

be dictated by the maximum tolerable rate of change in interest rates. In this way, a short-run interest rate target and a long-run money supply target could be reconciled.¹⁴

In practice, the central bank faces a stochastic rather than stable and known money demand function. In other words, it does not know what the "true" money supply currently is. The observed money supply is equal to the "true" amount plus or minus such periodic additions or subtractions as the central bank has to initiate or permit, in amounts it does not know, in order to keep interest rates (or free reserves) at their target level. Thus the central bank does not know how far away it is from its money supply target, nor what periodic additions or subtractions it should make in order to reach it.

The stochastic nature of the money demand function also prevents the central bank from experimentally learning the tradeoff between money supply and interest rate. It can change the money supply and observe the change in rates. But, quite aside from lags in the effect of monetary action, the central bank has no means of knowing what part of the movement in interest rates is a response to its own action and what part reflects changes in demand.

The estimation of the current value of a stochastic series is a difficult matter that besets all policy makers using time series. A highly sophisticated approach to it is discussed in the study by Marc Nerlove in this book.¹⁵ A simple procedure is to use a moving average. The moving average will itself be subject to random influences. Its variance will diminish, however, with the number of observations entering into the average so long as the underlying relation (which in the case of the money demand function in a growing economy would have to contain a trend factor) does not change in variability.¹⁶ If weekly money supply data are available, as is the case in the United States, a fairly good moving average could be built up over a month, certainly over a quarter. If monthly data are the best that

¹⁴ A transition of this kind is sketched in Jack M. Guttentag, "The Strategy of Open Market Operations," *Quarterly Journal of Economics*, February 1966, pp. 1-30.

¹⁵ See Chapter 6.

¹⁶ The variance of the moving average will behave like the variance of the mean of a sample as the size of the sample is increased, i.e., $\sigma_m^2 = \sigma^2/n$ provided the deviations from the average are independent. If they are autocorrelated, as seems probable, the variance will diminish more slowly as the number of observations entering into the average is increased.