Here I outline a paper by Clarida, Gali and Gertler (CGG) in the Quarterly Journal of Economics. The title is "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory." This is a prominent article in the area of monetary policy and macroeconomic fluctuations.

1 Introduction

- From the late 1960s through the early 1980s, the macroeconomy experienced high inflation and several recessions. Many attribute this to oil price shocks. Others argue that the persistent high inflation may have been due to poorly managed monetary policy. CGG set out to add rigor to this latter argument.

- CGG estimate a forward-looking interest rate rule before Paul Volker (pre-1979) and after Paul Volker (post-1979).

- CGG find that policymakers pre-1979 did not sufficiently raise the Federal Funds in response to expected inflation. As a result, real interest rates declined and fueled more inflation.

- Conversely, CGG find that policymakers post-1979 were more aggressive toward expected inflation. The Federal Funds rate was increased enough to ensure that real interest rates would rise.

- When embedded in a standard business-cycle model, the pre-Volker rules are shown to generate more instability than the post-Volker rules.

2 The Fed’s Policy Reaction Function: A Forward-Looking Model

2.1 A Simple Forward-Looking Rule

The policy reaction function is

\[ r_t^* = r^* + \beta (E[\pi_{t+k} | \Omega_t] - \pi^*) + \gamma E[x_{t,q} | \Omega_t] \]  

(1)

where

- \( r_t^* \) is the target Federal Funds rate
- \( r^* \) is the desired long-run Federal Funds rate
- \( \pi_{t,k} \) is the change in the price level between \( t \) and \( t+k \)
• $\pi^*$ is the target inflation rate

• $x_{t,q}$ is the output gap between $t$ and $t + q$

• $E$ is the expectation operator

• $\Omega_t$ is the information set including all information dated $t$ and earlier.

This type of rule is a good description of actual central bank policy (positive use) and can be derived from minimizing a quadratic-loss function subject to a standard macro model (normative use).

### 2.2 Implied Real Rate

To better understand the importance of $\beta$ and $\gamma$, consider the ex ante real interest rate target:

$$rr_t^* = rr^* + (\beta - 1)(E[\pi_{t,k}|\Omega_t] - \pi^*) + \gamma E[x_{t,q}|\Omega_t] \quad (2)$$

where $rr_t^* = r_t^* - E[\pi_{t,k}|\Omega_t]$. To the extent that agents respond to real rates of return, this shows clearly that rules with $\beta > 1$ and $\gamma > 0$ will be stabilizing. If either condition is not met, the rule may be destabilizing. The parameter values ($\beta = 1, \gamma = 0$) are therefore useful benchmarks.

### 2.3 Interest Rate Smoothing

In reality, the Federal Reserve does not respond immediately to a change in expected inflation or the output gap. Rather they tend to "smooth" changes in the interest rate. There is also some randomness to the Funds rate. The actual Federal Funds rate therefore follows:

$$r_t = \rho(L)r_{t-1} + (1 - \rho)r_t^* + \epsilon_t \quad (3)$$

where

• $\rho(L) = \rho_1 + \rho_2 L + \cdots + \rho_n L^n$

• $\rho \equiv \rho(1)$

The parameter vector $(\pi^*, \beta, \gamma, \rho)$ is then estimated using econometrics.

### 3 The Fed’s Policy Reaction Function: The Evidence

Quarterly data are collected on inflation, output, and the Federal Funds rate over the period 1960:1-1996:4 from CITIBASE. Because of the endogeneity of the RHS variables, a set of instrumental variables is necessary.
• Table I shows aggregate volatility pre- and post-Volker.

• Table II shows GMM estimates of the parameters.
  
  - $\hat{\beta} = 0.83 < 1$ for the pre-Volker period.
  - $\hat{\beta} = 2.15 > 1$ for the post-Volker period.
  - $\hat{\gamma} > 0$ and significant in both periods.
  - $\hat{\phi}$ indicates significant interest rate smoothing.

• Figures I and II show the actual and predicted Federal Funds rates (using the estimated parameters) over the two sample periods.

Finally, CGG argue that oil price shocks (Hamilton, 1983) cannot be the sole cause of the macro instability during the 1965-1982 period.

• First, they are unlikely to cause the persistent inflation that market the 1965-1982 period. This is more likely due to easy monetary policy.

• Second, the inflation increases started prior to the first OPEC oil price shock (De Long, 1997). See Figure III.

Figure IV shows that ex post real interest rate was declining with inflation increases pre-1979. After 1979, the ex post real interest rate increased sharply and inflation began to fall.

4 Interest Rate Rules and Economic Fluctuations

4.1 Baseline Model

CGG use the canonical Dynamic New Keynesian (DNK) model linearized around the zero-inflation steady state:

\[
\pi_t = \delta E[\pi_{t+1}|\Omega_t] + \lambda(y_t - z_t) \tag{4}
\]

\[
y_t = E[y_{t+1}|\Omega_t] - (1/\sigma)(r_t - E[\pi_{t+1}|\Omega_t]) + g_t \tag{5}
\]

\[
r_t^* = \beta E[\pi_{t+1}|\Omega_t] + \gamma x_t \tag{6}
\]

\[
r_t = \rho r_{t-1} + (1 - \rho)r_t^* \tag{7}
\]

The model is solved using the method of Blanchard and Kahn (1980). We will cover this method next semester. The parameter values are
• Quarterly discount factor is 0.99.

• Coefficient of relative risk aversion ($\sigma = 1$)

• Elasticity of inflation with respect to the output gap ($\lambda = 0.3$)

• $z_t (g_t)$ are supply (demand) shocks following an AR(1) process with persistence parameter of 0.9.

• $\beta$, $\gamma$, and $\rho$ are econometrically estimated.

4.2 Endogenous Fluctuations

If the Taylor principle is not satisfied and $\beta < 1$, the dynamic equilibrium is not a saddle-path. Instead, it is an indeterminate equilibrium that may support sunspots (self-fulfilling expectations) and contribute to macroeconomic instability. We will study this type of equilibrium next semester using Farmer’s textbook "The Macroeconomics of Self-Fulfilling Prophecies".

4.3 Fundamental Shocks and Monetary Policy Response

Table VII shows the volatility of inflation and output under varying $\beta$’s when the economy is hit by demand and supply shocks.

• Output and inflation volatility vary inversely with $\beta$.

• As $\beta$ approaches the Taylor threshold, the volatility in output and inflation increases sharply.

• The effect is more dramatic for demand shocks.

Figure VII shows the impulse response functions from a supply-side shock.

• The adverse supply shock immediately increases inflation and decreases output. This is similar to the OPEC oil shocks.

• When $\beta \approx 1$, inflation is persistent. When $\beta > 1$, inflation is much less persistent.

5 Summary

This paper "adds precision to the conventional wisdom" that monetary policy before 1979 was not sufficiently aggressive toward inflation and contributed to macroeconomic instability. The disinflation started under Paul Volker in 1979 and adherence to the Taylor principle through the Volker and Greenspan chairmanships is shown to have increased the stability and improved the performance of the macroeconomy.