stok206.tex

Comments on

Nancy Stokey, 'Rules versus discretion' after twenty-five years[1]

Lars E.O. Svensson[2]

Princeton University, NBER and CEPR

Nancy Stokey's (2002) interesting and thought-provoking paper has two parts. Part I, "Observability," discusses the choice of monetary-policy instruments by relying on Atkeson and Kehoe (2001). This discussion is in terms of a tradeoff between observability and "tightness" (the correlation with the monetary-policy goal). Part II, "Robustness," discusses the choice between discretion and commitment to a simple rule. This discussion is in terms of a tradeoff between flexibility and myopia on one hand and rigidity and farsightedness on the other.

I believe part I is better described as concerned with the choice of an *intermediate target* for monetary policy rather than a monetary-policy *instrument*. The setting of the monetary-policy instrument (the Fed funds rate in the U.S.) is usually directly observable, whereas the relation between the instrument setting and the monetary-policy goals is complex, making it difficult to infer the central bank's intentions from its instrument setting. Thus, I interpret part I as a discussion of the pros and cons of either an exchange-rate target or a money-growth target as intermediate targets, when the final target (the goal) is inflation.

The choice of an intermediate target is a classic problem in the design of monetary policy. An ideal intermediate target is (1) highly correlated with the goal, (2) easier to control than the goal, and (3) easier to observe than the goal. The idea is that, if such an ideal intermediate target can be found, it may be better to aim for the intermediate target rather than to aim directly for the goal, and this way indirectly achieve the goal.

In current real-world monetary policy, the idea of intermediate targeting has largely been abandoned (except in a specific sense mentioned below). Instead, central banks nowadays aim directly for their goals, typically low inflation and (to some extent) stable output gaps, as in (flexible) inflation targeting. The main problem with inflation targeting is that the control of inflation (and the output gap) is very imperfect, due to the lags in, and different strengths of, the various channels in the transmission process from instrument adjustments to actual inflation and output. This makes it difficult to judge whether current policy settings are, and past policy

[1] These comments were prepared for the NBER Macroeconomics Annual 2002, Cambridge, MA, April 2002. I thank Annika Andreasson for secretarial and editorial assistance.

[2] Email svensson@princeton.edu. Homepage: www.princeton.edu/∼svensson.

settings were, appropriate. The best solution to this problem is to regard inflation and output-gap forecasts as intermediate targets.

Indeed, as discussed in Svensson (1997a), the inflation forecast is an ideal intermediate target variable when inflation is the final target variable. The inflation forecast is by definition the current variable that has the highest correlation with future inflation. It is easier to control than actual inflation, for instance, because it leaves out a number of unanticipated shocks that will later affect actual inflation. It is in principle easier to observe than actual inflation, since it is a variable currently available, whereas the corresponding actual inflation will only be observed some two years later (due to the lags) and then be contaminated by a number of intervening shocks. In particular, transparent inflation-targeting central banks *make* their inflation forecasts observable, by having detailed *Inflation Reports* where the forecast is presented and motivated. (Thus, arguably, the only ideal intermediate target variables are the forecasts of the final target variables.)

Part II, "Robustness," discusses the tradeoff between flexibility and an inflation bias on the one hand and rigidity and no inflation bias on the other. This is a well-known and classic issue. For instance, the purpose of a fixed exchange rate or a currency board in a country may be to avoid inflation bias by importing less inflationary monetary policy from an anchor country. But this is a second-best solution, since monetary policy can then no longer be independent and respond to the specific shocks hitting the country.

In real-world monetary policy, however, it seems possible in many cases to get rid of any inflation bias *without* losing flexibility and stabilization. In order to discuss this, let us go back to the classic treatments in Kydland and Prescott (1977) and Barro and Gordon (1983a) of rules versus discretion and the time-consistency problem. Although these issues in principle apply to a number of different policies, monetary policy provides the best examples, having arguably suffered the largest problems and benefitted the most from their solutions.

The main result in the classic treatment was that discretion may result in an average inflation bias. The simplest way to illustrate this result is with the help of a simple Lucas-type Phillips curve,

$$y_t = \bar{y} + \alpha(\pi_t - \mathrm{E}_{t-1}\pi_t) + \varepsilon_t$$

where y_t is output in period t, $\bar{y}$ is potential output (the natural output level), α is a positive coefficient, π_t is inflation in period t, $\mathrm{E}_{t-1}\pi_t$ denotes rational expectations of inflation in period t conditional on information available in period $t-1$, and ε_t is a zero-mean iid shock. The

central bank is assumed to control either inflation or output, and has a quadratic loss function,

$$L_t = (\pi_t - \pi^*)^2 + \lambda(y_t - \bar{y} - k)^2,$$

where π^* is an inflation target, λ is a positive weight, and k is a positive parameter. This formulation implies that the output target, $\bar{y} + k$, is larger than potential output, $\bar{y}$.

Discretionary optimization of the central bank implies the first-order condition,

$$\pi_t - \pi^* + \lambda\alpha(y_t - \bar{y} - k) = 0.$$

Combining this first-order condition and the Phillips curve gives the equilibrium outcome for inflation and output,

$$\begin{aligned} \pi_t &= \pi^* + \lambda\alpha k - \frac{\lambda\alpha}{1 + \lambda\alpha^2}\varepsilon_t \\ y_t &= \bar{y} + \frac{1}{1 + \lambda\alpha^2}\varepsilon_t. \end{aligned}$$

In particular, there is an average inflation bias, in that the unconditional mean of inflation exceeds the inflation target,

$$\mathrm{E}[\pi_t] - \pi^* = \lambda\alpha k > 0.$$

Numerous solutions to the problem of average inflation bias under discretion has been suggested. One solution is a commitment to an optimal reaction function. In the absence of a commitment mechanism, this solution is not realistic. In particular, in any realistic problem, the optimal reaction function is quite complex and in practice unverifiable, making a commitment to it very difficult or impossible.

Another solution is by extension to non-Markov trigger-strategy equilibria, following Barro and Gordon (1983b). These have the inherent problem that follows from the Folk Theorem: there is no unique equilibrium. Furthermore, in the realistic situation with an atomistic private sector, there is no coordination mechanism by which a particular equilibrium could be achieved.[3] In addition, these equilibria are sometimes (and in Stokey's paper) referred to as having to do with "reputation." I think that is a (very common) misnomer. There is no uncertainty about the characteristics of the players in these settings. I think "reputation" is much more naturally associated with a situation of incomplete information, when the preferences of the central bank are not directly observable, as is the case in classic papers by Backus and Driffill (1985) and Cukierman and Meltzer (1986), and in the recent extension of the latter by Faust and Svensson

[3] Problems with trigger-strategy equilibria are further discussed in Ireland's (2002) comment on Stokey (2002).

(2001). In these papers, "reputation" is the private sector's best estimate of the preferences of the central bank.

A much noted suggestion is McCallum's (1995) "just do it". This assumes that the central bank, in the absence of a commitment mechanism, just ignores the incentives to deviate from the socially optimal outcome that arises under discretion. I find this suggestion problematic because, to my knowledge, neither McCallum nor anyone else has presented a model where "just do it" is an equilibrium outcome. The best rationale for "just do it" that I am aware of is in Faust and Svensson (2001): There, increased transparency about the bank's actions makes the bank's "reputation" (the private sector's estimate of the bank's unobservable internal time-varying objectives) more sensitive to its actions. This increases the cost for the bank of deviating from its announced social objective and pursuing its internal objectives, and thus works as an implicit mechanism for commitment to the announced objective.

Many papers have fruitfully applied a principal-agent approach to the time-consistency problem. Here society (the principal) can assign loss functions to the central bank (the agent) that may differ from society's loss function, in order to improve the discretionary problem.[4] That is, it is assumed that it is possible to commit the central bank to a particular loss function, whereas the minimization of that loss function occurs under discretion. A well-known suggestion is Rogoff's (1985) "weight-conservative" central bank, where the central bank is assigned a relative weight λ on output stabilization that is less than that of society. This reduces average inflation and inflation variance, but increases output variance. This is often described as a necessary tradeoff between inflation bias and "flexibility". However, this potential explanation of low inflation in some countries is rejected by the data: Countries with lower average inflation do not have higher output variability.

Another suggestion is an "inflation contract", by Walsh (1995) and Persson and Tabellini (1994) and further discussed in Svensson (1997b), where lower inflation is assumed to be accompanied by an increased bonus to the central bank or its governor. This idea has never been tried in the real world (not even in New Zealand, counter to common misperceptions).

A third suggestion is an "output-conservative" central bank, meaning a loss function for the central bank where the output target is equal to potential output, $k = 0$. This eliminates the average inflation bias without increasing output variability and is hence consistent with the data. This explanation have been suggested by Blinder (1998) for the Fed. I believe this is the best

[4] The possibility to improve the discretionary equilibrium by adjusting the parameters of the central-bank loss function was noted in Barro and Gordon (1983a, footnote 19).

single explanation for the apparent disappearance of average inflation bias in many countries. Indeed, I believe that the flexible inflation targeting currently applied in an increasing number of countries is consistent with central-bank loss functions where there is some modest weight on output gap stability and the output target equals potential output. Thus, this solution to the inflation bias problem need not imply any loss in flexibility. It is consistent with the insight that society had better find other policies than monetary policy (like structural policies improving competition) to increase average and potential output.[5]

Issues of commitment and discretion have been discussed in a more general linear quadratic model in early papers of Oudiz and Sachs (1985), Currie and Levine (collected in Currie and Levine (1993) and Backus and Driffill (1986), with the model equations

$$\begin{bmatrix} X_{t+1} \\ \mathrm{E}_t x_{t+1} \end{bmatrix} = A \begin{bmatrix} X_t \\ x_t \end{bmatrix} + Bi_t + \begin{bmatrix} \varepsilon_{t+1} \\ 0 \end{bmatrix}.$$

Here, X_t is a vector of predetermined variables (one of these can be unity, in order to handle constants in a convenient way), x_t is as vector of forward-looking variables (jump variables, non-predetermined variables), i_t is a vector of policy instruments, ε_t is a vector of zero-mean iid shocks, and A and B are matrices of appropriate dimension. The policy-makers intertemporal loss function in period t is

$$\mathrm{E}_t(1-\delta)\sum_{\tau=0}^{\infty}\delta^{\tau}L_{t+\tau},$$

where δ, $0<\delta<1$, is a discount factor and the period loss function, L_t, is quadratic,

$$L_t = (Y_t - \hat{Y})'W(Y_t - \hat{Y}),$$

where W is a positive semidefinite weight matrix, Y_t is a vector of target variables, and $\hat{Y}$ is a vector of corresponding target levels, which can be written

$$Y_t - \hat{Y} = C \begin{bmatrix} X_t \\ x_t \\ i_t \end{bmatrix},$$

where C is a matrix.

The optimal reaction function under *commitment* (the optimal "instrument rule") can be written

$$i_t = FX_t + \Phi\Xi_{t-1},$$

[5] Ireland (2002) interprets McCallum's "just do it" as modifying the central-bank loss function by setting $k=0$, but I can't find any support for that interpretation in McCallum (1995) (which in McCallum's notation would amount to setting $k=1$).

where F and Φ are matrices and Ξ_t is a vector of Lagrange multipliers for the equations for the forward-looking variables (the lower block of the model equations above), the equilibrium dynamics of which are given by

$$\Xi_t = SX_t + \Sigma\Xi_{t-1},$$

where S and Σ are matrices.

The equilibrium reaction function resulting from optimization under *discretion* can be written

$$i_t = \tilde{F}X_t,$$

where $\tilde{F}$ is a matrix. Compared to the optimal reaction function under commitment, there is generally "stabilization bias" (meaning that the matrix of response coefficients $\tilde{F}$ under discretion differs from the optimal response F under commitment, discussed in Svensson (1997b), for instance) and "lack of history dependence" ($\Phi \equiv 0$, discussed in Woodford (1999)). Optimization under discretion thus results in a higher loss than under commitment.

Several solutions to the problem of how to improve the equilibrium under discretion has been suggested for this more general setting. One solution is a commitment to the optimal reaction function above. Unfortunately, in realistic problems, the optimal reaction function is quite complex, making verification and other aspects of a commitment mechanism unrealistic.

A commitment to a *simple* (rather than optimal) instrument rule, like a Taylor rule, has been suggested as a compromise. A simple instrument rule could be verifiable and a commitment would in principle be feasible. No central bank has committed to a simple instrument rule, however, and prominent central bankers seem sceptic (see Svensson (2002) for further discussion).

One solution is a "commitment to continuity and predictability," suggested by Svensson and Woodford (2002), which argue that such a commitment is to some extent consistent with both the rhetoric and the practice of current inflation targeting. It consists of internalizing the cost of deviating from previous expectations, and boils down to a modified period loss function of the form

$$L_t = (Y_t - \hat{Y})'W(Y_t - \hat{Y}) + \Xi_{t-1}(x_t - \mathrm{E}_{t-1}x_t),$$

where Ξ_{t-1} is the vector of Lagrange multipliers from the previous decision period.

Another solution is a commitment to an "optimal targeting rule," discussed in Svensson and Woodford (2002) and Svensson (2002), and consistent with previous work of Sims (1980), Rogoff (1985), Walsh (1995) and Svensson (1997a). An optimal targeting rule is an Euler condition, an optimal first-order condition for the target variables, essentially the equality of the

marginal rate of transformation between the target variables, given by the model equations, and the corresponding marginal rate of substitution, given by the loss function. One attraction of optimal targeting rules is that they are usually much simpler and more robust than the optimal reaction function, making a commitment to them more realistic. For instance, all additive shocks to the model equations vanish from the optimal targeting rule (but not from the optimal reaction function). In the simple Kydland-Prescott-Barro-Gordon model above, the optimal targeting rule is

$$\pi_t - \pi^* + \lambda\alpha(y_t - \bar{y}) = 0.$$

With lags in the transmission mechanism of monetary policy, the optimal targeting rule involves forecasts of the target variables rather than current values.

Another alternative is a commitment to a "simple targeting rule," for instance, the simple rule emphasized by the Bank of England and Sweden's Riksbank that the two-year-ahead inflation forecast should be equal to the inflation target.

So what have we learnt about rules and discretion after twenty-five years? I believe the most important things we have learnt are:

- The problem of average inflation bias seems to be gone. The single best explanation for its disappearance is probably "output-conservativeness" of central banks, that is, central banks which, in addition to an explicit or implicit inflation target, have an explicit or implicit output target equal to potential output rather than exceeding potential output. This also means that average inflation bias can be avoided without loss in flexibility or stabilization of the output gap.

- Even if no average inflation bias occurs, discretion generally implies stabilization bias and lack of history dependence (although the quantitative importance of these two phenomena remains to be firmly established).

- A principal-agent approach to central banking is useful. Commitment to objectives (loss functions) is probably more realistic and relevant than commitment to particular reaction functions (instrument rules).

- Targeting rules may be more useful and realistic than instrument rules.

References

Atkeson, Andrew, and Patrick J. Kehoe, (2001), "The advantage of transparent instruments of monetary policy," Federal Reserve Bank of Minneapolis Staff Report 297.

Backus, David, and John Driffill (1985), "Rational expectations and policy credibility following a change in regime," *Review of Economic Studies* 52, 211–222.

Backus, David, and John Driffill (1986), "The consistency of optimal policy in stochastic rational expectations models," CEPR Discussion Paper No. 124.

Barro, Robert J., and David B. Gordon (1983a), "A positive theory of monetary policy in a natural-rate model," *Journal of Political Economy* 91, 589–610.

Barro, Robert J., and David B. Gordon (1983b), "Rules, discretion and reputation in a model of monetary policy," *Journal of Monetary Economics* 12, 101–121.

Blinder, Alan S. (1998), *Central Banking in Theory and Practice: The 1996 Robbins Lectures*, MIT Press, Cambridge, MA.

Cukierman, Alex and Allan H. Meltzer (1986), "A theory of ambiguity, credibility and inflation under discretion and asymmetric information," *Econometrica* 53, 1099–1128.

Currie, David, and Paul Levine (1993), *Rules, Reputation and Macroeconomic Policy Coordination,* Cambridge University Press, Cambridge.

Faust, Jon, and Lars E.O. Svensson (2001), "Transparency and credibility: Monetary policy with unobservable goals," *International Economic Review* 42, 369–397.

Ireland, Peter N. (2002), " 'Rules rather than discretion' after twenty-five years: What have we learned? What more can we learn?" *NBER Macroeconomics Annual 2002*, forthcoming.

Kydland, Finn E., and Edward C. Prescott (1977), "Rules rather than discretion: The inconsistency of optimal plans," *Journal of Political Economy* 85, 473–191.

McCallum, Bennett (1995), "Two fallacies concerning central-bank independence," *American Economic Review* 85, 207–211.

Oudiz, Gilles, and Jeffrey Sachs (1985), "International policy coordination in dynamic macroeconomic models," in William H. Buiter and Richard C. Marston, eds., *International Economic Policy Coordination*, Cambridge University Press, Cambridge.

Persson, Torsten, and Guido Tabellini (1994), "Designing institutions for monetary stability," *Carnegie-Rochester Conference Series on Public Policy* 39, 53–84.

Rogoff, Kenneth (1985), "The optimal degree of commitment to a monetary target," *Quarterly Journal of Economics* 100, 1169–1190.

Christopher A. Sims (1980), "Macroeconomics and reality," *Econometrica* 48, 1–48.

Stokey, Nancy L. (2002), " 'Rules versus discretion' after twenty-five Years," *NBER Macroeconomics Annual 2002*, forthcoming.

Svensson, Lars E.O. (1997a), "Inflation forecast targeting: Implementing and monitoring inflation targets," *European Economic Review* 41, 1111–1146.

Svensson, Lars E.O. (1997b), "Optimal inflation targets, 'conservative' central banks, and linear inflation contracts," *American Economic Review* 87, 98–114.

Svensson, Lars E.O. (2002), "What is wrong with Taylor rules? Using judgment in monetary policy through targeting rules," working paper, Princeton University.

Svensson, Lars E.O., and Michael Woodford (2002), "Implementing optimal policy through inflation-forecast targeting," working paper, Princeton University.

Walsh, Carl E. (1995), "Optimal contracts for independent central bankers," *American Economic Review* 85, 150–167.

Woodford, Michael (1999), "Optimal monetary policy inertia," NBER Working Paper No. 7261.