Operating Characteristics of the Taylor Rule

‘The Expectations Trap Hypothesis’, with Chris Gust, Federal Reserve Bank of Chicago Economic Perspectives, 2000

Objective:

• That a Taylor Rule Might Work Well in Practice Does Not Seem Surprising.

• Illustrate What Can Go Wrong with the Taylor Rule.

• Explore Hypothesis of Clarida-Gali-Gertler (QJE), That Take-Off In Inflation in 1970s Reflected Bad Taylor Rule.
Two Representations of CGG Hypothesis

• Both Cases: Estimated Policy Rule For the 1970s (Clarida-Gali-Gertler):

\[ R_t = \rho R_{t-1} + (1 - \rho)R^*_t. \]

\[ R^*_t = \text{constant} + \alpha E_t \log(\pi_{t+1}) + \gamma y_t, \pi_{t+1} = \frac{P_{t+1}}{P_t}, \]
\[ \rho = 0.75, \alpha = 0.80, \gamma = 0.44. \]

• With \( \alpha < 1 \), Multiple Equilibria in New Keynesian and Limited Participation Model.

• New Keynesian (CGG) Model.

• Limited Participation Model.
Mechanism By Which Taylor Rule with Small $\alpha$ Can Make Inflation Vulnerable to Expectations

- Clarida-Gali-Gertler Version of New Keynesian Model
  (a) People Expect High Inflation, $\pi^e$ rises.
  (b) If $\alpha < 1$, $R - \pi^e$ Falls, Stimulating Aggregate Demand
  (c) Output Rises.
  (d) The Rise in Output is Associated With Increased Marginal Costs, Leading to a Rise In Prices
  (e) This Justifies Original Rise in Expected Inflation.
CASH FLOW PATTERN IN LIMITED PARTICIPATION MODEL

**Monetary Authority**

- \( M-Q \)

**Financial Market**

- \( M-Q+X \)

**Goods Market**

- \( Q+WL \)

**Firms**

- \( M+X \)

**Households**

- \( M \)

- \( W_L \)

- \( X \)

**Money Injection**
• Limited Participation Model, With Working Capital Channel
  (a) People Expect High Inflation, $\pi^e$ rises.
  (b) If $\alpha < 1$, $R - \pi^e$ Falls, Leading People to Put Less Money Into Interest-Bearing Deposits.
  (c) Firms Who Need Money to Finance Production, Still Need it.
  (d) With Supply of Deposits Reduced, and Demand From Firms Unchanged, there is Pressure for $R$ to Rise a Lot.
  (e) To Prevent Huge Rise in $R$ (since $\alpha < 1$), Central Bank Must Inject Reserves into Banks.
  (f) The Injection of Reserves Leads to a Rise in Inflation, Justifying Original Rise in Inflation Expectations.
  (g) The Higher $R$ Forces a Slowdown in the Economy.
Households in Limited Participation Model:

Preferences:

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, L_t, H_t),$$

$$U(C, L, H) = \log \left[ C - \psi_0 (L + H)^{(1+\psi)} / (1 + \psi) \right],$$

Cash Constraint in Goods Market:

$$Q_t + W_t L_t \geq P_t (C_t + I_t),$$

Capital Evolution Equation:

$$K_{t+1} = I_t + (1 - 0.02) K_t.$$
Household Asset Evolution Equation:

\[ M_{t+1} = Q_t + W_t L_t - P_t (C_t + I_t) + R_t (M_t - Q_t + X_t) + D_t + r_t K_t, \]

Household Adjustment Costs for Changing \( Q_t \):

\[
H\left( \frac{Q_t}{Q_{t-1}} \right) = d \{ \exp \left[ c \left( \frac{Q_t}{Q_{t-1}} - 1 - x \right) \right] \\
+ \exp \left[ -c \left( \frac{Q_t}{Q_{t-1}} - 1 - x \right) \right] - 2 \}
\]

Steady State Properties:

\[ H = H' = 0, \quad H'' = 2c^2d > 0 \]
Firms:

First Order Conditions:

\[
\frac{W_t R_t}{P_t} = \frac{f_{L,t}}{\mu}, \quad \frac{r_t}{P_t} = \frac{f_{K,t}}{\mu}, \quad \mu = 1.4.
\]

Technology:

\[
f(K_t, L_t, v_t) = \exp(v_t)K_t^{0.36}L_t^{0.64},
\]

where

\[
v_t = 0.95v_{t-1} + \varepsilon_{v,t},
\]
Financial Sector

Loan Demand Equals Supply:

\[ W_t L_t = M_t - Q_t + X_t \]
Figure 1
Response of Model to an Exogenous Monetary Policy Shock

% dev from SS: deviation from unshocked nonstochastic steady state growth path expressed in percent terms
APR: annualized percentage rate

a: Price Level - % dev from SS

b: Employment - % dev from SS
c: Money Stock - % dev from SS
d: Consumption - % dev from SS

e: Inflation Rate - APR

f: Output - % dev from SS
g: Interest Rate - APR

h: Investment - % dev from SS
Figure 1
Response to a Technology Shock In Two Different Models

LP Model

IS/LM Model

% dev from SS: deviation from unshocked nonstochastic steady state growth path expressed in percent terms.
APR: annualized percentage rate.
Does a High Value for $\alpha$ Guarantee Stability?

- In the Models Analyzed Above, ‘Yes’.
- Easy to Find Models in Which Answer is ‘No’.
- Need Extra Protection, In Case the World is Better Captured by A Model in Which the Answer is No.
- One Piece of Protection: Monitor the Money Growth Rate.
- Example:
  - Euler Equations and Resource Constraint:

\[
\begin{align*}
  u_{c,t} & = \beta u_{c,t+1} \frac{R_t}{\pi_{t+1}} \text{ Intertemporal Euler} \\
  -\frac{u_{l,t}}{u_{c,t}} & = \frac{W_t}{P_t} \text{ Intratemporal Euler} \\
  \frac{R_t W_t}{P_t} & = \text{ Marginal Product of Labor} = 1 \\
  c_t & = l_t \text{ Resource Constraint} \\
  c_t & = \frac{M_{t+1}}{P_t} \text{ Binding Cash In Advance Constraint}
\end{align*}
\]
With $u = \log(c_t) + \gamma \log(1 - l_t)$:

$$\frac{c_{t+1}}{c_t} = \beta \frac{R_t}{\pi_{t+1}^e}$$

$$\frac{\gamma l_t}{1 - l_t} = \frac{1}{R_t}$$

Suppose $\alpha > 1$

* Expected Inflation, $\pi^e$, Jumps
* $R_t$ Jumps By More ($\alpha > 1$), so $R_t/\pi_{t+1}^e$ Jumps.
* High $R_t/\pi_{t+1}^e \Rightarrow$ jump in $c_{t+1}/c_t$
  Intertemporal Euler Equation Satisfied
* Higher $R \Rightarrow$ Lower $l_t$ (Consistent with $c_{t+1}/c_t$ High).
  Intratemporal Euler Equation Satisfied
* Higher $\pi^e$ Accommodated with
  Higher Money Growth, Consistent with Cash in Advance Constraint
  (Money Demand in Model).
Conclusion

- Performance of CGG Hypothesis Depends on the Assumptions You Make About the Macro-Economy
  - If You Assume the New Keynesian Model that CGG Adopt, Hypothesis is Rejected Because the Model Implies there was a Boom in the 1970s.
  - If You Assume a Limited Participation Model, the Hypothesis Passes Because the Model Implies that there Was Economic Weakness in the 1970s.

- In The Context of the Models Analyzed Here, the Right Fix is to Adopt a Taylor Rule with a Big Coefficient on Inflation. But, there are Other Models in Which this Does Not Work.
  - For Added Protection, Include an ‘Escape Clause’: Switch to a Money Growth Rule in Case Money Growth Gets Out of Control.
  - Note: This is a Version of the ECB’s
‘Two Pillar Strategy’.

• But, Was It Really Ignorance of Right Value of $\alpha$ That Prevented Burns from Stopping Inflation?

• Or, Was it the Institutional Environment, Which Forced Him To Focus on the Heavy Social Costs that Would Have to Be Paid if he Had Tried to Stop Inflation?