The Limits of *onetary Economics*

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Motivation

Is the medium-of-exchange role of money

relevant for Monetary Economics?

Monetary Economics without *M*

Current wisdom:

Medium-of-exchange considerations are irrelevant for monetary transmission in modern high-velocity credit economies

onetary Economics

Medium-of-exchange considerations are irrelevant for monetary transmission in modern high-velocity credit economies

Two results:

- Monetary equilibrium is continuous under a certain “cashless limit”
- Money plays small quantitative role in high-velocity calibrations

Our findings

- Generically, as velocity becomes arbitrarily large, the monetary equilibrium does not converge to the equilibrium of the economy without money

- Magnitude of effect of monetary policy on consumption and welfare in the cashless limiting economy depends on a *sufficient statistic*: $(1-\theta)\epsilon$

  - $1-\theta$: deposit spread that intermediaries impose on lenders

  - ϵ : price elasticity of demand for the goods purchased with cash or credit

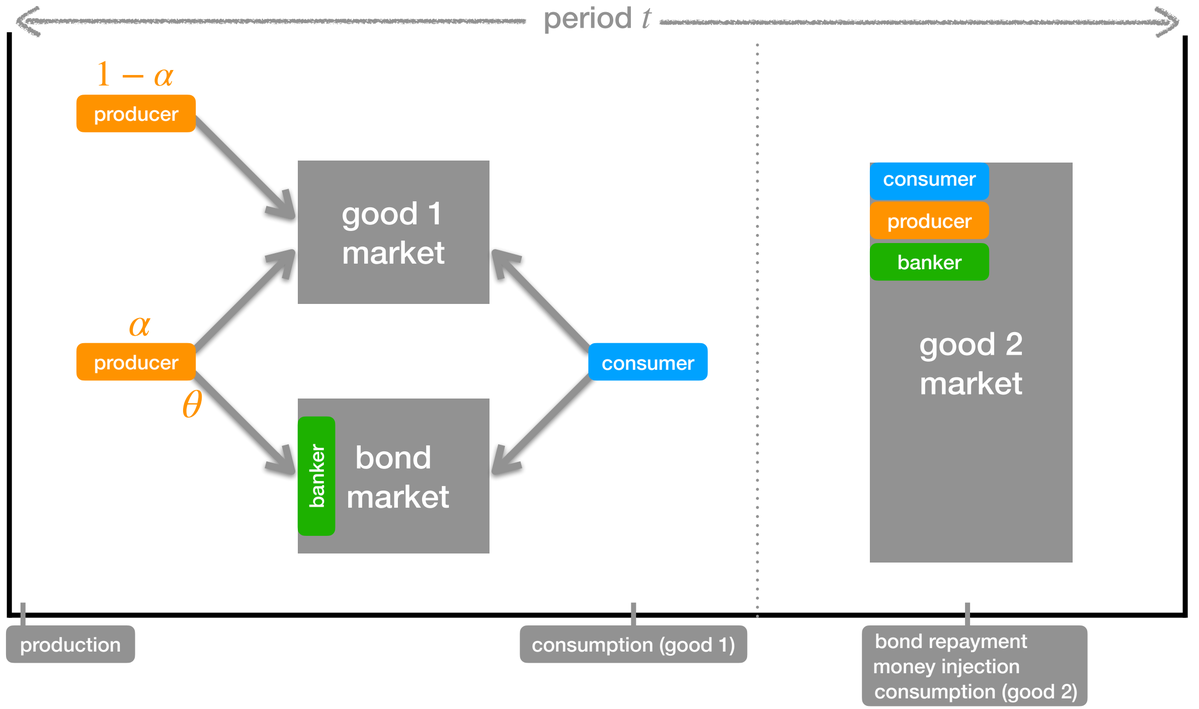
Intuition

Rate of return on money affects prices in transactions that do not involve money

- The *option* to engage in monetary trade disciplines the market power of credit/payment/settlement intermediaries
- Off-equilibrium *latent money demand* $\Rightarrow$ small volume of monetary trade feeds back into prices negotiated in all pure-credit non monetary transactions

Economic environment

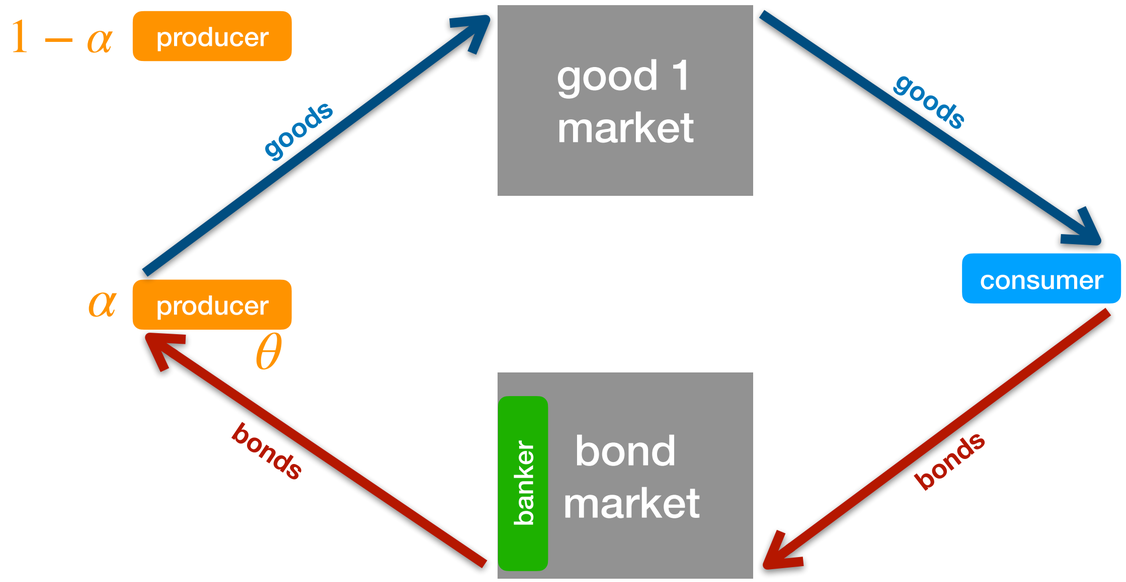
- consumers, producers, bankers; infinite horizon
- two stages $i \in \{1,2\}$ per period; good i consumed and produced in stage i
- good 1:
  - producer marginal cost: κ
  - consumer demand: $u'^{-1}(\cdot)$
  - first-best: c^* such that $u'(c^*) = \kappa$
- assets:
  - money $M_{t+1} = \mu M_t$
  - inside bond (claim to good 2 issued in stage 1)
  - relative price of good 1 in terms of the bond: φ
- stage-1 market structure:
  - two contemporaneous markets: goods-and-money | bonds-and-money
  - $\alpha \in [0,1]$ producers access both markets
    (the rest only access goods market, so must settle sales in cash)
  - bankers intermediate credit: $1-\theta \in [0,1]$ is their (Nash) bargaining power with producers (*deposit spread*)
  - All consumers can access both markets, and face no borrowing limit or markups in the credit market



Nonmonetary economy

producer

- Expected per-unit profit:
  $\Pi^n \equiv \alpha\theta\varphi^n - \kappa$
- In equilibrium:
  $\Pi^n = 0 \Rightarrow \varphi^n = \dfrac{\kappa}{\alpha\theta}$



φ^n: relative price of good 1 in terms of the bond

consumer

- Demand:
  $u'(c^n) = \varphi^n$

$$u'(c^n) = \frac{\kappa}{\alpha\theta} \Rightarrow \text{consumption too low unless } \alpha\theta = 1$$

(producer markup induced by deposit spread and imperfect access to credit)

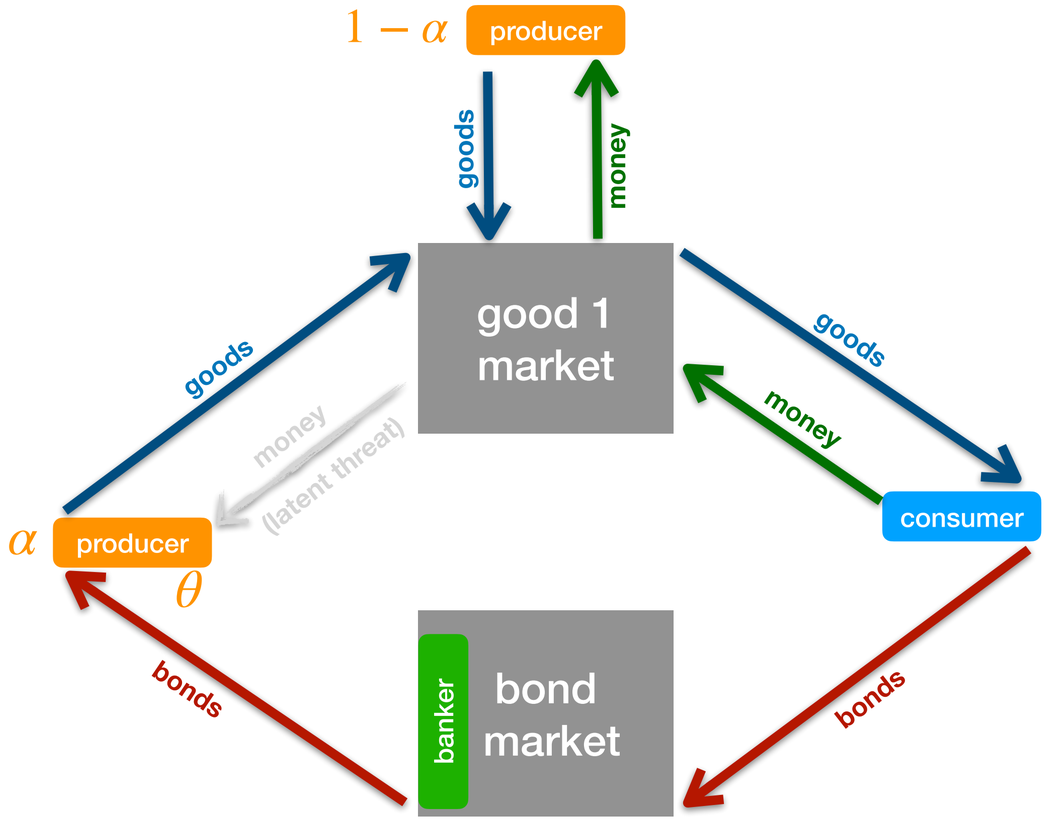
Monetary economy

producer

- Expected per-unit profit:
  $\Pi^m \equiv \alpha(1+\theta\rho)\varphi^m + (1-\alpha)\varphi^m - \kappa$
- In equilibrium:
  $$\Pi^m = 0 \Rightarrow \varphi^m = \frac{\kappa}{1+\alpha\theta\rho}$$

ρ : interest rate on the inside bond

$\varphi^m \equiv p_{1t}/p_{2t}$ (rel. price of good 1 in terms of good 2)



consumer

- Demand:
  $u'(c) = (1+\rho)\varphi^m$

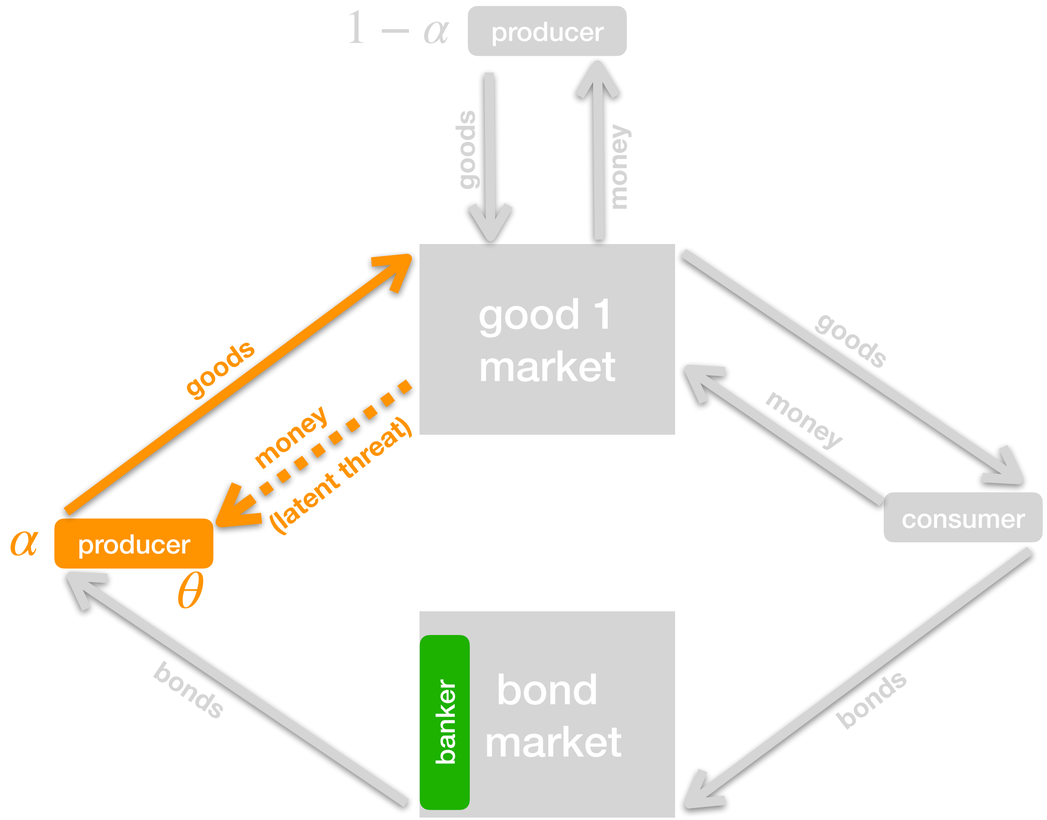
$$u'(c) = \frac{1+\rho}{1+\alpha\theta\rho}\kappa \Rightarrow \text{consumption too low unless } \alpha\theta = 1 \text{ or } \rho = 0$$

Difference between Monetary and *onetary:* (latent) money demand

producer

- Expected per-unit revenue:
  - $R^m \equiv \varphi^m + \alpha\theta\rho\varphi^m$ monetary economy
  - $R^n \equiv \alpha\theta\varphi^n$ nonmonetary economy
- To see the seller's *latent threat*, set $\theta = 0$; then

$$R^n = 0 < \varphi^m = R^m$$



Producers' off-equilibrium threat to sell for money disciplines intermediaries' market power

Stationary monetary equilibrium

	SME
bond rate	$\rho = \iota \equiv \dfrac{\mu - \beta}{\beta}$
relative price	$\varphi^m = \dfrac{1}{1 + \alpha\theta\iota}\kappa$
consumption	$c = u'^{-1}\left[(1+\iota)\,\varphi^m\right]$
price level	$p_t = \dfrac{M_t}{(1-\alpha)c}$
real balances	$Z \equiv \dfrac{M_t}{p_t} = (1-\alpha)c$
velocity	$V \equiv \dfrac{p_t c}{M_t} = \dfrac{1}{1-\alpha}$

Cashless limit

	SME	SME as $\alpha \to 1$
bond rate	$\rho = \iota \equiv \frac{\mu - \beta}{\beta}$	$\rho = \iota$
relative price	$\varphi^m = \frac{1}{1 + \alpha\theta\iota}\kappa$	$\varphi^m \to \frac{1}{1 + \theta\iota}\kappa$
consumption	$c = u'^{-1}\left[(1 + \iota)\,\varphi^m\right]$	$c \to u'^{-1}\left(\frac{1 + \iota}{1 + \theta\iota}\kappa\right)$
price level	$p_t = \frac{M_t}{(1 - \alpha)c}$	$P_t \to \infty$
real balances	$Z \equiv \frac{M_t}{p_t} = (1 - \alpha)c$	$Z \to 0$
velocity	$V \equiv \frac{p_t c}{M_t} = \frac{1}{1 - \alpha}$	$V \to \infty$

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Discontinuity: cashless limit ≠ nonmonetary economy

	SME	SME as $\alpha \to 1$	NME as $\alpha \to 1$
bond rate	$\rho = \iota \equiv \frac{\mu - \beta}{\beta}$	$\rho = \iota$	
relative price	$\varphi^m = \frac{1}{1 + \alpha\theta\iota}\kappa$	$\varphi^m \to \frac{1}{1 + \theta\iota}\kappa$	$\varphi^n \to \frac{\kappa}{\theta}$
consumption	$c = u'^{-1}\left[(1 + \iota)\,\varphi^m\right]$	$c \to u'^{-1}\left(\frac{1 + \iota}{1 + \theta\iota}\kappa\right)$	$c^n \to u'^{-1}\left(\frac{\kappa}{\theta}\right)$
price level	$p_t = \frac{M_t}{(1 - \alpha)c}$	$P_t \to \infty$	
real balances	$Z \equiv \frac{M_t}{p_t} = (1 - \alpha)c$	$Z \to 0$	
velocity	$V \equiv \frac{p_t c}{M_t} = \frac{1}{1 - \alpha}$	$V \to \infty$	

$$\lim_{\alpha \to 1}\left[\varphi^n - (1 + \rho)\varphi^m\right] = \frac{1 - \theta}{\theta}\frac{1}{1 + \theta\iota}\kappa > 0$$

Is the discontinuity quantitatively relevant?

Theorem. Let $\tau(\iota)$ denote the *compensating variation* associated with a deviation in the nominal policy rate from 0 (the Friedman rule) to ι in the cashless limit of the stationary monetary economy. Then,

$$\frac{d\tau(\iota)}{d\iota} \approx -(1-\theta)\,\epsilon$$

$1-\theta$: deposit spread that intermediaries impose on lenders

ϵ : price elasticity of demand for the goods purchased with cash or credit

Connection with the money-in-the-utility-function approach

The stationary equilibrium conditions of our model can be obtained from a reduced-form MIU representation with:

$$U\left(\boldsymbol{c}_t, \boldsymbol{h}_t, \frac{m_t}{p_t}\right) \equiv u\left(c_{1t}\right) + v\left(c_{2t}\right) + A\frac{m_t}{p_t} - \psi h_{1t} - h_{2t}$$

- A and ψ are treated as "deep" parameters, and U is separable in real balances
  $\Rightarrow$ monetary considerations are irrelevant

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- But our theory implies $A = A\left(\iota\right)$ and $\psi = \psi\left(\iota\right)$ (a *Kareken-Wallace-Lucas critique*)
  $\Rightarrow$ our mechanism is not captured by conventional MIU formulations

Conclusion

- Monetary equilibrium is *not* continuous in the cashless limit if there is market power in credit/payment/settlement intermediation
- In the cashless limit: $\frac{\Delta \text{welfare}}{\Delta \iota} \approx (1-\theta)\,\epsilon < 0$

Medium-of-exchange considerations are important for monetary transmission —even in near-cashless economies where credit supports a large volume of transactions with arbitrarily small aggregate real money balances

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