Currency Manipulation

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Motivation

- Highly persistent differences in interest rates across developed economies:
  - account for majority of carry trade anomaly. (Lustig & al. 2011, Hassan & Mano 2015)
  - correlate with equally persistent differences in K/Y ratios. (Hassan, Mertens, Zhang 2015)
- Risk-based view of these "unconditional" differences in currency returns: **Currencies with low interest rates pay lower returns because they tend to appreciate in "bad" times.**
- Various views of what makes a currency appreciate in bad times: *country size* (Hassan 2013, Martin 2012), financial development (Maggiori 2013), resilience to disaster risk (Farhi & Gabaix 2015), etc.

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- This paper: **interventions in currency markets that change the stochastic properties of exchange rates should change interest rates, expected returns on currencies, and allocation of capital across countries.**

$\Rightarrow$ Policies that make your currency appreciate in bad times lower your interest rate and increase capital accumulation.

General Argument on one Slide

Risk-based view of unconditional violations of UIP:

- A country's CPI depends on the world price of traded goods, λ_T, and a country-specific shock x^m.

$$p^m = a\lambda_T - bx^m$$

- The log real exchange rate is

$$s^{t,m} = p^t - p^m$$

- Consumption Euler equation: country that appreciates in bad times has a lower interest rate and accumulates more capital. UIP fails.

$$r^t + \mathbb{E}\Delta s^{t,m} - r^m = cov\left(\lambda_T, p^m \; - p^t \;\right)$$

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Risk-based view of unconditional violations of UIP:

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$$r^t + \mathbb{E}\Delta s^{t,m} - r^m = cov\left(\lambda_T, p^{m*} - p^{t*}\right) - \pi\sigma^2_{\lambda_T}$$

General insight:

- A policy that alters the covariance between p^m and λ_T can alter interest rates, currency returns, and the allocation of capital across countries.
- Illustrate implications with an application to exchange rate stabilization.

Exchange rate stabilization

Three facts:

1. **88% of countries stabilize their exchange rates relative to some target currency** Reinhart & Rogoff (2007)
   - Exchange rate stabilization: set of policies that reduce the variance of the real exchange rate relative to a target country without distorting the level.
   - Not sure if they also manipulate the level, but certainly the variance.
   - Examples: China, India, Singapore, Denmark...
2. **Almost all stabilizations are relative to the US dollar.**
3. **Most small economies stabilize their exchange rate while most large economies do not.**

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Remainder of this paper:

- Take the form of these policies as given, provide positive theory of their effects on risk premia, some possible rationalizations.

Setup (1/2)

- Time periods $1, 2$; Countries $n = \{m, t, o\}$
- Continuum of households $i \in [0,1]$ of which measure θ^m live in the "stabilizing" country, θ^t live in the "target" country, and θ^o live in an "outside" country.
- CRRA utility over consumption in time=2, $\gamma > 1$,

$$U(i) = E\left[\frac{1}{1-\gamma} C(i)^{1-\gamma}\right]$$

- Final consumption bundle is country-specific

$$C(i) = C_T(i)^{\tau} C_N(i)^{1-\tau}$$

- Each household owns a firm that uses capital and (one unit of) labor in the production of the **non-traded good** at time=2

$$Y_N^n = \exp[\eta^n] (K^n)^{\nu}$$

where $\eta^n \sim N(0, \sigma^2)$.

Setup (2/2)

- At time 1, each household is endowed with one unit of the traded good and one unit of capital.
- Capital can be freely shipped internationally only at time 1.
- **Households trade shares of stock in their non-traded sector** (three assets; three shocks $\Rightarrow$ first-order complete financial markets)

Model solution:

- Choose the homogeneous traded good as numéraire.
- Log-linearize, lowercase variables denote logs.

Freely Floating Exchange Rates (1/2)

- Equilibrium variables under freely floating regime denoted with $*$.

Main Implications

- Households ship traded goods to share risk

$$c_T^{n*} = \frac{(\gamma - 1)(1 - \tau)}{1 + (\gamma - 1)\tau} \left(\bar{y}_N - y_N^n\right)$$

- Marginal utility from traded consumption equalized across countries

$$\lambda_T^* = -(1 - \tau)(\gamma - 1) \sum_{n=1}^{N} \theta^n y_N^n$$

- Real exchange rate is difference in prices of consumption

$$s^{t,m*} = p^{t*} - p^{m*} = \frac{(1 - \tau)\gamma}{(1 - \tau) + \gamma\tau} \left(y_N^m - y_N^t\right).$$

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- All countries appreciate when they suffer a bad shock.
- Bad shocks in larger countries raise λ_T more (spill over to world price of traded good).

Freely Floating Exchange Rates (2/2)

- Large countries tend to appreciate with λ_T

$\Rightarrow$ Their currencies provide a better hedge again consumption risk

$\Rightarrow$ They have lower interest rates and pay lower returns (Hassan, 2013)

$$r^t + \Delta E s^{t,m} - r^m = -cov\left(\lambda_T, p^t - p^m\right)$$

$\Rightarrow$ They have lower cost of capital, accumulate more capital per capita.

$$k_N^{t*} - k_N^{m*} = \frac{(\gamma-1)^3(1-\tau)^2\tau}{(1+(\gamma-1)\tau)^2}\ (\theta^t - \theta^m)\sigma^2.$$

$\Rightarrow$ Higher K increases wages.

Key Insight

- **A country increase capital investment and wages by stabilizing its real exchange rate relative to a larger economy.**

Exchange Rate Stabilization

- The government has two goals:

P1 Lower the variance of its real exchange rate relative to target country

$$sd(s^{t,m}) = (1-\zeta)sd(s^{t,m*})$$

P2 without distorting its conditional mean

$$E\left(s^{t,m}|\{K^n\}\right) = E\left(s^{t,m*}|\{K^n\}\right).$$

- To achieve these goals:

1. levy state contingent taxes on consumption of traded goods
2. make a lump-sum transfer.

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- **How to stabilize:**

$y_N^t \downarrow$: target's marginal utility is higher than yours

$\rightarrow$ sell extra traded goods to increase yours.

Effect on Capital Accumulation

Proposition

A country that stabilizes its real exchange rate relative to a target country sufficiently larger than itself lowers its risk-free rate, increases capital accumulation, and increases the average wage in its country relative to the target country.

Example: A small country

- Has no effect on prices outside its own country
- But it can increase it covariance of its exchange rate with λ_T by stabilizing relative to a large country
- Corollary: Stabilization relative to a sufficiently larger country increases the world-market value of domestic firms.
- Lower risk-premium on domestic currency $\rightarrow$ lower cost of capital, higher price of domestic stocks.

Cost of Stabilization

- Stabilization changes states in which you buy and sell traded goods.

$$\Delta Res = \int_\omega Q(\omega)\ C_T^m(\omega)d\omega - \int_\omega Q^*(\omega)\ C_T^{m*}(\omega)d\omega$$

- When $y_N^t \downarrow$, ship out additional traded goods.

$\rightarrow$ By stabilizing relative to a large country, you insurance to the world market.

Proposition

If the stabilizing country is small ($\theta^m = 0$),

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2. *the cost of stabilization is negative if the target country is sufficiently large.*

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- BUT: cost of stabilization increases with size of stabilizing country, because large stabilizing countries have price impact.

$\Rightarrow$ Potential reason why most large countries do not stabilize.

Effect on the Target Country

- Currency manipulation by a large country changes world prices.
- Stabilizing country sells traded goods when $y_N^t \downarrow$, dampens the effects of target country shocks.

$\Rightarrow$ Reduces covariance between the target country's real exchange rate and λ_T.

Proposition

A country that becomes the target of stabilization imposed by a large country experiences a rise in its risk-free interest rate, a fall in capital accumulation, and a fall in average wages relative to all other countries. If the stabilizing country is smaller than the target country ($\theta^m < \theta^t$), the stabilization lowers the volatility of consumption in the target country.

- Chinese exchange rate peg diverts capital away from the US, even if it does not distort the level of the real exchange rate!
- China also provides consumption insurance to the US.

Welfare

- Perhaps surprisingly, effects on risk premia generate a rationale for "optimal stabilizations" within this frictionless model.

- **Key assumption**: Households can only trade stocks in their non-traded sectors.

For the purposes of welfare calculations, close the model:

- Government rebates cost of stabilization to its households ($\Delta Res = 0$).
- As a result, stabilization now endogenously affects the mean of the exchange rate (drop P2).
- All qualitative results continue to hold in this case (just more complicated algebra).

Welfare

Proposition

If households in the stabilizing country bear the cost of stabilization ($\Delta Res = 0$), then there exists a $\overline{\gamma}$ such that for $\gamma > \overline{\gamma}$ stabilizing relative to a larger target country strictly increases household welfare in the stabilizing country.

- Small stabilizing country only affects the value of its own firms (required rate of return on domestic stocks fall).
- Its households hold more of their domestic stock than foreigners (home bias).
- Value of its assets increase relative to the rest of the world $\Rightarrow$ valuation effect!

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$\Rightarrow$ **Stabilization can be an optimal non-cooperative policy, even in this frictionless world!**

Optimal Stabilizations

Direct implications:

1. **Governments of small countries will find it optimal to stabilize.**
2. **All stabilizations will target the same large country.**
3. **Governments of larger countries will find it optimal to float.**

⇒ Effects on risk-premia can provide a possible rationale for the pattern of stabilizations we see in the data.

- However, frictionless case may not be most relevant one.

Rationales for Stabilization

- Prior literature: stabilization may be second-best policy response to monetary or other frictions. (Lack of credibility of central bank, encourage trade.)

- We identify four additional forces that speak specifically to the choice of target country and operate even in a frictionless environment (increases capital accumulation; generates revenue; increases value of domestic firms; increases volatility of domestic consumption)

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- **Political Economy:** Politicians may favor policies that generate revenues at the central bank (Cukiermann & al., 1992) or increase capital accumulation and wages (of the median voter). (Persson & Tabellini, 2002)

$$EU^n + \mu_1 K^n - \mu_2 \Delta Res,$$

- **Balance-sheet effects:** Raising world-market value of domestic firms may ease borrowing constraints. (Kiyotaki & Moore, 1997) and shift wealth from foreigners to domestic households.

Nominal Stabilization when Prices are Sticky

- Extend model to allow for the price of traded goods to be rigid in local currency (Mussa (1986), Engel (1999), Cavallo et al (2014)).
- All consumption must be paid for in local currency and the Central Bank sets the money supply $M^n = \tilde{P}_T^n P^n C^n$.
- Central Banks adjust money supply to neutralize nominal price rigidity and recover allocation under freely floating regime.
- Stabilizing country deviates and uses M^m to drive a wedge between the domestic and world-market prices of traded goods, implement stabilization.

Proposition

If the price of the traded good is rigid in terms of the stabilizing country's currency **a nominal stabilization implements a real stabilization** *of equal strength* $\zeta = \tilde{\zeta}$

- Can implement real exchange rate stabilization by announcing a set of nominal exchange rates at which Central Bank buys and sells currency.

How General are these Results?

- Floating bands and interventions with a lack of credibility are simply weaker stabilizations.
- Positive results are robust to a wide range of models of exchange rate determination:
  - Preference shocks (Pavlova & Rigobon, 2007).
  - Segmented markets and nominal shocks (Alvarez, Atkeson, Kehoe, 2007).
  - CES aggregator between traded and non-traded goods
  - Stochastic endowments/production of traded goods
  - Differentiated traded goods.
- Key ingredients:
  1. Shocks to price of consumption in large countries spill over more to the rest of the world.
  2. Risk premia determine long-term differences in interest rates across countries.
  3. Currency manipulation places a wedge between the domestic and foreign prices of traded goods.

Conclusion

- Most countries stabilize their exchange rate. Existing theories give relatively little guidance on the effects of such stabilizations and on what might be special about the U.S. dollar as a target currency.
- Proposed a novel, **risk-based transmission mechanism** for effects of currency manipulation.
- Policies that induce a country's currency to appreciate in bad times lower its risk premium, lower the country's risk-free interest rate, and increase domestic capital accumulation and wages.

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- Policies that induce a country's currency to appreciate in bad times lower its risk premium, lower the country's risk-free interest rate, and increase domestic capital accumulation and wages.

1. Exchange rate stabilization relative to a larger country is such a policy.
2. Stabilizing towards larger countries is cheaper, can generate positive revenues, and may increase welfare.
3. Stabilization has external effects: Target country experiences a rise in interest rates, fall in investment and average wages. However, stabilization provides consumption insurance to target country.