9 Monetary-Policy Operating Procedures

9.1 Introduction

Previous chapters treated the nominal money supply or even inflation as the variable directly controlled by the monetary policy maker. While this approach does allow for an analysis of many important issues, it ignores the actual problems surrounding policy implementation. Central banks do not directly control the nominal money supply, inflation, or long-term interest rates likely to be most relevant for aggregate spending. Instead, narrow reserve aggregates, such as the monetary base, or very short-term interest rates, such as the federal funds rate in the United States, are the variables over which the central bank can exercise close control. Chapter 1 claimed that a short-term interest rate typically provides a better measure of monetary-policy actions than measures of the money supply do, but no explanation was given for why this might be the case. We have also not yet discussed the specific relationship between short-term interest rates, other reserve aggregates such as nonborrowed reserves or the monetary base, and the broader monetary aggregates such as $M1$ or $M2$. And there has been no discussion of the factors that might explain why many central banks choose to use a short-term interest rate rather than a monetary aggregate as their instrument for implementing monetary policy. These issues will be addressed in this chapter.

The actual implementation of monetary policy involves a variety of rules, traditions, and practices, and these collectively are called *operating procedures*. Operating procedures differ according to the actual instrument the central bank uses in its daily conduct of policy, the operating target whose control is achieved over short horizons (a short-term interest rate versus a reserve aggregate, for example), the conditions under which the instruments and operating targets are automatically adjusted in light of economic developments, the information about policy and the types of announcements the monetary authority might make, its choice of variables for which it establishes targets (e.g., for money-supply growth or the inflation rate), and whether these targets are formal or informal.

The objective in examining monetary-policy operating procedures is to understand what instruments are actually under the control of the monetary authority, the factors that determine the optimal instrument choice, and how the choice of instrument affects the manner in which short-term interest rates, reserve aggregates, or the money stock might reflect policy actions and nonpolicy disturbances. We first examine the factors that determine the optimal choice of an operating procedure. Then we focus on the relationship between the choice of operating procedure, the response of the market for bank reserves to various economic disturbances, and the way policy should be measured.

9.2 From Instruments to Goals

There are many interesting insights that can be obtained by ignoring the linkages between the actual tools controlled by the central bank and instead simply assuming that money growth, or even the inflation rate, can be controlled directly. But central banks do not directly control inflation, nor do their policy actions have effects on real economic activity that are always easy to determine. At best, policy actions taken today affect these variables several months in the future. The lags in the effects of policy, together with the infrequency with which observations on aggregate price indices and output become available, greatly complicate the implementation of monetary policy, even when there is agreement on the objectives. How should the central bank adjust its actual policy tools in response to economic developments? Should it focus only on its ultimate goals such as the inflation rate? Should it attempt to maintain some measure of the money supply on a target path? Should it keep a short-term nominal interest rate constant?

Discussions of monetary-policy implementation focus on *instruments*, *operating targets*, *intermediate targets*, and *policy goals*. Instruments are the variables that are directly controlled by the central bank. These typically include an interest rate charged on reserves borrowed from the central bank, the reserve requirement ratios that determine the level of reserves banks must hold against their deposit liabilities, and the composition of the central bank's own balance sheet (its holdings of government securities, for example). The instruments of policy are usually manipulated to achieve a prespecified value of an operating target, typically some measure of bank reserves (total reserves, borrowed reserves, or nonborrowed reserves—the difference between total and borrowed reserves), a very short-term rate of interest, usually an overnight interbank rate (the federal funds rate in the case of the United States), or a monetary-conditions index that combines an interest rate and the exchange rate.

Goals, such as inflation or deviations of unemployment from the natural rate, are the ultimate variables of interest to policy makers; instruments are the actual variables under their direct control. Intermediate target variables fall between operating targets and goals in the sequence of links that run from policy instruments to real economic activity and inflation. Because observations on some or all of the goal variables are usually obtained less frequently than are data on interest rates, exchange rates, or monetary aggregates, the behavior of these latter variables can often provide the central bank with information about economic developments that will affect the goal variables. For example, faster than expected money growth may signal that real output is expanding more rapidly than was previously thought. The central bank might change its operating target (in this case, raise the interbank rate or contract reserves) to keep the money growth rate on a path believed to be consistent with achieving its policy goals. In this case, money growth is serving as an intermediate target variable.

Instruments, operating targets, intermediate targets, and goals have been described in a sequence running from the instruments directly controlled by the central bank to goals, the ultimate objectives of policy. Actually, policy design operates in the reverse fashion: from the goals of policy, to the values of the intermediate targets consistent with the goals, to the values of the operating targets needed to achieve the intermediate targets, and finally to the instrument settings that yield the desired values of the operating targets. In earlier chapters, inflation and the money supply were treated as policy instruments, ignoring the linkages from reserve markets to interest rates to banking-sector behavior to aggregate demand. Similarly, it is often useful to ignore reserve-market behavior and treat an operating target variable, such as the overnight interbank interest rate or a reserve aggregate, as the policy instrument. Since these variables can be controlled closely over short time horizons, they are often also described as *policy instruments*.

A related point to note is that the definition of a policy instrument is often model dependent. Many of the models discussed in chapter 8, for example, treated the inflation rate as the direct instrument of monetary policy. The assumption was not that the central bank directly set prices in the economy; rather, it was that the central bank, through its actual policy tools, could exercise sufficiently close control over the inflation rate that errors in the control process could be ignored for the purpose of the particular model. Similarly, in chapter 10, a short-term rate of interest will be treated as the instrument of monetary policy. Again, this should be interpreted to mean that the central bank, by engaging in open-market operations (its actual instrument), can control the interest rate, so that for many purposes, we can simply ignore the reserve market and treat the short-term interest rate as if it were set directly by the central bank.

9.3 The Instrument Choice Problem

If the monetary policy authority can choose between employing an interest rate or a monetary aggregate as its policy tool, which should it choose? The classic analysis of this question is due to Poole (1970). He showed how the stochastic structure of the economy—the nature and relative importance of different types of disturbances—would determine the optimal instrument. The analysis of the instrument choice problem also provides a framework for discussing the role of policy targets, intermediate targets, and information in the conduct of policy.

9.3.1 Poole's Analysis

Suppose the central bank must set policy before observing the current disturbances to the goods and money markets, and assume that information on interest rates, but not output, is immediately available. This informational assumption reflects a situation in which the central bank can observe market interest rates essentially continuously, but data on inflation and output might be available only monthly or quarterly. In such an environment, the central bank will be unable to determine from a movement in market interest rates the exact source of any economic disturbances that might be affecting the economy. To make a simple parallel with a model of supply and demand, observing a rise in price does not indicate whether there has been a positive shock to the demand curve or a negative shock to the supply curve. Only by observing both price and quantity can these two alternatives be distinguished, since a demand shift would be associated with a price and quantity rise, while a supply shift would be associated with a rise in price and a decline in quantity. At the macro level, an increase in the interest rate could be due to expanding aggregate demand (which might call for contractionary monetary policy to stabilize output) or an exogenous shift in money demand (which might call for letting the money supply expand). With imperfect information about economic developments, it will be impossible to determine the source of shocks that have caused interest rates to move.

Poole asked whether, in this environment, the central bank should try to hold market interest rates constant or should hold a monetary quantity constant while allowing interest rates to move. And he assumed that the objective of policy was to stabilize real output, so that he answered his question by comparing the variance of output implied by the two alternative policies.

Poole treated the price level as fixed, and to highlight his basic results, we will do so as well. Since the instrument-choice problem primarily relates to the decision to hold either a market rate or a monetary quantity constant over a fairly short period of time (say, the time between policy board meetings), ignoring price-level effects is not unreasonable as a starting point for the analysis. A simple variant of the basic IS-LM model in log terms that can be used to derive Poole's results is given by

$$y_t = -\alpha i_t + u_t \tag{9.1}$$

$$m_t = y_t - c i_t + v_t. \tag{9.2}$$

Equation (9.1) represents an aggregate-demand relationship in which output is a decreasing function of the interest rate; demand also depends on an exogenous disturbance u_t with variance σ_u^2. Equation (9.2) gives the demand for money as a decreasing function of the interest rate and an increasing function of output. Money demand is subject to a random shock v_t with variance σ_v^2. Equilibrium requires that the demand for money equal the supply of money m_t. For simplicity, u and v will be treated as mean zero, serially and mutually uncorrelated processes. These two equations represent a simple IS-LM model of output determination, given a fixed price level.[1]

The final aspect of the model is a specification of the policy maker's objective, assumed to be the minimization of the variance of output deviations:

$$E[y_t]^2, \tag{9.3}$$

where all variables have been normalized so that the economy's equilibrium level of output in the absence of shocks is $y = 0$. Because the central bank's loss function is quadratic in output around the true steady-state value of zero, the problem of time inconsistency that was the focus of chapter 8 will not arise.

The timing is as follows: the central bank sets either i_t or m_t at the start of the period; the stochastic shocks u_t and v_t occur, determining the values of the endogenous variables (either y_t and i_t if m_t is the policy instrument or y_t and m_t if i_t is the policy instrument).

When the money stock is the policy instrument, (9.1) and (9.2) can be solved jointly for equilibrium output:

$$y_t = \frac{\alpha m_t + c u_t - \alpha v_t}{\alpha + c}.$$

Then, setting m_t such that $E[y_t] = 0$,[2] we obtain $y_t = (cu_t - \alpha v_t)/(\alpha + c)$. Hence, the value of the objective function under a money-supply procedure is

$$E_m[y_t]^2 = \frac{c^2\sigma_u^2 + \alpha^2\sigma_v^2}{(\alpha + c)^2}, \tag{9.4}$$

where the assumption that u and v are uncorrelated has been used.

Under the alternative policy, i_t is the policy instrument, and (9.1) can be solved directly for output. That is, the money market condition is no longer needed, although it will determine the level of m_t necessary to ensure money market equilibrium. By fixing the rate of interest, the central bank lets the money stock adjust

1. Note that the price level has been normalized to equal 1 so that the log of the price level is zero; $p = 0$. The income elasticity of money demand has also been set equal to 1.

2. This just requires $m = 0$ because of our normalizations.

endogenously to equal the level of money demand given by the interest rate and the level of income. Setting i_t such that $E[y_t] = 0$, output will equal u_t and

$$E_i[y_t]^2 = \sigma_u^2. \tag{9.5}$$

The two alternative policy choices can be evaluated by comparing the variance of output implied by each. The interest-rate operating procedure is preferred to the money-supply operating procedure if and only if

$$E_i[y_t]^2 < E_m[y_t]^2$$

and, from (9.4) and (9.5), this condition is satisfied if and only if

$$\sigma_v^2 > \left(1 + \frac{2c}{\alpha}\right)\sigma_u^2. \tag{9.6}$$

Thus, an interest-rate procedure is more likely to be preferred when the variance of money demand disturbances is larger, the LM curve is steeper (the slope of the LM curve is $1/c$), and the IS curve is flatter (the slope of the IS curve is $-1/\alpha$). Conversely, the money-supply procedure will be preferred if the variance of aggregate-demand shocks (σ_u^2) is large, the LM curve is flat, or the IS curve is steep.[3]

If only aggregate-demand shocks are present (i.e., $\sigma_v^2 = 0$), a money rule leads to a smaller variance for output. Under a money rule, a positive IS shock leads to an increase in the interest rate. This acts to reduce aggregate spending, thereby partially offsetting the original shock. Since the adjustment of i acts to automatically stabilize output, preventing this interest-rate adjustment by fixing i leads to larger output fluctuations. If only money-demand shocks are present (i.e., $\sigma_u^2 = 0$), output can be stabilized perfectly under an interest-rate rule. Under a money rule, money-demand shocks cause the interest rate to move to maintain money market equilibrium; these interest-rate movements then lead to output fluctuations. With both types of shocks occurring, the comparison of the two policy rules depends on the relative variances of u and v, as well as on the slopes of the IS and LM curves, as shown by (9.6).

This framework is quite simple and ignores many important factors. To take just one example, no central bank has direct control over the money supply. Instead, control can be exercised over a narrow monetary aggregate such as the monetary base, and variations in this aggregate are then associated with variations in broader

3. In the context of an open economy in which the IS relationship is $y_t = -\alpha_1 i_t + \alpha_2 s_t + u_t$, where s_t is the exchange rate, Poole's conclusions go through without modification if the central bank's choice is expressed not in terms of i_t but in terms of the monetary conditions index $i_t - (\alpha_2/\alpha_1)s_t$.

measures of the money supply. To see how the basic framework can be modified to distinguish between the base as a policy instrument and the money supply, suppose the two are linked by

$$m_t = b_t + hi_t + \omega_t, \tag{9.7}$$

where b is the (log) monetary base, and the money multiplier ($m_t - b_t$ in log terms) is assumed to be an increasing function of the rate of interest (i.e., $h > 0$). In addition, ω_t is a random money-multiplier disturbance. Equation (9.7) could arise under a fractional reserve system in which excess reserves are a decreasing function of the rate of interest.[4] Under an interest-rate procedure, (9.7) is irrelevant for output determination, so $\mathrm{E}_i(y_t)^2 = \sigma_u^2$, as before. But now, under a monetary-base operating procedure,

$$y_t = \frac{(c+h)u_t - \alpha v_t + \alpha\omega_t}{\alpha + c + h}$$

and

$$\mathrm{E}_b(y_t)^2 = \left(\frac{1}{\alpha + c + h}\right)^2 [(c+h)^2\sigma_u^2 + \alpha^2(\sigma_v^2 + \sigma_\omega^2)].$$

The interest-rate procedure is preferred over the monetary-base procedure if and only if

$$\sigma_v^2 + \sigma_\omega^2 > \left[1 + \frac{2(c+h)}{\alpha}\right]\sigma_u^2.$$

Because ω shocks do not affect output under an interest-rate procedure, the presence of money-multiplier disturbances makes a base rule less attractive and makes it more likely that an interest-rate procedure will lead to a smaller output variance. This simple extension reinforces the basic message of Poole's analysis; increased financial sector volatility (money-demand or money-multiplier shocks in the model used here) increases the desirability of an interest-rate-oriented policy procedure over a monetary-aggregate procedure. If money demand is viewed as highly unstable and difficult to predict over short time horizons, greater output stability can be achieved by stabilizing interest rates, letting monetary aggregates fluctuate. If, however, the main source of short-run instability arises from aggregate spending, a policy that stabilizes a monetary aggregate will lead to greater output stability.

4. See, for example, Modigliani, Rasche, and Cooper (1970) or McCallum and Hoehn (1983).

This analysis is based on the realistic assumption that policy is unable to identify and respond to underlying disturbances. Instead, policy is implemented by fixing, at least over some short time interval, the value of an operating target or policy instrument. As additional information about the economy is obtained, the appropriate level at which to fix the policy instrument changes. So the critical issue is not so much which variable is used as a policy instrument, but how that instrument should be adjusted in light of new but imperfect information about economic developments.

Poole's basic model ignores such factors as inflation, expectations, and aggregate-supply disturbances. These factors, and many others, have been incorporated into models examining the choice between interest-rate- and monetary-aggregate-oriented operating procedures. B. Friedman (1990) contains a useful and comprehensive survey. In addition, as Friedman stresses, the appropriate definition of the policy maker's objective function is unlikely to be simply the variance of output once inflation is included in the model. Poole's approach provides a means of determining the optimal instrument choice, given a particular objective function. In the case examined here, the objective was the minimization of the variance of output. While it is often useful to analyze policy under the assumption that policy is implemented using a specific instrument, it is also important to recognize that the choice of instrument is an endogenous decision of the policy maker and is therefore dependent on the objectives of monetary policy.

9.3.2 Policy Rules and Information

The alternative policies considered in the previous subsection can be viewed as special cases of the following policy rule:[5]

$$b_t = \mu i_t. \tag{9.8}$$

According to (9.8), the monetary authority adjusts the base, its actual instrument, in response to interest-rate movements. The parameter μ, both its sign and its magnitude, determine how the base is varied by the central bank as interest rates vary. If $\mu = 0$, then $b_t = 0$, and we have the case of a monetary-base operating procedure in which b is fixed (at zero by our normalization) and is not adjusted in response to interest-rate movements. If $\mu = -h$, then (9.7) implies that $m_t = \omega_t$, and we have the case of a money-supply operating procedure in which the base is automatically

5. Recall that we have normalized constants in equations such as (9.8) to be zero. More generally, we might have a rule of the form $b_t = b_0 + \mu(i_t - \mathrm{E}i_t)$, where b_0 is a constant and $\mathrm{E}i_t$ is the expected value of i_t. As we will see in chapter 10, issues of price-level indeterminacy can arise if the average value of b_t is not tied down (as it is in this case by b_0).