Avoiding Liquidity Traps

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Model

\[ e^{-rt}u(c, M/P) dt, \]

\[ Pc + P_\tau + M + B = RB + Py. \]

Let \( m \equiv M/P \) denote real balances and \( a \equiv (M + B)/P \) real financial wealth. Let \( u_{cm} > 0 \).

\[ c + \tau + a = (R - \pi)a - Rm + y, \]

where \( \pi \equiv \dot{P}/P \) is the instant rate of inflation.

\[ \lim_{t \to \infty} e^{-\int_0^t [R(s) - \pi(s)] ds} a(t) \geq 0 \]

\[ u_c(c, m) = \lambda \]
\[ u_m(c, m) = \lambda R \]

\[ \dot{\lambda} = \lambda (r + \pi - R) \]
\[ 0 = \lim_{t \to \infty} e^{-\int_0^t [R(s) - \pi(s)] ds} a(t) \]
Monetary Policy

\( R = R(\pi). \)

We refer to monetary policy as active at an inflation rate \( \pi \) if \( R'(\pi) > 1 \) and as passive if \( R'(\pi) < 1 \).

Assumptions

\[ R'(\pi) \geq 0 \quad \forall \pi. \]
\[ R(\pi) \geq 0 \quad \forall \pi. \]
\[ \exists \pi^* > -r : R(\pi^*) = r + \pi^* \text{ and } R'(\pi^*) > 1 \]

Examples

\[ R = R(\pi) = R^* \left( \frac{\pi}{\pi^*} \right)^{A_{r^*}} \]
\[ R = R(\pi) \equiv R^* e^{A_{r^*}(\pi - \pi^*)} \]
FISCAL POLICY

\[ \dot{a} = (R - \pi)a - Rm - \tau \]

**RICARDIAN**

\[
\lim_{t \to \infty} e^{-\int_0^t [R(s) - \pi(s)] ds} a(t) = 0
\]

\[ \tau + Rm = \alpha a \]

\( \alpha \) is chosen arbitrarily by the government subject to the constraint that \( \alpha \geq \alpha > 0 \). This policy states that consolidated government revenues are always higher than a certain fraction \( \alpha \) of total government liabilities. A special case is a balanced-budget rule: tax revenues are equal to interest payments on the debt: \( \alpha = R \), provided \( R \) is bounded away from zero.

\[
\lim_{t \to \infty} e^{-\int_0^t [R(s) - \pi(s)] ds} a(t) = a(0) \lim_{t \to \infty} e^{-\int_0^t \alpha(\pi(s)) ds}
\]

**NON-RICARDIAN**

\[
\frac{A(t)}{P(t)} = \int_t^\infty e^{-\int_t^\nu [R(\pi) - \pi] ds} \{ R(\pi (v)) m (\pi (v)) + \bar{\tau} \} dv
\]

**LOCALLY RICARDIAN**

\[ \tau + Rm = \alpha(\pi)a; \quad \alpha' > 0. \]

Assume

\[ \alpha(\pi^*) > 0, \quad \alpha(\pi^L) \leq 0 \]
\[ R(\pi) = r + \pi \]

Assuming that consumption and real balances are Edgeworth complements \((u_{cm} > 0)\) and that the instant utility function is concave in real balances \((u_{mm} < 0)\), equations

\[
\begin{align*}
\lambda &= L(R); \quad L' < 0. \\
\dot{\pi} &= \frac{-L(R(\pi))}{L'(R(\pi))R'(\pi))} [R(\pi) - \pi - r] \\
\dot{a} &= (R(\pi) - \pi - \alpha) a
\end{align*}
\]
Example 1: Targeting the growth rate of nominal government liabilities

\[
\frac{\dot{A}}{A} = k,
\]

where \(k\) is assumed to satisfy

\[
R(\pi^L) \leq k < R(\pi^*)
\]

Expressing \(\dot{A}/A\) as \(\dot{a}/a + \pi\) and combining the above fiscal policy rule with the instant government budget constraint yields

\[
\tau + Rm = (R(\pi) - k)a
\]

This fiscal policy rule is a special case of the one given when \(\alpha(\pi)\) takes the form \(R(\pi) - k\).

Under this policy, the government manages to fend off a low inflation equilibrium by threatening to implement a fiscal stimulus package consisting in a severe increase in the consolidated deficit should the inflation rate become sufficiently low. Interestingly, this type of policy prescription is what the U.S. Treasury as well as a large number of academic and professional economists are advocating as a way for Japan to lift itself out of its current deflationary trap.
Example 2: A balance-budget requirement

Consider now a fiscal policy rule consisting of a zero secondary deficit, that is:

\[ P_\tau = RB, \]

Recalling that \( a = B/P + m \), we can rewrite the balanced budget rule as

\[ \tau + Rm = R(\pi) a \]

It follows that a balanced budget requirement is a special case of the fiscal policy rule in which \( \alpha(\pi) = R(\pi) \). Clearly, in this case \( \alpha(\pi) \) is increasing because so is \( R(\pi) \). Condition

\[ \alpha(\pi^*) > 0 \]

is satisfied because \( R(\pi^*) \) is by assumption greater than zero. However, condition

\[ \alpha(\pi^L) \leq 0 \]

is only satisfied if \( R(\pi^L) = 0 \). This means that a balanced budget rule is effective in avoiding a liquidity trap only in the case where the Taylor rule leads the monetary authority to cut nominal rates all the way to zero at sufficiently low rates of inflation, so that the low inflation steady state occurs at a zero nominal interest rate.
Example 3. **Monetary Policy Regime Switch**

\[
\frac{\dot{M}}{M} = \mu > -r \\
\frac{\dot{m}}{m} = \mu - \pi
\]

\[\dot{m} = \frac{r + \mu - \frac{u_m(y,m)}{u_c(y,m)}}{\frac{1}{m} + \frac{u_{cm}(y,m)}{u_c(y,m)}}\]

Transversality:

\[
\lim_{t \to \infty} e^{-\int_0^t \left[ \frac{u_m(y,m)}{u_c(y,m)} - \mu \right] ds} M(0) + e^{-\int_0^t \frac{u_m(y,m)}{u_c(y,m)} ds} B(t) = 0,
\]
\[
\dot{m} = \frac{u_c(y, m)}{u_{cm}(y, m)} \left[ r + \pi(m) - R(\pi(m)) \right],
\]

\[0 \leq B(t) \leq \bar{B}e^{gt}; \quad \bar{B} \geq 0.\]
\[ \dot{m} = \begin{cases} 
\frac{u_c(y,m)}{u_{cm}(y,m)} \left[ r + \pi(m) - R(\pi(m)) \right] & \text{for } m \leq \tilde{m} \\
\left[ \frac{1}{m} + \frac{u_{cm}(y,m)}{u_c(y,m)} \right]^{-1} \left[ r + \mu - \frac{u_m(y,m)}{u_c(y,m)} \right] & \text{for } m > \tilde{m} 
\end{cases} 
\]

\[ m^* < \hat{m} < \tilde{m} < m^L \]

\[ \pi^L < \mu < \pi^* . \]

\[ u_m(y, m^*)/u_c(y, m^*) = r + \pi^* \]

\[ u_m(y, \hat{m})/u_c(y, \hat{m}) = r + \mu \]

\[ u_m(y, m^L)/u_c(y, m^L) = r + \pi^L . \]
\[
U' (\tilde{c}) = \frac{\beta}{\pi_{t+1}} R (\pi_t) U' (\tilde{c})
\]
\[
R (\pi_t) = R^* + a (\pi_t - \pi^*) , \quad R^* = r + \pi^*
\]
\[
\pi_{t+1} = a/\beta \pi_t + (R^* - a\pi^*)
\]
Modified Leeper

\[ \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma} \]

\[ M_{t+1} + B_{t+1} = M_t + B_t(1 + R_{t+1}) + p_t y \left( \frac{M_t}{p_t} \right) - p_t c_t + p_t T_t \]

\[ c = y(m) = m^\alpha \]