Exchange Rate Policies at the Zero Lower Bound

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Motivation

• Global financial crisis of 2008, shift toward safe assets

• Massive appreciations of “strong" currencies

• Exchange rate interventions to prevent those appreciations
  • Difficulties in maintaining these exchange rate objectives

• Example: the Swiss franc
  • Went from 1.6 to 1.10 francs per euro (2007-2011)
  • Swiss National Bank established a currency floor with the euro in 2011
  • Eventually abandoned the floor on January 15 2015
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What we do

- Simple model of exchange rate policy
  - Zero lower bound (ZLB) constraint on nominal interest rates
  - Limited international arbitrage

- Consider two cases: Away from ZLB and At the ZLB

- Away from ZLB: country can implement exchange rate objective, loses monetary independence. Mundellian Trilemma

- At the ZLB: country can implement exchange rate objective, but interest rates cannot adjust. Interest rate parity violated, capital inflows
  - Central Bank *has to* accumulate foreign reserves, and this is *costly*

- Use framework to interpret recent events (Today: Swiss currency floor)
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Environment

- Two period small open monetary economy

- Three agents (excluding fiscal authority)
  
  1. **Households**: have endowments, standard consumption/saving problem, utility benefits for holding money \((m)\), money satiation
  
  2. **Foreign investors**: They have limited wealth \(\overline{w}\), buy domestic/foreign assets
  
  3. **Central Bank**: issues money \((M)\), buys domestic/foreign assets \((A, F)\). Assume no fiscal support from government in period 1

- Central bank has a plan for the exchange rate, \((s_1, s_2)\)
  
  - For simplicity, think \(s_1 > s_2\)

- We ask under what conditions the Central bank can implement its plan, and the implications of such policy
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Interest Rate Parity

Domestic households can borrow/save in domestic assets $a$. They can also save in foreign assets $f$. Hence, in any equilibrium we must have

$$(1 + i) \geq (1 + i^*) \frac{S_2}{S_1},$$

When holding with equality, we have the standard interest rate parity

$$(1 + i) = (1 + i^*) \frac{S_2}{S_1}. \quad ([IP])$$

If inequality strict, domestic interest rates high relative to foreign

- Households buy only domestic bonds ($f = 0$)
- Foreigners invest all their wealth $\bar{w}$ in domestic assets (bonds and/or money) and make arbitrage profits
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Intertemporal Resource Constraint

Consolidating households, government, and central bank budget constraint

\[ c_1 - y_1 = \frac{m^* + a^*}{s_1} - [f + F] \]

\[ c_2 - y_2 = (1 + i^*)(f + F) - \frac{m^* + a^*(1 + i)}{s_2} \]

Substituting for \( a^* \) and assuming that foreigners have no liquidity benefit from domestic currency \((m^* = 0)\), we obtain

\[ \left( c_1 + \frac{c_2}{(1 + i)^{s_1/s_2}} \right) = \left( y_1 + \frac{y_2}{(1 + i)^{s_1/s_2}} \right) - \left[ 1 - \frac{(1 + i^*)^{s_2/s_1}}{(1 + i)^{s_2/s_2}} \right] F \quad ([IRC]) \]

Present value of consumption \quad Present value of income \quad Intervention losses

If [IP] holds, last term disappears (classic [IRC])
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\]

If [IP] does not hold, accumulation of foreign reserves entails resource costs
Away from ZLB: The Trilemma

Suppose that \((1 + i^*) \frac{s_2}{s_1} > 1\). There exists an \(i > 0\) that makes [IP] hold

**Theorem**

*If \(w\) large enough, [IP] holds in every monetary equilibrium*

**Idea** ⇒ Away from ZLB, the Central Bank cannot sustain [IP] deviations

- Foreign investors strictly prefer bonds to money. Central Bank cannot issue interest paying liabilities and balance sheet limited by domestic money satiation

Exchange rate policy \((s_1, s_2)\) can be sustained

- Central Bank loses monetary independence
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At the ZLB: Deviations from Interest Rate Parity

Suppose that \((1 + i^*) \frac{s_2}{s_1} \leq 1\). No \(i > 0\) that make [IP] hold

**Theorem**

*The unique equilibrium features* \(i = 0\), and deviations from [IP]*

**Idea** ⇒ At the ZLB, the Central Bank can sustain deviations from [IP]

- Foreign investors indifferent between bonds and money. Central Bank can expand balance sheet without limits

Exchange rate policy \((s_1, s_2)\) can be sustained, but there are **costs**

- Capital inflows as foreigners chase arbitrage profits
- Resource costs

\[
\left[ 1 - \frac{(1 + i^*) \frac{s_2}{s_1}}{(1 + i)} \right] \times F
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Some Interesting Results

1. An increase in $\bar{w}$ or a decline in $i^*$ while economy is at the ZLB

   - Increases foreign reserves of the Central Bank under the current exchange rate policy
   - Always welfare reducing

   Idea: interest rate fixed by exchange rate policy and ZLB. More financial integration raises capital inflows and intervention losses

2. Suppose $i = 0$. Then, a tax on money allows the Central Bank to achieve $(s_1, s_2)$ without [IP] deviations

   - Negative nominal interest rates allow the Central Bank to restore [IP]
   - Rationale for negative rates: avoid capital inflows and intervention losses
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Measuring the Losses from Exchange Rate Policies

- Sufficient statistic to measure losses associated to exchange rate policies

\[ \text{Losses}_t = \left[ 1 - \frac{(1 + i_t^*)^{s_t+1}}{(1 + i_t)} \right] \times F_t \]

- We construct empirical counterparts to both terms
  - Measure daily deviations from covered interest rate parity (CIP) as a proxy to arbitrage profits

- Questions
  - Do we observe deviations from CIP?
  - Are deviations from CIP associated to strong demand for assets denominated in Swiss franc?
  - How sizable are the measured losses?
Starting from 2008, persistent CIP deviations (Du et al., 2016)

Positive deviations → investing in Swiss denominated assets profitable
- SNB accumulates foreign reserves when CIP deviations are large
- Demand for assets denominated in francs sensitive to CIP deviations
We can measure losses as the product of CIP deviations and reserves.

Flow cost of 0.2%-1% of real GDP
Conclusion

- Mundellian Trilemma at the zero lower bound
- Exchange rate objectives can be implemented, but
  - Expect capital inflows and costs from FX interventions
- Simple sufficient statistic to measure costs of interventions
  - In the case of Switzerland, flow losses between 0.2%-1% of GDP
- Framework for understanding recent events
  - Costs of intervention increase in foreign capital
    - Swiss currency floor abandoned just before the ECB QE was announced
  - Negative nominal interest rates could complement exchange rate policies
    - Switzerland and Denmark first to experience with negative rates