Essential interest-bearing money

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The Lagos-Wright Model

- Leading framework in contemporary monetary theory

- Models individuals exposed to idiosyncratic risk generated by the random arrival of opportunities to produce and consume output over time

- Risk is modeled as the outcome of random search in a decentralized market; or as the outcome of random shocks to preferences and technologies in a centralized market

- Either way, the key simplifying property of the framework is quasi-linear preferences, which removes the distribution of wealth as an endogenous state variable

Optimal Monetary Policy (Standard Approach)

- Assume lump-sum tax instrument (society has coercive power)
- Then Friedman rule is implementable
  - via deflation (use tax to contract the money supply); or
  - via interest-bearing money (use tax to finance interest obligation)
- Interest-bearing money is not essential
- Absent lump-sum taxes, constrained-efficient allocation achieved with zero intervention

My Paper

- Examine optimal policy design in a Lagos-Wright model where

  1. trade is competitive among agents

  2. *all* trade is voluntary (including trade between agents and government)

Results

- I identify a class of incentive-feasible policies that improve welfare beyond what is achievable with zero intervention

- Any policy in this class necessarily entails a non-negative inflation rate and a strictly positive nominal interest rate

- Despite the absence of a lump-sum tax instrument, there exists an incentive-feasible policy that implements the first-best allocation

Environment

- Preferences and resource constraints

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{x_t(i) + \pi \left[u(c_t(i)) - h(y_t(i))\right]\right\}$$

$$\begin{aligned} \int x_t(i)di &\leq 0 \\ \int c_t(i)di &\leq \int y_t(i)di \end{aligned}$$

- First-best is y^* satisfying $u'(y^*) = h'(y^*)$ and $\{x_t(i)\}$ satisfying $E_t x_t(i) = 0$

Market structure, timing, and policy

- Government intervention occurs at the beginning of each day, *prior* to day-market trading

- Agent who enters with money m has an *option* of transforming m into $Rm - T$ units of money

- Note: money is like an interest-bearing bond subject to a redemption fee

- Day and night markets competitive; let (v_1, v_2) denote price of money

Decision-making

- Day budget constraint

$$x = v_1 \left[\omega(Rm_1 - T) + (1 - \omega)m_1 - m_2\right]$$

or

$$x = \omega(Rq_1 - \tau) + (1 - \omega)q_1 - \phi q_2$$

- $(q_1, q_2) \equiv (v_1 m_1, v_2 m_2)$ real money balances, day and night

- $\omega \in [0, 1]$ prob. of exercising redemption option

- $\phi \equiv v_1/v_2$ and $\tau \equiv v_1 T$ real redemption fee

Day market

$$D(q_1) \equiv \max_{\omega, q_2} \{\omega(Rq_1 - \tau) + (1-\omega)q_1 - \phi q_2 + N(q_2)\}$$

$$\begin{array}{lll} \omega = 1 & \text{if} & (R-1)q_1 > \tau \\ \omega \in [0,1] & \text{if} & (R-1)q_1 = \tau \\ \omega = 0 & \text{if} & (R-1)q_1 < \tau \end{array}$$

$$\phi = N'(q_2)$$

$$D'(q_1) = \begin{cases} R & \text{if} \quad (R-1)q_1 > \tau \\ 1 & \text{if} \quad (R-1)q_1 < \tau \end{cases}$$

Night market

$$C(q_2) \equiv \max_{c, q_1^+} \left\{ u(c) + \beta D(q_1^+) : q_1^+ = (v_1^+/v_1)\phi(q_2 - c) \;\geq 0 \right\}$$

$$I(q_2) \equiv \beta D((v_1^+/v_1)\phi q_2)$$

$$P(q_2) \equiv \max_{y, q_1^+} \left\{ -h(y) + \beta D(q_1^+) : q_1^+ = (v_1^+/v_1)\phi(q_2 + y) \right\}$$

[A1] Assume that debt-constraint binds tightly for consumers (hence, will not exercise redemption)

[A2] Assume inactive agents exercise redemption option (so producers will too)

Government

- Let M denote money supply; M^{-} is "previous" period's money supply

- [A1] implies M^{-} is held entirely by producers and inactives at beginning of day

- [A2] implies producers and inactives will find it optimal to exercise redemption

- Hence, $(R-1)M^{-}$ interest obligation, offset in part by redemption fee revenue $(1-\pi)T$

- Government can also create new money at rate μ; so GBC is

$$(R-1)M^{-} = M - M^{-} + (1-\pi)T$$

- Using $v_1 M \equiv \phi q_2$, GBC expressed in real terms is

$$\tau = (R/\mu - 1)(1-\pi)^{-1}\phi q_2$$

Defn: An *incentive-feasible policy* (R, μ, τ) satisfies GBC and conditions [A1] and [A2].

Stationary competitive eqm (conditional on a given I-F policy)

$$\delta\beta\pi u'(y) = [1 - \delta\beta(1-\pi)]h'(y)$$

where $\delta \equiv R/\mu$

$$\phi = \pi u'(y) + (1-\pi)h'(y)$$

$$\tau = (\delta - 1)(1-\pi)^{-1}\phi y$$

$$F(q_1) = \begin{cases} \pi & \text{for} \quad 0 \leq q_1 < (\phi/\mu)y \\ 1-\pi & \text{for} \quad (\phi/\mu)y \leq q_1 < (\phi/\mu)2y \\ 1 & \text{for} \quad (\phi/\mu)2y \leq q_1 < \infty \end{cases}$$

Zero Intervention

- $R = \mu = 1$ and $\tau = 0$ is trivially an incentive-feasible policy

- Implies $\delta = 1$; which, by eqm condition above determines an equilibrium level of output $0 < y_0 < y^*$

- In a monetary equilibrium, the debt-constraint for consumers will bind tightly so that [A1] holds

- Condition [A2] holds trivially as well

- Note: there exists a class of incentive-feasible policies (R, μ) satisfying $\delta = R/\mu = 1$ and $R > 1$ that implements the zero intervention allocation y_0 as an equilibrium

- Money is superneutral when it is introduced in the form of interest

Welfare-improving I-F policies

- Restrict attention to policies that satisfy

$$1 < \delta < 1/\beta$$

- Note that any such policy necessarily entails $\tau > 0$ (exclusive money finance is not possible)

- Need to check whether [A2] holds: will inactive agents exercise redemption?

- They enter the day with $q_1 = (\phi/\mu)y$ and will exercise iff $(R-1)q_1 > \tau$; or iff

$$\left(\delta - \frac{1}{\mu}\right)\phi y > \left(\frac{\delta - 1}{1-\pi}\right)\phi y$$

which implies

$$\mu > \left[\frac{1-\pi}{1-\delta\pi}\right] > 1 \text{ for } \delta > 1$$

- So deflation is not incentive-feasible; implies $R > 1$ is necessary

- Need to check whether [A1] holds: are consumers debt-constrained?

- Answer is *yes* if $\delta < 1/\beta$; which I have assumed

Proposition 1 *Under the range of incentive-feasible policies* $1 < \delta < 1/\beta$ *and* $\mu > 1$*, there exists a stationary monetary equilibrium with an allocation* $y_0 < \hat{y}(\delta) < y^*$ *characterized by*

$$\delta\beta\pi u'(\hat{y}) = [1 - \delta\beta(1-\pi)]h'(\hat{y})$$

- Note: $\hat{y}(\delta)$ is strictly increasing in δ and *ex ante* welfare is strictly increasing in $\hat{y}$ over range $1 < \delta < 1/\beta$

- Corollary: policy $\delta \nearrow 1/\beta$ implements first-best

Relation to literature

- **Berentsen, Camera and Waller** (JET 2007) also make a case for interest-bearing money
- Introduce a "bank" in the day-market that pays interest on deposits of cash from producers, redirecting these funds to consumers in the form of interest-bearing loans
- For this solution to work, the bank must be endowed with at least a limited record-keeping technology (seems reasonable, but not necessary if policy is designed correctly)

- **Hu, Kennan and Wallace** (JPE 2009) study a LW model and report that first-best implementation is possible with zero intervention; at least, if agents are sufficiently patient

- They assume pairwise meetings in one of the subperiods

- This grants "maximum freedom" in designing trading protocols conducive to efficient implementation

- The search friction places limits on coalition formation; that is, it effectively imposes a communication barrier between the members of a match and the rest of the community

- As the size of a meeting is increased (say, by replicating the buyer-seller pair in each meeting), the core converges to a competitive equilibrium

- HKW result will fail to hold when trade among individuals is competitive; see also Tsu and Wallace (JET 2007)

- **Kocherlakota** (JET 2003) also makes a case for an (illiquid) interest-bearing government asset

- Advantage: linear mechanism

- Disadvantage: requires trading restriction

Conclusion

- The modeling choice of centralized versus decentralized trade appears to have important policy implications

- I identify a class of incentive feasible policies that improve welfare beyond what achievable with zero intervention when trade is centralized

- Any such policy in this class requires a strictly positive nominal interest rate and a non-negative inflation rate

- "Banking" is not essential here; what is missing?