Private Money and Self-Fulfilling Prophecies

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1. Introduction
2. Model
3. Results
4. Conclusion

Motivation

Many privately issued assets have money-like properties:

- Bank deposits.
- Exchange traded funds (ETFs).

Private money is perceived as a destabilizing institution:

- Public debate.
- Calls for regulatory reform.

This Paper

This paper seeks to gain a better theoretical understanding of:

- The sources underlying the destabilizing nature of private money.
- How these interact with the intrinsically useless nature of fiat money.
- What monetary policy must do to stabilize the economy.

When claims on the profits of firms are used as payment instruments:

- There is a strategic complementarity in search effort, leading to endogenous boom-bust dynamics.
- Introducing a risk-free fiat money eliminates some but not all boom-bust cycles. Additional policies like a TARP or emergency lending are needed.
- Targeting narrow money growth makes an economy prone to self-fulfilling inflation dynamics when private assets are a good substitute for fiat money.

Existing literature

Self-fulfilling inflation dynamics: Azariadis (1981), Lagos and Wright (2003), Altermatt et al. (2021)
Private assets in a monetary economy: Geromichalos et al. (2007), Lagos and Rocheteau (2008), Lagos (2010), Rocheteau and Wright (2013), Geromichalos and Herrenbrueck (2016, 2017) Altermatt (2017).

Claims on economy activity as payment instruments: Guerrieri and Lorenzoni (2009), Angeletos and La'O (2013), Branch and Silva (2019).

Coordination in search markets: Diamond (1982), Cooper and John (1988), Howitt and McAfee (1987, 1992).

Instability of financial intermediation: Rubinstein and Wolinsky (1987), Peck and Shell (2003), Gu et al. (2013), Gorton and Ordoñez (2014), Gu et al. (2019).

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Environment

Time t is discrete and continues forever.

Agents trade in alternating markets as in Lagos and Wright (2005).

1. Decentralized market where good q is traded.
2. Centralized market where good x is traded (numeraire).

Mass one of infinitely lived buyers with preferences

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[u(q_t) - s(e_t) + x_t \right], \quad \text{where} \quad q_t \in \mathbb{R}_+, \quad e_t \in \{l, h\}, \quad x_t \in \mathbb{R}.$$

Overlapping generations of two-period lived firms owned by the households.

- Born in CM_t, endowment y in DM_{t+1}, produce q at endowment cost $c(q)$.
- Remaining endowment plus DM_{t+1} revenues paid as dividend in CM_{t+1}.

All aggregate uncertainty comes from a sunspot observable by all agents.

Decentralized market

Pairwise matches between buyers and firms.

- Terms of trade (q_t, p_t) determined by bargaining, summarized by $v : q \to p$.
- Match surplus for a buyer is $L(q_t) = u(q_t) - v(q_t)$.
- Match surplus for a firm is $\Pi(q_t) = v(q_t) - c(q_t)$.
- Unconstrained quantity $\hat{q}$ s.t. $u'(\hat{q}) = v'(\hat{q})$.
- Liquidity constraint $p_t \leq a_t$ and capacity constraint $c(q_t) \leq y_t$.

$$q_t = \begin{cases} v^{-1}(a_t) & \text{if } a_t < v(\hat{q}) \\ \hat{q} & \text{if } a_t \geq v(\hat{q}) \end{cases} \quad \text{and} \quad p = \begin{cases} a & \text{if } a_t < v(\hat{q}) \\ v(\hat{q}) & \text{if } a_t \geq v(\hat{q}) \end{cases}.$$

A buyer is matched to a firm with probability e_t, where e_t is search effort.

- $e_t \in \{l, h\}$
- $k = s(h) - s(l)$

Centralized market and optimal decisions

Asset market:

- Pricing according to a stochastic discount factor: $z_{t-1} = \mathbb{E}_{t-1}\{\beta(1+\iota_t)z_t\}$
- Arrow securities span the aggregate state space.

In CM$_{t-1}$ buyers adjust asset positions by producing or consuming x_{t-1}, and can choose a_t contingent on the aggregate state at time t—they solve:

$$\max_{a_t \geq 0} \left\{ -\iota_t a_t + \max_{e_t \in \{l,h\}} \left\{ e_t L(\underbrace{\min\{v^{-1}(a_t), \hat{q}\}}_{=q_t}) - s(e_t) \right\} \right\}$$

Aggregate profits and CM$_t$ dividend payments by firms are:

$$\mathcal{F}_t = y + e_t \Pi(\underbrace{\min\{v^{-1}(a_t), \hat{q}\}}_{=q_t}).$$

Equilibrium

M_t is fiat money supply at end of CM$_t$, ϕ_t is the CM$_t$ value of fiat money, and Υ_t the CM$_t$ value of a newborn firm.

Given a sequence $\{M_{t-1}\}_{t=0}^{\infty}$ for fiat money supply, an equilibrium is a (stochastic) process $\{a_t, e_t, \mathcal{F}_t, \iota_t, \phi_t, \Upsilon_t\}_{t=0}^{\infty}$ so that:

1. The LOOP holds: $\phi_t = \mathbb{E}_t\{\beta(1+\iota_{t+1})\phi_{t+1}\}$ and $\Upsilon_t = \mathbb{E}_t\{\beta(1+\iota_{t+1})\mathcal{F}_{t+1}\}$.
2. Markets clear: $a_t = \phi_t M_{t-1} + \mathcal{F}_t$, where $\mathcal{F}_t = e_t \Pi(\min\{v^{-1}(a_t), \hat{q}\}) + y$.
3. Buyers choose a_t and e_t optimally.

Buyers' optimal decisions are such that

$$\iota_t = \frac{e_t L'(q_t)}{v'(q_t)} \quad e_t \in \begin{cases} \{h\} & \text{if } \iota_t < \tilde{\imath}(k) \\ \{l,h\} & \text{if } \iota_t = \tilde{\imath}(k) \\ \{l\} & \text{if } \iota_t > \tilde{\imath}(k) \end{cases}, \quad \text{and} \quad a_t \geq v(q_t) \quad \text{with "=" if } \iota_t > 0.$$

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Private asset economy

$q_t \in [0, \hat{q}]$ determined as a function of e_t:

$$v(q_t) \leq e_t \Pi(q_t) + y, \quad \text{with "=" if } q_t < \hat{q} \ .$$

- q_t depends positively on e_t and y.
- Given e_t and y, q_t is uniquely determined $\rightarrow q^l(y), q^h(y)$.

e_t depends on the marginal liquidity value of assets:

- $(e_t, q_t) = (l, q_t^l(y))$ is an equilibrium outcome iff $lL'(q^l)/v'(q^l) \geq \tilde{\imath}(k)$.
- $(e_t, q_t) = (h, q_t^h(y))$ is an equilibrium outcome iff $hL'(q^h)/v'(q^h) \leq \tilde{\imath}(k)$.

Proposition

There is a set of (k, y) with positive mass for which there exists a continuum of private asset equilibria.

Introducing a risk-free fiat money

For risk-free fiat money with inflation rate π, the LOOP implies:

$$\mathbb{E}_{t-1}\{\iota_t\} = \frac{\pi - \beta}{\beta} \equiv i$$

- i is the *Fisher rate* and $i = 0$ is the *Friedman rule*.

If all uncertainty regarding time t is resolved already at time $t-1$:

$$e_t L'(q_t)/v'(q_t) = i \quad \text{and} \quad e_t = \begin{cases} h & \text{if } i < \tilde{\iota}(k) \\ l \text{ or } h & \text{if } i = \tilde{\iota}(k) \\ l & \text{if } i > \tilde{\iota}(k) \end{cases}.$$

- Except for a knife-edge case, there is a unique equilibrium.

Sunspot equilibria with risk-free fiat money I

In DM$_t$, there is scope for coordinating on the sunspot.

$$v(q_t) \leq e_t \Pi(q_t) + y + m, \quad \text{with "=" if } q_t < \hat{q}$$

- $m \equiv M_{t-1}\phi_{t-1}/\pi$ is determined endogenously in CM$_{t-1}$.
- In DM$_t$, it acts similarly as y due to inflation target.

Like before, we now have $q^l(m+y)$ and $q^h(m+y)$.

- $(e_t, q_t) = (l, q^l(y+m))$ with prob. $\rho^l > 0$ only if $lL'(q^l)/v'(q^l) \geq \tilde{\iota}(k)$.
- $(e_t, q_t) = (h, q^h(y+m))$ with prob. $\rho^h > 0$ only if $hL'(q^h)/v'(q^h) \leq \tilde{\iota}(k)$.

Value of fiat money m determined endogenously by

$$\rho^l lL'(q_t^l)/v'(q_t^l) + \rho^h hL'(q_t^h)/v'(q_t^h) = \mathbb{E}_{t-1}\{\iota_t\} = i.$$

- If $m > 0$, we have a sunspot equilibrium.

Sunspot equilibria with risk-free fiat money II

Proposition

There is a set of (i, k, y) with positive mass for which there exist sunspot equilibria.

Corollary

If policy approaches the Friedman rule, the set of sunspot equilibria vanishes.

The main implication:

- Away from the FR, fiat money is a risk-free but costly asset.
- Buyers still find it attractive to rely on private assets.
- Because asset positions can only be adjusted in the CM, there is a scope for coordination failure in the DM.

Stabilization policies

To stabilize the economy, government should intervene in the DM.

- If $a_t < v \circ \tilde{q}(k)$, there is a drop in search effort.

To prevent a bust, inject liquidity according to feedback rule:

$$I_t = \min\{v(\tilde{q}) - m - \mathcal{F}_t, 0\}/\phi_t$$

- Helicopter money $\rightarrow$ need lump-sum taxation to prevent inflation.
- Buy assets at the boom price (TARP) $\rightarrow$ need fiscal space to cover losses.

If the government can enforce repayment:

- Emergency lending.

Passive monetary policy I

If monetary policy simply targets narrow money growth:

$$M_t = \mu M_{t-1} \quad \text{where } \mu \geq \beta.$$

Forward looking dynamic system for the value of fiat money balances

$$m_t = f(m_{t+1})$$

- Equilibrium is a sequence $\{m_t\}_{t=0}^{\infty}$ s.t. $m_t = f(m_{t+1})$ and $\lim_{t\to\infty} \beta^t m_t$.
- A monetary steady state is an $m^{ss} > 0$ s.t. $m^{ss} = f(m^{ss})$.

With fixed search effort or random matching, $f(\cdot)$ is a function.

- If and only if $f'(m^{ss}) < -1$ there is a two-cycle.
- The use of private assets with endogenous divided reduces f'.
- Existence of two-cycles still require very concave u.

Passive monetary policy II

Forward looking dynamic system for the value of fiat money balances

$$m_t = f(m_{t+1})$$

With endogenous search effort, for a set of k with positive mass:

- For $m_{t+1} \in [\underline{m}, \overline{m}]$, both $e_{t+1} = h$ and $e_{t+1} = l$ are feasible.
- Hence, $f(\cdot)$ is a correspondence.
- $f'(m^{ss}) < -1$ is sufficient but not necessary for a two-cycle.

Proposition

If μ is in a neighborhood of $\beta(1 + \tilde{\imath}(k))$, meaning that steady state Fisher rate is close to $\tilde{\imath}(k)$, a two-cycle exists irrespective of the other parameters.

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Conclusion

In a model where search effort and the dividend of private assets are determined endogenously:

- The use of private assets in payment generates a strategic complementary in search effort.
- This gives rise to endogenous boom-bust dynamics.

Fiat money helps to stabilize the economy if monetary policy is active:

- Targeting narrow money growth leaves scope for deterministic cycles.
- Stabilize inflation to ensure that fiat money is a risk-free alternative for private assets.
- If the inflation target deviates from the FR, combat financial panics by injecting liquidity according to a feedback rule.

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