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Time Inconsistency and the Exchange Rate Channel of Monetary Policy*

Kai Leitemo

Norges Bank, NO-0107 Oslo, Norway
kai.leitemo@bi.no

Øistein Røisland

Norges Bank, NO-0107 Oslo, Norway
ostein.roisland@norges-bank.no

Ragnar Torvik

Norges Bank and Norwegian University of Science and Technology, NO-7491 Trondheim, Norway
ragnar.torvik@svt.ntnu.mo

Abstract

This paper analyses time-inconsistency problems related to the exchange rate channel of monetary policy. Within a simple open-economy macroeconomic model, where the exchange rate is the only forward-looking variable, we show that a difference emerges between optimal policy under discretion and under commitment. Moreover, the nature of the time-inconsistency problem resembles that resulting from standard New Keynesian models: when cost-push shocks occur, the exchange rate channel gives rise to excessive output stabilisation and insufficient inertia in monetary policy under a discretionary policy.

Keywords: Monetary policy; time inconsistency; exchange rate

JEL classification: *E*42; *E*52; *E*61

I. Introduction

Time-inconsistency problems in monetary policy have received considerable attention in economic theory. The earlier literature focused on time inconsistency leading to the well-known inflationary bias and on means of overcoming policy imperfections. More recently, time-inconsistency issues have attracted renewed attention due to the large influence of the New Keynesian theoretical framework.[1] It has been shown that there is a time-inconsistency problem regarding optimal stabilisation when supply shocks occur.

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[1] See the survey by Clarida, Galí and Gertler (1999).

Central to this literature is the "New Keynesian Phillips curve", which states that current inflation depends on the output gap (or some other measure of marginal costs) and expected future inflation. The New Keynesian Phillips curve is clearly attractive on theoretical grounds, since it can be derived from optimising behaviour. The empirical evidence is somewhat mixed, however.[2] The aim of this paper is not to debate the realism of the assumptions underlying the New Keynesian monetary policy literature. The objective is rather to examine whether similar time-inconsistency problems may occur under alternative assumptions. As we will show, the conclusions are robust as long as the openness of the economy is taken into account. Despite disagreement about the degree to which price setting is forward-looking, it is widely accepted that asset prices, such as the exchange rate, are forward-looking. Here, we analyse time-inconsistency problems related to the exchange rate channel of monetary policy. We find that the optimal policy is time inconsistent due to the forward-looking exchange rate channel, even though price and output determination is purely backward-looking. Although this is not surprising in itself, since the existence of forward-looking variables in general leads to time inconsistency, we show that the *nature* of the time-inconsistency problem is in many respects similar to that resulting from the standard New Keynesian model.

II. The Model

In order to focus on the time-inconsistency problem related to the exchange rate channel of monetary policy, we chose a model where the exchange rate is the only forward-looking variable. Specifically, we opted for the simple, but frequently cited, open-economy model of Ball (1999), where the adjustment mechanisms for output and inflation are purely backward-looking. However, while there are no forward-looking variables in the Ball model, we introduce forward-lookingness by imposing uncovered interest rate parity with rational expectations. The model can be summarised as follows:

$$y_t = \rho y_{t-1} - \alpha_1 r_{t-1} + \alpha_2 e_{t-1} + \varepsilon_t^y, \tag{1}$$

$$\pi_t = \pi_{t-1} + \beta y_{t-1} + \gamma(e_{t-1} - e_{t-2}) + \varepsilon_t^\pi, \tag{2}$$

[2]Gali, Gertler and López-Salido (2001), Sbordone (2002) and others have found that the forward-looking element in the Phillips curve is important. Fuhrer (1997) finds, however, that the forward-looking element is not significant for the US economy. Roberts (1997, 1998) argues that the New Keynesian Phillips curve does not fit well when rational expectations are imposed. Ball (1994), Mankiw (2001) and Mankiw and Reis (2001) argue that the New Keynesian Phillips curve yields theoretical implications at odds with reality.

$$e_t = e_{t+1|t} + r_t^* - r_t, \tag{3}$$

where y_t is output, r_t is the real interest rate, e_t is the real exchange rate, π_t is consumer price inflation and the ε's are white noise shocks. All variables (except the interest rate) are measured in logs as deviations from their respective steady-state values. Equation (1) is an open economy IS curve with output persistence. Output depends negatively on the lagged real interest rate and positively on the lagged real exchange rate. Equation (2) is a traditional open-economy Phillips curve, where the change in inflation depends positively on lagged output and lagged change in the real exchange rate. The Phillips curve can be derived from separate equations for domestic goods and imported inflation.[3] The real exchange rate is determined according to the uncovered interest rate parity condition in equation (3), where r_t^* is the foreign real interest rate and $e_{t+1|t}$ the real exchange rate expected to prevail in period $t+1$ given information available at period t.

The monetary policy problem is to minimise

$$W_t = E_t \sum_{\tau=0}^{\infty} \delta^\tau L_{t+\tau}, \tag{4}$$

where δ is the discount factor and $L_{t+\tau}$ is the period loss function, which is given by[4]

$$L_t = \pi_t^2 + \lambda y_t^2. \tag{5}$$

The weight λ measures the weight attached to output stability relative to inflation stability.

III. Optimal Policy under Commitment and Discretion

As in Ball (1999), we assume that the instrument of the central bank is the short-term real interest rate r_t. The objective of monetary policy is to choose a path for the interest rate that minimises the expected loss. With forward-

[3]See the appendices in Ball (1999) and Leitemo (2000) for derivations of equation (2) under different assumptions.

[4]In the standard open-economy New Keynesian model, as in Clarida, Galí and Gertler (2001), *domestic* inflation, as opposed to CPI inflation, enters the welfare loss function. The reason is that the price rigidity that leads to welfare losses originates from domestic producers. In a more general case with price rigidities also among importers, which lead to imperfect pass-through, this result will probably not hold. The model considered here does not make any assumptions about where price rigidities occur. Thus, we focus on a loss function with CPI inflation, which corresponds to what central banks tend to stabilise in practice.

looking variables, there is a difference between the case of discretion and the case of commitment to an optimal rule.

The inclusion of uncovered interest rate parity and rational expections makes the analytical solution intractable. As is common in the literature on monetary policy in dynamic rational expectations models, the results can thus be illustrated through impulse–response functions based on numerical optimisation. To highlight the qualitative results, we consider the case of a very open economy, where the direct exchange rate channel to inflation is large relative to the indirect demand channel. Specifically, we chose the following parameter values: $\rho = 0.8$, $\alpha_1 = 0.4$, $\alpha_2 = 0.2$, $\beta = 0.1$ and $\gamma = 0.4$. The standard deviations of ε_t^y and ε_t^π are set at 0.5 in the baseline case. The relative weight on output stabilisation is set at $\lambda = 0.5$.

In closed-economy models, it is always optimal to stabilise demand shocks completely, since such shocks drive inflation and output in the same direction. In open-economy models, this result does not hold in general. A positive demand shock, followed by an increase in the interest rate, results in an exchange rate appreciation, which in isolation contributes to lower inflation. Thus, in open-economy models there is a tradeoff between inflation and output stabilisation also when demand shocks occur. However, the time-inconsistency problem that results from this tradeoff is small in our model compared with the time-inconsistency problem that results when cost-push shocks occur. We therefore focus on optimal monetary policy responses to cost-push shocks.

Figure 1 shows the effects of a 1 percentage point cost-push shock ε_t^π. Under discretion, the central bank raises the (real) interest rate quite sharply, but reduces it relatively fast, so that the interest rate is close to neutral after three to four periods. The reason for the hump-shaped response of inflation is that the exchange rate appreciates initially, but then depreciates at a rate equal to the interest rate differential. Under commitment, the central bank raises the interest rate by less than under discretion, but keeps it above neutral for a longer period. This leads to a more prolonged period of output remaining below potential than in the case of discretion. This result is thus similar to the results from forward-looking closed-economy models, as shown by Woodford (1999a). In the New Keynesian model, the intuition is straightforward: when price setters are forward-looking, a prolonged period of tight monetary policy weakens the reason to increase prices in the first place. Initially, the central bank therefore faces a more favourable output/inflation tradeoff. The cost is a more persistent deflationary policy. But, as Woodford (1999a, p. 282) concludes: "a certain amount of such pain is worthwhile if it can be made credible in advance, in order to restrain earlier price increases".

The intuition for our result is analogous, but applies to the foreign exchange market: when foreign exchange market participants anticipate a

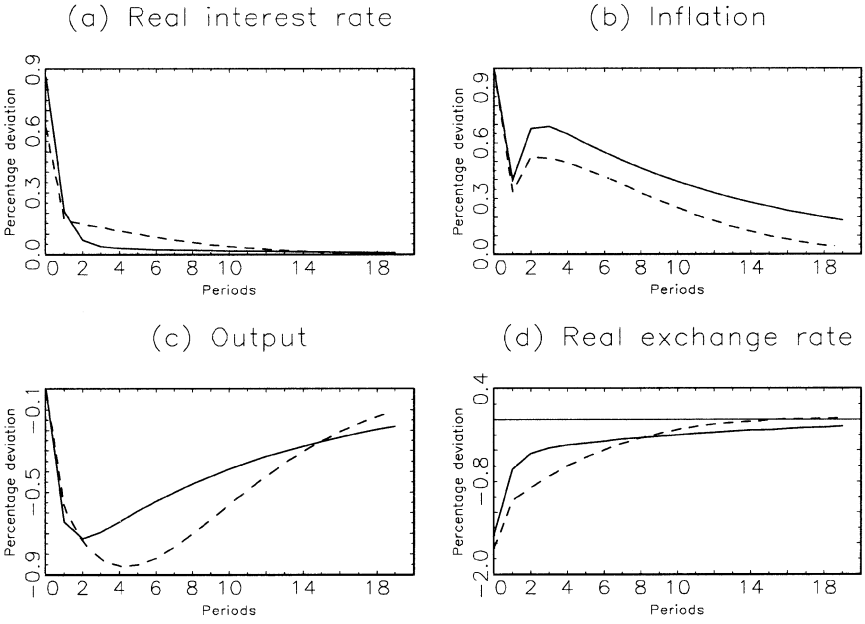

Fig. 1. Cost-push shock
Note: solid lines denote the discretionary solution and dashed lines the commitment solution

prolonged period of a positive interest rate differential, it leads to a larger appreciation of the exchange rate for a given interest rate differential today. This dampens the effect of the domestic cost-push shock on CPI inflation, and inflation is brought back to the target more quickly. The gain from more stable inflation more than offsets the loss from higher output variability.

Under discretion, the central bank has an incentive to renege on carrying out the prolonged period of tight monetary policy. Market participants understand this, and the exchange rate will thus not strengthen as much as under commitment. In order to induce a sufficiently large appreciation, the central bank has to raise the interest rate more today than what is required under commitment. Due to the higher interest rate differential, the rate of depreciation that follows after the initial appreciation is larger under discretion than under commitment. Therefore, the central bank is not able to bring inflation down as fast as it could if it were able to commit to a future interest rate path.

Woodford (1999b) finds that optimal monetary policy in forward-looking models is characterised by *inertia* in monetary policy, which results in a more prolonged period of tight monetary policy following a cost-push shock.

Table 1. *Expected loss and unconditional variances*

	var(π)	var(y)	Expected loss
Commitment	2.12	2.85	4.97
Discretion	3.22	2.15	5.37

We have seen that the same qualitative result holds in an open economy where the exchange rate is the only forward-looking variable.[5]

Table 1 reports expected loss and unconditional variances of the variables under commitment and under discretion. Note that the variance of output is lower under discretion than under commitment, while the variance of inflation is higher. Hence, there is an output stabilisation bias under discretion. A similar output stabilisation bias also emerges in the New Keynesian framework[6] and in the New Classical framework.[7]

IV. Summary

In models with forward-looking behaviour, the optimal monetary policy is generally time inconsistent. In the recent literature on time inconsistency and optimal monetary policy, the New Keynesian Phillips curve is the most frequently used supply-side specification. While this specification is attractive for a number of reasons, in particular its microeconomic foundation, the empirical support for the New Keynesian Phillips curve is mixed. In this paper, we have investigated whether the results in the New Keynesian literature hold in an open-economy model with a backward-looking Phillips curve, but with forward-looking behaviour in the foreign exchange market. We show that the policy imperfection under discretion in our model resembles the policy imperfection in New Keynesian models. In both types of models, the discretionary policy response to cost-push shocks is characterised by insufficient inertia and excessive output stabilisation. While in the New Keynesian models the gain from commitment stems from affecting the pricing behaviour directly, the gain from commitment in our model stems from affecting the exchange rate. If the central bank is able to commit to a

[5]The reason for inertia in monetary policy in the Ball model is that CPI inflation is affected by the *change* in the exchange rate. In an alternative specification, where only the *level* of the exchange rate enters the inflation equation, there is no inertial policy response beyond the inertia which stems from persistence in output and inflation. A comparison of the two alternative models can be provided on request.

[6]See Clarida *et al*. (1999, Section 4.2.1).

[7]See Svensson (1997).

future (state-contingent) path for the interest rate, it would be able to affect the exchange rate and thereby inflation in a more favourable manner.

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