Optimal inflation in a model of inside money

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Optimal inflation

Inflation produced by lump-sum transfers can be optimal in models of outside money

- see Levine 1990, Kehoe et al 1992, Green and Zhou 2005, Molico 2006, Deviatov 2006

- the transfers improve extensive margins in a way that more than offsets their harmful effect on intensive margins

This paper: inflation can be optimal in a model of inside money—essentially, in Cavalcanti and Wallace 1999

Inflation in Cavalcanti and Wallace (1999)

- Inflation occurs if more inside money is issued at each date than is redeemed (retired)

- Even with individual money holdings in $\{0, 1\}$, inflation allows the post-trade distribution of money holdings to differ from the pre-trade distribution

- Using a representative-agent notion of welfare, we show in some numerical examples that some inflation is optimal

Interpretation of *inside money*

trade-credit instruments

- issued by monitored people when they buy from nonmonitored people

- used by nonmonitored people in trade among themselves

- redeemed (accepted) by *all* monitored people when they sell to nonmonitored people

Interpretation of *inflation* with $\{0, 1\}$ money holdings

With divisible money, a standard normalization:

- holds the stock of money fixed
- represents inflation by a proportional tax on money holdings

Our approach: a probabilistic version of such a tax:

- a person who ends a period with a unit of money loses it with some probability

The background environment (Trejos-Wright 1995)

- discrete time
- unit measure of infinitely-lived people who maximize expected discounted utility
- period utility is $u(\cdot) - c(\cdot)$, where $y^* = \arg\max[u(y) - c(y)] > 0$
- production is perishable
- pairwise meetings at random
  - prob of being producer or consumer $= 1/K$, where $K \geq 2$
  - prob of no meeting $= 1 - (2/K)$

Monitoring (Cavalcanti-Wallace 1999)

Initial and permanent split of people into two groups

- fraction α are m people: perfectly monitored
- fraction $1 - \alpha$ are n people: anonymous (not monitored at all) and can hide money
- α is exogenous (society's monitoring capacity)

Money (only durable object)

- inside money
  - issuer-specific and perfectly recognizable (no counterfeiting)
  - issued only by m people and the planner

- individual money holdings in $\{0, 1\}$

Comments on the model

- We see money-transactions and credit-transactions
- To get both, need some monitoring, but not perfect monitoring
- The above model is an extreme way to get both:
  - model analogue of money-transaction: production by n person
  - model analogue of credit-transaction: production by m person
- In the above model, allowing inside money raises welfare

Symmetric and steady-state allocations

- Allocation: initial distributions of money holdings, trades, transfers

- Steady states: everything is constant

- Symmetry:
  - all people in the same situation take the same action (could be a lottery)
  - all monies issued by m people who have not defected and any money issued by the planner are treated as perfect substitutes

Weakly implementable allocations and the optimum problem

Implementable allocations: immune to

- individual defection and cooperative defection of any pair in a meeting
- Only punishment: an m agent $\rightarrow$ n agent (and cannot issue money)

Optimum problem: choose an implementable, symmetric, steady-state allocation to maximize ex ante expected utility before assignment of

- monitored status
- initial money holdings

Features of our examples

- If $\alpha = 1$, then first-best is implementable; i.e., impose

$$\frac{u(y^*)}{c(y^*)} \geq 1 + K(1-\beta)/\beta. \tag{1}$$

- If $\alpha = 0$, then paying interest on money would be good; i.e, impose

$$\frac{u(y^*)}{c(y^*)} < 1 + \frac{K(1-\beta)/\beta}{1-\theta}, \tag{2}$$

  when θ (fraction with money) $= 1/2$.

- For given u, c, and K, let β^* be such that (1) holds at equality and let β^{**} be such that (2) holds at equality. We set $\beta \approx (\beta^* + \beta^{**})/2$.

Examples

$$u(y) = 1 - e^{-10y}, c(y) = y, K = 3$$

Implies

$$y^* = \ln(10)/10 \approx .23$$

and

$$\beta^* \approx 0.51 \text{ and } \beta^{**} \approx 0.67 \text{ and, hence, } \beta = .59$$

$$\alpha \in \{1/4, 1/2, 3/4\}$$

Table 1. Aggregates			
	$\alpha = 1/4$	$\alpha = 1/2$	$\alpha = 3/4$
ex ante welfare*	.233	.326	.431
pre-meeting welfare, m	.380	.432	.488
pre-meeting welfare, n without money	.100	.113	.133
pre-meeting welfare, n with money	.358	.401	.458
pre-meeting fraction of n with money**	.299	.371	.398
inflation rate	.082	.104	.114

* Welfare is relative to first-best welfare: $[u(y^*) - c(y^*)]/[K(1-\beta)]$.

** m people hold no money.

Table 2. Output in meetings (y/y^*)			
(producer)(consumer)	$\alpha = 1/4$	$\alpha = 1/2$	$\alpha = 3/4$
$(n0)(n1)$	.606	.663	.739
$(n0)(m)$	.606	.663	.739
$(m)(n0)$	.296	.141	.107
$(m)(n1)$	.717	.818	.911
$(m)(m)$	.717	.818	.911

- Money trades: consumer surrenders one unit in rows 1, 2, and 4
- inflow to n (row 2) $>$ outflow from n (row 4) $\Rightarrow$ inflation
- Binding producer IR constraint in rows 1, 2, 4, 5.
- n consumer faces a lower average price than an n producer

Robustness of the optimality of inflation

- almost certainly generic
- could also hold with a larger set of individual money holdings: $\{0, 1, 2, ..., B\}$
- will not hold with a degenerate distribution of money holdings

Why did it take so long to get this result????