The open-economy ELB: Contractionary Monetary Easing and the Trilemma*

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Can financially integrated economies retain monetary independence?

Under Mundell’s trilemma, yes
  - as long as the exchange rate is flexible
  - capital flows do not pose problems

However, growing concerns by both academics and policy makers
  - Global financial cycle affects also countries with flex exchange rate
    (Rey, 2013, 2016)
  - FED/VIX tightening has recessionary effects in EMs
    (Dedola et al., 2017; Iacovello and Navarro, 2019; Bräuning and Ivashina, 2019)
Monetary policy trade-offs

- Recent literature finds new trade-offs for monetary policy (MP)
  - **Borrowing constraints** ⇒ output vs consumption stabilization
    (Ottonello, 2015; Farhi and Werning, 2016; Aoki et al., 2016; Davis and Presno, 2017; Akinci and Queralto, 2019)
  - **DCP** ⇒ depreciations less stimulative and generate LOOP deviations
    (Gopinath et al., 2019; Egorov and Mukhin, 2019)

- In these models monetary easing remains expansionary in EMs
  - EMs should still respond by easing MP which is counterfactual
    (Obstfeld et al., 2005; Obstfeld, 2015; Han and Wei, 2018)
  - MP retains control on output ⇒ **Trilemma is not violated**
    (Gourinchas, 2017)
Our contribution

MP may lose control of output even with flex exch rate due to ELB
- Interest rate below which monetary easing becomes contractionary
- Trilemma fails
- ELB due to interaction between capital flows and collateral constraints

ELB moves with the global financial cycle
- EMs hike rates when global financial cycle tightens

Rich policy implications
- Complementary policy tools are needed to free MP from ELB
- MP faces novel inter-temporal trade-off
Contractionary monetary easing?

- Why considering the possibility of contractionary monetary easing?
  - **EMs concerned** that interest cuts may trigger outflows and lower output (Blanchard et al., 2016; Gudmundsson, 2017; Basci et al., 2008)
  - Idea gained prominence during Asian financial crisis (Cespedes et al., 2004; Christiano et al., 2004)
  - Possibility of contractionary easing is also studied in AEs (Brunnermeier and Koby, 2017; Eggertsson et al., 2017)
ELB can arise whenever MP affects tightness of collateral constraints

We consider two examples

- Carry-trade capital flows, novel and closer to micro-evidence (di Giovanni et al., 2019)
- Currency mismatches, standard in the literature

For analytical solutions, we use SOE 3-period model

- Steady state from period 2 onward
- Period 1 to characterize conditions under which ELB arises
- Period 0 to analyze ex-ante implications
Model with carry-trade capital flows

- Household sector includes borrowers and savers that maximize

\[ E_0 \sum_{t=0}^{\infty} \beta^t \ln C_t^i \]

with \( C_t = C_{H,t}^{1-\alpha} C_{F,t}^\alpha \) subject to the following budget constraints

\[
P_t C_t^B + L_{t-1} I_{t-1}^L = \Pi_t^B + L_t
\]

\[
P_t C_t^S + D_t = \Pi_t^S + D_{t-1} I_{t-1}^D
\]

- Firms hire workers to produce domestic goods subject to sticky prices

\[ P_{H,t} = P_{H,t}^* = 1 \text{ for } t < 2 \]
Domestic banks

- Banks collect deposits to provide loans and buy government bonds

\[ N_t + D_t = L_t + B_t + R_t \]

- They act competitively to maximize networth

\[ N_{t+1} = L_t I_t^L + B_t I_t^B + R_t I_t - D_t I_t^D \]

subject to the leverage constraint

\[ L_t + \lambda B_t \leq \phi N_t \]

with \( \phi > 1 \) and \( \lambda \in (0, 1) \)
Interest rates

- No arbitrage between reserves and deposits implies
  \[ I_t^D = I_t \]

- Lending and bond rates increase above policy rate if constraint binds
  \[ I_t^L \geq I_t \]
  \[ I_t^B = \lambda I_t^L + (1 - \lambda) I_t \]
Foreign investors

- Foreign intermediaries borrow internationally to buy domestic bonds
  - They are subject to an agency friction à la Gabaix Maggiori (2015)
  - Foreign demand for government bonds is proportional to excess return

\[
B_t^F = \frac{1}{\gamma_t} \mathbb{E}_t \left[ \frac{e_t}{e_{t+1}} \frac{I_t^B}{I_t^*} - 1 \right]
\]

- The parameter $\gamma_t$ captures tightness of global financial conditions
- In equilibrium, the model generates carry-trade capital flows
  \[ \Rightarrow \text{EM monetary easing triggers capital outflows} \]
Public sector and market clearing

- Government rolls over public debt (no fiscal policy)
  \[ B_t^G = B_{t-1}^G I_{t-1} \]

- We ignore balance-sheet operations by the central bank
  \[ R_t \downarrow 0 \]

- Market clearing requires
  \[ Y_{H,t} = C_{H,t} + C_{H,t}^* \]
  \[ B_t^G = B_t + B_t^F \]
Steady-state equilibrium

- From $t \geq 2$, model is in steady state
  - flexible prices, no domestic or international financial frictions
  - $I_t \beta = 1$
  - assume $\beta = 1 \Rightarrow P_2 C_2^i = \Pi_2^i$

- Nominal spending equal to money supply
  $$P_2 C_2^i = M_2^i$$

- Using market clearing, exchange rate is
  $$e_2 = M_2 / M_2^*$$

normalize $M_2 = M_2^* = 1$
Time 1 equilibrium

- Time-1 output is determined by

\[ Y_{H,1} = (1 - \alpha) \left( \frac{\omega_2}{I_{L1}} + \frac{1 - \omega_2}{I_1} \right) + \frac{\alpha}{I_1^*} \]

- If leverage constraint does not bind, \( I_{L1} = I_1 \)
  \[ \Rightarrow \text{monetary easing is expansionary} \]

- However, monetary easing triggers capital outflows if \( \gamma_1 > 0 \)

\[ e_1 = \frac{I_1^*}{I_1} \left( 1 + \gamma_1 \left( B_1^F + \frac{\alpha}{I_1} \right) \right) \]

\[ B_1^F = \frac{B_1^F}{1 + \gamma_1 \alpha / I_1} \]

where \( B_1^F = B_0^F I_0^B \)
By triggering outflows, MP easing moves banks towards constraint

This effect is possibly compounded by stronger loan demand

\[ L_1 = \mathbb{L}_1 + \frac{\omega_2}{I_1} - \Pi_1^B \]

\[ \rightarrow \text{we turn off loan demand by setting } \Pi_1^B = \frac{\omega_2}{I_1} \]

Leverage constraint binds once policy rate reaches ELB

\[ I_1^{ELB} = \frac{\gamma_1 \alpha}{\mathbb{B}_1^F / \mathbb{B}_1^F - 1} \]

where \( \mathbb{B}_1^F = \mathbb{B}_1^G - \left( \phi N_1 - \mathbb{L}_1 \right) / \lambda \) is capital shortfall
Constrained equilibrium

- Once constraint binds, $I_1^L$ increases as outflows crowd out lending.
- If carry-trade flows are strong enough, i.e. $\gamma_1$ is high,
  - $\Rightarrow$ Decline in borrowers’ demand $>$ increase in savers’ demand
  - $\Rightarrow$ Monetary easing becomes contractionary
  - $\Rightarrow$ ELB places upper bound on output achievable through MP
Global liquidity and monetary shocks

- A tightening of global financial conditions worsens the ELB
  - Lower global liquidity raises the ELB
  - Higher foreign policy rates reduce output at the ELB

- Despite flexible exchange rate, MP unable to stabilize output

⇒ Trilemma is violated
Time 0 equilibrium

- How should MP behave in good times if ELB may bind in the future?
- ELB gives rise to novel \textit{inter-temporal trade-off} for MP
  - Tighter ex-ante MP lowers future ELB

Policy implications

- Monetary policy becomes \textit{less effective} even when ELB doesn’t bind
- Keep economy \textit{below potential} to gain future monetary space
- \textbf{Hike policy rates} when GFC tightens even if ELB doesn’t bind yet
Policy tools against the ELB - fiscal policy

- **Fiscal consolidation** with lump-sum taxes $T_1$ has mixed effects on ELB
  - It relaxes bank constraints but raises loan demand by taxed borrowers
  - Thus, it lowers ELB only if $\lambda > T_1^B / T_1$

- **A recapitalization** of the banking sector lowers the ELB
  - even if financed with $T_1^B$ since banks are leveraged $\phi > 1$

- **Subsidies on capital inflows** lower the ELB
  - despite increasing public debt
Policy tools against the ELB - central bank operations

- Balance sheet of the central bank is
  \[ N_t^{CB} + R_t = B_t^{CB} + e_t X_t \]

- **Quantitative easing** relaxes the ELB despite strengthening outflows
  - Central bank acts as financial intermediary

- **Unsterilized FX** intervention by buying FX relaxes ELB
  - It reduces outflows by depreciating exchange rate

- **Sterilized FX** intervention by selling FX to buy bonds relases ELB
  - Positive effect of QE prevails over exchange rate appreciation

- **Forward guidance** ineffective against ELB (≠ ZLB)
  - Higher \( M_2 \) increases outflows and raises ELB
Model with currency mismatches

- Homogeneous households, only borrowers
- Export prices are sticky in domestic currency
- 

  UIP holds

  - Banks borrow abroad in foreign currency
    - Exchange rate depreciation reduces networth
      \[
      N_t = L_{t-1} I^{L}_{t-1} - e_t D_{t-1}^* I_{t-1}^*
      \]
    - Leverage constraint requires
      \[
      L_1 \leq \phi N_1
      \]

\[
\Rightarrow I^L_{t+1} \geq I_t
\]
Time 1 equilibrium

- Time-1 output is determined by

\[ Y_{H,1} = \frac{1 - \alpha}{I_1^L} + \alpha \frac{e_1}{I_1^*} \]

- If leverage constraint does not bind \( \Rightarrow \) expansionary effects
  - Banks increase leverage to expand credit \( \Rightarrow \) \( I_1^L \) declines
  - Exchange rate depreciation stimulates foreign demand

- Once constraint binds \( \Rightarrow \) contractionary effects if \( D_1^* \) high enough
  - Exchange rate depreciation tightens leverage constraint
  - Banks have to reduce lending \( \Rightarrow \) \( I_1^L \) increases
Global monetary shock

- Under currency mismatches, the ELB is
  \[ I_1^{ELB} = I_1^* \frac{\phi D_1^*}{(\phi - 1)L_1} \]

- A foreign monetary tightening raises the ELB
  ⇒ possibly pushing EMs into recession, despite flexible exchange rates
Model with currency mismatches

**Time-0 equilibrium**

- Domestic loans and foreign debt are equal to

\[
\begin{align*}
L_1 &= L_0 I_0 + \frac{\delta \alpha}{E_0 [I_1]} \\
D^*_1 &= D^*_0 I^*_0 + \frac{\delta \alpha}{E_0 [I^*_1]}
\end{align*}
\]

- As with carry traders, higher \( I_0 \) reduces \( I_1^{ELB} \)
  - Intertemporal trade-off for MP
  - Time-0 MP becomes less effective

- Novel aspect about US monetary policy
  - Ex-post, optimal to reduce \( I^*_1 \) if ELB binds
  - Ex-ante, expectation of lower \( I^*_1 \) raises FX debt and increases ELB
Policy tools against the ELB

- **Recapitalization** of banking sector lowers ELB
  → They relax leverage constraint

- **Subsidies to capital inflows** effective to delink exchange rate from $I_1$
  → They appreciate $e_1$

- **Forward guidance** ineffective
  → Future monetary easing depreciates $e_1$, raising ELB

- **FX intervention** by the central bank is ineffective
  → UIP holds

- **Time-0 “prudential” capital controls** lower time-1 ELB
  → They reduce foreign currency borrowing
Conclusions

- Theory rationalizes concerns about loss of monetary independence
- Existence of open-economy ELB
  - Interest rate below which further easing becomes contractionary
- Despite flexible exchange rates, MP unable to stabilize output
  - Violation of the Trilemma
- ELB generates novel inter-temporal trade-off for MP...
- ...and calls for complementary policy tools