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)

⇒ 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)

⇒ 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 \((1 - \alpha)\),

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

- 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 \(\theta_t\) 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 \( \Gamma_F \) measures the limits to the mobility of private-sector capital

- Microfoundation: position limits + heterogeneity in (fixed) participation cost
- 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

⇒ 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

\[ \frac{\theta_t}{\theta_t} = r_t - \rho \]

- **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

\[ \Pi_{lt}^F - \text{fixed cost} = b_{lt}^F (r_t - r^*_t) = \frac{1}{\Gamma_F} (r_t - r^*_t)^2 \]

- 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:

\[ \dot{nfa}_t = \alpha (c^* - \theta_t) + r_t^* nfa_t - \frac{1}{\Gamma_F} \tau_t^2 \]

\( \text{net exports} \quad \text{interest income} \quad \text{cost from UIP deviations} \)
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:

\[
 r_t^* = \begin{cases} 
 \rho - \delta & t \leq 3 \\
 \rho & t > 3 
\end{cases} \quad \delta > 0
\]
Optimal policy: UIP spread \( \tau = r - r^* \)

- Novel properties when \( \Gamma_F \in (0, \infty) \)
  - **Smoothing & forward guidance:** \( \tau_0 = 0, \tau_t > 0 \ \forall t > 0, \tau_t \) 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

**Diagram:**
- Real exchange rate
- Time $t$ (years)
- Smooth exchange rate
- $\Gamma_F = \infty$
- $\Gamma_F = 0$
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 $\Gamma_F$ 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 \textit{wrong NFA}

- How should they be designed?
  - Should be \textit{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: \textit{Too low global interest rates and self-defeating currency wars}
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. $|b_{lt}^j| \leq X$

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

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

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

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