Monetary Policy in a Channel System

Aleksander Berentsen
University of Basel

Cyril Monnet
Federal Reserve Bank of Philadelphia
Figure 1: Interest-rate channel of the European Central Bank

EONIA (Euro OverNight Index Average) and Eurepo (reference rate for the Euro GC repo market)

Source: European Banking Federation and ECB
Features

- All loans are secured with collateral (typically REPOS)

- Stock of money endogenous (few open market operations)

- Money market
Objectives

• What is the optimal interest-rate corridor?

• Shift of corridor vs. changing the size?

• What do collateral requirements imply for the optimal policy?

• How does monetary policy without open market operations work?
Central banks operating a channel system

- New Zealand
- England
- Canada
- ECB
- FED
Environment

• General equilibrium model with microfoundations for money

• Time discrete.

• $[0, 1]$ continuum of $\infty$-lived agents.

• Walrasian markets that open/close sequentially, in each $t$. 
Sequence without money market

Settlement Market
Produce and consume

Standing Facility
Deposit rate $i_d$
Lending rate $i_l$

Goods Market
Produce or consume

$n$ sellers
1-$n$ buyers

Idiosyncratic shock
Sequence with money market

$t$

Settlement Market
Produce and consume
$m, b$

$t + 1$

Signal

Money Market
interest rate $i_m$

Idio. Shock

Standing Facility
deposit rate $i_d$
lending rate $i_l$

Goods Market
Produce or consume
Production and Consumption

Settlement market: Settle financial claims, trade collateral. Consume/produce general good.

- Get $-h$ utility if $h$ units are produced.
- Get $h$ utility if $h$ units are consumed.

Money Market: Adjust money holdings. No production/consumption.

Goods market: Consume or produce perishable good

- Produce with probability $n$ at costs $c(q_s) = q_s$
- Consume with probability $1 - n$ and get $u(q)$
Collateral

- General goods can be stored.
- Return in $t + 1$ is $R \geq 1$ with $\beta R < 1$.
- If liquidated in $t$, return is $R = 0$.

- *Only* central bank can verify collateral.
- Accepts stored general goods as collateral.
First-best allocation

Expected lifetime utility of a representative agent

\[(1 - \beta)\mathcal{W} = (1 - n)[u(q) - q] + (\beta R - 1)b\]

First best allocation \((q^*, b^*)\), where:
- \(u'(q^*) = 1\), and
- \(b^* = 0\) if \(\beta R < 1\).
Money

- Perfectly divisible, no holding restrictions.

- Central bank prints/burns paper money at not cost. Fiat.

- No lump-sum transfers.

- Endogenous growth rate

\[ M_t = M_{t-1} - (1 - n)i_t \ell_{t-1} + ni_d d_{t-1}. \]
Definition 1 A symmetric stationary monetary equilibrium is a list \((\gamma, q, z_l, z_m, b)\) satisfying (1)-(5) with \(z_l \geq 0\) and \(z_m \geq 0\).

\[
1 - \frac{\beta R}{\beta R} \geq (1 - n) \left[ u'(q)/\Delta - 1 \right] \quad (= 0 \text{ if } b > 0)
\]

\[
\frac{\gamma - \beta (1 + i_d)}{\beta (1 + i_d)} = (1 - n) \left[ u'(q) - 1 \right]
\]

\[
\gamma = 1 + i_d - (1 - n)(i_l - i_d) \frac{z_l}{z_m}
\]

\[
q = z_m + z_l
\]

\[
z_l = \beta R b / \Delta
\]

where \(\Delta = (1 + i_l) / (1 + i_d)\).
Proposition 1 For any $\Delta \geq 1$ there exists a unique symmetric stationary equilibrium such that

\begin{align*}
z_\ell > 0 \text{ and } z_m = 0 & \quad \text{if and only if } \Delta = 1 \\
z_\ell > 0 \text{ and } z_m > 0 & \quad \text{if and only if } 1 < \Delta < \tilde{\Delta} \\
z_\ell = 0 \text{ and } z_m > 0 & \quad \text{if and only if } \Delta \geq \tilde{\Delta}.
\end{align*}

where

$$\tilde{\Delta} = \frac{1 - n\beta}{1/R - n\beta} \quad \text{and} \quad \Delta = \frac{1 + i_\ell}{1 + i_d}.$$
**Remarks**

- Indeterminacy: Given allocation \((q(\Delta), b(\Delta))\), any pair \((i_\ell, i_d)\) satisfying \(\Delta = \frac{1+i_\ell}{1+i_d}\) is consistent with this allocation.

- Increasing \(\Delta\) reduces \(q\) and \(b\).

- Liquidity premium

\[ V_b - \beta R > 0 \text{ if } \lambda_\ell > 0 \]
Proposition 2 There exists a critical value $\bar{R}$ such that if $R < \bar{R}$, then the optimal policy is $\Delta = \frac{1+i_\ell}{1+i_d} \geq \tilde{\Delta}$. Otherwise the optimal policy is $\Delta = \frac{1+i_\ell}{1+i_d} \in (1, \tilde{\Delta})$.

- Since $\beta R < 1$ it is never optimal to set a zero band.
- If $R < \bar{R}$, central bank chooses $b = 0$ and $q = \tilde{q}$.
- If $R > \bar{R}$, central bank chooses $b > 0$ and $\hat{q} > q > \tilde{q}$. 
MONEY MARKET

Settlement Market
Produce and consume

Money Market
interest rate \(i_m\)

Standing Facility
deposit rate \(i_d\)
lending rate \(i_l\)

Goods Market
Produce or consume

\(t\) \hspace{2cm} \text{Signal} \hspace{2cm} \text{Idio. Shock} \hspace{2cm} (t + 1)
Result: Policy

- Money market rate

\[ i_m = i_\ell - n\beta R\delta = i_\ell - n\beta R(i_\ell - i_d) \]

- Shift of corridor moves money market rate \( i_m \) proportional.

- Increasing deposit rate \( i_d \) increases \( i_m \) but policy becomes less tight!!!!

- Increasing borrowing rate increases \( i_m \) and policy becomes tighter.
Result: ECB puzzle

- Money market rate

\[ i_m = i_\ell - n\beta R(i_\ell - i_d) \]

- If \( n = 1/2 \) and \( \beta R \to 1 \), then \( i_m \to (i_\ell + i_d)/2 \).

- If \( n = 1/2 \) and \( \beta R < 1 \), then \( i_m > (i_\ell + i_d)/2 \) (ECB)
Result: Inflation

• Inflation from Fisher equation:

\[ \gamma = \frac{1 + i_m}{R} = \frac{1 + i_\ell}{R} - n_\beta (i_\ell - i_d) \]

• Steady state: higher interest rates \( \implies \) higher inflation
Final remarks

• Widespread belief that modeling the details of implementation a given interest-rate rule is unimportant

• Our analysis reveals that a characterization of optimal policy and its implementation cannot be separated.

• Any interest-rate rule in a system with zero deposit rate uniquely determines how “tight” or “loose” the policy is.

• The same rule has no meaning in a channel system since it does not determine whether a policy is “tight” or “loose.”

• In a channel system, optimal policy must must state an interest-rate corridor rule.

• New insight, which goes beyond what we already know from literature on the optimal design of interest-rate rules.