The Expansionary Lower Bound: A Theory of Contractionary Monetary Easing*

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*The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

Introduction

- Over last few years, growing skepticism about monetary policy (MP)
  - EMs unable to insulate themselves from US monetary shocks
    Rey (2015,2016), Rajan (2015)
  - Monetary policy in EMs undermined by carry-trade flows
    Blanchard et al. (2016)
  - Prolonged low interest rates can jeopardize financial stability
    Borio and Zabai (2016)

Our contribution

- Theory of interaction between MP and borrowing constraints
  $\Rightarrow$ can rationalize previous concerns about MP
- Key implication is existence of "Expansionary Lower Bound" (ELB)
  $\Rightarrow$ Interest rate below which further easing becomes contractionary
- ELB can be positive
  $\Rightarrow$ stronger constraint for MP than ZLB
- ELB can be influenced by foreign monetary policy
  $\Rightarrow$ international spillovers

Structure of the paper

- General model deriving conditions for the existence of the ELB
  - MP is assumed to affect borrowing constraints
  - ELB exits if easing tightens borrowing constraints enough
- Three applications that endogeneize how MP affects constraints
  - Open economy with currency mismatches
  - Open economy with carry traders
  - Closed economy and bank profitability

General model

- Consider a closed or open economy model with borrowers and savers
- Agents face borrowing constraint Φ_t
- Assume that Φ_t is affected by monetary policy
- Two conditions are required for the existence of the ELB
  1. Monetary easing should make borrowing constraints binding

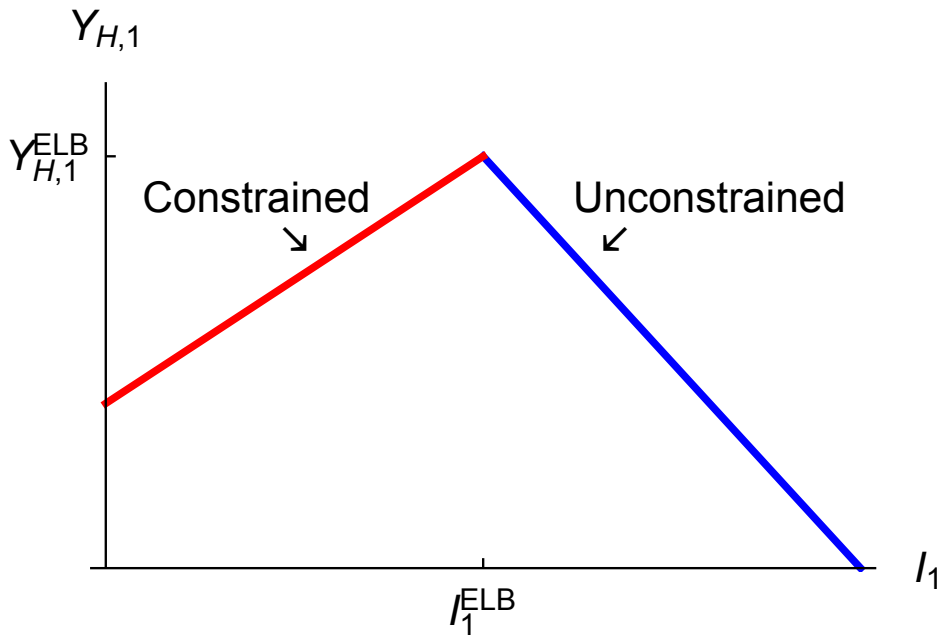
$$\frac{\partial \left(\Phi_t - \left(\Pi_t^B - P_t \tilde{C}_t^B \right) \right)}{\partial I_t} > 0$$

  2. Once constraints bind, easing should reduce aggregate demand

$$\frac{\partial \left(\Phi_t + \Pi_t^B + P_t C_t^S \right)}{\partial I_t} \geq 0$$

The Expansionary Lower Bound

- The ELB places a limit on the ability of MP to stimulate output



The ELB and currency mismatches

- Small open economy populated by
  - Households: borrow from domestic banks
  - Banks: borrow from foreigners in FX
  - Firms: produce differentiated varieties under monopolistic competition
- Discrete time
  - $t = 0$: to analyze ex-ante implications of ELB
  - $t = 1$: ELB can emerge
  - $t \geq 2$: long-run steady state

Households

- Home households maximize

$$\mathbb{E}_0 \left[\ln C_0 + \beta \ln C_1 + \frac{\beta}{1-\beta} \ln C \right]$$

where

$$\ln C_t = (1-\alpha) \ln C_{H,t} + \alpha \ln C_{F,t}$$

- Subject to budget constraints

$$\begin{aligned} P_0 C_0 &= \Pi_{H,0} + L_0 - N_0 \\ P_1 C_1 &= \Pi_{H,1} + L_1 - L_0 I_0^L \\ PC &= \Pi_H + (1-\beta)\left(N_2 - L_1 I_1^L\right) \end{aligned}$$

Financial Sector

- Financial firms borrow abroad in FX and lend domestically

$$N_{t+1} = L_t I_t^L + R_t I_t - e_{t+1} D_t^* I_t^*$$

where R_t are central bank reserves $(R_t \downarrow 0)$

- Financial firms face the time-1 collateral constraint

$$L_1 \leq \phi N_1$$

- FOCs are

$$I_t = I_t^* \frac{e_{t+1}}{e_t}$$

$$I_t^L = I_t + \mu_t$$

Equilibrium

- Long-run spending is determined by money supply

$$\begin{aligned} PC &= M \\ P^*C^* &= M^* \end{aligned}$$

- We first characterize time-1 equilibrium given state variables

$$\begin{aligned} \mathbb{L}_0 &= I_0^L L_0 \\ \mathbb{D}_0^* &= I_0^* D_0^* \end{aligned}$$

- We then consider time-0 equilibrium and endogeneize $\mathbb{L}_0$ and $\mathbb{D}_0^*$

Time-1 equilibrium when banks are unconstrained

- If banks are unconstrained $\Rightarrow I_1^L = I_1$ and

$$\begin{aligned} \bar{P}_H Y_{H,1} &= (1-\alpha)\frac{M}{\beta I_1} + e_1 \frac{\alpha M^*}{\beta^* I_1^*} \\ e_1 &= \frac{I_1^*}{I_1}\frac{\alpha M}{\alpha^* M^*} \end{aligned}$$

- A domestic interest rate cut stimulates spending on domestic goods
  - It increases domestic demand
  - It increases foreign demand by depreciating the exchange rate
- However, monetary easing makes collateral constraint binding

  $\rightarrow$ Exchange rate depreciation reduces bank networth

Time-1 equilibrium when banks are constrained

- Once banks are constrained

$$I_1^{L,con} = \frac{\alpha M/\beta_1}{(\phi - 1)\,\mathbb{L}_0 - e_1\left(\phi \mathbb{D}_0^* - \frac{\alpha^* M^*}{I_1^* \beta_1^*}\right)}$$

- Domestic monetary easing
  - still stimulates foreign demand by depreciating the exchange rate
  - but it curbs domestic demand by raising lending rates

  $\Rightarrow$ Which effect prevails depends on extent of currency mismatch

The ELB under currency mismatches

- If foreign currency liabilities are sufficiently large to satisfy

$$\phi\left(1-\alpha\right)\mathbb{D}_0^* > \frac{\alpha^* M^*}{\beta_1^* I_1^*}$$

monetary policy faces an ELB given by

$$I_1^{ELB} = I_1^* \frac{\alpha M}{\alpha^* M^*} \frac{\phi \mathbb{D}_0^*}{\left(\phi-1\right)\mathbb{L}_0}$$

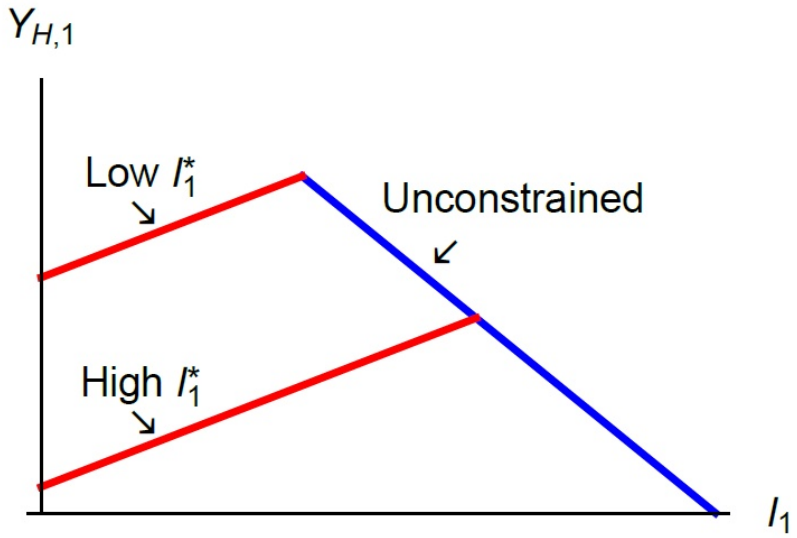
so that the maximum attainable level of output is

$$Y_{H,1}^{ELB} = \frac{\alpha^* M^*}{I_1^* \beta_1^*} \frac{\left(\phi-1\right)\mathbb{L}_0}{\phi \mathbb{D}_0^* \alpha \bar{P}_H}$$

The ELB and foreign monetary policy

- Foreign MP tightening raises the ELB

  $\Rightarrow$ Despite flexible exchange rates, EMs can be pushed into recession



Escaping the ELB

How to escape the ELB?

- Forward guidance ineffective
  → ELB can be lowered by reducing M, but no effect on $Y_{H,1}^{ELB}$
  → Differently from ZLB, ELB is endogenous
- Recapitalization policies may help
  → Equity injections relax collateral constraints and support lending
- Capital controls or foreign exchange rate intervention may work too
  → Helpful to delink domestic monetary conditions from exchange rate

Time-0 equilibrium

- Monetary easing at $t = 0$ raises the ELB at $t = 1$

$$I_1^{ELB} = \frac{\phi}{\phi - 1} \frac{\delta \alpha M I_1^* / \mathbb{E}_0 [I_1^*]}{N_0 I_0 + \delta \alpha M / \mathbb{E}_0 [I_1]}$$

$\Rightarrow$ Monetary easing at $t = 0$ becomes less effective

$$Y_{H,0} = \frac{(1-\alpha) M / \bar{P}_H}{\beta_0 \beta_1 I_0 \mathbb{E}_0 [I_1]} + e_0 \frac{\alpha^* M^* / \bar{P}_H}{\beta_0^* \beta_1^* I_0^* \mathbb{E}_0 [I_1^*]}$$

- US commitment to keep I_1^* low partially undone by higher $\mathbb{D}_0^*$

$$\mathbb{D}_0^* = \delta \frac{\alpha^* M^*}{\mathbb{E}_0 [I_1^*]}$$

The ELB and carry traders

- Household and firm sector similar to previous application except
  - Domestic heterogeneity between borrowers and savers
  - Local currency pricing so that foreign demand not affected by I_t
- Banks raise domestic deposits and hold government bonds

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

$$L_1 + \xi B_1 \leq \phi N_1$$

with FOCs

$$\begin{aligned} I_t^D &= I_t \\ I_t^L &= I_t + \mu_t \\ I_t^B &= \xi I_t^L + (1-\xi) I_t \end{aligned}$$

Carry traders

- Foreign investors follow a carry-trade strategy

$$B_t^F = \propto \left(I_t^B - I_t^*\right)$$

- To obtain closed-form solutions, we assume

$$B_t^F = \tilde{B}_t^F + \gamma \left(\frac{1}{I_t^*} - \frac{1}{\tilde{I}_t^B}\right)$$

- UIP no longer holds
- Monetary easing still depreciates exchange rate to clear bond market

Time-1 equilibrium

- Time-1 output is given by

$$Y_{H,1} = \left(\frac{\omega}{I_1^L} + \frac{1-\omega}{I_1} \right) \frac{1-\alpha}{\bar{P}_H \beta_1} + \frac{\alpha^*}{\bar{P}_H^* \beta_1^* I_1^*}$$

- Monetary easing stimulates output while banks are unconstrained

  ...but it eventually makes constraints binding

- Once banks are constrained, if γ is large enough

$$\frac{\partial I_1^{L,con}}{\partial I_1} < 0$$

  $\Rightarrow$ Easing still stimulates savers' spending, but reduces borrowers'

The ELB under carry-trade flows

- If foreign investors are sensitive enough to interest rate differential

$$\gamma > \frac{\omega\left(1-\omega\right)}{\xi\left(\omega-\xi\right)\beta_1}$$

monetary policy faces an ELB given by

$$\frac{1}{I_1^{ELB}} = \frac{\Theta_1 + \xi\left(R_1 + \tilde{B}_1^F + \frac{\gamma}{I_1^*}\right) - \left(\xi - \eta_1\right) B_1^G}{\frac{\omega}{\beta_1} + \xi\gamma}$$

- Foreign monetary tightening raises the ELB

Escaping the ELB

- Fiscal consolidation lowers the ELB by reducing government bonds
  $\rightarrow$ but only if it does not impose excessive tax burden on borrowers
- Quantitative easing is also effective
  $\rightarrow$ central bank purchases relax banks' balance-sheets

The ELB and bank profitability

- Closed economy model with domestic borrowers and savers
- Banks face the collateral constraint

$$L_1 \leq \phi^N N_1 + \phi^\Upsilon \left(\Upsilon_1 - \Delta_1\right)$$

where Υ_1 and Δ_1 are profits and dividend payments

$$\begin{aligned} \Upsilon_1 &= L_1 I_1^L - D_1 I_1^D - N_1 \\ \Delta_1 &= N_1 \left(I_1^D + \nu - 1\right) \end{aligned}$$

Market power and deposit floor

- Banks have market power in both lending and deposit markets
- If collateral constraint not binding, banks charge lending spread ϵ^L

$$I_1^L = I_1 + \epsilon^L + \mu_1$$

- Banks try to also charge a deposit spread ϵ^D
  $\rightarrow$ but deposit rates cannot decline below $\underline{I}_1^D$

$$I_1^D = Max\left[I_1 - \epsilon^D, \underline{I}_1^D\right]$$

Time-1 equilibrium

- Output and net profits are given by

$$\begin{aligned} Y_{H,1} &= \left(\frac{\omega}{I_1^L} + \frac{1-\omega}{I_1^D}\right)\frac{M}{\beta_1 \bar{P}_H} \\ \Upsilon_1 - \Delta_1 &= L_1\left(I_1^L - I_1^D\right) - \nu N_1 \end{aligned}$$

- If collateral constraint and deposit floor are not binding,
  - Monetary easing is expansionary and
  - profits increase with expansion of aggregate lending
- Once deposit floor binds, $I_1^D = \underline{I}_1^D$,
  - Easing reduces profits and eventually makes collateral constraints bind
  - At that point, easing is unable to stimulate output and ELB emerges

$$I_1^{ELB} \leq \underline{I}_1^D + \epsilon^D$$

Conclusion

- Interaction between monetary policy and borrowing constraints

  $\Rightarrow$ Expansionary Lower Bound

  Interest rate below which monetary easing is contractionary

- The ELB can
  - be positive, thus more binding than ZLB
  - be affected by foreign monetary policy $\rightarrow$ international spillovers
  - emerge under various conditions:
    currency mismatch, carry trade, bank profitability