Open Market Operations

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New Monetarist model with money and bonds, $A_m$ and $A_b$

- study two policies: LR inflation and a one-time OMO
- assets can differ in acceptability or pledgeability
- these differences are microfounded in information theory
- with random or directed search, and bargaining, price taking or posting

Results:

- negative nominal rate, liquidity trap, sluggish prices, multiplicity
- OMO’s work, unless liquidity is not scarce or if the economy is in a trap, *but what matters is $\Delta A_b$ and not $\Delta A_m$*
Related Literature

- **NM surveys:**

- **Related monetary policy analyses:**

- **McAndrews (May 8 speech):**

  *The Swiss National Bank, the European Central Bank, Danmarks Nationalbank, and Swedish Riksbank recently have pushed short-term interest rates below zero. This is ... unprecedented.*
Environment

- Each period in discrete time has two subperiods:
  - in DM, sellers produce $q$; buyers consume $q$
  - in CM, all agents work $\ell$, consume $x$ and adjust portfolios

- Period payoffs for buyers and sellers:
  
  $U^b(x, \ell, q) = U(x) - \ell + u(q)$
  
  $U^s(x, \ell, q) = U(x) - \ell - c(q)$

- NB: the buyers can be households, firms or financial institutions.
Assets

- $A_m$ and $A_b$ can be used as payment instruments (Kiyotaki-Wright), collateral for loans (Kiyotaki-Moore) or repos (combination).
  - asset prices: $\phi_m$ and $\phi_b$
  - pledgeability parameters: $\chi_m$ and $\chi_b$

- Nominal returns:
  - real liquid bonds: $1 + \rho = (1 + \pi) / \phi_b$
  - nominal liquid bonds: $1 + \nu = \phi_m / \phi_b$
  - nominal illiquid bonds: $1 + \iota = (1 + \pi) (1 + r)$
Acceptability

- 3 types of DM meetings or trading needs/opportunities:
  - $\alpha_m = \text{prob(type-}m\text{ mtg)}$: seller accepts only money
  - $\alpha_b = \text{prob(type-}b\text{ mtg)}$: seller accepts only bonds
  - $\alpha_2 = \text{prob(type-}2\text{ mtg)}$: seller accepts both

- Special cases:
  - $\alpha_b = 0$: no one takes only bonds
  - $\alpha_b = \alpha_2 = 0$: no one takes bonds
  - $\alpha_b = \alpha_m = 0$: perfect subs
Policy instruments:

- money growth rate = inflation rate: $\pi$
- liquid real bond supply: $A_b$
- nominal bonds: omitted for talk but results (in paper) are similar
- tax: $T$ adjusts to satisfy GBC after $\Delta$ monetary policy

NB: trading $A_b$ for $A_m \iff$ changing $A_b$ with $A_m$ fixed

- due to the ‘radical’ assumption that prices clear markets
- classical neutrality holds, but OMO’s can still matter

NB: $A_b$ can be used to target $\rho$ within bdds $[\rho, i]$
Let $z_m = \phi_m a_m$ and $z_b = a_b$. Then

$$W(z_m + z_b) = \max \{ U(x) - \ell + \beta V(\hat{z}_m, \hat{z}_b) \}$$

subject to

$$x + T = z_m + z_b + \ell - (1 + \pi) \hat{z}_m - \phi_b \hat{z}_b$$

- Lemma (history independence): $(\hat{z}_m, \hat{z}_b) \perp (z_m, z_b)$
- Lemma (linear CM value function): $W'(\cdot) = 1$
Let the terms of trade be given by $p = \nu(q)$ where $\nu$ is a mechanism (e.g., Walras, Nash, Kalai...). Then

$$V(z_m, z_b) = W(z_m + z_b) + \alpha_m [u(q_m) - p_m]$$
$$+ \alpha_b [u(q_b) - p_b] + \alpha_2 [u(q_2) - p_2]$$

Liquidity constraint: $p_j \leq \bar{p}_j$, where

$$\bar{p}_m = \chi_m z_m, \quad \bar{p}_b = \chi_b z_b \text{ and } \bar{p}_2 = \chi_m z_m + \chi_b z_b$$
Types of equilibria

Lemma: We always have $p_m = \bar{p}_m$ but we can have either

1. $p_2 = \bar{p}_2$, $p_b = \bar{p}_b$ (constraint binds in all mtgs)
2. $p_2 < \bar{p}_2$, $p_b = \bar{p}_b$ (constraint slack in type-2 mtgs)
3. $p_2 < \bar{p}_2$, $p_b < \bar{p}_b$ (constraint slack in type-2 & type-$b$ mtgs)

Consider Case 1, where

\[ \nu(q_m) = \chi_m z_m, \quad \nu(q_b) = \chi_b z_b \quad \text{and} \quad \nu(q_2) = \chi_m z_m + \chi_b z_b \]
Case 1 (bonds are scarce)

- Euler equations,

\[ \iota = \alpha_m \chi_m \lambda(q_m) + \alpha_2 \chi_m \lambda(q_2) \]
\[ s = \alpha_b \chi_b \lambda(q_b) + \alpha_2 \chi_b \lambda(q_2), \]

- where
  - \( \iota = \) nominal rate on an illiquid bond
  - \( s = \) spread between yields on illiquid and liquid bonds
  - \( \lambda(q_j) = \) Lagrange multiplier on \( p_j \leq \bar{p}_j \)
Nominal yield on liquid bond

- Standard accounting yields

\[ \rho = \frac{\alpha_m \chi_m \lambda(q_m) - \alpha_b \chi_b \lambda(q_b) + (\chi_m - \chi_b)\alpha_2 \lambda(q_2)}{1 + \alpha_b \chi_b \lambda(q_b) + \alpha_2 \chi_b \lambda(q_2)} \]

- While \( \iota > 0 \) is impossible, \( \rho < 0 \) is possible when, e.g.,

  - \( \chi_m = \chi_b \) and \( \alpha_m \lambda(q_m) < \alpha_b \lambda(q_b) \) (\( A_b \) has higher liquidity premium)
  - or \( \alpha_m \lambda(q_m) = \alpha_b \lambda(q_b) \) and \( \chi_m < \chi_b \) (\( A_b \) is more pledgeable).
Negative rates in practice

- Not all Treasury securities are equal; some are more attractive for repo financing than others... Those desirable Treasuries can be hard to find: some short-term debt can trade on a negative yield because they are so sought after. *The Economist*

- Interest rates on Swiss government bonds have been negative for a while. These bonds can be used as collateral in some markets outside of Switzerland where the Swiss franc cannot. *Aleks Berentsen*
Case 1 policy results

- Effects of LR inflation: $\Delta \pi > 0 \Rightarrow$ no effect on $q_b$ and
  \[
  z_m \downarrow q_m \downarrow q_2 \downarrow s \uparrow \phi_b \uparrow \quad \text{and} \quad \rho \rightsquigarrow \quad \text{(Fisher vs Mundell)}
  \]

- Effects of one-time OMO: $\Delta A_b > 0 \Rightarrow$
  \[
  z_m \downarrow q_m \downarrow q_2 \uparrow q_b \uparrow s \downarrow \phi_b \uparrow \quad \text{and} \quad \rho \uparrow
  \]

- Sluggish prices: $\Delta A_m > 0$ and $\Delta A_b < 0 \Rightarrow \Delta z_m > 0 \Rightarrow P$ goes up by less than $A_m$ (quantity eqn fails for OMO)
Other cases

- **Case 2:** $p_2 < \bar{p}_2$ and $p_b = \bar{p}_b$
  
  - $\Delta \pi > 0 \Rightarrow z_m \downarrow, q_m \downarrow, s \uparrow$ and no effect on $q_b$ or $q_2$
  
  - $\Delta A_b > 0 \Rightarrow q_b \uparrow, s \downarrow$ and no effects on $z_m$, $q_m$ or $q_2$

- **Case 3:** $p_2 < \bar{p}_2$ and $p_b < \bar{p}_b$
  
  - $\Delta \pi > 0 \Rightarrow z_m \downarrow, q_m \downarrow$ but no other effects
  
  - $\Delta A_b > 0 \Rightarrow$ no effect on anything (Ricardian equivalence)

- Cases 1, 2 or 3 obtain when $A_b$ is low, medium or high, resp.
Effects of inflation
Effects of OMO's
Variations

- **Nominal bonds:**
  - $A_b$ and $A_m$ grow at rate $\pi$ and OMO is a one-time change in levels.
  - Results are the same except $\partial q_b / \partial \pi < 0$ in Case 1.

- **Long-term bonds:**
  - Imply multiplier effects, but not big enough to generate multiple equilibria.
  - Still, $\partial z_m / \partial A_b$ is bigger, so prices look even more sluggish after injections of cash by OMO.
Liquidity trap

- Injections of cash... by a central bank fail to decrease interest rates and hence make monetary policy ineffective.” Wikipedia

- After the rate of interest has fallen to a certain level, liquidity-preference may become virtually absolute in the sense that almost everyone prefers cash to holding a debt which yields so low a rate of interest. In this event the monetary authority would have lost effective control over the rate of interest.” Keynes
Liquidity trap with heterogeneous buyers

- Type-\(i\) buyers have \(\alpha^j_i = \text{prob(type-}j\text{ mtg)}\)
- For some type-\(i\) (e.g., banks) \(\alpha^j_2 > 0 = \alpha^j_m = \alpha^j_b\)
- They hold bonds and hold money iff \(A_b < \bar{A}_b\)
  - \(A_m, A_b > 0 \Rightarrow\) they must have same return adjusted for \(\chi\)'s
  - Hence, \(\forall A_b < \bar{A}_b\) we get the lower bdd
    \[
    \rho = \frac{\chi_m - \chi_b}{\lambda + \chi_b}
    \]
- NB: In this economy \(\rho = 0\) iff \(\chi_m = \chi_b\) or \(\iota = 0\) (Friedman rule).
Liquidity trap with random search: Example
Directed search with heterogeneous sellers

- Type-\(m\) and type-2 sellers sort into segmented submarkets.
- Buyers can go to any submarket and are indifferent if both open.
- We consider bargaining and posting terms of trade.
- Generates a liquidity trap but now buyers choose their types.
- Arrival rates are endogenous functions of submarket seller/buyer ratio \(\sigma\).
  - \(\Rightarrow\) policy affects output on extensive and intensive margins.
  - \(\Rightarrow\) effect of money injection on \(\mathbb{E}q\) is ambiguous.
Liquidity trap with directed search: Example
As in LPW, set $\chi_j = 1$ and let buyers produce bad assets at 0 cost
- all sellers recognize $A_m$ (for simplicity)
- but have cost $\kappa$ to recognize $A_b$, where $\kappa$ differs by seller

Sellers’ benefit of being informed is $\Delta = \Delta(z_m)$

If $\alpha = \text{prob}(\text{seller mtg})$ and $\theta = \text{buyers’ bargaining power}$, e.g.,

$$\Delta(z_m) = \frac{\alpha(1 - \theta)}{\theta} \left[ u \circ q_2(z_m) - u \circ q_m(z_m) - z_b \right].$$
Equilibrium acceptability

- Measure of informed sellers $n_2 = F \circ \Delta (z_m) = N(z_m)$ defines IA curve
- Euler eqn for buyers defines RB curve $z_m = Z(n_2)$
- Both slope down $\Rightarrow$ multiplicity
  - higher $z_m \Rightarrow$ fewer sellers invest in information
  - higher $n_2 \Rightarrow$ buyers hold less real money balances
- Paper derives clean comparative statics despite multiple equil and endogenous $\alpha$'s
Endogenous pledgeability

As in LRW, buyers in CM can produce bad assets at costs $\beta \gamma_m z_m$ and $\beta \gamma_b z_b$

Set $\alpha_2 > 0 = \alpha_m = \alpha_b$ (for now) and $\theta = 1$ as in std signalling theory

Let $p_m$ and $p_b$ be real money and bond payments

IC for money:

\[
\begin{align*}
\text{cost of legit cash} & \leq \text{cost of counterfeit} \\
\iota z_m + \alpha_2 p_m & \leq \gamma_m z_m
\end{align*}
\]

IC for bonds is similar
Pledgeability constraints

- Sellers’ IR constraint at equality: \( c(q) = p_m + p_b \)
- Buyers’ feasibility constraints: \( p_m \leq z_m \) and \( p_b \leq z_b \)
- Buyers’ IC: \( p_m \leq \chi_m z_m \) and \( p_b \leq \chi_b z_b \) where:
  \[
  \chi_m = \frac{\gamma_m - \iota}{\alpha} \quad \text{and} \quad \chi_b = \frac{\gamma_b - s}{\alpha}
  \]
- NB: \( \chi_j \) depends on cost \( \gamma_j \), policy \( \iota \) and market spread \( s \)
- Paper delivers clean comparative statics despite multiple equil and endogenous \( \chi \)’s
Types of equilibria in an example

\[ \gamma_m = 1 \]
\[ \chi_m \in (0,1) \]
\[ \chi_b = 1 \]

\[ \gamma_b = \frac{\alpha \gamma_m}{\gamma_m - \tau} \]

\[ \gamma_m \]
\[ t + \alpha \]
\[ \gamma_b \]

No monetary equilibrium
OMO money injection w/ endog pledgeability
Conclusion: I

- New Monetarist theory used to analyze monetary policy:
  - money and bonds differing in liquidity, grounded in information theory
  - robust across environments
- The model can generate negative nominal interest, liquidity traps, sluggish prices and multiplicity
- Take Away: printing money and buying T-bills is a bad idea
- It’s probably worse with LR bonds (Quantitative Easing)
Bonds either have or do not have liquidity value:
- if they don’t then OMO’s (and QE) are irrelevant
- if they do then the Fed has it all wrong

What is the effect on $M$ on $P$? Ill posed.
- Quantity eqn holds for transfers but not OMO’s

What is the effect of $\pi$ on the nominal rate? Ill posed.
- Fisher eqn holds for $\iota$ but not $\rho$.

It is not so easy to check Quantity and Fisher eqns in the data!