Information and Liquidity

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Questions

1. How does the liquidity of an asset affect:
   - its price?
   - terms of trade/allocations in real transactions?

2. How are these results sensitive to monetary policy?
   - i.e. the rate of return on the most liquid asset: cash.
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1. How does the liquidity of an asset affect:
   - its price?
   - terms of trade/allocation in real transactions?

2. How are these results sensitive to monetary policy?
   - i.e. the rate of return on the most liquid asset: cash.

3. Why/when is a dominated medium of exchange used?

4. Is this sensitive to monetary policy?
The Model: Key Features

- A medium of exchange is *essential* in some transactions.

- There exist multiple assets that differ with respect to:
  
  - promise to future payoffs.
  
  - probability of acceptance (*liquidity*) in these transactions.
    
    - first exogenous, then endogenous.
The Model: Key Features

- A medium of exchange is *essential* in some transactions.

- There exist multiple assets that differ with respect to:
  - promise to future payoffs.
  - probability of acceptance (*liquidity*) in these transactions.
    - first exogenous, then endogenous.
    - buyers can create counterfeit assets.
    - sellers can verify value of assets.
Findings

1. Assets used as medium of exchange: liquidity premium.

2. Inflation causes a decrease in the rate of return on assets.
   - Formalization of the Tobin effect.
   - The Fisher equation does not hold.
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2. Inflation causes a decrease in the rate of return on assets.
   - Formalization of the Tobin effect.
   - The Fisher equation does not hold.

3. Use of dominated med. of exchange potentially explained by:
   - Coordination failure between buyers and sellers.

4. Inflation can increase liquidity of other assets.
   - E.g. dollarization in high inflation regimes.
The Model: Timing

- Period divided into two sub-periods [Lagos & Wright ('05)].

Decentralized Market (DM) | Centralized Market (CM) | (DM)
---|---|---

$t$ | $t + 1$

Trade | Redeem assets, Work, Consume, Choose portfolio

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Assets

- Two perfectly divisible assets:
  
  1. Fiat money.
     
    - Supply: $M$.
    
    - Grows at rate $\gamma$: $\dot{M} = \gamma M$.
    
    - Price (in terms of CM good): $\phi$.
  
  2. Claims to a real asset.
     
    - Fixed supply: $A$.
    
    - Yields constant dividend: $\delta$.
    
    - Price (in terms of CM good): $\psi$. 
Centralized Market (CM)

- Agents choice variables:
  1. \( x \equiv \text{general consumption good (numeraire)} \).
  2. \( h \equiv \text{hours of labor} \).
  3. \( (\hat{m}, \hat{a}) \equiv \text{portfolio of cash / assets} \).
    - detail: agent with \( a \) assets may not bring all to DM.
    - \( \hat{a}_1 \) left in CM, \( \hat{a}_2 \) brought to DM.

- Agent’s CM wealth:
  \[ y = \phi m + (\delta + \psi)(a_1 + a_2) \.]
Centralized Market Maximization Problem

- Maximization Problem

\[ W(y) = \max_{x, h, \hat{m}, \hat{a}_1, \hat{a}_2} \{ U(x) - h + \beta V(\hat{m}, \hat{a}_1, \hat{a}_2) \} \]

\[ \text{s.t. } x = h + y - \phi(\hat{m}) - \psi(\hat{a}_1 + \hat{a}_2) + (\gamma - 1)M \]

- First order conditions

\[ x : U'(x) = 1 \]

\[ \hat{m} : \phi \geq \beta V_1(\hat{m}, \hat{a}_1, \hat{a}_2), = \text{ if } \hat{m} > 0 \]

\[ \hat{a}_1 : \psi \geq \beta V_2(\hat{m}, \hat{a}_1, \hat{a}_2), = \text{ if } \hat{a}_1 > 0 \]

\[ \hat{a}_2 : \psi \geq \beta V_3(\hat{m}, \hat{a}_1, \hat{a}_2), = \text{ if } \hat{a}_2 > 0 \]
Decentralized Market (DM)

- Meetings are bilateral and anonymous.
  - a medium of exchange is essential.
- $q \equiv$ specialized consumption good.
- $\lambda \equiv$ arrival rate of opportunities to buy.
  - utility: $u(q)$.
- $\lambda \equiv$ arrival rate of opportunities to sell.
  - disutility: $-c(q)$. 
Two Types of Meetings

- **Type 1:** measure \(1 - \rho\) of agents accept only \(m\).
  - Arrival rate \(\lambda_1 = (1 - \rho)\lambda\).
  - Buyers’ transferable wealth \(y_1 = \phi m\).

- **Type 2:** measure \(\rho\) of agents accept \(m\) and \(a\).
  - Arrival rate \(\lambda_2 = \rho\lambda\).
  - Buyers’ transferable wealth \(y_2 = \phi m + (\psi + \delta)a_2\).
Decentralized Market Maximization Problem

- **Bargaining:** Nash bargaining pins down
  - \( p_j = \) real value paid by buyer.
  - \( q_j = \) amount of good seller produces.

- **Value function:**
  \[
  V(m, a_1, a_2) = (1 - \lambda)W(y) + \lambda_1 [u(q_1) + W(y - p_1)]
  + \lambda_2 [u(q_2) + W(y - p_2)] + k,
  \]

- **Solving the model:**
  - differentiate and insert into FOC to get Euler eqns.
  - use bargaining solution to eliminate \( \phi \) and \( \psi \).
Equilibrium

- ∃! steady-state monetary equilibrium.
  - \( \hat{m} > 0 \) and \( \hat{a}_2 > 0 \).
  - two cases: \( \hat{a}_1 > 0 \) or \( \hat{a}_1 = 0 \).

- If \( A > \bar{A} \), \( \hat{a}_1 > 0 \) and \( \psi = \delta/r \).
  - asset price = fundamental value.

- If \( A < \bar{A} \), \( \hat{a}_1 = 0 \) and \( \psi > \delta/r \).
  - asset price = fundamental value + liquidity premium.
Monetary Policy and Liquidity when $A < \bar{A}$

- $R_m = \frac{\hat{\phi}}{\phi} = \frac{1}{\gamma} = \frac{(1 + r)}{(1 + i)}$.

- $R_a = \frac{(\hat{\psi} + \delta)}{\psi} = 1 + \frac{\delta}{\psi}$.

<table>
<thead>
<tr>
<th>$\chi$</th>
<th>$\frac{\partial q_1}{\partial \chi}$</th>
<th>$\frac{\partial q_2}{\partial \chi}$</th>
<th>$\frac{\partial \phi}{\partial \chi}$</th>
<th>$\frac{\partial \psi}{\partial \chi}$</th>
<th>$\frac{\partial R_m}{\partial \chi}$</th>
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<tbody>
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<td>$i$</td>
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- Inflation effects asset prices/returns and consumption in DM.

- Fisher equation does not hold.
Endogenous Liquidity

- All agents can verify cash at no cost.

- To verify claim to assets requires investment:
  - cost of investment for agent $i \in [0, 1]$ is $\kappa(i)$ with $\kappa'(i) \geq 0$.
  - flow cost, paid in preceding CM.

- Fraction of agents that accept asset, $\rho$, equivalent to fraction of agents that invest in verification technology.
  - $\rho = \text{probability of a type 2 meeting.}$
Equilibrium with Endogenous Liquidity

- Given $\rho$, expected return from investment:

$$\Pi(\rho) = \beta \lambda \left\{ S[q_2(\rho)] - S[q_1(\rho)] \right\}.$$  

where $S[q_j(\rho)]$ is seller’s surplus from type $j$ meeting.

- Decision rule is trivial:

  - invest if $\Pi(\rho) \geq \kappa$, not otherwise.
Equilibrium with Endogenous Liquidity

- Define
  1. CDF \( F \equiv \kappa^{-1}(i) \).
  2. Mapping \( T(\rho) = F[\Pi(\rho)] \).

- Equilibrium is a fixed point \( T(\rho^*) = \rho^* \).
  - existence follows from Brouwer.
  - simple conditions guarantee \( \rho^* \in (0, 1) \).
  - easy and natural to get multiplicity.
  - some examples...
Possible Equilibria: One Medium of Exchange

Case 1: $\rho^* = 1$

Case 2: $\rho^* = 0$

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Possible Equilibria: Two Media of Exchange

Case 3: Unique Equilibrium

Case 4: Multiple Equilibria
Monetary Policy and Liquidity

- Regime 1: \( i = 5\% \), Regime 2: \( i = 10\% \).
Conclusion

- When assets bear liquidity premium, real rates depend on perfectly anticipated inflation.
  - Fisher equation does not hold.
- Inflation reduces return on assets and affects allocations.
- Willingness to accept assets depends on monetary policy.
  - Inflation makes alternative assets more acceptable.
- Applications: $M$ vs. interest-bearing assets, dollars vs. pesos...