TOPIC 6

MONETARY POLICY: POLICY RULES, OPTIMAL POLICY AND MODELS FOR POLICY ANALYSIS

I. INFLATION DYNAMICS


Overview

The goal of the paper is to provide a theoretical explanation for the dynamic properties of inflation that are observed in the data.

Specifically: The Phelps-Taylor, overlapping wage contract model implies disinflations are costless – furthermore, disinflationary “booms” are also costless!
Simple Theoretical Foundations

Consider a two-period contracting specification with unit markup factor from wages to prices. Hence,

\[ p_t = \frac{1}{2}(x_t + x_{t-1}) \]  

(1)

with \( p_t \) the log price and \( x_t \) the contract wage.

Taylor (1980) contracting equation:

\[ x_t = \frac{1}{2} \left(x_{t-1} + E_t x_{t+1}\right) + y_t \]

Together with (1),

\[ p_t = \frac{1}{2}(p_{t-1} + E_t p_{t+1}) + \frac{\gamma}{2} \left(y_t + y_{t-1}\right) \]
Thus, the Taylor model imparts inertia on prices but not on inflation, since,

$$\pi_t = E_t\pi_{t+1} + \gamma y_t$$

All the persistence in $\pi$ depends on the persistence in $y$.

**Implications:**

- A one-period shock to output affect inflation for one-period only (no propagation of inflation).
- A shock to inflation that does not affect output lasts for one-period only.
- If current and expected $y_t$ are zero, then inflation must be at its steady-state, regardless of past values of $y_t$. 
The New Contracting Specification

Agents care about *relative* wages over the life of the contract, so that,

\[
x_t - p_t = \frac{1}{2} (x_{t-1} - p_{t-1} + E_t(x_{t+1} - p_{t+1})) + \gamma_t
\]

Substituting into (1) again,

\[
\pi_t = \frac{1}{2} (\pi_{t-1} + E_t\pi_{t+1}) + \hat{\gamma}_t
\]

where \( \hat{\gamma}_t \) is a moving average of current and past output.

Inflation now has persistence of its own!
Comparing Contracting Specifications

Taylor’s model implies that the nominal wage is set so that the expected real wage over the life of the contract is consistent with expected excess demand,

\[ x_t = \frac{1}{2} (p_t + E_t p_{t+1}) + \gamma y_t \]

In Fuhrer and Moore’s model, however, agents compare the real value of their wage contracts previously negotiated and still in effect, and with contracts expected to be negotiated over the duration of the contract.

In Taylor’s model, if excess demand is negative then expected inflation must exceed current inflation. But this requires inflation to immediately drop to its new equilibrium at the beginning of the disinflationary
program, and then to rise to its, lower equilibrium from below.

In Fuhrer and Moore’s model, when excess demand is negative, the level of inflation will be falling. Rearranging,

\[
(\pi_{t+1} - \pi_t) - (\pi_t - \pi_{t-1}) = \gamma_t
\]

Inflation must drop below zero at the beginning of a credible disinflation.
Empirical Evidence

VAR of $\pi$, $y$, and $r$.

- Inflation is very persistent.
- High level of output is followed by high level of inflation six quarters later.
- High level of inflation is negatively correlated with a low level of output ten quarters later.
Matching the Models to the Data

- Relative contracting model = Fuhrer and Moore
- Standard contracting model = Taylor

Overview

The paper presents an alternative to the Taylor and Fuhrer and Moore models that induces inflation persistence while meeting Lucas’s *natural rate hypothesis* – i.e. the form of the monetary policy rule should not have a permanent effect on the output gap.

**Origins of the Model:** Barro and Grosman (1976) and Mussa (1978, 1982).
The \( p \)-bar model

**Basic assumption:** prices adjust to shocks incompletely within each period. Thus, output is determined by the quantity demanded at the resulting price level.

**Key assumptions:** each period’s price level is a function of the “hypothetical” market clearing price that would make output equal to its potential.

Hence, if \( y_t \) is log output, \( \bar{y}_t \) is “capacity” output or natural rate, and \( \bar{p}_t \) is log prices at market clearing levels, then

\[
p_t - p_{t-1} = \gamma(\bar{p}_{t-1} - p_{t-1}) + E_{t-1}(\bar{p}_t - \bar{p}_{t-1}) \quad \gamma \in (0,1) \quad (1)
\]
In terms of output and under general assumptions,

\[ p_t - p_{t-1} = \gamma_1(y_{t-1} - \bar{y}_{t-1}) + E_{t-1}(\bar{p}_t - \bar{p}_{t-1}) \quad \gamma_1 > 0 \quad (1*) \]

**Justification:** prices must be set at the start of the period and production equals whatever quantity is demanded at that price.

**Shortcoming:** inventories usually give producers a third way of responding to shocks.

**Determining** $\bar{p}_t$

**Aggregate Demand:**

\[ y_t = \beta_0 + \beta_1(m_t - p_t) + \beta_2E_{t-1}(p_{t+1} - p_t) + \beta_3y_{t-1} + \nu_t \quad (2) \]

\[ \nu_t - \nu_{t-1} = \varepsilon_t \text{ which is white noise.} \]
The expression for aggregate demand can be obtained from a simple IS-LM relation, such as,

\[
\begin{align*}
y_t &= b_0 + b_1[r_t - E_{t-1}(p_{t+1} - p_t)] + b_2y_{t-1} + \nu_{1t} \\
m_t - p_t &= c_0 + c_1y_t + c_2r_t + \nu_{2t}
\end{align*}
\]

and solving out for \( r_t \).

**Properties:**

From (1*) into (2),

1. 
\[
y_t - \bar{y}_t = \beta_1(m_t - E_{t-1}m_t) + [1 - \gamma_1(\beta_1 + \beta_2)](y_{t-1} - \bar{y}_{t-1}) \\
+ (v_t - E_{t-1}v_t) - (\bar{v}_t - E_{t-1}\bar{v}_t)
\]

therefore, only the surprise component of monetary policy matters: \((m_t - E_{t-1}m_t)\) and the policy *ineffectiveness proposition* holds.
2. Further manipulation yields,

\[ y_t - \bar{y}_t = [1 - \gamma_1(\beta_1 + \beta_2)](y_{t-1} - \bar{y}_{t-1}) + \zeta_t \quad \text{AR}(1) \]

where \( \zeta_t \) collects a number of shocks.

3. Solving for \( \Delta p_t \)

\[
\Delta p_t = \gamma_1(y_{t-1} - \bar{y}_{t-1}) + \frac{1}{\beta_1 + \beta_2} \left[ \beta_1 (\mu_0 + \mu_1 \Delta m_{t-1}) + \beta_2 \Delta y_{t-1} - \theta u_{t-1} \right]
\]

the sources of inertia are:

- \( y_{t-1} - \bar{y}_{t-1} \)
- \( \Delta m_{t-1} \)
- \( \Delta \bar{y}_{t-1} \) (appearing in the shocks \( u_{t-1} \))

4. Natural Rate Hypothesis: The unconditional mean of the output gap, \( E(y_t - \bar{y}_t) \), cannot be affected by any aspect of monetary policy
Proof

\[ E(y_t - \bar{y}_t) = (1 - \gamma_1 (\beta_1 + \beta_2)) E(y_{t-1} - \bar{y}_{t-1}) \]

Taylor’s and Fuhrer and Moore’s models do not meet the NRH – it seems implausible that output could be kept permanently high (relative to capacity) by any pattern of monetary policy.

Empirical Properties of p-bar Model

- \( \bar{p}_t \) and \( \bar{y}_t \) are unobservable (although one only needs the values of one since the other can be determined internally).
- The p-bar model implies that the output gap is stationary.
- The results are positive to mixed.
Comments by Fuhrer

There are 3 grades of NRH

1. **Basic NRH**: the NAIRU is independent of inflation in wages or prices.
2. **2nd order NRH**: Monetary policy cannot affect the NAIRU by inducing a constant change in the rate of inflation.
3. **3rd order NRH**: monetary policy cannot affect the NAIRU by inducing a constant higher order difference in the rate of inflation.
Claim: Taylor and Fuhrer and Moore meet the basic and 2\textsuperscript{nd} order NRH.

However, is a violation of NRH necessarily bad? NO

- Historically, monetary policy targets the level of inflation or zero change.
- Monetary policy has never aimed to induce a constant rate of inflation so we do not know what it can do to the natural rate.

Claim: the p-bar model probably makes inflation too persistent.