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

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CEBRA - Boston Policy Workshop
July 2017

*The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.
Over last few years, growing skepticism about monetary policy (MP)

- EMs unable to insulate themselves from US monetary shocks
- 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 ⇒ can rationalize previous concerns about MP
- Key implication is existence of “Expansionary Lower Bound” (ELB) ⇒ Interest rate below which further easing becomes contractionary
- ELB can be positive ⇒ stronger constraint for MP than ZLB
- ELB can be influenced by foreign monetary policy ⇒ 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 $\Phi_t$
- Assume that $\Phi_t$ 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 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

\[ E_0 \left[ \ln C_0 + \beta \ln C_1 + \frac{\beta}{1 - \beta} \ln C \right] \]

where

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

- Subject to budget constraints

\[
\begin{align*}
P_0 C_0 &= \Pi_{H,0} + L_0 - N_0 \\
P_1 C_1 &= \Pi_{H,1} + L_1 - L_0 I_0^L \\
PC &= \Pi_H + (1 - \beta) \left( N_2 - L_1 I_1^L \right)
\end{align*}
\]
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
  
  \[ PC = M \]
  \[ P^* C^* = M^* \]

- We first characterize time-1 equilibrium given state variables
  
  \[ L_0 = I_0^L L_0 \]
  \[ D_0^* = I_0^* D_0^* \]

- We then consider time-0 equilibrium and endogeneize \( L_0 \) and \( D_0^* \)
Time-1 equilibrium when banks are unconstrained

- If banks are unconstrained ⇒ $I_L^1 = I_1$ and

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

$$e_1 = \frac{I_1^* \alpha M}{I_1 \alpha^* M^*}$$

- 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
  → Exchange rate depreciation reduces bank networth
Time-1 equilibrium when banks are constrained

Once banks are constrained

\[ I_{1,\text{con}}^L = \frac{\alpha M/\beta_1}{(\phi - 1) L_0 - e_1 \left( \phi D_0^* - \frac{\alpha^* M^*}{I_1^* \beta_1^*} \right)} \]

Domestic monetary easing

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

⇒ Which effect prevails depends on extent of currency mismatch
The ELB under currency mismatches

- If foreign currency liabilities are sufficiently large to satisfy

\[ \phi (1 - \alpha) \mathbb{D}_0^* > \frac{\alpha^* M^*}{\beta^* I_1^*} \]

monetary policy faces an ELB given by

\[ I_{ELB}^1 = I_1^* \frac{\alpha M}{\alpha^* M^* (\phi - 1) \mathbb{L}_0} \frac{\phi \mathbb{D}_0^*}{\phi \mathbb{D}_0^* \alpha \mathbb{P}_H} \]

so that the maximum attainable level of output is

\[ Y_{H,1}^{ELB} = \frac{\alpha^* M^* (\phi - 1) \mathbb{L}_0}{I_1^* \beta_1^* \frac{\phi \mathbb{D}_0^*}{\phi \mathbb{D}_0^* \alpha \mathbb{P}_H}} \]
The ELB and foreign monetary policy

- Foreign MP tightening raises the ELB
  ⇒ Despite flexible exchange rates, EMs can be pushed into recession

![Diagram showing the relationship between ELB and interest rates.](image-url)
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 $t = 1$

$$I_{1}^{ELB} = \frac{\phi}{\phi - 1} \frac{\delta \alpha M I_{1}^{*}}{N_{0} I_{0} + \delta \alpha M} \frac{I_{1}}{E_{0} [I_{1}]}$$

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

$$Y_{H,0} = \frac{(1 - \alpha) M}{\beta_{0} \beta_{1} I_{0} E_{0} [I_{1}]} + e_{0} \frac{\alpha^{*} M^{*}}{\beta_{0} \beta_{1}^{*} I_{0}^{*} E_{0} [I_{1}]}$$

- US commitment to keep $I_{1}^{*}$ low partially undone by higher $D_{0}^{*}$

$$D_{0}^{*} = \delta \frac{\alpha^{*} M^{*}}{E_{0} [I_{1}^{*}]}$$
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

$$I_t^D = I_t$$
$$I_t^L = I_t + \mu_t$$
$$I_t^B = \xi I_t^L + (1 - \xi) I_t$$
Carry traders

- Foreign investors follow a carry-trade strategy

\[ B_t^F = \alpha (I_t^B - I_t^*) \]

- 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
  \[ Y_{H,1} = \left( \frac{\omega}{I_1^L} + \frac{1 - \omega}{I_1} \right) \frac{1 - \alpha}{P_H \beta_1} + \frac{\alpha^*}{P_H^* \beta^* I^*_1} \]

- Monetary easing stimulates output while banks are unconstrained
  ...but it eventually makes constraints binding

- Once banks are constrained, if \( \gamma \) is large enough
  \[ \frac{\partial I_{L,con}^L}{\partial I_1} < 0 \]

  \( \Rightarrow \) Easing still stimulates savers’ spending, but reduces borrowers’
The ELB under carry-trade flows

- If foreign investors are sensitive enough to interest rate differential

\[ \gamma > \frac{\omega (1 - \omega)}{\xi (\omega - \xi) \beta_1} \]

monetary policy faces an ELB given by

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

- Foreign monetary tightening raises the ELB
Escaping the ELB

- Fiscal consolidation lowers the ELB by reducing government bonds → but only if it does not impose excessive tax burden on borrowers
- Quantitative easing is also effective → 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

\[ L_1 \leq \phi^N N_1 + \phi^\gamma (\gamma_1 - \Delta_1) \]

where \( \gamma_1 \) and \( \Delta_1 \) are profits and dividend payments

\[ \gamma_1 = L_1 I_1^L - D_1 I_1^D - N_1 \]
\[ \Delta_1 = N_1 (I_1^D + \nu - 1) \]
Market power and deposit floor

- Banks have market power in both lending and deposit markets.
- If collateral constraint not binding, banks charge lending spread $\epsilon^L$
  \[ I_1^L = I_1 + \epsilon^L + \mu_1 \]
- Banks try to also charge a deposit spread $\epsilon^D$
  → but deposit rates cannot decline below $I_1^D$
  \[ I_1^D = \text{Max} \left[ I_1 - \epsilon^D, I_1^D \right] \]
Time-1 equilibrium

- Output and net profits are given by
  \[ Y_{H,1} = \left( \frac{\omega}{I_1^L} + \frac{1-\omega}{I_1^D} \right) \frac{M}{\beta_1 \bar{P}_H} \]
  \[ \gamma_1 - \Delta_1 = L_1 (I_1^L - I_1^D) - \nu N_1 \]

- 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, \( I_1^D = I_1^D \),
  - Easing reduces profits and eventually makes collateral constraints bind
  - At that point, easing is unable to stimulate output and ELB emerges
  \[ I_1^{ELB} \leq I_1^D + \epsilon^D \]
Interaction between monetary policy and borrowing constraints
⇒ 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 → international spillovers
  emerge under various conditions:
    currency mismatch, carry trade, bank profitability