Collateral Scarcity, Inflation, and the Policy Trap: A New Monetarist Perspective

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Key Questions

- An important feature of the financial crisis, and the post-crisis period, is a scarcity of safe assets.
- A safe-asset scarcity implies
  - low real rates of interest
  - higher inflation rates than would normally be observed with short-term nominal interest rates at zero.
- What implications does a safe-asset scarcity have for monetary policy?
  - How might policy work differently?
  - What is an optimal policy under these circumstances?
  - What do conventional monetary policy rules – primarily the Taylor rule – imply for economic performance?
Key Results

- Safe asset scarcity associated with:
  - binding asset market constraints
  - liquidity premium on government debt
  - non-Ricardian economy

- Given a safe asset scarcity,
  - a lower nominal interest rate reduces consumption and output.
  - zero lower bound is suboptimal.

- Taylor rules can go wrong.
  - Taylor principle can lead to multiple steady states, and multiple equilibria converging to the zero lower bound.
  - Failure to account correctly for endogeneity in the real rate of interest can lead to failure to achieve a specified inflation target.

- Central banker may think he/she has learned that higher nominal interest rates imply lower inflation. But inflation can be increased permanently only by increasing the nominal interest rate.
Literature

- New Monetarism: Williamson and Wright (2010a, 2010b).
Model

- Continuum of households.
- Each household has:
  - continuum of consumers with unit mass
  - a worker/seller
- Household maximizes
  \[ E_0 \sum_{t=0}^{\infty} \beta^t \left[ \int_0^1 u(c_t(i)) \, di - \gamma n_t \right], \]
  - \( i \) indexes consumers in the household
  - \( c_t(i) \) is consumption, \( n_t \) is labor supply.
  - one unit labor input produces one unit output; household cannot consume its own output.
Model: Timing

- Household enters the period with a portfolio of assets – maturing government bonds and money.
- Trade on competitive asset market – new bond issues by government, lump sum taxation, central bank open market operations.
- Worker/seller produces output – can sell it on market 1 or market 2.
- Market 1: only money accepted in exchange for goods.
- Market 2: money, government bonds, credit accepted in exchange for goods.
- $\theta$ consumers chosen at random (by nature) to go to market 1, $1 - \theta$ to market 2.
- Household allocates assets to consumers, who go to each market and consume on the spot.
- Large household stands in for financial intermediation arrangements.
Household’s Problem

Maximize

\[ E_0 \sum_{t=0}^{\infty} \beta^t \left[ \theta u(c^1_t) + (1 - \theta) u(c^2_t) - \gamma n_t \right]. \]

Subject to:

\[ \theta c^1_t + q_t b^2_t + q_t b^a_{t+1} + m^2_t \leq \frac{p_{t-1}}{p_t} (m_t + b^a_t + b^g_t) + \tau_t, \text{ [finance constraint]} \]

\[ b^a_{t+1} \geq 0, \text{ [key asset market constraint]} \]

\[ (1 - \theta) c^2_t = b^2_t + m^2_t + \kappa_t, \text{ [market 2]} \]

\[ \theta c^1_t + q_t (1 - \theta) c^2_t + m_{t+1} + b^g_{t+1} + q_t b^a_{t+1} = \frac{p_{t-1}}{p_t} (m_t + b^a_t + b^g_t) + \tau_t + n_t + q_t \kappa_t - \kappa_t \]
Consolidated government budget constraints:

\[ \bar{m}_0 + q_0 \bar{b}_0 = \tau_0 \]

\[ \bar{m}_t - \frac{p_{t-1}}{p_t} \bar{m}_{t-1} + q_t \bar{b}_t - \frac{p_{t-1}}{p_t} \bar{b}_{t-1} = \tau_t, \quad t = 1, 2, 3, \ldots \]

Fiscal policy rule:

\[ V_t = \bar{m}_t + q_t \bar{b}_t, \]

Implies

\[ \tau_0 = V_0, \]

\[ \tau_t = V_t - \frac{p_{t-1}}{p_t} V_{t-1} - \bar{b}_{t-1} \frac{p_{t-1}}{p_t} (1 - q_{t-1}), \]

\[ V_t \] exogenous – fiscal policy will in general be suboptimal, with alternative assumptions about monetary policy: exogenous \( q_t \), optimal, Taylor rule.
\[ \{ c_t^1, c_t^2, \pi_{t+1} \}_{t=0}^{\infty} \] satisfying

\[ -\gamma + \beta E_t \left[ \frac{u'(c_{t+1}^1)}{\pi_{t+1}} \right] = 0, \]

\[ u'(c_t^2) - q_t u'(c_t^1) = 0, \]

\[ u'(c_t^2) - \gamma = 0 \text{ and } V_t + q_t \kappa_t \geq \theta c_t^1 + (1 - \theta) q_t c_t^2, \]

or

\[ u'(c_t^2) - \gamma \geq 0 \text{ and } V_t + q_t \kappa_t = \theta c_t^1 + (1 - \theta) q_t c_t^2, \]
$q_t = \frac{u'(c_t^2)}{\gamma} \beta E_t \left[ \frac{u'(c_{t+1})}{\pi_{t+1} u'(c_t)} \right] \quad \text{[nominal bond]}$

liquidity premium \quad \text{fundamental}

$1 = \frac{u'(c_t^1)}{\gamma} \beta E_t \left[ \frac{u'(c_{t+1})}{\pi_{t+1} u'(c_t)} \right] \quad \text{[money]}$

liquidity premium \quad \text{fundamental}

$s_t^a = \frac{u'(c_t^2)}{\gamma} \beta E_t \left[ \frac{u'(c_{t+1})}{u'(c_t)} \right] \quad \text{[real bond]}$

liquidity premium \quad \text{fundamental}
Unconstrained Equilibrium

- Asset market constraint does not bind – household holds some bonds over until the next period.
- $u'(c^2_t) - \gamma$, or $c^2_t = c^*$, so no liquidity premium on bonds.

\[
\begin{align*}
    u'(c^1_t) &= \frac{\gamma}{q_t}, \\
    \pi_t &= \frac{\beta}{q_t}.
\end{align*}
\]

\[
V_t + q_t \kappa_t \geq \theta c^1_t + (1 - \theta) q_t c^*
\]

- Friedman rule is optimal if it’s attainable, i.e. if and only if

\[
V_t + \kappa_t \geq c^*
\]

for all $t$. 
Asset market constraint binds – all bonds used in transactions, and credit constraint binds.

\((c_t^1, c_t^2)\) solve

\[
V_t + q_t \kappa_t = \theta c_t^1 + (1 - \theta) q_t c_t^2
\]

\[
u'(c_t^2) - q_t u'(c_t^1) = 0,
\]

Constrained equilibrium is feasible in period \(t\) if and only if

\[
V_t + \kappa_t < c^*
\]

i.e. if and only if Friedman rule is not attainable.

If that condition holds, then equilibrium is constrained for \(q_t \in (\hat{q}, 1]\), and unconstrained for \(q_t \leq \hat{q}\).
If $q$ increases in a constrained equilibrium (nominal interest rate falls),

- $c_1$ may rise or fall.
- $c_2$ falls.
- output falls.
- welfare falls if $q$ is sufficiently close to 1 – zero lower bound is suboptimal, given fiscal policy.

If $V_t = V$ and $\kappa_t = \kappa$ for all $t$,

\[ s^a_t = \frac{u'(c_2)\beta}{\gamma}. \]
Figure 7: Equilibrium Allocations

\[ u'(c_2) = q_1 u'(c_1) \]

\[ u'(c_2) = u'(c_1) \]
Tighter Credit Limit in a Constrained Equilibrium

- Reduction in $\kappa_t$ – financial crisis shock.
- $c_1$, $c_2$, and output decline.
- Inflation rate rises, given the nominal interest rate.
- Same effects as for a reduction in $V_t$, so government debt substitutes for credit.
Figure 8: A Decrease in $V$ or $\kappa$, Constrained Equilibrium
Liquidity Trap

- What happens when $q = 1$?

  - Unconstrained equilibrium:
    - $c_1 = c_2 = c^*$, $\pi = \beta$
    - Friedman rule.

  - Constrained equilibrium:
    - $c_1 = c_2 = V + \kappa < c^*$
    - $\pi = \frac{\beta u'(V + \kappa)}{\gamma}$
    - Gross real interest rate $= \frac{\gamma}{\beta u'(V + \kappa)}$
Taylor Rule

- Clear what optimal monetary policy is, given fiscal policy. What if the central bank follows a suboptimal, but conventional, rule?

- Taylor rule:
  \[
  \frac{1}{q_t} = \max[\pi_t^\alpha (\pi^*)^{1-\alpha} x_t, 1]
  \]

- $x_t =$ adjustment the central bank makes for the real rate of return on government debt.

- $\alpha > 0$, with $\alpha > 1$ defining the “Taylor principle.”
Taylor Rule: Unconstrained Equilibrium

- Confine attention to $V_t = V$, $\kappa_t = \kappa$, deterministic equilibria.
- Consider two alternatives:
  - $x_t = \frac{1}{\beta}$
  - $x_t = \frac{1}{\sigma_t^2}$ (account for endogeneity in the real rate).
- $\alpha > 1$ implies two steady states:
  - $\pi = \pi^*$, $q = \frac{\beta}{\pi^*}$
  - $\pi = \beta$, $q = 1$
  - with endogenous $x_t$, a continuum of nonstationary equilibria converging to the zero lower bound.
- $\alpha < 1$ implies one steady state:
  - $\pi = \pi^*$, $q = \frac{\beta}{\pi^*}$
  - with endogenous $x_t$, a continuum of nonstationary equilibria converging to the steady state.
Figure 10: Taylor Rule Equilibrium, Unconstrained, $\alpha > 1$
Figure 11: Taylor Rule Equilibrium, Unconstrained, $\alpha < 1$

\[ [(q_t \pi^*)/\beta]^{1-\alpha} \]
Taylor Rule: Constrained Equilibrium

- $x_t = \frac{1}{\beta}$ implies Taylor rule ill-behaved – won’t in general yield an equilibrium where $\pi = \pi^*$.
- $x_t = \frac{1}{s_t^2}$ implies behavior similar to unconstrained case, but with a different lower bound on inflation.
Figure 15: Taylor Rule Equilibrium, Constrained, $\alpha < 1$, Endogenous Real Interest Rate

\[
\pi_{t+1} = \beta u'(V+\kappa)/\gamma
\]

\[
\pi_t^{\alpha(\pi^*)^{1-\alpha}}
\]

(0,0)
Figure 14: Taylor Rule Equilibrium, Constrained, $\alpha > 1$, Endogenous Real Interest Rate

\[ \beta u'(V+\kappa)/\gamma \]

\[ \pi_{t+1} \]

\[ \pi_{t} \]

\[ \pi_{t} \alpha(\pi^{*})^{1-\alpha} \]

\[ (0,0) \]

\[ \pi_{0} \]

\[ \pi_{1} \]

\[ \pi_{2} \]

\[ \pi_{t} \]
Market Segmentation and Liquidity Effects

- No production – each household has a fixed endowment $y$ per period.
- Household preferences
  \[ E_0 \sum_{t=0}^{\infty} \beta^t u(c_t^j), \]
  \( j = T \) denotes a trader household, \( j = N \) denotes a non-trader.
- \( \sigma \) traders, \( 1 - \sigma \) non-traders.
- Traders participate in asset markets, have access to credit, and pay taxes
- Non-traders exist in a cash-only world.


### Constraints

- **Traders:**

\[
q_t c_t^T + q_t b_{t+1}^a \leq \frac{(m_t^T + b_t^g + b_t^a)}{\pi_t} + \frac{\tau_t}{\sigma} + q_t \phi_t y,
\]

\[
q_t c_t^T + m_{t+1}^T + b_{t+1}^g + q_t b_{t+1}^a = \frac{(m_t^T + b_t^g + b_t^a)}{\pi_t} \]

\[
+ \frac{\tau_t}{\sigma} + q_t \phi_t y + (1 - \phi_t)y.
\]

- **Non-traders:**

\[
c_t^N \leq \frac{m_t^N + b_t^N}{\pi_t},
\]

\[
c_t^N + m_{t+1}^N + b_{t+1}^N = \frac{m_t^N + b_t^N}{\pi_t} + y.
\]
\{\tau_0, \tau_1, \tau_2, \ldots\} \text{ exogenous.}

\begin{align*}
\frac{c_t}{\pi_t}^N &= \frac{y}{\pi_t}, \\
\frac{c_t}{\sigma}^T &= \frac{y \left[ 1 - \frac{(1-\sigma)}{\pi_t} \right]}{\sigma}
\end{align*}
Equilibrium, Continued

- **Unconstrained equilibrium**

\[ u'(c_t^T) = \beta E_t \left[ \frac{u'(c_{t+1}^T)}{\pi_{t+1} q_{t+1}} \right]. \]

\[ \tau_t \geq y \left[ q_t (1 - \sigma \phi_t) - \frac{q_t (1 - \sigma)}{\pi_t} - \frac{\sigma (1 - \phi_{t-1})}{\pi_t} \right] \]

- **Constrained equilibrium**

\[ u'(c_t^T) \geq \beta E_t \left[ \frac{u'(c_{t+1}^T)}{\pi_{t+1} q_{t+1}} \right]. \]

\[ \tau_t = y \left[ q_t (1 - \sigma \phi_t) - \frac{q_t (1 - \sigma)}{\pi_t} - \frac{\sigma (1 - \phi_{t-1})}{\pi_t} \right] \]
Unconstrained equilibrium:

- Random experimentation by central banker may make him/her think that lowering the nominal interest rate raises inflation.
- But raising inflation permanently requires raising the nominal interest rate permanently.
- Taylor rule has similar properties to the baseline model – but inflation continues to fall after the nominal interest rate reaches the zero lower bound.

Constrained equilibrium:

- Taylor rule can be particularly ill-behaved – equilibrium does not exist under weak conditions.
Figure 16: Effects of a Nominal Interest Rate Increase in Period T

\[ i_t \]

\[ r_t \]

\[ \rho \]
Figure 17: Taylor Rule Dynamics

\[ \frac{[-\rho+(\alpha-1)i^*]}{\alpha} \]
Conclusions

- Safe asset scarcity associated with:
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  - liquidity premium on government debt
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