A Theory of Foreign Exchange Interventions

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Introduction

- **Monetary policy (MP)** alone not enough for small open economies
- Extra instruments in the toolkit?
  1. Capital controls & macroprudential policies
  2. Foreign exchange interventions (FXI)
- Rapidly growing theoretical literature on (1), fewer on (2)

This paper

- Provides a framework to address important questions about FXI:
  - When should they be used?
  - How should they be designed?
  - Interaction with capital controls?
  - Credibility?
  - Implications for international monetary system?
- Key friction: **imperfect capital mobility**

Contributions to literature

1. FXI with imperfect mobility
   - **Amador, Bianchi, Bocola and Perri (2017)**; Benes et al (2013); Blanchard, De Carvalho, and Adler (2015); **Cavallino (2017)**; Chang and Velasco (2016); Devereux and Yetman (2014); Kumhof (2010); **Gabaix and Maggiori (2015)**; **Liu and Spiegel (2015)**; Ostry, Ghosh, Chamon, and Qureshi (2012)

   $\Rightarrow$ new analytical results, time consistency, coordination

2. Capital controls & reserve accumulation
   - **Capital controls**: Bianchi (2011); **Costinot, Lorenzoni and Werning (2014)**; **Farhi and Werning (2014)**; Heathcote and Perri (2014)
   - **Reserve accumulation**: Aizenman and Lee (2007); Alfaro and Kanczuk (2009); Benigno and Fornaro (2012); Bianchi et al. (2012); Hur and Kondo (2014); Jeanne and Rancière (2011); Jeanne (2012); Korinek and Serven (2010)

   $\Rightarrow$ mathematical connection, i.e., FXI as "extra" cost

Model: Overview

- Small open economy; continuous time; deterministic
- Two key ingredients:
  1. Sole supplier of home good + home-bias
     $\Rightarrow$ intervention motive (terms-of-trade manipulation); other rationales in paper
  2. Limited arbitrage between home & foreign bond markets
     $\Rightarrow$ effectiveness of FXI
- Goal: study response to **fundamental** shocks
  - Endowment & foreign interest rate shocks

Key Ingredient #1: Terms-of-trade Manipulation

- Preferences with home bias $(1-\alpha)$,

$$u(\{c_{Ht}, c_{Ft}\}) = \int_0^\infty e^{-\rho t}\left((1-\alpha)\ln c_{Ht} + \alpha \ln c_{Ft}\right) dt$$

- Home sole supplier of home goods $\{y_{Ht}\}$,

$$p_t(c_{Ht} + c_{Ht}^*) = p_t y_{Ht}$$

- Define dollar expenditure $\theta_t \equiv p_t^{-(1-\alpha)} c_t$. Assuming $p_t c_t^* = \alpha c^*$,

$$(1-\alpha)\theta_t + \alpha c^* = p_t y_{Ht}$$

$$\frac{\dot{\theta}_t}{\theta_t} = r_t - \rho$$

$\Rightarrow$ use r_t to influence θ_t and manipulate $p_t y_{Ht}$ (Farhi and Werning, 2014)

Key Ingredient #2: Imperfect Intermediation

- **Finite-elasticity** demand for home bonds by **foreign** arbitrageurs

$$b_{lt}^F = \Gamma_F^{-1}(r_t - r_t^*)$$

where Γ_F measures the limits to the mobility of private-sector capital

  - Microfoundation: position limits + heterogeneity in (fixed) participation cost ▸ details
  - Reduced-form as in Gabaix and Maggiori (2015); Liu and Spiegel (2015) and Cavallino (2017)

- Central Bank has **free** access to local- and foreign-bond markets

$\Rightarrow$ Managing the portfolio $\{b_{Gt}^*, b_{Gt}\}$ allows planner to manipulate $r_t - r_t^*$

  - As in Gabaix and Maggiori, 2015; Liu and Spiegel, 2015; and Cavallino, 2017.

Financial markets: Summary

- **Home:** no access to foreign bond markets

$$\frac{\dot{\theta}_t}{\theta_t} = r_t - \rho$$

- **Intermediaries:** limited access to local bond markets

$$b_{lt}^F = \frac{1}{\Gamma_F}(r_t - r_t^*)$$

- **Central Bank:** may access both freely

FXI policy: An extra cost

- Carry-traders create cost for country

$$\Pi^F_{lt} - \textit{fixed cost} = b^F_{lt}(r_t - r^*_t) = \frac{1}{\Gamma_F}(r_t - r^*_t)^2$$

  - **Convex**: higher spreads $\Rightarrow$ higher participation
  - Not necessarily cost for Central Bank ($\neq$ quasi-fiscal deficit)

- Let $\tau_t \equiv r_t - r^*_t$ denote the UIP deviation. Can show:

$$\dot{\text{nfa}}_t = \underbrace{\alpha(c^* - \theta_t)}_{\text{net exports}} + \underbrace{r^*_t \text{nfa}_t}_{\text{interest income}} - \underbrace{\frac{1}{\Gamma_F}\tau_t^2}_{\text{cost from UIP deviations}}.$$

Planners' problem

- Planner solves:

$$\max_{\{\theta_t,\tau_t\}} \int_0^\infty e^{-\rho t} V(\theta_t) dt$$

subject to

$$\frac{\dot{\theta}_t}{\theta_t} = r_t^* + \tau_t - \rho$$

$$\int_0^\infty e^{-\int_0^t r_s^* ds} \left[\alpha(\theta_t - c^*) + \frac{1}{\Gamma_F} \tau_t^2 \right] dt = nfa_0.$$

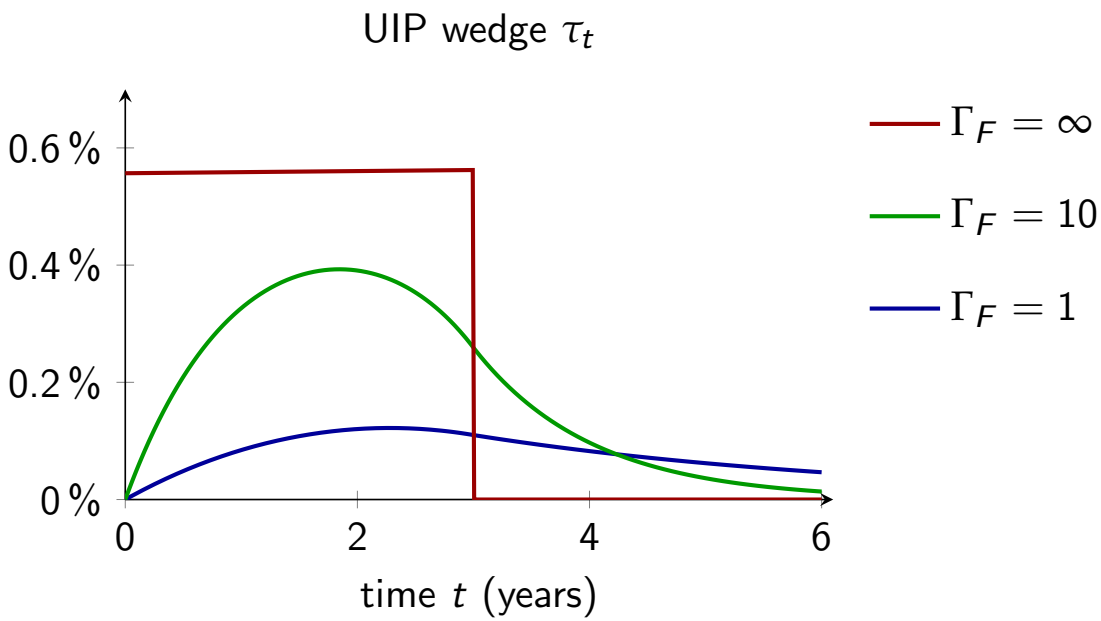
- $\Gamma_F \to \infty$: isomorphic to capital control problem (**different economics!**)
- Capital controls and FXI are **complements** ($\uparrow \Gamma_F$ relaxes problem)
- Can always replicate "frictionless" competitive equilibrium ($\tau = 0$)
  - Example: y_{Ht} and y_{Ft} shocks

Foreign interest rate shock

- Capital-inflow shock:

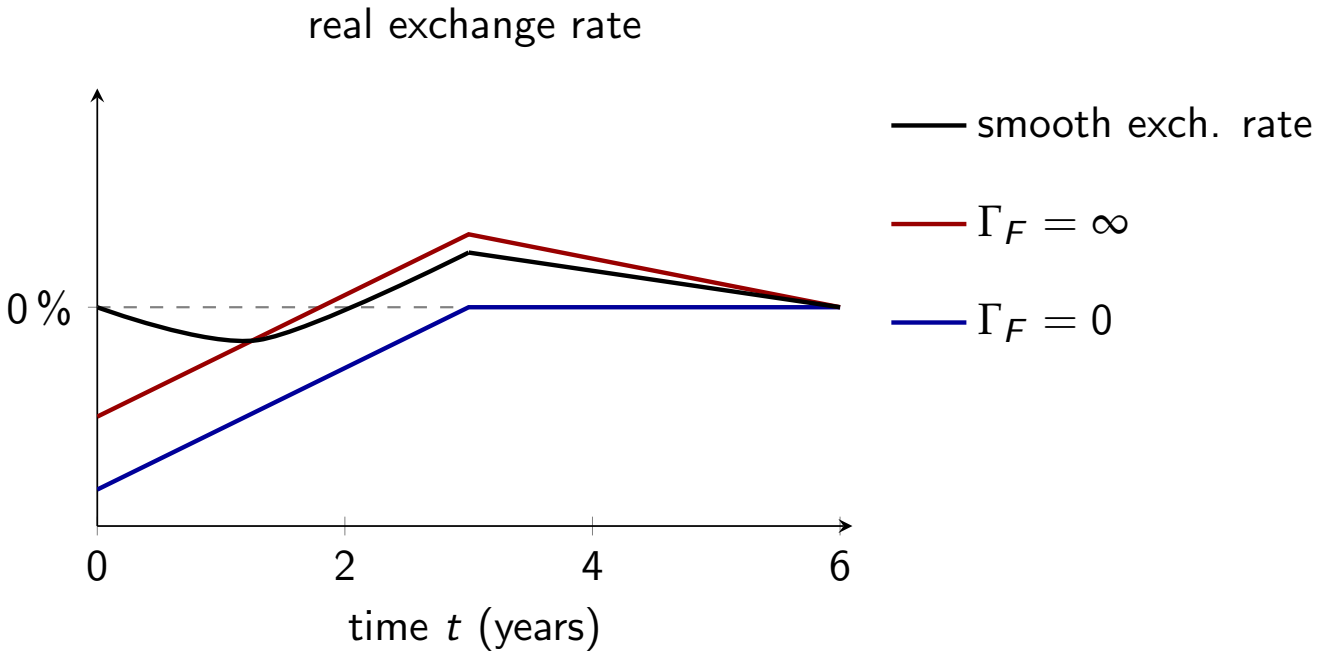
$$r_t^* = \begin{cases} \rho - \delta & t \leq 3 \\ \rho & t > 3 \end{cases} \qquad \delta > 0$$

Optimal policy: UIP spread $\tau = r - r^*$



- Novel properties when $\Gamma_F \in (0, \infty)$
  - **Smoothing & forward guidance**: $\tau_0 = 0$, $\tau_t > 0 \ \forall t > 0$, τ_t is continuous
  - **Time inconsistency**: As credibility vanishes, only $\tau_t = 0$ is implementable

Exchange Rate: Less volatile but not smooth



- Smoothing the exchange rate invites **costly speculation**
  - Higher interest rate & expected appreciation
  - Optimal policy lowers volatility by promising future depreciation

More in the paper

1. Other Rationale: Constraints on monetary policy
   - Planner leans against the wind to alleviate the recession (no ToT manipulation)
2. Nonfundamental shocks (related to Cavallino 2017)
   - Home economy now **makes money** by intervening
   - Effect of Γ_F may be the opposite
   - Properties hold for transformation of UIP wedge (not **actual** UIP wedge)
3. Implications for International Monetary System (multicountry model)
   - Decentralized FXI $\Rightarrow$ too much reserve accumulation $\Rightarrow$ i^* too low

Conclusions

- When should they be used?
  - When the private-sector on its own would pick **wrong NFA**
- How should they be designed?
  - Should be **small, persistent and anticipated** to be powerful
  - Smooth wedge, but exchange rate should be allowed to jump
- Interactions with capital controls?
  - Complements: enhance effectiveness
- Credibility?
  - Key input to lower cost of intervention
- Implications for international monetary system?
  - Nash: **Too low global interest rates** and **self-defeating currency wars**

Financial markets

- Continuum of intermediaries $j \in [0, \infty)$ may access both home and foreign-bond markets at a cost:
  - Foreign intermediary j pays transaction cost j to participate in home bond market
  - They face limits on their net open position $X > 0$, i.e. $|b^j_{It}| \leq X$
- Intermediary j participates iff

$$X \cdot |r_t - r_t^*| > j$$

  - Marginal intermediary $\bar{j} \Rightarrow \bar{j} = X|r_t - r_t^*|$
- Thus, total demand is given by

$$b_{It} = \Gamma_F^{-1}(r_t - r_t^*)$$

where $\Gamma_F \equiv X^{-2}$. back