Exchange Rate Pass-Through, Capital Flows, and Monetary Autonomy

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Valuation effects and ERPT

Exchange rate movements have cross-border valuation effects

- Lane-Milesi-Ferretti 2007, Gourinchas-Rey 2007, Lane-Shambaugh 2010, ...

This paper: **New source of fear of floating**

- Interaction country-level FX exposure $\leftrightarrow$ incomplete ERPT
  - $\neq$ within-country heterogeneity/constraints
  - e.g. Krugman 1999, ..., Aoki-Benigno-Kiyotaki 2018, Bocola-Lorenzoni 2018
- Macroprudential policy depends on ERPT

Simple example

Suppose country has to repay $1 (sudden stop)

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- 10% depreciation revalues debt by 10% (in LC)
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If only **50% pass-through** to import prices

- need to depreciate by 20% to get same expenditure switching
- 20% depreciation revalues debt by 20% (in LC)
- negative 10% valuation effect in real terms

Optimal policy under this trade-off

Ex-post: higher FC debt pushes the economy into deeper recession

as would ZLB/fixed exchange rate, but here driven by ERPT

Ramsey policy: Tax debt + myopic MP

endogenous AD externalities, function of ERPT

Imperfect macropru: Role for MP commitment

commitment: Promise depreciation to induce hedging

no commitment: Contractionary MP ex-ante

Extension: Exit incentives in a monetary union

Model

Model 1/5: Preferences and technology

- Two countries, Home (SOE) and Foreign $(^*)$
- Two tradable goods, H and F
- Home produces H good

$$Y_t = AN_t$$

  Foreign has an endowment of F good $Y^*_{F,t}$
- Home representative agent preferences:

$$E\left[\sum_t \beta^t \left(\omega \log C_{H,t} + (1-\omega)\log C_{F,t} - \chi \frac{N_t^{1+\psi}}{1+\psi}\right)\right]$$

  Foreign demand for Home goods:

$$C^*_{H,t} = \zeta \times \left(P^*_{H,t}\right)^{-\eta}$$

Model 2/5: Prices

$\mathcal{E}_t \uparrow$: nominal depreciation

Price stickiness: LC price of Home goods

$$P_{H,t} = P_H$$

Exchange rate pass-through (exogenous):

$$P_{F,t} = \mathcal{E}_t^{\lambda}$$
$$P^*_{H,t} = \mathcal{E}_t^{-\lambda^*}$$

- PCP: $\lambda = \lambda^* = 1$
- LCP: $\lambda = \lambda^* = 0$
- DCP: $\lambda = 1, \lambda^* = 0$

Model 3/5: Financial markets

Incomplete markets:

risk-free one-period nominal bonds in FC

borrow F_{t+1} at t, repay $R^* F_{t+1}$ at $t+1$

Poisson sudden stop shock: constant probability π of permanent tightening of borrowing constraint from

$$\overline{B} \quad (\text{state } s_{t-1} = \overline{s})$$

$$\text{to } \underline{B} = 0 \quad (\text{absorbing state } s_t = \underline{s})$$

→ no “price in constraint” a la Bianchi, Mendoza, ...

Model 4/5: Budget constraints

Household budget constraint in LC:

$$P_H C_{H,t} + P_{F,t} C_{F,t} \leq W_t N_t + \Pi_t + T_t - \mathcal{E}_t \left[(1 + \tau_t^F) R^* F_t - F_{t+1} \right]$$

+ Government budget balance:

$$T_t = \tau_t^F \mathcal{E}_t R^* F_t$$

⇒ Country budget constraint in F goods:

$$C_{F,t} \leq \mathcal{E}_t^{1-\lambda-\lambda^*(1-\eta)} \cdot \zeta - \mathcal{E}_t^{1-\lambda} \left[R^* F_t - F_{t+1} \right]$$

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Model 5/5: Equilibrium

Given $\{P^*_{F,t} = 1, R^*_t = R^*, P_H\}$ and policies $\{\mathcal{E}_t, \tau^F_t\}(s^t)$, an equilibrium is given by

$$\{C_{H,t}, C_{F,t}, N_t, Y_t, W_t, P_{F,t}, F_t\}(s^t)$$

such that households optimize, gov. budget balance,

output demand-determined

$$Y_t = C_{H,t} + C^*_{H,t}$$

Natural allocation and departure

Labor wedge of an equilibrium allocation

$$\tau = 1 + \frac{U_N}{AU_{C_H}}$$

$\tau = 0$ replicates flex price

natural exchange rate $\mathcal{E}^n$

natural output Y^n

$\tau > 0 \Leftrightarrow$ recession $Y < Y^n$

Ramsey policy

Planning problems

$V(C_F, \mathcal{E})$ = indirect utility

Ex-ante

$$W(F_0) = \max_{\{\mathcal{E}_t, C_{F,t}, F_{t+1}\}_{t\geq 0}} \quad E_0 \left[\sum_{t=0}^{\infty} \beta^t V(C_{F,t}, \mathcal{E}_t) \right]$$

$$\text{s.t.} \quad \begin{cases} C_{F,t} \leq \mathcal{E}_t^{1-\lambda-\lambda^*(1-\eta)} \zeta - \mathcal{E}_t^{1-\lambda}(R^* F_t - F_{t+1}) \\ F_{t+1} \leq B(s^t) \end{cases}$$

Ex-post, sudden stop at time T

$$\underline{W}(F_T) = \max_{\{\mathcal{E}_t, C_{F,t}\}_{t\geq T}} \quad \sum_{t=T}^{\infty} \beta^{t-T} V(C_{F,t}, \mathcal{E}_t)$$

$$\text{s.t.} \quad C_{F,T} \leq \mathcal{E}_T^{1-\lambda-\lambda^*(1-\eta)} \zeta - \mathcal{E}_T^{1-\lambda} R^* F_T$$

$$\text{for } t \geq T+1 \quad C_{F,t} \leq \mathcal{E}_t^{1-\lambda-\lambda^*(1-\eta)} \zeta$$

Ex-post: Optimal MP in sudden stop

Abstract from ToT by assuming $1 - \lambda - \lambda^*(1 - \eta) = 0$

well-studied: Corsetti-Pesenti, Benigno-Benigno, De Paoli, ...

Optimal monetary policy trades off

macro stabilization vs. valuation effect

Proposition

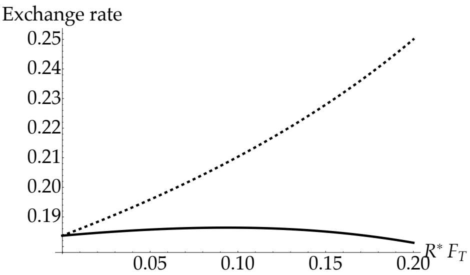
$\tau_T \geq 0$ increasing in F_T

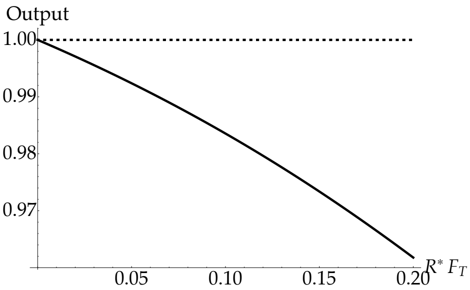
$\mathcal{E}_T$ increasing then decreasing in F_T

DCP $(\lambda = 1, \lambda^* = 0)$ neutral: $\tau_T = 0$ for any F_T

Example: focus on import pass-through

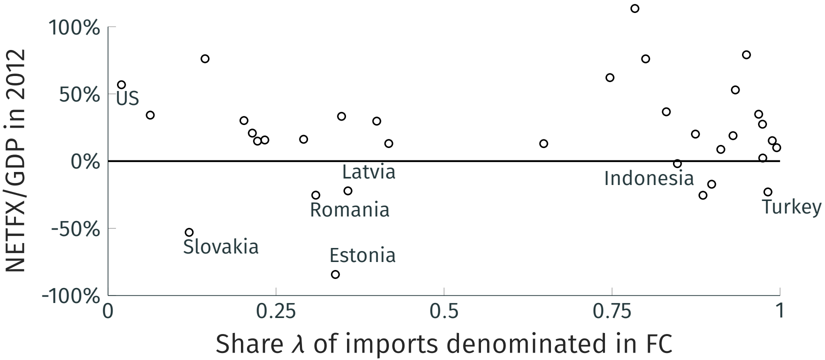
Export price-elasticity $\eta = 0 \Rightarrow$ constant Y^n, $\tau_T = 0$ at $F_T = 0$





Dashed: Natural (replicate flex prices). Thick: Optimal.

Net FX vs. import invoicing



Data from Benetrix-Lane-Shambaugh 2015, Gopinath 2016

Optimal policy

Proposition

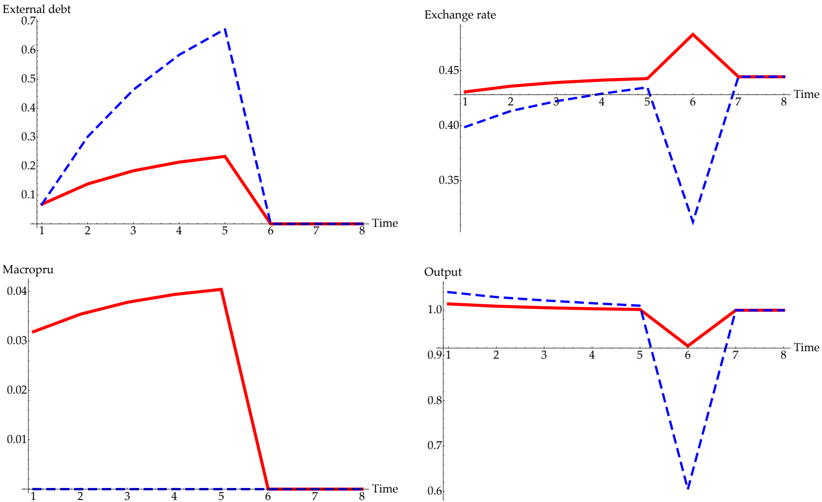
- Ex-ante borrowing socially excessive. Optimal tax on debt

$$1 + \tau_t^F = E_t\left[\frac{1+\alpha\tau_{t+1}}{1+\alpha\tau_t}\right] + Cov_t\left[\frac{U_{C_F,t+1}}{E_t\left[U_{C_F,t+1}\right]}, \frac{1+\alpha\tau_{t+1}}{1+\alpha\tau_t}\right]$$

- Under optimal $\{\tau_t^F\}$, **no need for MP commitment**

Same tax as in Farhi-Werning 2016, but depends on current amount of debt + ERPT (e.g. DCP $\rightarrow$ no tax needed)

Thick red line: Ramsey. Blue dashed line: Discretionary MP + no macropru.



Imperfect macroprudential instruments

Commitment

Example with fully anticipated sudden stop at $t = 1$.

$$\max_{\{\mathcal{E}_0,\mathcal{E}_1,C_{F,0},C_{F,1},F_1\}} V(C_{F,0},\mathcal{E}_0) + \beta V(C_{F,1},\mathcal{E}_1)$$

$$\text{s.t.} \quad C_{F,0} \leq \zeta + \mathcal{E}_0^{1-\lambda}[F_1 - R^* F_0]$$

$$C_{F,1} \leq \zeta - \mathcal{E}_1^{1-\lambda} R^* F_1$$

$$U_{C_{F,0}} = \beta R^* \left(\frac{\mathcal{E}_1}{\mathcal{E}_0}\right)^{1-\lambda} U_{C_{F,1}}$$

Proposition

Relative to perfect τ^F:

appreciate $\mathcal{E}_0 \downarrow$ + promise depreciation $\mathcal{E}_1 \uparrow$

but **time-inconsistent**

No commitment: lean against the wind?

Markov Perfect Equilibrium

At $t = 1$, $\mathcal{E}_1 = \mathcal{E}^m(R^* F_1)$

At $t = 0$:

$$\max_{\mathcal{E}_0, C_{F,0}, C_{F,1}, F_1} \quad V(C_{F,0}, \mathcal{E}_0) + \beta V(C_{F,1}, \mathcal{E}^m(R^* F_1))$$

$$\text{s.t.} \quad C_{F,0} = \zeta + \mathcal{E}_0^{1-\lambda}\left[F_1 - R^* F_0\right]$$

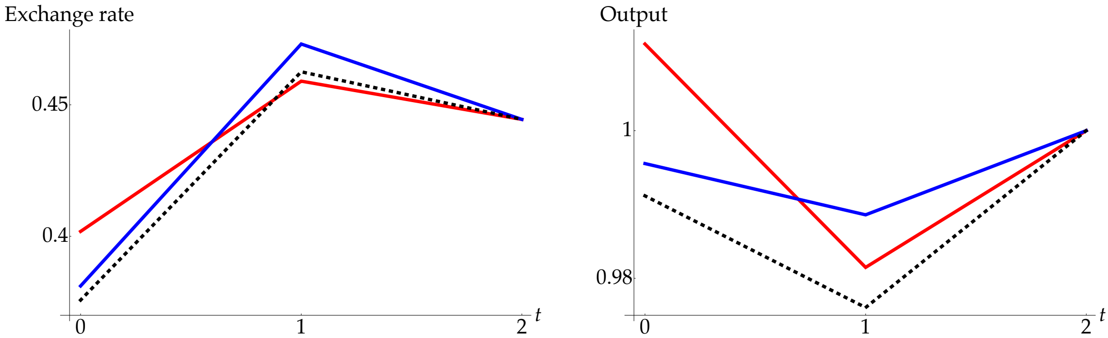
$$C_{F,1} = \zeta - \mathcal{E}^m(R^* F_1)^{1-\lambda} R^* F_1$$

$$U_{C_{F,0}} = \beta R^* \left(\frac{\mathcal{E}^m(R^* F_1)}{\mathcal{E}_0}\right)^{1-\lambda} U_{C_{F,1}}$$

$\rightarrow$ ex-ante lean even more ($\mathcal{E}_0 \downarrow$) than under commitment

note: log-u special

The value of commitment w/o macropru



Red thick line: Ramsey. Blue thick line: No macropru, full commitment. Black dotted line: No macropru, no commitment.

Exiting a monetary union

Capital flows in a monetary union

- Core β^*, periphery β, union-wide interest rate $R^* = 1$:

$$\beta R^* < 1 = \beta^* R^*$$

  $\longrightarrow$ CA imbalances.
- Euro-denominated credit boom in periphery $F \uparrow$ until sudden stop.
- Fixed exchange rate $\overline{\mathcal{E}}$.
- When sudden stop hits, can repudiate partially

$$F \longrightarrow \mu F \quad \text{costs} \quad C(1-\mu)$$

  and abandon peg to implement $\mathcal{E}^m(\mu F)$ iff

$$\underbrace{\max_{\mu}\left\{\underline{W}(\mu F) - C(1-\mu)\right\} - \kappa}_{W_\kappa^{exit}(F)} > \underbrace{\left[V\left(\zeta - \overline{\mathcal{E}}^{1-\lambda} F, \overline{\mathcal{E}}\right) + \frac{\beta}{1-\beta} V\left(\zeta, \overline{\mathcal{E}}\right)\right]}_{W^{stay}(F)}$$

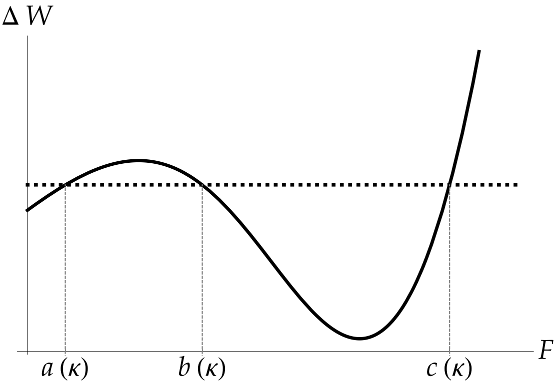
Two opposite effects of debt

1. **At low levels of debt,** $\frac{d\Delta W_{\kappa}}{dF} > 0$
    - When debt rises...
    - ...country poorer upon sudden stop...
    - ...natural exchange rate $\uparrow$, making $\overline{\mathcal{E}}$ more overvalued ...
    - ...incentives to exit MU $\uparrow$

Two opposite effects of debt

1. **At low levels of debt,** $\frac{d\Delta W_\kappa}{dF} > 0$
    - When debt rises...
    - ...country poorer upon sudden stop...
    - ...natural exchange rate $\uparrow$, making $\overline{\mathcal{E}}$ more overvalued ...
    - ...incentives to exit MU $\uparrow$
2. **But as debt increases,** $\frac{d\Delta W_\kappa}{dF} < 0$
    - Less depreciation after exit...
    - ...incentives to exit MU $\downarrow$

Falling into a debt trap



Ex-post incentives to leave MU

Q: Optimal national macropru? ▸ Macropru

Conclusion and next steps

Theory

- Financial implications of incomplete ERPT
  - New source of fear of floating
- Optimal policy
  - Ex-ante, ex-post
  - Different constraints on instruments
  - Role of commitment
  - DCP neutral $\rightarrow$ can focus on domestic objective + borrowing is efficient

Next

- Quantitative (debt maturity vs. price rigidity)
- FC/LC portfolio (w/ Fanelli)
- Endogenous pricing $\leftrightarrow$ debt $\leftrightarrow$ MP

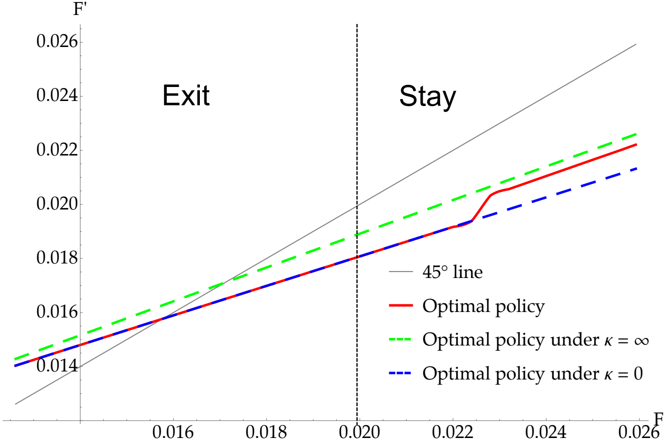
Appendix

National macroprudential policy ▸ back

- Ex-post, whether stay or exit, large recession $\tau_T > 0$.
- **Q:** If the country has independent macroprudential policy, should it save its way out of the trap?

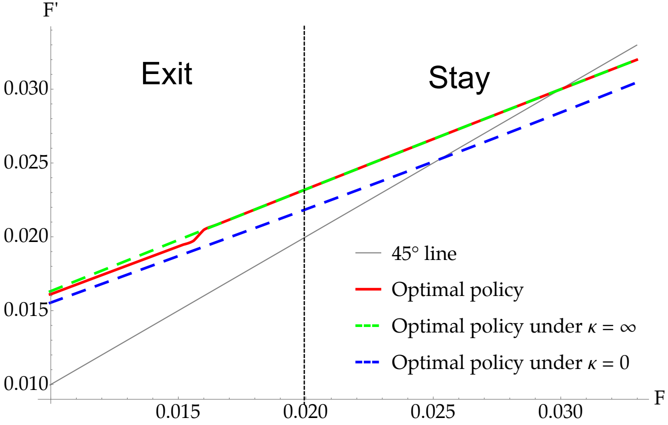
$$W_\kappa(F_t) = \max_{F_{t+1}} \Big\{ V\left(\zeta - \overline{\mathcal{E}}^{1-\lambda}(F_t - F_{t+1}), \overline{\mathcal{E}}\right) + \beta\left[(1-\pi)W_\kappa(F_{t+1}) + \pi \max\left(W_\kappa^{exit}(F_{t+1}), W^{stay}(F_{t+1})\right)\right]\Big\}$$

High βR^*



F'
0.026
0.024
0.022
0.020
0.018
0.016
0.014
Exit
Stay
45° line
Optimal policy
Optimal policy under κ = ∞
Optimal policy under κ = 0
0.016
0.018
0.020
0.022
0.024
0.026
F

Low βR^*



F'
Exit
Stay
0.030
0.025
0.020
0.015
0.010
0.015
0.020
0.025
0.030
F
45° line
Optimal policy
Optimal policy under κ = ∞
Optimal policy under κ = 0

Intermediate βR^*