

## More Evidence on the Robustness of the Taylor Rule<sup>1</sup>

### 1. Introduction

In a recent paper Amano, Coletti and Macklem (1998) explore, *inter alia*, the relationship between monetary policy rules and increasing credibility. Overall, we find credibility to be a good thing in the sense that with more credibility the monetary authority is able to achieve both less inflation and output variability. In order to achieve these gains, however, the monetary authority must change the calibration of its inflation-forecast-based (IFB) rule since efficient parameterizations of IFB rules change with shifts in credibility.<sup>2</sup> In other words, if the monetary authority wishes to obtain efficient outcomes, it faces the extremely difficult task of adjusting its IFB rule with changes in unobservable credibility. This result suggests that an alternative rule which does not require re-optimization to obtain better outcomes would be desirable. In this note, we explore whether the Taylor rule fulfils this property. The Taylor rule appears an interesting case to consider since Amano (1998a) finds it to completely dominate IFB rules in minimizing output and inflation variability using the Amano, Coletti and Macklem (ACM) base-case approach. Moreover, other work notably Levin, Wieland and Williams (1998) finds the Taylor rule to be robust across a number of different models, suggesting that the Taylor rule holds up well in the face of model uncertainty.

The outline of this note is as follows. The next section compares the results of the Taylor rule to that of the IFB rule under three different calibrations of credibility using stochastic

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1. Thanks are due to Kim Huynh and Hope Pioro for their usual excellent help.
  2. There are two free parameters in the our IFB rule: (i) the weight on deviations of expected inflation from target; and (ii) the lead of expected inflation.

simulations of CPAM. Section 3 then offer some suggestions for future research.

## 2. Simulation Results

In this section, we examine the effect of different levels of credibility on the ability of a Taylor rule to generate efficient monetary policy frontiers via stochastic simulations of CPAM. We use VAR shocks without cross correlations to compare efficient frontiers mapped out by a simple Taylor rule to those produced by an IFB rule.<sup>3</sup> The form of the Taylor rule we consider is

$$rsl_t = rsl^* + \alpha \tilde{\pi}_t + \lambda \tilde{y}_t \quad (1)$$

where  $rsl_t$  is the slope of the term structure of interest rates,  $rsl^*$  represents the equilibrium yield spread,  $\tilde{\pi}_t$  is deviations of current consumer price inflation from its target level,  $\tilde{y}_t$  represents deviations of output from its long-run trend, and the parameters  $\alpha$  and  $\lambda$  represent weights on the corresponding deviations from desired levels.

We start by establishing a base-case efficient monetary policy frontier for the Taylor rule using the same approach as in ACM. Figure 1 presents the root-mean-squared deviations (RMSD) of inflation from its target against the RMSD of the output gap for the reaction functions considered. The two surfaces plotted in the figure represent the envelope of global efficiency frontiers for Taylor and IFB rules.<sup>4</sup> The efficient frontier for the Taylor rule has a weight of 1.0 on  $\tilde{y}_t$ , and varies  $\alpha$  over the range 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0 while the efficient frontier for the IFB rule is taken from ACM. One important result stands out in the figure. In contrast to the results reported in Black, Macklem and Rose (1998), we find the Taylor rule to completely dominate the IFB rule. For instance, the IFB rule  $j8\theta9$ <sup>5</sup> (which corresponds to an IFB rule that

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3. We use only the main diagonal of impulse response functions from a six variable VAR as our stochastic shocks (see ACM for details). We do not use the off-diagonal responses since this type of shock structure appears to generate very odd temporal correlations between inflation and output fluctuations in CPAM (see Amano 1998b)

4. Rules which generate nominal interest rate variability (standard deviation) greater than the average level of the interest rate are excluded from the figure.

5. The term  $j8\theta9$  corresponds to an IFB rule with an eight-period ahead inflation forecast and a weight of nine on deviations of expected inflation from the target.

produces the lowest RMSD for output given a RMSD for inflation) is completely dominated by any parameterization of the Taylor rule we consider. The  $\alpha 2\lambda 1$  rule, for example, allows us to reduce output variation from about 2.3 to 1.8 per cent while maintaining inflation RMSD at about 1.2 per cent. Interestingly, the standard deviation of the nominal interest rate is lower for the  $\alpha 2\lambda 1$  rule than for the  $j809$  rule (3.7 versus 4.3 per cent) suggesting the presence of a free lunch when moving from IFB to Taylor rules, at least in CPAM.

We now increase credibility and examine its effect on the efficient frontier generated by the Taylor rule in Figure 1. To increase credibility in CPAM, we simply increase the weight placed on the perceived target within the inflation expectations generating mechanism (this comes at the expense of the weight on lagged inflation). Recall that the perceived target in CPAM is anchored by the four to five year-ahead model-consistent solution for inflation, so provided that the monetary authority follows a sensible monetary rule, the perceived target will be close to the actual. This reflects the idea that when monetary policy is more credible, private agents place more weight on the inflation objective and less weight on the recent history of inflation when forming inflation expectations. We consider two cases of more credibility, *cred-I* which increases the weight on the perceived target from 0.0025 to 0.1125 and *cred-II* which increases the weight to 0.225 (see ACM for more details on increasing credibility within CPAM).

The results of this exercise are plotted in Figure 2. The frontier traced out by the crosses represents the efficient Taylor frontier under the *cred-I* case while the frontier given by the circles represents the efficient Taylor frontier under *cred-II*. As in the base case, these efficient frontiers have a weight of 1.0 on  $\tilde{y}_t$ , and varies  $\alpha$  over the range 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0. The figure also reproduces the efficient frontiers for the base-case IFB and Taylor rules as a basis for comparison. One result is striking: unlike the IFB rule, the Taylor rule does not require a monetary authority to re-calibrate its free parameters in order to reap the benefits of increased credibility. In other words, the efficient frontiers generated by the Taylor rule shift towards the origin without a change in its calibration. Take, for example, the  $\alpha 2\lambda 1$  rule. In the base-case simulations this rule results in output and inflation variations of about 1.8 and 1.2 per cent,

respectively while under the more credibility cases the same calibration delivers better outcomes. In particular, the  $\alpha 2\lambda 1$  rule reduces output variation to about 1.6 and inflation volatility to about 1.0 in the *cred-I* case and further reduces these volatilities to about 1.5 and 0.74 in the *cred-II* case. In contrast, ACM find that a monetary authority would need to re-calibrate an IFB rule with each change in credibility or else it would not be able to reap the benefits of increased credibility. More significantly, increased credibility could lead to worse outcomes if the monetary authority did not re-adjust its IFB rule. For instance, the  $j809$  IFB rule which lies on the efficient frontier in the base case moves into the interior of this surface (i.e. more inflation and output volatility) with each increase in credibility. More specifically, the output and inflation standard deviations increase from 2.3 and 1.2 in the base case to 2.4 and 1.3 under *cred-I* and to 8.1 and 2.3 under *cred-II*.

The results above raise the question: Why does the Taylor rule outperform IFB rules along the dimensions considered in this paper? One possible reason is that IFB rules use model-consistent solutions which make them sensitive to the structure of the model and efficient parameterizations of the rule shift with each change in model structure. In contrast, the Taylor rule relies only on contemporaneous information so it is not as sensitive to changes in the structure of the model. From the point of view of a monetary authority reliance on only contemporaneous information seems a particular advantage since economists' ability to generate a economy-consistent inflation forecast is questionable.

### 3.0 Suggestions for Future Research

Given the results reported in this note and in Amano (1998a) the Taylor rule deserves serious study as a possible alternative to the Bank's current IFB rule approach. One line of future research would be to redo the simulations in ACM and compare the results of IFB and Taylor rules when different types economic behaviour change. Another line of research could explore whether there is a useful role for the exchange rate in a Taylor-style rule (see for example, Ball 1997 and Srour 1998). Finally, we could explore whether the Taylor rule can be made more operational by using lags of the output gap. The idea is that the current output gap is measured with error whereas the output gap  $k$  periods in the past is measured more accurately. This view is similar to the recent

U.S. experience where the measures of NAIRU have changed (and presumably become more accurate) with the passing of time. One way to explore this question is to examine the different outcomes between the following two Taylor rules:

$$rsl_t = rsl^* + \alpha\tilde{\pi}_t + \lambda(\tilde{y}_t + \varepsilon_t) \quad (2)$$

$$rsl_t = rsl^* + \alpha\tilde{\pi}_t + \lambda\tilde{y}_{t-k} \quad (3)$$

where  $\varepsilon$  is a measurement error corresponding to the current measure of the output gap. We could then undertake stochastic simulations using both rules to determine how big the uncertainty (or measurement error) around the current output gap must be before it is advantageous to use a lagged output gap in a monetary policy rule. Note that this formulation would allow us to explore the implications of probing by revising lag measures of the output gap via some updating rule such as a Kalman filter.

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Figure 1  
Global Efficient Policy Frontier for IFB and Taylor Rules

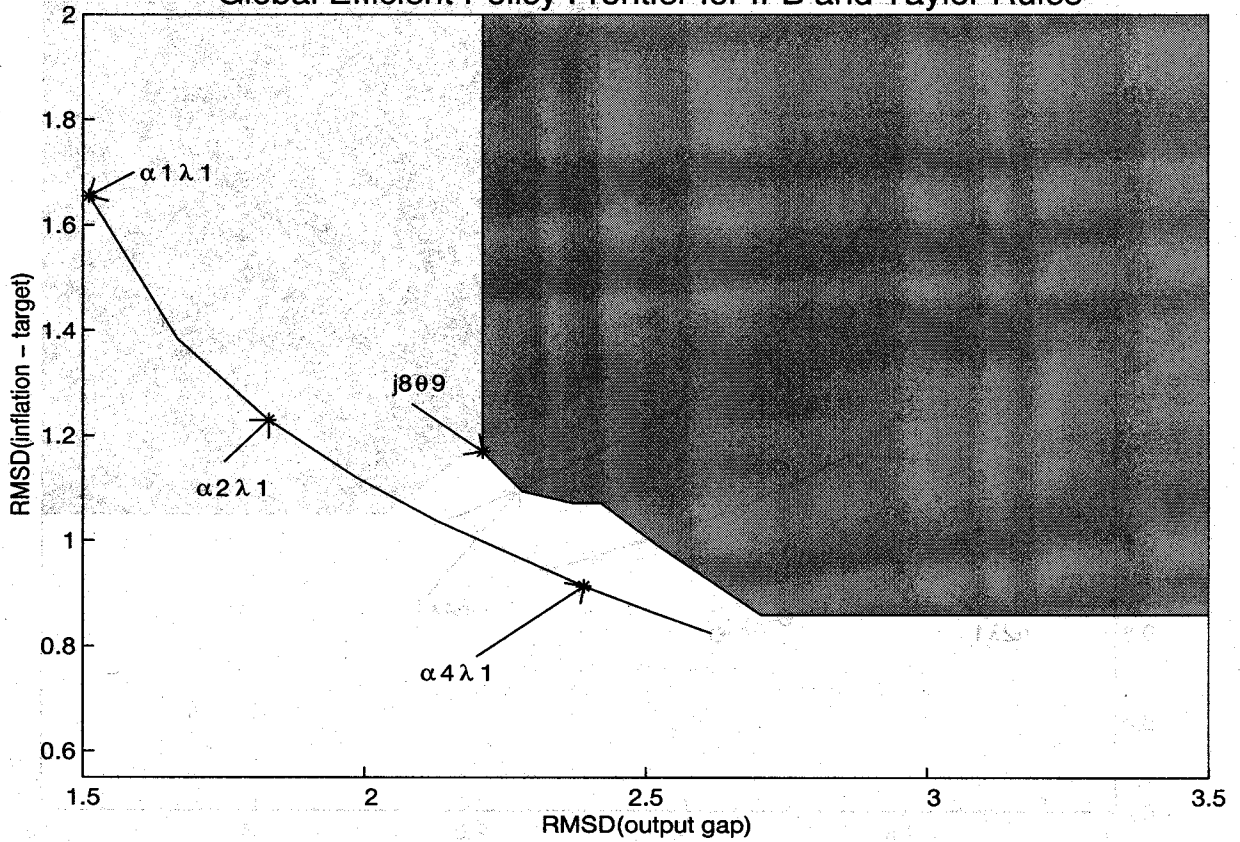


Figure 2  
 Global Efficient Policy Frontier for IFB and Taylor Rules with Credibility

