{b-f}{1+a}$$

$$\frac{\partial Y}{\partial R} = \frac{(f-b)d - c}{1+a} \equiv \phi_R$$

- $bd - ac$: Mundell-Fleming effect ('exp. switching' vs. 'exp. reducing'). Assumed positive.
- $-f(d+g) + bg$: financial spillovers from US monetary policy.
- risk premia (χ): depends on exp. switching (b) vs. spillovers (f).
- $\phi_R < 0$: 'normal' transmission, $\phi_R > 0$: 'perverse' transmission

Spillovers and Transmission of Mon. Pol.

Weak Spillovers

$\phi_{R^*} > 0$

$\phi_R < 0$

Intermediate Spillovers

$\phi_{R^*} < 0$

$\phi_R < 0$

Strong Spillovers

$\phi_{R^*} < 0$

$\phi_R > 0$

'Normal' Transmission	'Perverse' Transmission

$$\phi_{R^*} = \frac{d+g}{1+a}(\underline{f} - f) \quad ; \quad \phi_R = \frac{d}{1+a}(f - \bar{f})$$

Optimal Monetary Policy

Suppose the domestic central bank cares about output volatility and the trade balance (Bernanke, 2017):

$$\mathcal{L}^o \equiv \min \frac{1}{2}\mathbb{E}Y^2 - \alpha \mathbb{E}NX$$

Proposition (Optimal Policy)

$$R^o = \frac{1}{\phi_R}\left[Y^o - \frac{\xi + a\xi^*}{1+a} - \frac{b-f}{1+a}\chi - \phi_{R^*}R^*\right]$$

where $Y^o = -\alpha\left(a + \frac{bd}{\phi_R}\right)$ *is the optimal level of output, and the exchange rate satisfies:*

$$E^o = -\frac{(d+g)(\bar{f} - \underline{f})}{f - \bar{f}}R^* - \frac{c/d}{f - \bar{f}}\chi - \frac{d}{\phi_R}\left(Y^o - \frac{\xi + a\xi^*}{1+a}\right)$$

Non-Monotonous Impact of Financial Frictions

Proposition (Non-Monotonous Impact of Financial Frictions)

- *if financial frictions are weak* ($f < \underline{f}$)

$$\phi_{R^*} > 0, \quad \phi_R < 0, \quad 0 < \frac{\partial R^o}{\partial R^*} \leq 1$$

- *if financial frictions are intermediate* ($\underline{f} < f < \overline{f}$)

$$\phi_{R^*} < 0, \quad \phi_R < 0, \quad \Longrightarrow \frac{\partial R^o}{\partial R^*} < 0$$

- *if financial frictions are strong* ($f > \overline{f}$)

$$\phi_{R^*} < 0, \quad \phi_R > 0, \quad \Longrightarrow \frac{\partial R^o}{\partial R^*} > 1 \quad \textit{and} \quad \frac{\partial E^o}{\partial R^*} < 0$$

$\text{Corr}(R, R^*)$ non-monotonous with the strength of the financial spillovers.

Choice of FX regime

Consider shocks to R^{*} ($\sigma^2_{R^*}$) and to risk premia χ (σ^2_{χ}).
Contrast a full float ($R = 0$) to a peg ($R = (1 + g/d)R^{*} + \chi/d$)

Proposition

- *A pure float is preferred to a peg as long as monetary policy transmission is 'normal'*
- *A peg if preferred to a pure 'float' when monetary policy transmission if perverse*

$$\mathcal{L}^f < \mathcal{L}^p \iff f < \bar{f}$$

Note: $\mathcal{L}^o \leq \min \left\langle \mathcal{L}^f, \mathcal{L}^p \right\rangle$

The Known Unknowns

The Known Unknown: ϕ_R and ϕ_{R^*}.

- There is very little credible direct evidence on the transmission of monetary policy in EMEs (ϕ_R)
  - Few EMEs with asset markets trading the relevant instruments for a high-frequency identification
  - Few countries with credible 'narrative' (Romer and Romer) shocks
  - Giorgiadis and Jancokova (2018): 60 empirical studies of MP shocks in EMEs and SOEs, with only 5 using HFI and none using a narrative approach
- There is very little credible direct evidence on the effect of R^* for EMEs (ϕ_{R^*})
  - R^* shocks are pre-determined for EMEs. But
  - R^* could reponse to global shocks (omitted variable)
  - the estimated IRF includes the (endogenous) response of domestic monetary authorities ($\partial R / \partial R^*$)

This should be a major objective for applied research.

Making Progress

Estimating the strength of financial frictions with a small open macro model for Chile

- Small Open Economy (**H**) and rest of the world (**U**)
- Standard NK DSGE à la Galì (2011) with financial frictions
  - Two types of Households (Patients and Impatients)
  - A Manufacturing sector (and a Copper sector)
  - Credit constraints vary with E, controlled by a parameter ψ_{be}
  - Wages and prices are sticky
  - Export and Import Prices set in US dollar (dollar pricing)
- Various shocks: productivity, sudden stop, copper, credit supply, monetary policy (U.S. and home), world demand.

$$\zeta_t^{\#} = \rho^{\#}\zeta_{t-1}^{\#} + \sigma^{\#}\varepsilon_t^{\#}$$

- Model estimated with Bayesian methods on data for 1999-2015.

Literature

- Monetary Spillovers for EMEs
  - Aoki, Benigno & Kiyotaki (2016), Blanchard (2016), Devereux & Yu (2016), Rey (2013), Akinci & Queralto (2018), Hnatkovska, Lahiri and Vegh (2016)
- DSGE literature and estimation
  - Galì and Monacelli (2008), Iacovello (2015), Mendoza (2010), Gourinchas Philippon & Vayanos (2016)s
  - An & Schorfheide (2007)
- Literature on currency invoicing ('dominant currency paradigm')
  - Devereux, Shi & Xu (2007), Goldberg & Tille (2007), Corsetti & Pesenti (2007), Gopinath (2015), Gopinath et al (2018), Egorov & Mukhin (2019)

Households

$$U^i = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_i^t \left(\frac{\left(C_t^i\right)^{1-\sigma_c}}{1-\sigma_c} - \frac{\left(N_t^i\right)^{1+\varphi}}{1+\varphi} \right)$$

- Borrowers, β_b (mass χ),

$$P_t C_t^b = W_t N_t^b + \Pi_t + B_t^h - (1+i_t) B_{t-1}^h + COP_t$$

- Savers, $\beta > \beta_b$ (mass $1-\chi$),

$$P_t C_t^s = W_t N_t^s + \Pi_t + (1+i_t) S_{t-1} - S_t + COP_t$$

COP: revenues from copper sector. Π: manufacturing profits.
r_t^*: dollar borrowing rate; i_t domestic nominal rate; e: log real exchange rate.

Output, Wage Rigidities and Copper Sector

- Manufacturing output:

$$Y_t^m = \exp(a_t) N_t \quad ; \quad a_t - \bar{a} = \rho_a (a_{t-1} - \bar{a}) + \zeta_t^a$$

- Wage-calvo process yields a Phillips curve:

$$\pi_t^w = \beta \mathbb{E}_t \pi_{t+1}^w - \lambda_w \left(w_t - \gamma c_t - \varphi n_t + \mu^w \right)$$

where $w = \ln(W/P)$, $c = \ln C$, $n = \ln N$.

- Total output:

$$\begin{aligned} Y_t &= Y_t^m + COP_t \\ \ln COP_t &= e_t + \zeta_t^{co} \end{aligned}$$

Invoicing & Financial Frictions

- CES demand aggregator:
- θ_{ij}^{k}: fraction of firms from i selling in market j in currency k.
  - $\theta_{ij}^{i} = 1$: producer currency pricing
  - $\theta_{ij}^{j} = 1$: local currency pricing
  - $\theta_{ij}^{u} = 1, i \neq j$: dominant currency pricing
- Borrowers borrow from bank that funds itself on dollar wholesale funding markets. Imposes a borrowing limit: $\chi B_t^h \leq \bar{B}_t^h$

$$\bar{b}_t^h = \ln\left(\frac{\bar{B}_t^h}{P_t}\right) = \bar{b}^h + \rho_{bh}(\bar{b}_{t-1}^h - \bar{b}^h) - \psi_{be}(e_t - \bar{e}) + \zeta_t^{bh}$$

  ψ_{be}: intensity of financial spillovers
- Firms pay a share ψ_{wc} of production costs in advance. Funding cost i_t.

$$MC_t = \frac{W_t}{A_t}(1 + \psi_{wc} i_t)$$

Interest Rates & World Demand

- U.S.Taylor Rule:

$$i_t^u = \bar{i} + \rho_{iu}(i_{t-1}^u - \bar{i}) + (1 - \rho_{iu})\phi_{iu}(c_t^u - \bar{c}^u) + \zeta_t^{mu}$$

- Dollar funding cost:

$$r_t^* = i_t^u - \psi_b(e^{\mathrm{NFA}_t - \overline{\mathrm{NFA}}} - 1) + \zeta_t^{rp}$$

- Domestic Taylor rule

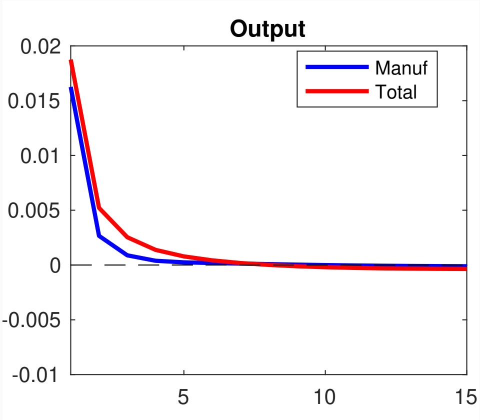
$$i_t = \bar{i} + \rho_m(i_{t-1} - \bar{i}) + (1 - \rho_m)(\phi_m \pi_t^h + \phi_y(y_t - \bar{y})) + \zeta_t^m$$

- Uncovered Parity Condition (first order)

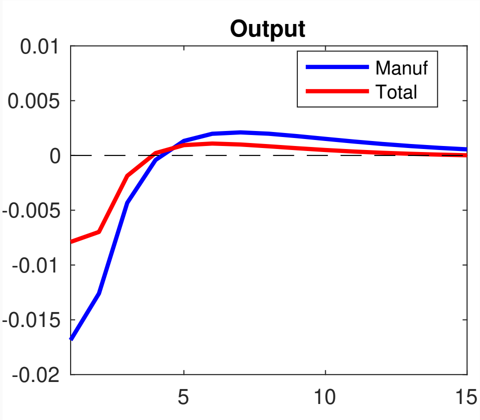
$$i_t = r_t^* + \mathbb{E}_t(e_{t+1} - e_t + \pi_{t+1})$$

- World Demand: $c_t^u = \bar{c}^u + \rho_{cu}(c_{t-1}^u - \bar{c}^u) - (1 - \rho_{cu})\phi_{iu}(i_t^u - \bar{i}) + \zeta_t^{cu}$

IRF: US Monetary Policy Tightening

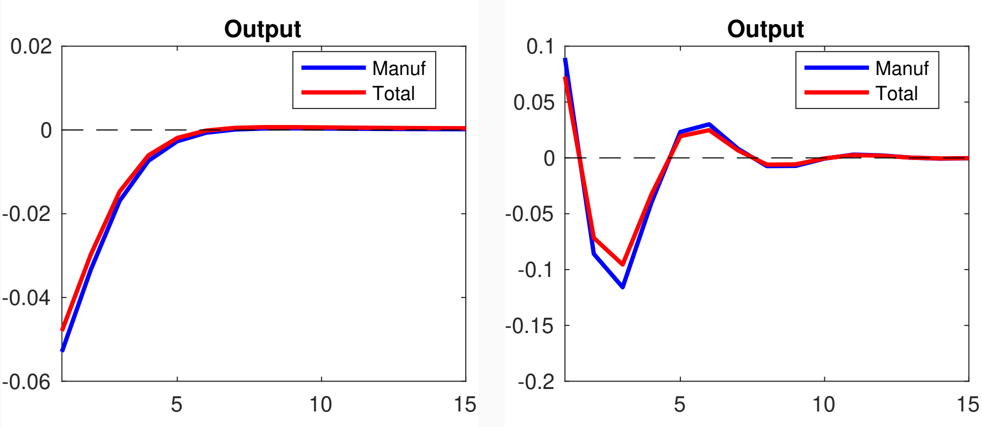


(a) Low Spillovers: $\psi_{be} = 0$



(b) Intermediate Spillovers: $\psi_{be} = 3$

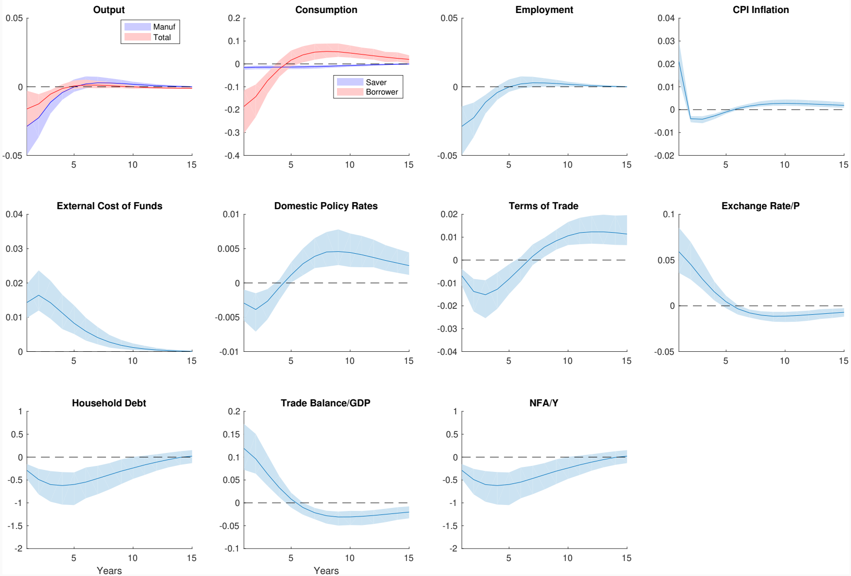
IRF: Chile Monetary Policy



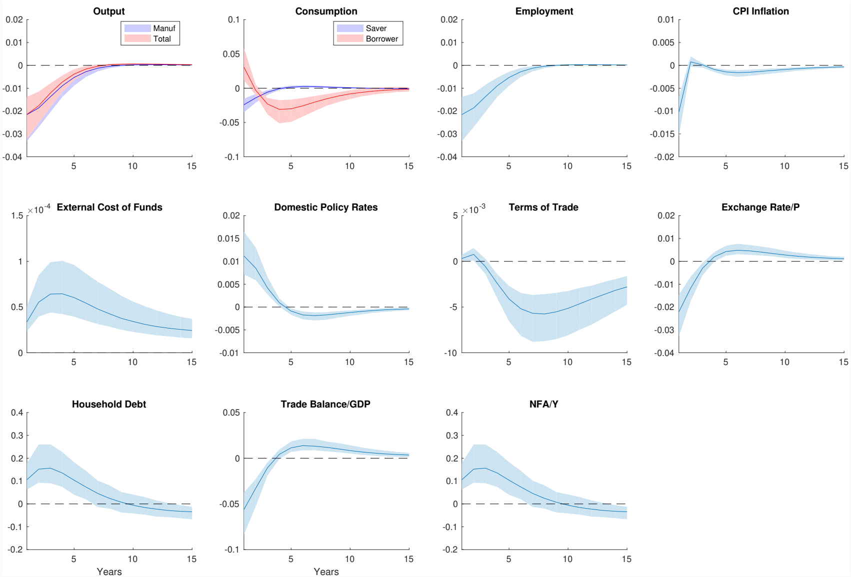
(a) Low Spillovers: $\psi_{be} = 0$

(b) High Spillovers: $\psi_{be} = 20$

Estimate $\psi_{be} = 4.96$. Bayesian IRF: US Monetary Policy



Estimate $\psi_{be} = 4.96$. Bayesian IRF: Chile Monetary Policy



‘Reserve Currency Paradox’: the search for a ‘financial determination’ of exchange rates.

‘Reserve Currency Paradox’

A popular interpretation of the international monetary system: the US as a 'global supplier of safe asset' (either demand or supply explanation)

- Accounts for structure of US external balance sheet (long risky, short safe)
- Accounts for excess return in normal times (‘exorbitant privilege’)
- Accounts for valuation losses in times of crisis (‘exorbitant duty’)

(Gourinchas, Rey & Govillot 2010, Maggiori 2017, Hall 2016, Barro & Mollerus 2014, Farhi & Maggiori 2018)

But these models have a hard time producing an appreciation of the dollar in times of crisis! (Reserve Currency Paradox)

‘Reserve Currency Paradox’

Why? The ‘goods market constraint’. Consider a model with 2 goods (T/N), CES preferences:

$$q = \left(\frac{\gamma y^N}{(1-\gamma)c^T} \right)^{-1/\theta} \quad ; \quad P = [\gamma + (1-\gamma)q^{1-\theta}]^{1/(1-\theta)}$$

- Bad times require a transfer of T to ROW: $c^T \downarrow$ in US, $q \downarrow$, $P \downarrow$, RER depreciates
- Goods market logic: insurance payment requires adjustment in relative prices.

Possible solutions:

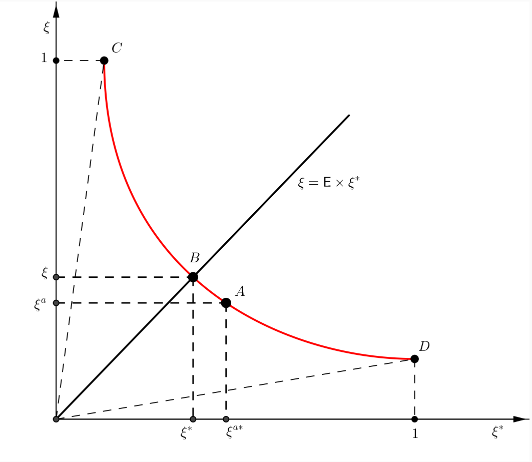
- Risk-on/Risk off: risk appetite $\downarrow$ in bad (but not worst). $\uparrow$ insurance demand (GRG, 2010)
- Signaling about future risks (Stavrakeva and Tang, 2018). General Equilibrium?
- Delinking the goods market side entirely (Jian et al, 2018; Camanho et al, 2018) – what does it mean?

Suspicion: our models don’t have enough ‘disconnect’, so movements in exchange rates are required to match quantity adjustments.

Known Unknown: international portfolio models with realistic β on the US dollar

Safe asset scarcity and exchange rate adjustment

Elasticity of Exchange Rates in a Global Safety Trap



- In a global safe asset trap, different possible allocations of the global demand gap across countries, corresponding to different realizations of exchange rates.
- $\implies$ exchange rates become more 'elastic', potentially indeterminate (Caballero, Farhi & Gourinchas, 2016)
- Potential for Currency Wars and scope for coordination (note: $\neq$ from arg. for fixed exchange rates)
- Known Unknown: are spillovers regime-dependent?

Global Trade and the Dollar: Invoicing or FX Borrowing?

Dominant Currency: Real or Financial?

Trade (invoicing) and financial side (FX borrowing) dimensions of dominant currency

- Dollar invoicing model successful to explain (a) low responsiveness of terms of trade, (b) expenditure switching on imports, (c) pass-through of exports and imports prices and quantities from short to long horizons. (Gopinath et al, 2018)
- Strategic complementarities (Mukhin, 2018)
- Important interactions between invoicing and FX borrowing decisions (Gopinath & Stein, 2018)
- Important prediction (Gopinath et al, 2018): global trade (excl. US) declines when dollar appreciates.
- But: result would hold equally well with dollar borrowing (tighter conditions, decline in aggregate demand and trade)
- Yet policy prescriptions and transmission largely different (adjust invoicing vs. borrow in domestic currency).

Known Unknown: Disentangling the impact of invoicing vs. borrowing choices on aggregate trade