Floor Systems and the Friedman Rule:

The Fiscal Arithmetic of Open Market Operations

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A general question

- Prior to the financial crisis, many central banks implemented monetary policy using a *corridor system* (or *channel system*)
  - CB lends to banks at an interest rate above its target
  - and pays a rate below its target on deposits (excess reserves)
  - use open market operations to steer market rate to target
- Unconventional policies have created large excess reserves
  - moves a central bank into a *floor system*
  - market rates determined largely be CB deposit facility (IOER)

Q: How should CBs operate when “normal times” return?

- A floor system has some clear advantages
  - removes banks' opportunity cost of holding reserves
    - banks hold more of this safe, perfectly liquid asset
    - and spend fewer resources trying to economize on reserves
  - a partial implementation of the well-known Friedman rule (see: *A Program for Monetary Stability*, 1959)
- But few CBs operated a floor system prior to the crisis
  - exception: RBNZ adopted a floor system in 2006
- Why?
  - are there good reasons to prefer a corridor system?
  - or is the floor system an idea whose time has come?

One issue: Possible fiscal consequences

- In a floor system, the central bank:
  - has a larger balance sheet, and
  - pays interest on its liabilities at (or near) the market rate
- What are the fiscal implications of operating this way?
  - e.g., how are these interest payments financed?
- Some recent work focuses on the Fed's future path
  - will use a floor system as balance sheet gradually shrinks
  - rising interest rates ⇒ capital losses + higher interest expenses
  - could make equity, net revenue negative in some periods
    - see Carpenter et al. (2015), Christensen et al. (2015), Greenlaw et al. (2013), plus del Negro and Sims (2015), Hall and Reis (2015)

- Separately, Berentsen et al. (2014; BMW) raise concerns about the *steady-state* fiscal implications of a floor system
- Study a GE model in the tradition of Lagos and Wright (2005)
  - imperfect interbank market and role for CB facilities
  - builds on Berentsen and Monnet (2008)
- Give conditions under which the optimal floor system requires the government to subsidize the central bank
  - due to large interest cost (not capital losses)
  - raises political concerns about CB independence
  - the “unpleasant fiscal arithmetic” of a floor system

What we do

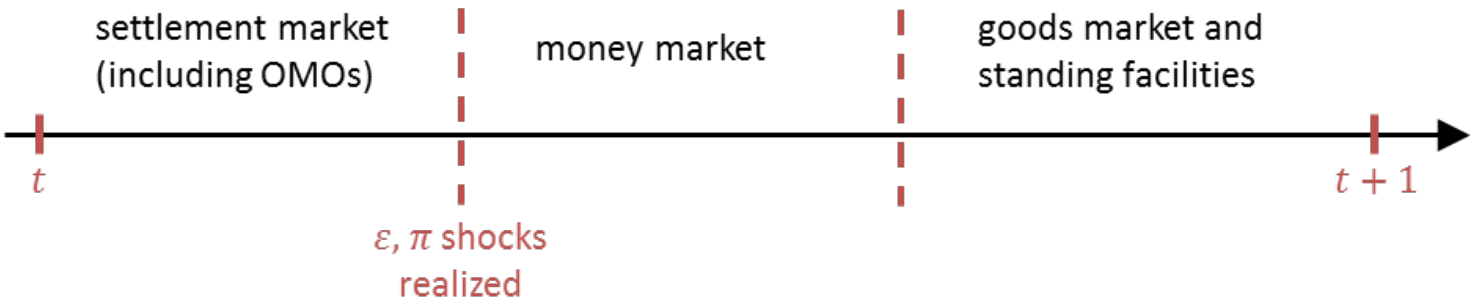
- We revisit this general issue, aiming to better understand:
  - conditions under which the CB requires a subsidy to operate
  - and when using a floor system generates higher welfare
- We use the BMW model with a couple of modifications
  - assume the CB operates through open market operations
  - … using *short-term* government bonds (Assumption 1)
- Idea is to focus purely on implementing monetary policy
  - conceptually distinct from unconventional policies related to CB's choice of assets
  - importantly: using a realistic accounting system

Results

- Under our accounting, the CB *never* requires subsidies
  - in any monetary equilibrium, CB's net revenue is non-negative
  - no unpleasant arithmetic in this sense
- Optimal policy is a floor system
- Under the optimal policy, CB net revenue is zero in all periods
  - not surprising; seigniorage revenue = 0 under the Friedman rule
- If the CB must raise positive revenue, optimal policy may still be a floor system if the CB has other policy tools available
  - example: reserve requirements
- Conclusion: Floor system still seems an attractive option

The model

- Discrete time: $t = 0,1,2,\ldots$
- Agents are infinitely lived
  - two types of private agents, *buyers* and *sellers*
  - a government that conducts fiscal policy (taxes, transfers, debt)
  - a central bank that can creates money (reserves) through OMOs
- In each period:



The government's finances

- Initial period:
  - govt issues bonds to buy ψ units of settlement good
    - consumes these goods (or transfers to households)
    - no taxes in this period
- All other periods:
  - govt collects lump sum taxes and receives net revenue of CB
    - no further consumption/transfers after initial period
  - budget constraint:

$$\rho_t B_{t+1} + T_t + S_t = B_t$$

- Stock of nominal bonds grows at fixed rate $1 + \eta$
  - same for nominal money supply; η = net inflation rate

Central bank's finances

- In period t:

Assets		Liabilities		
Bonds	$\rho_t B_{t+1}^{CB}$	Money	$M_t + L_t - D_t$	(settlement market)
Loans	L_t	Deposits	D_t	(standing facilities)

- When $t+1$ begins:

Assets		Liabilities	
Bonds	B_{t+1}^{CB}	Money	$M_t + L_t - D_t$
Loans	$(1+i_\ell)L_t$	Deposits	$(1+i_d)D_t$
		Surplus	S_{t+1}

$$S_{t+1} = B_{t+1}^{CB} + (1-i_\ell)L_t - (M_t + L_t + D_t) - (1+i_d)D_t$$

or:

$$\boxed{S_{t+1} = i_t M_t + i_\ell L_t - i_d D_t}$$

Preliminaries

- Definition:
  - *unpleasant fiscal arithmetic* occurs if $S_t < 0$ for some t
    - note: differs from definition in BMW because of different accounting
- Proposition: In any monetary equilibrium,

$$i_{m,t} \in [i_d, i_\ell] \text{ and } i_t \in [i_d, i_\ell] \text{ for all } t$$

  - market interest rates all lie within the CB's corridor
- Definition:
  - The CB operates a *corridor system* in period t if $i_d < i_{m,t} < i\_\ell$
  - It operates a *floor system* in period t if $i_d = i_{m,t} < i_\ell$
    - note: these definitions refer to a property of equilibrium

Main result

Proposition: $S_{t+1} \geq 0$ holds for all t in any monetary equilibrium.

- Proof:

$$\begin{aligned} S_{t+1} &= i_t M_t + i_\ell L_t - i_d D_t \\ &\geq i_d (M_t + L_t - D_t) \\ &\geq 0 \end{aligned}$$

- Under Assumption 1, unpleasant fiscal arithmetic never arises
  - note: does not require equilibrium to be stationary
  - also does not depend on detailed features of the model
- Key point: central bank's assets ≥ liabilities
  - and assets earn the market rate of return

Optimal policy

- Assume $\psi \geq 1$
  - initial government debt is sufficiently large

Proposition: The optimal policy sets $1 + i_d = \frac{\eta}{\beta}$.

- corresponds to a floor system (with $i_t = i_{m,1} = i_d$)
- implements the first-best allocation as a stationary equilibrium

Proposition: Under the optimal policy, $S_{t+1} = 0$ for all $t \geq 0$

- that is, seignorage revenue = 0 under the Friedman rule

- Bottom line: A floor system looks like an attractive option

Revenue requirements

- Suppose we require $S_t \geq \overline{S}_t$ for all t
  - assume requirement is uniformly bounded over time
  - and ψ is large enough
- Give CB one more policy tool: reserve requirement
  - requires bank i to hold at least C_t^i,
  - pay interest on required reserves at rate i_C

Proposition: The optimal policy is a floor system with $i_C < i_d$

- Intuition: required reserves act as a lump-sum tax here
  - better than the distortions associated with a corridor system
  - but recall the Friedman rule is optimal in many environments with distortionary taxes (Chari et al. 1996)

Central bank surplus in practice

- In practice central banks issue (a lot of) currency, which does not pay interest
  - 2006: 93% of Fed's liabilities were Federal Reserve Notes
- Central bank revenue associated with currency is large
  - 2006: Fed earned roughly $35 billion on portfolio financed by currency
  - compared with $12 *million* from lending to depository institutions
- Demand for currency creates a large buffer for CBs
  - helps keep net income positive even after expenses, etc.

Conclusions

- Do fiscal considerations argue against using a floor system?
  - or, might a floor system be costly for the central bank?
- If CB follows Assumption 1: No
  - intuition: Assumption 1 ⇒ no interest rate or credit risk
  - as long as CB earns the market rate on its assets …
  - … it can afford to pay the market rate on (all of) its liabilities
  - Fed's possible losses come from choice of assets, not floor system
- Possible caveats:
  - result may change if government bonds are in short supply
  - or if there is credit risk in (some) government bonds
    - how should unpleasant arithmetic be defined in this case?

- Back to the general question:

  How should CBs implement monetary policy going forward?

  - or, What are the arguments against a floor system?

- May be reasons outside this model to prefer a corridor system
  - under the optimal policy here, interbank market trading vanishes
    - is that a problem?
  - commitment and political economy considerations

- Interesting issues for research