Information, Liquidity, Asset Prices and Monetary Policy

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Introduction

- why hold money?
  - money plays the role as a medium of exchange
- why use fiat money rather than other assets?
  - recognizability → difference in liquidity
  - asset as an imperfect substitute to money
- question of this paper:
  - what causes the difference in recognizability?
  - asymmetric information rather than self-fulfilling prophecy
A modified version of Lagos and Wright (2005)

- discrete time
- a continuum of infinitely lived agents, of total measure 1
- two subperiod in each period:
  - subperiod 1: decentralized market for heterogeneous goods
    - produce heterogeneous goods that meet others’ want
    - random matching → partners
    - bilateral bargaining → terms of trade
    - medium of exchange: fiat money, and asset
  - subperiod 2: centralized market for homogeneous good
    - agents produce homogenous goods
    - assets are claims to homogeneous goods in the future
    - walrasian market for the homogeneous goods and all assets
Asset

- fiat money: bears no fruit; cannot be privately produced
- other asset
  - fake ones bearing no fruits can be mixed with good asset
  - cost of producing fake asset is zero
- importance recognizability
  - assets can be accepted a medium of exchange only when they are recognized to be good asset
    - in DM, fiat money are recognizable
    - other assets recognizable with some probability
    - in CM, all assets are recognizable
Agents’ period payoff

- period payoff:
  - payoff in subperiod 1: $u(q) - c(q')$, where $u(0) = c(0) = c'(0) = 0$, $U'(0) = u'(0) = \infty$
    
    - $q$: consumption from purchase
    - $q'$: production for sales

  - payoff in subperiod 2: $U(X) - H$
    
    - $X$: consumption of homogeneous goods
    - $H$: cost of producing $H$ units
Agents’ expected payoff $I$

- payoff at time $0$ $E_0 \sum_{t=0}^{\infty} \beta^t \{u(q_t) - c(q'_t) + U(X_t) - H_t\}$
  - in DM each period:
    * probability $\lambda$: produce and sell
    * probability $\lambda$: buy and pay by money or asset
    * probability $1 - 2\lambda$: no trade
    * conditional on having a trade: payoff depends on
      - asset holdings of buyer
      - the recognizability of the assets in the portfolio
Recognizability of asset

- Suppose there are \( n \) assets, numbered from 1 to \( n \).
- Agents recognize a subset of the assets \( S \in 2\{1,...,n\} \).
- The type of meeting is the set of recognizable assets of buyers.
- The measure over the random type of meeting: \( \rho_S \).
- Trade in decentralized markets depend not on total wealth but on the total wealth of recognizable assets.
Agents’ expected payoff II

- \( W_t(y) \) value function in CM; \( V_t(a) \) value function in DM, \( \phi_t \)
- asset price
- payoff at time \( t \)

\[
V_t(a) = \mathbb{E}_t \sum_{\tau=t}^{\infty} \beta^{\tau-t} \{ u(q_\tau) - c(q_\tau') + U(X_\tau) - H_\tau \} \\
= \lambda \int \sum_s \rho_s \left[ u(q_t(y_s)) + W_t(y - p_t(y_s)) \right] dF_t(\tilde{a}) \\
+ \lambda \int \sum_s \rho_s \left[ -c(q_t(\tilde{y}_s)) + W_t(y + p_t(\tilde{y}_s)) \right] dF_t(\tilde{a}) \\
+ (1 - 2\lambda) W_t(y)
\]

- \( y_s = \phi \cdot a_1 s, \ y = \phi \cdot a \)
Agents’ problem in the centralized market

Assume stationarity

\[ W(y) = \max_{X, H, \hat{a}} U(X) - H + \beta V(\hat{a}) \]

s.t.

\[ X = H + y - \sum_j \phi_j \hat{a}_j + T \]

\[ H \in [0, \bar{H}] \]

\[ X \geq 0 \]

\[ a_j \geq 0 \]

\[- W(y)' = 1 \text{ where } y = \sum_j (\delta_j + \phi_j) a_j \]
Agents’ problem in the decentralized market

\[ V(a) = W[y(a)] + \lambda \sum_{S \in P} \rho_S \{ u[q_S(a)] - p_S(a) \} + \lambda K \]

- \((q_S(a), p_S(q_S(a)))\) is decided by bargaining
  - and depends on \(y_S = \phi \cdot a1_S\)
- \(K\): expected gain from trade as a seller
  - it does not depend on \(a\)
Definition of equilibrium

A stationary equilibrium is asset holding \( a \) at the beginning of DM, asset holding at the beginning of CM, consumption and production in both subperiod, and prices \( \phi_j \) given \( \phi_j^- \) such that

- given \( \phi_j \), the allocation solves agents’ problem in both subperiods
- market clearing in CM: \( a = A \)
- allocation satisfies the Transversality condition
Decision in the centralized market

\[ W(y) = \max_{X,H,\hat{a}} U(X) - H + \beta V(\hat{a}) \]

\[ \text{s.t. } X = H + y - \sum_j \phi_j \hat{a}_j + T \]
\[ H \in [0, \bar{H}] \]
\[ X \geq 0 \]
\[ a_j \geq 0 \]

where \( y = \sum_j (\delta_j + \phi_j) a_j \)

- FOC (assume \( H < \bar{H} \)):

\[ -\phi_j + \beta \frac{\partial V(\hat{a})}{\partial \hat{a}_j} \leq 0, = \text{ if } \hat{a}_j > 0, \forall j \]

- \( W'(y) = 1 \): agents with different \( a \) → same \( \hat{a} \)
Decision in the decentralized market

\[ V(a) = W[y(a)] + \lambda \sum_{S \in P} \rho_S \{ u[q_S(a)] - p_S(a) \} + \lambda K \]

bargaining outcome:

- If \( y_S(a) \geq y^* \), then
  - \( p_S(a) = y^* \), and \( q_S(a) = q^* \)
  - \( u'(q^*) = c'(q^*) \)

- If \( y_S(a) < y^* \), then
  - \( p_S(a) = y_S(a) \), \( q_S(a) < q^* \)
  - \( y_S(a) = z(q) = \theta c(q) + (1 - \theta) u(q) < z(q^*) \)
  - \( \theta \): bargaining power of seller

- A wedge between MU and MC: \( u'(q) > c'(q) \)
Euler Equation

\[ \phi_j^- = \beta (\delta_j + \phi_j) \left\{ 1 + \lambda \sum_{S \in P} \rho_S l(q_S(A))1_{j \in S} \right\} \]

\[ l(q) = \frac{u'(q) - c'(q)}{z(q)} \]

- asset price depends on:
  - dividend: \( \delta_j \)
  - search friction: \( \lambda \)
  - recognizability: \( \rho_S \)
  - liquidity premium: \( l(q) \)
Trade-off of holding assets

- gain: dividend in CM
- loss: risk of being not recognized in DM
  - as $\lambda \to 0$, $\delta_{\text{fiat money}} = 0 < \delta_{\text{other asset}}$
    - the price of fiat money decreases exponentially relative to that of other assets
  - as $\rho_S \to 0$
    - liquidity premium goes down
  - trade-off between recognizability and dividend gain
Comparative statics on liquidity premium

- if there is only one asset not perfectly recognizable:
  - liquidity premium decreases monotonically with asset supply
  - liquidity is "saturated" at certain point with zero premium

- if there are two assets: recognizable fiat money and equity
  - liquidity premium for more recognizable wealth is higher
Value of an asset

- value of a asset:
  - fundamental value
  - value as a medium of exchange
- value as a medium of exchange depends on
  - recognizability of the asset in DM
Information acquisition

- with information acquisition, $\rho_S$ endogenized
- strategic complementarity between decisions of information acquisition
- possibility of multiple equilibria
- sensitivity of liquidity to asset supply or fundamentals
Conclusion

Thank you.