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Targeting vs. Instrument Rules for Monetary Policy

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Abstract

Svensson (2003) argues strongly that specific targeting rules—first order optimality conditions for a specific objective function and model—are normatively superior to instrument rules for the conduct of monetary policy. That argument is based largely upon four main objections to the latter plus a claim concerning the relative interest-instrument variability entailed by the two approaches. The present paper considers the four objections in turn, and advances arguments that contradict all of them. Then in the paper's analytical sections, it is demonstrated that the variability claim is incorrect, for a neo-canonical model and also for a variant with one-period-ahead plans used by Svensson, providing that the same decision-making errors are relevant under the two alternative approaches. Arguments relating to general targeting rules and actual central bank practice are also included.

1. Introduction

In the recent literature on monetary policy analysis, several writers have emphasized the distinction between instrument rules—i.e., formulae for setting controllable instrument variables in response to current conditions—and targeting rules, as proposed by Svensson (1997, 1999).[1] In a major contribution, Svensson (2003) has presented a sophisticated and comprehensive case for the use of targeting rules, arguing that "monetary-policy practice is better discussed in terms of targeting rules than instrument rules" (2003, p. 429).[2] The superiority of targeting rules is, moreover, claimed to pertain to both normative and positive perspectives (pp. 428–430). Svensson's paper is rich in both analytical and practical content, and provides insights that can be usefully pondered by all students of monetary policy analysis. It is our belief, nevertheless, that the paper seriously overstates the relative attractiveness of targeting rules, from both normative and positive perspectives, and describes inaccurately the properties of instrument rules. To develop this argument is the purpose of the present paper. As a major part of our argument, one concrete and important claim of Svensson's, regarding interest rate variability induced by instrument rules with strong feedback, is studied in detail. In the wide variety of cases considered, we find all results to be inconsistent with the claim.

The outline of the present paper is as follows. Section 2 presents explanations of the basic concepts and an introduction to the issues. Section 3 then takes up, and disputes, four particular criticisms of instrument rules that are central to the argument in Svensson (2003), after which Section 4 does the same for two additional criticisms. In Sections 5 and 6, the

[1] See, for example, Svensson (1997, 1999, 2003), Svensson and Woodford (2002), Rudebusch and Svensson (1999), Clarida, Galí, and Gertler (1999), Cecchetti (2000), Giannoni and Woodford (2003a, 2003b), Jensen (2002), Walsh (2003), and Woodford (2003).

paper turns to the precise analytical claim mentioned above and develops results in a number of settings that show it to be incorrect. Finally, Section 7 provides a very brief recapitulation.

2. Basic Ideas

What is the distinction between instrument and targeting rules? A rule of the former type refers, quite simply, to some formula prescribing instrument settings as a function of currently observed variables. Well known examples include the Taylor rule (1993), several interest rate rules studied by Henderson and McKibbin (1993a, 1993b), and the activist monetary base rules of McCallum (1988) and Meltzer (1987). Precisely which variables are observable is of course a matter that can be debated in practical analyses, but is one on which the analyst has to take some explicit position. Note that expectations (based on current information) of present or future variables may be among the variables that the rule responds to.[3] The definition of targeting rules is somewhat more complex. There has been some evolution since Svensson's (1997, 1999) introduction of the concept,[4] but his current terminology recognizes both general and specific variants. Basically, a general targeting rule is the specification of a central bank objective function,[5] whereas a specific targeting rule is an optimality condition implied by an objective function together with a specified model of the economy (pp. 448–460).[6] Initially, optimization was presumed to be of the discretionary

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[2] In what follows, quotations with page-number indications but no author or year indication, refer to that paper, i.e., Svensson (2003).
[3] In cases in which expectations are based on current-period information, however, Svensson refers to this type of policy rule as an "implicit instrument rule."
[4] In particular, only specific (not general) targeting rules were considered in Svensson (1997) and they were called "target rules."
[5] Svensson (2003, p. 430) further requires that these be "*operational objectives*" (italics in original), i.e. numerical targets for particular variables, rather than a general concept such as "price stability."
[6] Svensson has explained to us that he does not require that a specific targeting rule necessarily expresses an optimality condition, as he has in the past (1997, p. 1136), and his definition on p. 429 conforms to that explanation. On p. 430, however, he states that "… specific targeting rules essentially specify operational Euler equations." Also, on p. 455 Svensson states that "A specific targeting rule specifies a condition … [that] may be an optimal first-order condition, or an approximate first-order condition." In the remainder of this

type, with period-by-period re-optimization based on prevailing "initial conditions," but in Svensson (2003) the possibility of optimization from a "timeless perspective" (see Woodford, 1999) is also considered.

It is not our intention to argue that analysis with instrument rules is in all respects preferable to the use of targeting rules. Even if we held that belief, moreover, we would not think it socially desirable for all researchers to employ the same approach. Nevertheless, we are more attracted to analysis with instrument rules than with targeting rules and believe that a few words should be included to indicate why—especially since Svensson's numerous writings argue so strongly in favor of the targeting-rule position.

First, it seems terminologically inappropriate to refer to the specification of the policymaker's objective function as a *rule*. Obviously, for a given objective function desirable instrument settings—i.e., policy actions—can be very different under the same prevailing conditions depending on the policymaker's preferred model or models of the economy. There are words available to describe policymakers' objectives—for example, "policymakers' objectives"—so there is nothing analytical to be gained by reference to them as "general targeting rules." It is terminologically useful, rather, for objectives and rules to be clearly distinguished. Next, from the substantive perspective, the adoption of an objective function is innocuous if the function accurately represents the central bank's true preferences. But if it does not represent the true preferences and is made public, as in the scheme suggested in Svensson's Section 5.3.3, then the central bank will be describing its objectives dishonestly to the public, which seems inconsistent with Svensson's emphasis on

paper, accordingly, we shall follow Svensson's practice by typically treating specific targeting rules as first-order optimality conditions.

transparency.[7]

Second, the problem with specific targeting rules—i.e., first-order optimality conditions—is that they are obviously model-dependent.[8] It is unclear which portion of today's macroeconomic models are most questionable, but it is entirely clear that there is much dispute among leading scholars concerning the proper specification of several of the crucial relationships. Yet a condition that implies policy optimality in one model may be highly inappropriate under other specifications. Consequently, an attractive approach to policy design, promoted (e.g.) by McCallum (1988, 1999), is to search for an instrument rule that performs at least moderately well—avoiding disasters—in a variety of plausible models. In other words, it is our belief that it is unwise to restrict policy analysis to optimal-policy exercises, which will typically be optimal only for the single model being utilized. Yet such analysis is precisely what is contemplated by focus on specific targeting rules.

A good illustration of the model-dependence of optimality conditions is provided in a recent paper by Levin and Williams (2003), which is a follow-up to the robustness study of Levin, Wieland, and Williams (1999). The initial experiments of Levin and Williams (2003) involve calculation of the consequences of using a policy rule, designed to be optimal in one model, in other models. The three models in their introductory example are (i) a "New Keynesian" baseline model (NKB) that is highly prominent in recent theoretical research, (ii) an alternative specification (denoted FHP) with more sources of inertia utilized by Fuhrer (2000), and the empirically-oriented (RS) model of Rudebusch and Svensson (1999). Suppose a specific targeting rule is optimal in a calibrated version of the NKB model, with a

[7] Svensson has informed us that he would have the central bank explain the discrepancy between its objective function and preferences to the public. We consider that such a need reflects a substantial degree of non-transparency.
[8] The existence of model dependency is recognized by Svensson (p. 450).

loss function that assigns output gap variability a weight of λ (as in Section 5 below) and also gives interest rate variability a weight of 0.1, both in relation to inflation variability relative to target. If that optimality condition is used instead in the FHP model, the loss values are 95 or 150 percent higher (for λ values of 0.0 and 0.5, respectively) than the minimum loss in that model. Even more strikingly, if this NKB optimality condition is transferred to the RS model, the combination generates explosive oscillations—an "infinite" percentage deterioration. Next, a specific targeting rule that is optimal in the FHP model produces losses that are 173 or 130 percent greater than minimum in the NKB model, and explosive oscillations in the RS model. Finally, a rule that is optimal in the RS model generates analogous loss increases of 219 or 254 percent in the NKB model and 146 or 128 percent in the FHP model.

As an extension of our position, we would suggest that it is not desirable *always* to limit analysis to cases in which an explicit objective function has been specified. Explicitness is itself a virtue, of course, other things equal. But it is unclear what weights actual central bankers assign to various terms in their objective functions as well as to the specification of the terms. It is also unclear what weights and terms *should* appear, since there is professional disagreement over proper model specification.[9] Accordingly, it can be useful to explore the way in which different properties of a modelled economy (e.g., variances of key endogenous variables) are related to policy rule parameters, leaving it to actual policymakers to assign the relevant weights. Examples of this approach appear in some of our previous papers, e.g., McCallum and Nelson (1999a, 1999b), as well as in Bryant, Hooper, and Mann (1993).

[9] Our position does not deny the attractiveness in principle of basing policymaker objective functions on the preferences of individual agents.

3. Four Main Objections

After some preliminary discussion, Svensson considers the case of central bank (henceforth, CB) commitment to an optimal instrument rule (which he terms an implicit reaction function when the rule includes any current endogenous variables) and concludes that the implied approach is "completely impractical." Indeed, Svensson states that "commitment to an optimal instrument rule has no advocates, as far as I know" (p. 439). With this particular judgment we have no serious disagreement; see McCallum (1999, pp. 1490–1495), for example. Consequently, Svensson moves on to consideration of simple instrument rules (pp. 439–441), with one subsection entitled "Problems of a commitment to a simple instrument rule" (pp. 441–444). We now examine that subsection's arguments in some detail, since they evidently constitute the most important ingredients of Svensson's position.

In the subsection in question, there are four main objections to instrument rules that are identified and discussed. The first is "(1) the simple instrument rule may be far from optimal in some circumstances" (p. 441). In particular, "[a] *first* obvious problem for a Taylor-style rule … is that, if there are other important state variables than inflation and the output gap, it will not be optimal… For a smaller and more open economy [than the U.S.], the real exchange rate, the terms of trade, foreign output, and the foreign interest rate seem to be the minimal essential state variables that have to be added" [for the rule to be optimal] (p. 442). But Taylor rules do not comprise the entire class of simple instrument rules; nominal income growth rules provide just one obvious counter-example. Thus the foregoing is not actually an argument against simple instrument rules, but merely an objection to one particular class. Furthermore, it is not clear that the supposed departure from optimality resulting from the absence of the other state variables, pertaining to open economies, is quantitatively or even qualitatively important. Indeed, in Clarida, Galí, and Gertler's (2001) small open economy model there are no additional terms in the welfare function besides the two Taylor-rule state variables—inflation and the output gap—provided that the former is defined in terms of domestic-goods price inflation. Similarly, the McCallum-Nelson (1999a, 2000b) open-economy model can be formulated entirely in terms of CPI inflation, output, and the real interest rate, with openness only changing the interpretation of the model parameters.

"A *second* problem," Svensson states, "is that a commitment to an instrument rule does not leave any room for judgmental adjustments and extra-model information…" (p. 442). This claim is difficult for us to understand, since there seem to be various ways in which judgmental adjustments to instrument rule prescriptions could be made. For example, the interest rate instrument could be set above (or below) the rule-indicated value when policymaker judgments indicate that conditions, not adequately reflected in the CB's formal quantitative models, imply different forecasts and consequently call for additional policy tightening (or loosening). This way of incorporating judgment is not the same as the one proposed by Svensson, which he represents by the inclusion in the structural equations of the CB's macroeconomic model of an unobservable exogenous stochastic variable that is not generated by a simple process such as "an exogenous autoregressive process" (p. 433). These exogenous deviations appear in the model's structural equations. "Judgment" is then the CB's estimate of these deviation variables. But it is unclear that this approach reflects the only, or even the best, way of representing the role of judgment in policymaking.[10] Thus the

[10] Svensson also states that "a commitment to a simple instrument rule does not provide any rules for when discretionary departures from the simple instrument rule are warranted" (p. 442). But a procedure that did do

fact that the above-mentioned way of incorporating judgment is different from Svensson's seems to be beside the point, i.e., does not justify his quoted statement.[11]

Svensson suggests that "a *third* problem with simple instrument rules would seem to be that a once-and-for-all commitment to an instrument rule would not allow any improvement of the … rule when new information about the transmission mechanism, the variability of shocks, or the source of shocks arrives" (p. 442). But the words "would seem" appear in the foregoing quotation because Svensson does not actually make the foregoing argument. After mentioning it, he goes on to recognize that Woodford's (1999) "timeless perspective" type of commitment does permit modification of rules when new information is developed.[12] Such rules can, as is indicated below, be implemented by means of an instrument rule. Furthermore, the implied type of commitment—to a procedure rather than a formula—could be applied to instrument rules obtained by other procedures.

Finally, switching from a normative to a positive point of view, Svensson states that "an obvious *fourth* problem is that commitment to a simple instrument rule is far from an accurate description of current monetary policy" as practiced by inflation-targeting or other CBs. He continues: "No central bank has (to my knowledge) announced and committed itself to an explicit instrument rule" (p. 444). But, as McCallum and Nelson (2000a, p. 15) have argued previously, no actual central bank has announced or committed itself to an explicit objective function, which is a necessary condition for either the general or

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this would hardly seem to reflect what most analysts would think of as "judgment". It would be, rather, a complex rule.

[11] We do not mean to deny that Svensson has insightful and constructive observations to make regarding incorporation of judgment; our objection is to the asymmetry that he paints with respect to such incorporation via targeting and instrument rules.

[12] For discussions, see Woodford (1999) and Svensson and Woodford (2003).

specific type of targeting rule promoted by Svensson.[13] Indeed, commitment to an optimal specific targeting rule would in addition entail commitment to be bound by the output of a new optimal control exercise, conducted with a particular quantitative macroeconomic model, each decision period (e.g., each month). Such exercises could, Svensson says, be modified by judgment. But are they actually conducted by the CBs that he identifies as the world's leaders in this regard, those of the United Kingdom, New Zealand, and Sweden? If so, what is the value of the weight λ on output-gap variability announced and utilized by each of these CBs? What is the specification of the model utilized?

In short, it seems appropriate to conclude that all four of the objections to instrument rules emphasized by Svensson are equally applicable—or equally inapplicable—to targeting rules.

4. Additional Objections

Two other debatable points deserve some brief attention, before we turn to a major analytical issue in Sections 5 and 6. One of these concerns Svensson's argument against the view that "simple instrument rules fit actual central-bank behavior well" (p. 444). In opposition to this idea, Svensson states that "even the best empirical fits leave one third or more of the variance of changes in the [interest instrument] rate unexplained." In this regard it is important to note that the statement pertains to the variability of *first differences* of the interest rate, as found in the study by Judd and Rudebusch (1998). In terms of *levels*, the fraction of the variance that is unexplained is approximately 0.02 (i.e., about 2 percent).[14] Neither of these measures is "correct," of course, but to put matters in perspective, we note

[13] Note that at a minimum it would be necessary for the CB to state explicitly its value for the objective function parameter labeled λ below and in Svensson's eq. (2.2).

that 33 percent would be a comparatively *small* unexplained variance fraction for the first difference of most important variables in typical quarterly macroeconometric models. In the well-known Rudebusch and Svensson (1999) model, for example, the unexplained variance fractions for changes in inflation and the output gap are about 71 percent and 87 percent, respectively.[15]

Our second point concerns Svensson's contention that actual central banks noted for their inflation-targeting regimes, including the Reserve Bank of New Zealand, the Bank of Canada, and the Bank of England, use in practice procedures that are more reasonably characterized by the notion of a targeting rule rather than an instrument rule. We have already mentioned than none of these central banks has publicly adopted an explicit objective function. But furthermore, we find that descriptions of their policy procedures provided by officials and economists of these central banks read more like instrument rules than specific targeting rules.

As a first example, there are several short articles describing the policy procedures of the Bank of Canada that appear in the Summer 2002 issue of the *Bank of Canada Review*. These do not refer to targeting rules or optimal control exercises, but discuss instrument rules quite explicitly—see, e.g., Cote, Lam, Liu, and St-Amant (2002). Another relevant reference to the use of instrument rules in Canadian policy is provided by Longworth and O'Reilly (2002). At the risk of being excessively repetitive, let it be said explicitly that we do not claim that the Bank of Canada—or any actual central bank—strictly follows an instrument

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[14] Judd and Rudebusch (1998, p. 14) report a residual standard deviation of 0.27 for the Greenspan period 1987 Q3−1997 Q4. Over that span, the standard deviation of the quarterly average funds rate is 1.93 (annual percentage units). Thus the unexplained fraction of variability is $(0.27/1.93)^2 = 0.0196$.

[15] These figures pertain to the model's "inflation equation" and "output equation," for which the reported residual standard errors are 1.009 and 0.819 (Rudebusch and Svensson 1999, p. 208). The sample standard deviations for first differences of the relevant inflation and output gap series over the 1961.1-1996.2 sample period are 1.197 and 0.877 so we have $(1.009/1.197)^2 = 0.711$ and $(0.819/0.877)^2 = 0.872$.

rule, but rather that their practices are closer to the analytical representation of an instrument rule than to the analytical representation of a targeting rule.

For the Bank of England, a natural starting place is a publication by Bean and Jenkinson (2001) entitled "The Formulation of Monetary Policy at the Bank of England," which describes the role of forecasts in policy decisions (made individually by members of the Monetary Policy Committee). This paper's discussion explains that a variety of models and techniques are used in the process, but recognizes the special status of the "MM" quarterly macroeconometric model. In the publication *Economic Models at the Bank of England: September 2000 Update*, there are several examples of policy experiments with MM involving alternative instrument rules (Bank of England 2000, pp. 13–20). The more recent discussion by Allsopp (2002, Section 3) suggests that "the broad features of the reaction function in place in the UK increasingly seem to be publicly-understood and built into expectations."

A still more recent discussion of the UK policy framework is that in a document prepared by the UK Treasury (2003). That study uses a comparison of "interest rate decisions [with] those that a Taylor rule would suggest" as one measure of whether "the current frameworks have allowed monetary policy to perform a stabilizing role" (2003, pp. 33, 35). By contrast, there is no attempt to evaluate policy using a numerically-specified loss function or Euler equation. The study does note criticisms of the instrument-rule approach, citing Svensson (2003) in that regard. But it characterizes the deviation of actual policy from the Taylor rule as reflecting discretionary adjustments: "[prescriptions from] Taylor rules… are typically different from the actual rates chosen by central banks, which use discretion to determine rates based on a wider range of information" (2003, p. 36). In addition, in a speech accompanying the release of this study, the Chancellor of the Exchequer (who sets the target for monetary policy in the UK and appoints several of the members of the Monetary Policy Committee) was explicit in characterizing actual policy in a Taylor-rule manner: "For a 1 per cent rise in British inflation, the British interest rate would, other things being equal, tend to rise by 1.5 per cent" (Brown, 2003).

In the case of New Zealand, descriptions of the Reserve Bank's policy procedures (e.g., Hampton, 2002) make no mention of optimal control exercises, but clearly refer to a role for an instrument rule in use of the Forecasting and Policy System. In addition, it is interesting to note that Svensson's own extensive and authoritative independent review of New Zealand monetary policy (2001, p. 66) suggests that "The Reserve Bank may want to consider some further developments of its Forecasting and Policy System (FPS). Alternative interest rate reaction functions and alternative interest rate paths could be used and presented systematically to the MPC to provide a larger menu of policy choices for discussions and consideration."

5. Volatility from Instrument Rules?

We now turn to our main analytical discussion. Svensson's subsection 5.5 expresses sharp and specific disagreement with a crucial argument made by McCallum (1999, p. 1493) and McCallum and Nelson (2000a) concerning the relationship between targeting and instrument rules. In particular, these two papers argue that an instrument rule can be written so as to entail instrument responses that would tend to bring about the satisfaction of any specific target rule (which usually amounts to a first-order condition for CB optimality). By increasing the response coefficient attached to the discrepancy between the relevant prevailing conditions and the desired first-order condition, the average discrepancy can be made arbitrarily small.[16] Thus, in a sense one can accomplish with an instrument rule anything that can be accomplished with a specific targeting rule, according to our argument. Svensson (p. 461) has objected to this argument, however, on the grounds that "this is a dangerous and completely impracticable idea. It is completely inconceivable in practical monetary policy to have reaction functions with very large response coefficients, since the slightest mistake in calculating the argument of the reaction function would have grave consequences and result in extreme instrument-rate volatility." A similar objection is expressed, in milder language, by Svensson and Woodford (2003).

Our intuition was that imbedding a first-order condition in an instrument rule with a large but finite reaction coefficient (such as μ_1 below) would typically entail less severe instrument movements than would imposition of the relevant specific targeting rule, since the latter is equivalent to use of an "infinite" reaction coefficient.[17] In other cases, large μ_1 values might entail somewhat greater interest volatility but in such cases the magnitude of this volatility would approach that obtained with the targeting rule as μ_1 grows without bound. In our paper (2000a) we did not, however, explore the effects of mistakes in calculating the argument of the reaction function. In the following paragraphs we shall, accordingly, investigate the validity of Svensson's conjecture.

For this exercise, suppose initially that the economy is represented by the following model, which is a version of the neo-canonical specification used by Bullard and Mitra

[16] The sign of the response coefficient must, of course, be appropriate—so that policy is tightened when aggregate demand needs to be reduced, etc.

[17] It is important to note that—in contrast to Svensson's suggestion on p. 461—we actually do not recommend the adoption of a large reaction coefficient; see McCallum and Nelson (2000a, pp. 20–24). Our point, instead, is that an instrument rule with a large reaction coefficient is less open to Svensson's objection than is its associated specific targeting rule.

(2002), Clarida, Galí, and Gertler (1999), Jensen (2002), Woodford (1999, 2003), McCallum and Nelson (1999b, 2000a), and many others:

(1) $y_t = E_t y_{t+1} + b_1(R_t - E_t\pi_{t+1}) + \xi_t,$ $b_1 < 0$

(2) $\pi_t = \alpha y_t + \beta E_t\pi_{t+1} + u_t.$ $\alpha > 0, 0 < \beta < 1$

Here, y_t is the output gap, π_t is the inflation rate, and R_t is the one-period nominal interest rate. Equation (1) is the now-familiar expectational IS function and (2) is the Calvo price adjustment relation—both consistent under well-known assumptions with optimizing behavior by individuals in the economy (e.g., Woodford, 2003).

Supposing that the CB wishes to minimize the loss function

$E_t \Sigma_{j=0}^{\infty} \beta^j (\pi_{t+j}^2 + \lambda y_{t+j}^2),$

the optimum first-order condition in the absence of commitment is $\pi_t = -(\lambda/\alpha)y_t$, or,

(3) $\pi_t + (\lambda/\alpha)y_t = 0.$[18]

This is the specific targeting rule that is implied for this model, assuming the absence of commitment, by Svensson's approach. The corresponding instrument rule proposed in McCallum and Nelson (2000a) is

(4) $R_t = (1-\mu_2)\{\bar{r} + \pi_t + \mu_1[\pi_t + (\lambda/\alpha)y_t]\} + \mu_2 R_{t-1},$

where $\bar{r}$ is the average long-run real rate of interest. The term $\bar{r}$, which is included along with π_t so as to express (4) in a Taylor-style form, is normalized to zero by expressions (1) and (2). For present purposes the interest-rate smoothing coefficient μ_2 may also be set equal to zero, yielding $R_t = \pi_t + \mu_1[\pi_t + (\lambda/\alpha)y_t]$.

[18] See the papers cited in the previous paragraph. Note that while we use Svensson's symbol λ for the weight on the output gap in the objective function, our other choices for symbols do not follow Svensson's notation, as the latter is somewhat non-standard.

To incorporate mistakes of the type contemplated by Svensson, we modify (3) and (4) to become

(3') $\pi_t + (\lambda / \alpha) y_t + e_t = 0$

and

(4') $R_t = (1-\mu_2)\{\bar{r} + \pi_t + \mu_1[\pi_t + (\lambda/\alpha) y_t + e_t]\} + \mu_2 R_{t-1}$,

where e_t represents a stochastic mistake term. We have included the same mistake term e_t into both the targeting and instrument rule, a step that seems necessary to provide a reasonable basis for comparison. Since the issue is whether use of an instrument rule (with a large μ_1 parameter) leads to excessive variability (when there are policy errors) *in comparison to the corresponding targeting rule*, it would make no sense to omit the errors from the targeting rule.

In our experiments, we shall treat e_t as a first-order autoregressive (AR(1)) process—usually as white noise—with AR parameter ρ_e and innovation ε_t (standard deviation σ_ε). Various values for σ_ε and ρ_e are considered. Behavioral parameter values for the model are taken to be $b_1 = -0.5$, $\alpha = 0.03$, and $\beta = 0.99$. Also, the stochastic shock term ξ_t in (1) includes a term reflecting $\bar{y}_t - E_t \bar{y}_{t+1}$, which must be included—in addition to a white noise preference shock v_t —because (1) and (2) are expressed in terms of the output gap rather than output. The natural-rate value $\bar{y}_t$ is assumed to follow a first-order autoregressive process with AR parameter 0.95 and innovation standard deviation 0.007. The white noise preference shock has standard deviation 0.02 and the shock term u_t in the price adjustment equation (2) is taken to be white noise with standard deviation 0.005. For the results given below, the value of the CB preference parameter λ is set at 0.1.

We begin by reporting in Table 1 results of using different values for the feedback parameter μ_1 (setting $\mu_2 = 0$ here and in subsequent cases). The first column pertains to the μ_1 value of 0.5, as suggested by Taylor (1993). Successive columns then use values of 5.0 and 50.0. Finally, the last column includes results for "$\mu_1 = \infty$," i.e., for the targeting rule (3'). In each cell, two values are reported. The first is the unconditional expected value of the loss function, which is (with $\beta = 0.99$) 100 times the unconditional expectation of the single-period loss. The second is the standard deviation of R_t, the interest rate instrument. These values are based on analytical expressions for the unconditional variances of π_t, y_t, and R_t implied by the model-plus-rule systems.

The first row of Table 1 gives results for the reference case in which there is no e_t mistake term. The pattern is similar to those in McCallum and Nelson (2000a, Table 4) in that the value of the loss function with the instrument rule (4') approaches the value with the target-rule first-order condition (3'). Here, however, the R_t standard deviation (SD) values are also reported. Not surprisingly, they also show the instrument-rule values approaching the targeting-rule value smoothly as μ_1 grows without bound. In the second row the mistake or error term e_t is included as white noise with a SD of 0.002. With this small variability, the results are not much affected. Then in row three the SD of e_t is increased to a magnitude that is similar to that of the other model shocks. In this case again, nevertheless, there is no tendency for the large μ_1 values to generate poor performance. Indeed, the variability of R_t is slightly smaller with $\mu_1 = 50$ than with the targeting rule holding exactly. (The same remains true if we set $\mu_1 = 500$.) For more stringent tests, we increase the SD of the error term by a factor of ten in the fourth row and then, in row five, revert to 0.02 for the innovation SD but with an autoregressive parameter of $\sigma_e = 0.8$. In both these cases the SD of the interest rate increases slightly as we switch from a large μ_1 coefficient value of 50 in the instrument rule to the use of the analogous targeting rule.

Table 2 repeats the same experiments from Table 1 but with the first-order targeting rule and its instrument-rule version pertaining to policy behavior of the "timeless perspective" type of commitment, rather than discretion.[19] In this case, the optimality condition is

(5) $$\pi_t + (\lambda / \alpha)(y_t - y_{t-1}) + e_t = 0$$

and the analogous instrument rule (with $\mu_2 = 0$) is

(6) $$R_t = \bar{r} + \pi_t + \mu_1[\pi_t + (\lambda/\alpha)(y_t - y_{t-1}) + e_t]$$

when the e_t mistake terms are included. Here the values and patterns are quite different than in Table 1, but the same finding vis-à-vis Svensson's conjecture is obtained. There is, in other words, no tendency for large μ_1 values in (5) to lead to high R_t volatility or to poor performance, in comparison with the specific targeting-rule results of condition (5).

6. Model with Predetermined Output and Inflation

There are various modifications to the model (1)-(2) that could be examined,[20] to determine whether the foregoing results obtain generally, but one in particular is of special relevance. This modification stems from recognition that the examples in Svensson's (2003) paper are worked out in terms of models (pp. 432–435) in which agents' actions in period t have no effect on output or inflation until period t+1. Accordingly, we now modify our model (1)–(2) so as to possess that property. Thus consider the following specification, in which symbols are the same as above.[21]

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[19] This is the type of rule recommended by Woodford (1999, 2003) and by Svensson and Woodford (2003).
[20] We have verified that inclusion of serial correlation in the u_t shock process does not alter our basic result.
[21] Our specification is equivalent to Svensson's, in which t +1 is used wherever we use t, etc.

(7) $y_t = E_{t-1}y_{t+1} + b_1(E_{t-1}R_t - E_{t-1}\pi_{t+1}) + v_t$, $b_1 < 0$

(8) $\pi_t = \alpha E_{t-1}y_t + \beta E_{t-1}\pi_{t+1} + u_t$. $\alpha > 0, 0 < \beta < 1$

Here we have used the law of iterated expectations, e.g., $E_{t-1}(E_t X_{t+1}) = E_{t-1}X_{t+1}$. With this modification, the optimal discretionary first-order condition imposed in period t—i.e., the specific targeting rule—becomes

(9) $E_t\pi_{t+1} + (\lambda/\alpha)\, E_t y_{t+1} = 0$

instead of (3). (See Svensson, p. 452.) Accordingly, the implied instrument rule with $\mu_2 = 0$ and $\bar{r} = 0$ is

(10) $R_t = E_{t-1}\pi_t + \mu_1[E_{t-1}\pi_t + (\lambda/\alpha)E_{t-1}y_t]$.

Again the relevant experiment, designed to compare these two approaches with policy mistakes, entails specifications with random error terms included in both rules. The model to be solved then consists of equations (7), (8), and either

(11) $E_{t-1}\pi_t + (\lambda/\alpha)E_{t-1}y_t + e_{t-1} = 0$

or

(12) $R_t = E_{t-1}\pi_t + \mu_1[E_{t-1}\pi_t + (\lambda/\alpha)E_{t-1}y_t + e_{t-1}]$.

Here the random mistake terms are dated $t-1$ so as to respect the notion that output and inflation in t are predetermined. (For discussion of an alternative timing, see the Appendix.)

Before turning to more complex cases, let us consider an analytical solution for the simple special case in which discretion obtains and the three disturbance terms are all white noises. Then the MSV solution to the system (7), (8), and (11) is of the form

(13a) $\pi_t = \phi_{11}u_t + \phi_{12}v_t + \phi_{13}e_{t-1}$

(13b) $y_t = \phi_{21}u_t + \phi_{22}v_t + \phi_{23}e_{t-1}$

(13c) $R_t = \phi_{31}u_t + \phi_{32}v_t + \phi_{33}e_{t-1}$.

With this specification, we have $E_{t-1}\pi_t = \phi_{13}e_{t-1}$, $E_{t-1}\pi_{t+1} = 0$, $E_{t-1}y_t = \phi_{23}e_{t-1}$, and $E_{t-1}y_{t+1} = 0$. Undetermined coefficient calculations then yield $\phi_{11} = 1$, $\phi_{12} = 0$, $\phi_{13} = -\alpha/[\alpha+(\lambda/\alpha)]$, $\phi_{21} = 0$, $\phi_{22} = 1$, $\phi_{23} = -1/[\alpha+(\lambda/\alpha)]$, $\phi_{31} = 0$, $\phi_{32} = 0$, and $\phi_{33} = -1/b_1[\alpha+(\lambda/\alpha)]$.

For comparison we need to solve with the instrument rule (12) in place of the targeting rule (11). The solution is again of the form (13) and now the undetermined coefficient calculations yield $\phi_{11} = 1$, $\phi_{12} = 0$, $\phi_{13} = \alpha b_1\mu_1/[1-(1+\mu_1)\alpha b_1-(\lambda/\alpha)\mu_1 b_1]$, $\phi_{21} = 0$, $\phi_{22} = 1$, $\phi_{23} = b_1\mu_1/[1- (1+\mu_1)\alpha b_1-(\lambda/\alpha)\mu_1 b_1]$, $\phi_{31} = 0$, $\phi_{32} = 0$, and $\phi_{33} = \mu_1/[1-(1+\mu_1)\alpha b_1-(\lambda/\alpha)\mu_1 b_1] > 0$. Then to compare the variability of R_t under the two types of policy behavior, we need only to calculate the magnitude of ϕ_{33} for the two cases, since $\mathrm{Var}(R_t) = \phi_{33}^2\, \sigma_e^2$ in both cases. But with $\mu_1 > 0$, it is just a matter of algebra to verify that ϕ_{33} is smaller in the second case, with the instrument rule. So again we find that mistakes involving the first-order optimality condition are less serious (in terms of interest rate variability) with use of the instrument rule than the corresponding targeting rule. Also, it is straightforward to verify that as $\mu_1 \to \infty$, the instrument-rule expression for ϕ_{33} approaches the targeting-rule expression.

The case just examined is, however, excessively special. Indeed, inspection of the solutions given above shows that, for the discretionary case with all white noise shocks, there is no effect of different μ_1 values on the mean value (unconditional expectation) of the objective function. In other words, with no source of serial correlation in the model, and the existence of an information lag, the discretionary policy rule has no stabilizing properties for π_t and y_t in the model (7)–(8). Thus we need to consider cases with autocorrelated disturbances and/or with TP optimization. For the latter case we find, from Svensson's equation (5.28), that the relevant targeting and instrument rules are, respectively,

(14) $\quad E_{t-1}\pi_t + (\lambda/\alpha)[E_{t-1}y_t - E_{t-2}y_{t-1}] + e_{t-1} = 0$

and

(15) $\quad R_t = E_{t-1}\pi_t + \mu_1[E_{t-1}\pi_t + (\lambda /\alpha)(E_{t-1}y_t - E_{t-2}y_{t-1}) + e_{t-1}].$

In Tables 3 and 4 we report numerical results with the model (7)−(8). Again we report standard deviations based on analytical covariances. In most of the cases, the standard deviation of the policy-error term is kept at $\sigma_\varepsilon = 0.02$. For Table 3, which pertains to discretionary behavior, the policy specifications are (11) and (12) for the targeting and instrument rules whereas in Table 4, with timeless perspective behavior, the relevant rules are (14) and (15). In both tables the first three rows apply to cases with white noise shocks so we see that, as in the analytical solution given above, policy activism is not helpful in achieving policy objectives. Indeed, when policy errors are included, as in rows 2 and 3, the activist rules tend to be harmful. This should not be greatly surprising, since there are no general optimality results pertaining to the formulations being considered. In the final two rows of each table serially correlated shocks are present, however, so policy activism can potentially be helpful.[22] Indeed, in Table 4 we see that larger values of μ_1 lead to reduced values of the loss function.

Be that as it may, with regard to the issue at hand the results are clear-cut: there is no tendency for the variability of R_t to grow alarmingly with large values of μ_1. Indeed, the variability of R_t is smaller with large values of μ_1 used in the instrument rule than with the associated specific targeting rule. In addition, the results provided by the targeting rules (11) and (14) are, as before, very closely approximated by those of the instrument rules (12) and (15) for large values of μ_1.

[22] Where autocorrelation is included in the u_t process, the innovation variance is kept at 0.005^2.

7. Conclusion

Svensson (2003) argues strongly that general and specific targeting rules, which amount to commitments to specified objective functions and first-order conditions (respectively), are normatively superior to instrument rules for the conduct of monetary policy. By contrast, we suggest that it is unhelpful to refer to "general targeting rules" as policy rules, from a terminological perspective, and that substantively their adoption is either innocuous or else represents a departure from transparency. Most of the present paper's discussion is focused, accordingly, upon specific targeting rules—i.e., the first-order optimality conditions implied by the combination of a specific objective function and a specific model.

Svensson's argument that specific targeting rules are superior to instrument rules is based largely upon four main objections to the latter plus a claim concerning the relative interest-instrument variability entailed by the two approaches. Our Section 3 considers the four objections in turn, and advances arguments that contradict all of them. Then in the paper's analytical sections (5 and 6), it is demonstrated that the variability claim is incorrect, for a neo-canonical model and also for a variant with one-period-ahead plans used by Svensson, providing that the same decision-making errors are relevant under the two alternative approaches.

We suggest, then, that despite its large quantity of meticulous analysis, Svensson (2003) does not develop any compelling reasons for preferring targeting rules over instrument rules, from a normative perspective. We also suggest, regarding the positive perspective, that no actual central bank has expressed explicitly the magnitude of objective function parameters that are essential for the utilization of a targeting rule.

Appendix

In correspondence, Svensson has argued, "I don't think your exercise [of Sections 5 and 6] actually gets to the problem and gives a good representation of the issue. One reason is that I think your approach assumes that everyone immediately knows what the central-bank error [e_{t-1}] is and takes that into account in the expectations formation. It would be more relevant to consider the equilibrium when expectations are formed without knowing the error." To evaluate this suggestion, we must consider what is meant by the "error." What we have in mind is precisely the type defined by Svensson (2003, p. 461), namely, "a mistake in calculating the argument of the reaction function." Since the central bank's decision regarding R_t is made in period t−1 in Svensson's analysis—see his p. 435—the error must be realized in period t−1; hence our use of e_{t-1} in equations (11), (12), (14), and (15). Furthermore, Svensson assumes that private agents possess the same information as the central bank (p. 432) and that actual and privately-expected interest rates coincide (p. 435). Accordingly, we contend that the analysis of Section 6 above does accurately reflect the issue spelled out in Svensson's Section 5.5, so that his objection given above is inapplicable.

An alternative formulation would be to assume some type of policy error that affected R_t but not $E_{t-1}R_t$, representing private expectations, a case mentioned by Svensson and Woodford (2003, p. 57). An implementation error, brought about by imperfect interest-rate control, would be one such possibility. Analytically, the location of the error term in this case would be outside the square brackets in expressions (14) and (15), however, so that the multiplying effect of a large μ_1 coefficient would not occur. The other relevant possibility is that the central bank uses information not possessed by private agents in making its decision. In that case it is true that large μ_1 coefficients would yield large variability of R_t, but this case is apparently inconsistent with the information assumptions of Svensson (2003) and Svensson and Woodford (2003, pp. 12–13). In addition, the rationale for assuming that actions by private agents in period t depend upon lagged information does not carry over to the case of R_t, since asset market prices are in reality observable on a day-to-day or hour-to-hour basis.

Table 1

Results with Model (1)–(2), Discretionary Policy, $\lambda = 0.1$

Entries are loss times 10^3 and SD of R_t

	Inst. rule (4') $\mu_1 = 0.5$	Inst. rule (4') $\mu_1 = 5.0$	Inst. rule (4') $\mu_1 = 50$	Target rule (3') $\mu_1 = \infty$
$\sigma_\varepsilon = 0.0$ $\rho_e = 0.0$	3.70 .0191	2.52 .0360	2.48 .0397	2.48 .0402
$\sigma_\varepsilon = 0.002$ $\rho_e = 0.0$	3.70 .0191	2.53 .0360	2.48 .0397	2.48 .0402
$\sigma_\varepsilon = 0.02$ $\rho_e = 0.0$	3.77 .0198	2.81 .0375	2.83 .0414	2.83 .0419
$\sigma_\varepsilon = 0.20$ $\rho_e = 0.0$	11.02 .0572	30.93 .1121	37.31 .1240	38.16 .1255
$\sigma_\varepsilon = 0.02$ $\rho_e = 0.80$	4.42 .0192	3.58 .0361	3.58 .0398	3.59 .0403

Table 2

Results with Model (1)–(2), Timeless Perspective Policy, $\lambda = 0.1$

Entries are loss times 10^3 and SD of R_t

	Inst. rule (6) $\mu_1 = 0.5$	Inst. rule (6) $\mu_1 = 5.0$	Inst. rule (6) $\mu_1 = 50$	Target rule (5) $\mu_1 = \infty$
$\sigma_\varepsilon = 0.0$ $\rho_e = 0.0$	11.26 .0336	2.83 .0403	2.30 .0401	2.31 .0401
$\sigma_\varepsilon = 0.002$ $\rho_e = 0.0$	11.27 .0336	2.86 .0403	2.34 .0401	2.33 .0401
$\sigma_\varepsilon = 0.02$ $\rho_e = 0.0$	11.71 .0337	5.99 .0403	5.88 .0401	5.92 .0401
$\sigma_\varepsilon = 0.20$ $\rho_e = 0.0$	55.62 .0449	319.47 .0417	359.99 .0428	364.75 .0430
$\sigma_\varepsilon = 0.02$ $\rho_e = 0.80$	54.37 .0396	60.70 .0463	59.17 .0460	59.05 .0460

Table 3

Results with Model (7)–(8), Discretionary Policy, $\lambda = 0.1$

Entries are loss times 10^3 and SD of R_t

	Inst. rule (12) $\mu_1 = 0.5$	Inst. rule (12) $\mu_1 = 5.0$	Inst. rule (12) $\mu_1 = 50$	Target rule (11) $\mu_1 = \infty$
$\sigma_\varepsilon = 0.0$, $\rho_e = 0.0$ $\rho_u = 0.0$	7.03 .0025	6.99 .0022	6.99 .0021	6.99 .0021
$\sigma_\varepsilon = 0.02$, $\rho_e = 0.0$ $\rho_u = 0.0$	7.10 .0060	7.27 .0108	7.34 .0119	7.35 .0121
$\sigma_\varepsilon = 0.2$, $\rho_e = 0.0$ $\rho_u = 0.0$	14.4 .0539	35.4 .1061	41.8 .1175	42.7 .1189
$\sigma_\varepsilon = 0.02$, $\rho_e = 0.0$ $\rho_u = 0.9$	772 .0841	779 .0847	780 .0848	780 .0849
$\sigma_\varepsilon = 0.02$, $\rho_e = 0.8$ $\rho_u = 0.9$	773 .0840	780 .0841	780 .0841	780 .0841

Table 4

Results with Model (7)(8), Timeless Perspective Policy, $\lambda = 0.1$

Entries are loss times 10^3 and SD of R_t

	Inst. rule (15) $\mu_1 = 0.5$	Inst. rule (15) $\mu_1 = 5.0$	Inst. rule (15) $\mu_1 = 50$	Target rule (14) $\mu_1 = \infty$
$\sigma_\varepsilon = 0.0$, $\rho_e = 0.0$ $\rho_u = 0.0$	8.58 .0058	7.01 .0025	6.99 .0022	6.99 .0021
$\sigma_\varepsilon = 0.02$, $\rho_e = 0.0$ $\rho_u = 0.0$	9.02 .0065	10.2 .0027	10.6 .0026	10.6 .0026
$\sigma_\varepsilon = 0.2$, $\rho_e = 0.0$ $\rho_u = 0.0$	52.9 .0304	324 .0113	365 .0152	369 .0156
$\sigma_\varepsilon = 0.02$, $\rho_e = 0.0$ $\rho_u = 0.9$	446 .0392	308 .0098	306 .0128	306 .0131
$\sigma_\varepsilon = 0.02$, $\rho_e = 0.8$ $\rho_u = 0.9$	488 .0444	362 .0249	360 .0260	360 .0261

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