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Inflation targeting, credibility and non-linear Taylor rules

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Inflation Targeting, Credibility and Non-Linear Taylor Rules*

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Abstract

In this paper we systematically evaluate how central banks respond to inflation deviations from target. We present a stylized New Keynesian model in which agents' inflation expectations are sensitive to inflation deviations from target. To (re-)establish credibility, optimal monetary policy under discretion is shown to set higher interest rates today if average inflation exceeded the target in the past. Moreover, policy responds non-linearly to past inflation gaps. This is reflected in an additional term in the central bank's optimal instrument rule, which we refer to as the "credibility loss". Augmenting a standard Taylor (1993) rule with the latter term, we provide empirical evidence for the interest rate response for a sample of five inflation targeting economies. We find that past deviations from the inflation target are feeding back into the reaction function and that this influence is economically meaningful. A deterioration in credibility (*ceteris paribus*) forces central bankers to undertake larger interest rate steps.

Keywords: Inflation expectations, credibility, reaction function, Taylor rule.

JEL classification: C32, E31, E43, E52, E58.

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1 Introduction

Over the past two decades, many central banks adopted an inflation targeting (IT) framework. While generally considered successful in stabilizing inflation, many IT economies nevertheless experienced frequent episodes in which inflation deviated from the inflation target, even for a prolonged periods of time. In this paper we systematically evaluate how central banks responded to these inflation deviations from target. Accordingly, our analysis focuses on the following question: Do past deviations from target prompt central banks to set contemporaneous interest rates more aggressively?

In a first step, we present a stylized model in which agents' inflation expectations are sensitive to inflation deviations from target. Credibility deteriorates if the central bank misses the announced target rate. To re-establish credibility, optimal monetary policy is shown to respond to average past inflation being, say, above target by setting higher interest rates today. This is reflected in an additional term in the central bank's optimal instrument rule, which we refer to as the "credibility loss". The central bank responds non-linearly to past inflation deviations with the strength of the interest rate adjustment increasing in the credibility loss. In a second step, we provide empirical evidence for the interest rate response to the credibility loss for a sample of five IT economies.

This analysis contributes to two strands of the literature. First, a few contributions address the nature of inflation deviations from target. In light of the recent inflation lift-off in the UK, Corder and Eckloff (2011) identify "sustained off-target inflation (SOTI) episodes" for a large set of IT countries. These authors are particularly interested in how SOTI episodes feed into inflation expectations. It is shown that short- and medium-term inflation expectations drift in the direction of inflation deviations. Svensson (2012) aims at evaluating the costs of inflation deviations in terms of additional unemployment. If inflation expectations remain anchored and inflation exceeds the target, unemployment increases. He finds that average unemployment has been 0.8 percentage points higher due to positive inflation deviations. The persistence of inflation and long-term inflation expectations is addressed by Davis (2012). He modifies a standard New Keynesian model by introducing agents whose beliefs about the central bank's target rate lie between two extremes. Past inflation observations are used to update private beliefs about the target, which are interpreted as a measure of central bank credibility.

A second branch of the literature points to important non-linearities in interest rate setting that are neglected in the standard specification of estimated Taylor (1993) rules. The evidence provided by Dolado et al. (2004, 2005), Kim et al. (2005), Chevapatrakul et al. (2009) and Wolters (2012), to name just a few selective contributions, suggests that policy rates are adjusted in a non-linear way to inflation and output (gap) movements. The precise nature of non-linearity differs across studies

and depends on the theoretical motivation. Furthermore, central banks often announce a target range around their inflation target, i.e. small deviations of inflation from target are tolerated while large deviations are fought vigorously. Inflation deviations judged to be within a "comfort zone" require no monetary action.¹ As a result, the interest rate response to inflation is non-linear.

Three different motivations for non-linear interest rate setting are offered in the literature. First, the Phillips curve trade-off could be non-linear. Nobay and Peel (2000) and Dolado et al. (2005), among others, introduce convexity or concavity in a short-run Phillips curve that nests the linear trade-off as a special case. This non-linearity is eventually reflected in non-linear policy steps. Second, asymmetric central bank preferences, i.e. deviations from the standard linear-quadratic framework, could be the reason for the central bank to adjust interest rates non-linearly in response to inflation and output figures. Surico (2007a,b), Ruge-Murcia (2003), Nobay and Peel (2003), and Cukierman and Muscatelli (2008) introduce different notions of preference asymmetries in models of optimal monetary policy. Third, non-linearity could arise from uncertainty of policy makers about key economic data, the true model describing the economy or about important parameters governing the monetary transmission mechanism (see Meyer et al. 2001, Swanson 2006 and Tillmann 2011).

This paper offers an additional rationale for non-linear interest rate adjustment. If past inflation deviations from target feed into current inflation expectations and if the absolute size of the deviation matters, we show that the resulting instrument rule includes not only the inflation rate, but also past inflation multiplied by the absolute size of past inflation deviations, which we refer to as the "credibility loss". Augmenting a standard Taylor (1993) rule with the credibility loss term, we provide empirical evidence for this modified interest rate rule for a sample of five IT economies. We find that past deviations from the inflation target are feeding back into the reaction function and that this influence is economically meaningful. A deterioration in credibility, *ceteris paribus*, forces central bankers to undertake larger interest rate steps.

This paper is organized as follows. Section two presents an illustrative model that motivates our empirical specification. Section three describes our empirical approach and introduces the data set. The results are discussed in section four. Section five draws some conclusions.

2 An illustrative model

In this section we present a simple, illustrative model to motivate an additional term in a conventional instrument rule of monetary policy. The model appends an

¹See Mishkin (2008) for a discussion.

expectations formation mechanism proposed by Bomfim and Rudebusch (1997) to an otherwise standard New Keynesian model. The economic structure is described by the following New Keynesian Phillips Curve and the IS curve, respectively

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t + e_t \quad (1)$$

$$y_t = E_t y_{t+1} - \frac{1}{\sigma} (i_t - E_t \pi_{t+1} - r), \quad (2)$$

where π_t is the inflation rate, y_t is the output gap, i_t is the short-term nominal interest rate set by the central bank and r is the natural real interest rate which is assumed to be constant. An i.i.d. supply shock is denoted by e_t and E_t is the expectations operator. The coefficients β , κ and σ are strictly positive.

The central bank minimizes squared fluctuations of inflation around a constant target π^* and squared fluctuations of the output gap weighted by a relative weight $\delta > 0$

$$\mathcal{L} = (\pi_t - \pi^*)^2 + \delta y_t^2. \quad (3)$$

The central bank is assumed to be unable to commit to the fully optimal, i.e. inertial, policy plan. Instead, monetary policy operates under discretion and takes expectations of future inflation and future output as given. Optimal monetary policy then results in the standard targeting rule

$$y_t = -\frac{\kappa}{\delta} (\pi_t - \pi^*), \quad (4)$$

according to which the central bank "leans against the wind" and depresses the real economy to counteract positive deviations of inflation from target. The strength of the economic contraction needed to fight an inflation deviation from target increases in the slope of the Phillips curve and decreases in the central bank's weight on output stabilization.

The formation of agents' expectations is assumed to follow a simple rule of thumb suggested by Bomfim and Rudebusch (1997), that nests the expectations formation under Rational Expectations as a special case. Future inflation expectations are determined as a weighted average of the constant inflation target and the average of past inflation rates

$$E_t \pi_{t+1} = \lambda_t \pi^* + (1 - \lambda_t) \tilde{\pi}_{t-1}, \quad (5)$$

where $\tilde{\pi}_{t-1}$ is the average of past inflation rates, $\frac{\pi_{t-1} + \dots + \pi_{t-q}}{q}$, and λ_t is the relative weight attached to the inflation target. For $\lambda_t = 1$ the model collapses to the standard case of Rational Expectations, in which expected inflation is equal to the inflation target due to the absence of serial correlation in the shock process, the lack of any backward-looking element in the model equations and the discretionary nature of optimal monetary policy. The higher λ_t , the higher the degree of central bank credibility. Credibility itself reflects past inflation performance and is modeled

as a function of the absolute deviation of average past inflation from the inflation target, i.e.

$$\lambda_t = 1 - \alpha |\tilde{\pi}_{t-1} - \pi^*|, \quad (6)$$

where α is a positive constant. Taken together, expected inflation evolves according to

$$E_t \pi_{t+1} = \pi^* + \alpha (\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*|. \quad (7)$$

While certainly ad hoc, this process of expectations formation is meant as an illustrative description of how past deviations of inflation from target affect the current level of credibility and, as a consequence, expectations of future inflation.² In the following, we refer to the term $(\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*|$ as the "credibility loss" of the central bank. Figure 1 plots the credibility loss as a function of $\tilde{\pi}_{t-1}$ for an inflation target of two percent. Credibility deteriorates non-linearly if past inflation deviated from target. While credibility suffers only mildly when inflation lies in the proximity of the inflation target, the credibility loss becomes steeper for larger inflation deviations.

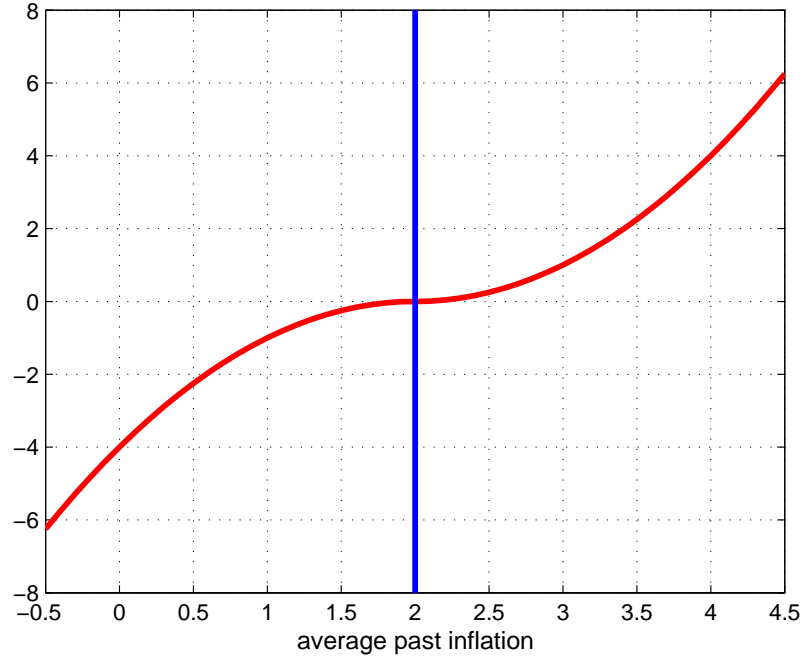


Figure 1: The credibility loss as a function of average past inflation for an inflation target of 2%

To complete the process of expectations formation, we have to specify expectations of future output. Together with the formation of inflation expectations, the optimal

²An alternative would be to let the public solve a signal extraction problem to disentangle persistent and transitory shifts in the monetary policy rule or the inflation target, respectively. See Erceg and Levin (2003) for this approach. Alichì et al. (2009) use an endogenous credibility process similar to the one utilized here.

policy trade off under discretion implies that expected output evolves according to

$$E_t y_{t+1} = -\frac{\kappa}{\delta} \alpha (\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*|. \quad (8)$$

Thus, while our model allows for deviations from Rational Expectations, expectations of inflation and output remain mutually consistent. Output expectations inherit the dependence on the credibility loss from the process of inflation expectations.

To obtain the interest rate rule followed by the central bank, we insert both expectations into the IS curve and solve for the short-term interest rate, which is the policy instrument of the central bank. The resulting interest rate rule is

$$i_t = (\pi^* + r) + \frac{\sigma \kappa}{\delta} (\pi_t - \pi^*) + \alpha \left(1 - \frac{\sigma \kappa}{\delta}\right) [(\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*|]. \quad (9)$$

Monetary policy raises interest rates as a response to current inflation deviations from target and to the credibility loss, i.e. average past inflation deviations. The latter determinant, which leads to a non-linear interest rate reaction, is absent in the conventional model. If average past inflation is, say, above target, the central bank sets a higher interest rate compared to a situation in which average past inflation meets the target. Thus, in light of past deviations the central bank tries to (re-)establish credibility by fighting inflation more aggressively. The response to past inflation deviations grows non-linearly in the absolute size of the deviation. This instrument rule resembles the well-known Taylor (1993) rule augmented by our credibility loss term. Note, however, that the equation misses the conventional interest rate response to the output gap.

The solution for inflation and output can be found by inserting the targeting rule and the expectations formation process back into the NKPC

$$\pi_t = \frac{\kappa^2 + \beta \delta}{\delta + \kappa^2} \pi^* + \alpha \beta \frac{\delta}{\delta + \kappa^2} (\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*| + \frac{\delta}{\delta + \kappa^2} e_t \quad (10)$$

$$x_t = -\frac{\kappa \kappa^2 + \beta \delta}{\delta + \kappa^2} \pi^* - \alpha \beta \frac{\kappa}{\delta + \kappa^2} (\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*| - \frac{\kappa}{\delta + \kappa^2} e_t. \quad (11)$$

For $\alpha = 0$ and $\pi^* = 0$ the solution collapses to the standard outcome under discretionary monetary policy. The higher the degree of central bank credibility, i.e. the closer λ is to unity, the less persistent inflation becomes. Put differently, the presence of imperfect credibility introduces persistence into the economy.

3 Econometric methodology and data

In this section, we use the interest rate rule derived from our simple model as a starting point for the estimation of Taylor rules augmented by a measure of credibility. Our empirical methodology contains two different types of reaction functions.

3.1 Empirical specification

First, we estimate the theoretically derived model to establish the influence of credibility on interest rate setting:

$$i_t = \beta_0 r_t + \beta_1 (\pi_t - \pi^*) + \beta_2 [(\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*|] + \epsilon_t. \quad (12)$$

The central bank adjusts the interest rate in response to contemporaneous inflation deviations (coefficient β_1) and the credibility loss term. The coefficient for the latter (β_2) indicates if past deviations from the inflation target are feeding back into today's interest rate setting. As mentioned before, the theory-consistent interest rate rule does not contain a response to output. As explained below, we allow for time variation in the real interest rate.

Nowadays central banks usually adjust their target rates gradually to changes in inflation and output.³ Such an interest rate smoothing behaviour itself could be a source for off-target inflation periods as a central bank adjust towards the new target rate in small steps only, thereby accepting a miss of the target for a certain period. To disentangle interest rate smoothing and losses in credibility, we combine a standard Taylor rule and our theoretical reaction function:

$$i_t = \rho i_{t-1} + (1 - \rho)(\beta_0 r_t + \beta_1 (\pi_t - \pi^*) + \beta_2 [(\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*|]) + \beta_3 y_t + \epsilon_t. \quad (13)$$

This specification incorporates a partial adjustment of the central bank target rate to the inflation gap and output as well as the credibility loss with $0 \leq \rho < 1$ denoting the degree of interest rate smoothing.

3.2 Data issues

Our sample covers five IT economies: Australia (AUS), Canada (CAN), New Zealand (NZ), Sweden (SWE) and the United Kingdom (UK).⁴ The sample period starts with the introduction of inflation targets in AUS (April 1993), SWE (January 1993) and the UK (October 1992). The Bank of Canada and the Reserve Bank of New Zealand formally introduced inflation targeting in February 1991 and January 1990, respectively. However, both central banks implemented their current inflation target after a prolonged disinflationary period. Consequently, we start in January 1995 (CAN) and January 1993 (NZ), respectively, when both central banks have adopted their current level of target inflation (2%).⁵ Our sample period ends in December 2008 as some of the central banks examined in this paper conduct monetary policy

³See Coibion and Gorodnichenko (2012) for recent evidence on interest rate smoothing.

⁴Note that the IT episodes in other economies (for instance, Norway and some emerging market economies) are too short for this type of analysis as it requires a 60 month initialisation period before the actual estimation period.

⁵Note that the Bank of England also changed its inflation target. Before January 2004, the midpoint of its inflation band was 2.5% defined in terms of the retail price index.

by unconventional means since then. Table 1 provides a summary of the countries employed in this sample and their inflation target characteristics.

Table 1: Sample countries and inflation targets

Country	IT since	Disinflation	Target	Sample start
Australia (AUS)	1993/04		2.5%	1993/04
Canada (CAN)	1991/02	until 1994/12	2%	1995/01
New Zealand (NZ)	1990/01	until 1992/12	2%	1993/01
Sweden (SWE)	1993/01		2%	1993/01
United Kingdom (UK)	1992/10		2%	1992/10

Source: Roger (2009) and central bank websites.

We compute the term $[(\tilde{\pi}_{t-1} - \pi^*) |\tilde{\pi}_{t-1} - \pi^*|]$ as an indicator of credibility losses in the central bank’s reaction function. In case of inflation range targeting, we use the midpoint of the target range as the inflation target π^* .⁶ One interesting feature of this indicator is its non-linear structure (see also Figure 1). Small deviations from the target become negligible, whereas larger deviations (in particular, those larger than one percentage point) result in a higher ”penalty” in the central bank’s reaction function. This can also be interpreted as a threshold effect, insofar as the credibility loss term plays a noticeable role only if it takes larger values.

As this indicator relies on an average of past inflation rates, we have to decide about the appropriate lag length. This amounts to an assumption about how long the memory of households and agents is when it comes to deviations from the central bank’s inflation target. As mentioned above, interest rate smoothing is one reason for the off-target inflation periods observed in many IT economies. However, this temporary effect due to interest rate smoothing should vanish when considering a full tightening and easing cycle, i.e., positive and negative deviations from target should average out. By using a credibility loss indicator with the memory of 60 months, we should be able to disentangle actual credibility losses from temporary ”credibility losses” resulting from the central bank’s interest rate smoothing behaviour.

Data are collected at the monthly frequency from the OECD (inflation, output and long-term interest rates) and IMF (central bank target rates) statistical databases. We employ the central bank target rates as the left-hand side variable; the consumer price index (CPI) inflation and the growth rate of industrial production (IP)⁷ serve

⁶Some of the central banks are required to keep inflation in a band, rather than meeting a single inflation target value. However, the focus on the midpoint of inflation bands should not be a concern as our indicator (i) is constructed over a longer horizon and, therefore, not prone to temporary fluctuations and (ii) nets out positive and negative deviations from the midpoint. Moreover, even in countries with an inflation band, inflation should be close to the target midpoint in the medium run.

⁷Some preliminary regressions indicate that actual output growth (see, for instance, Gorter et al. 2008) outperforms output gap measures based on (i) the Hodrick-Prescott filter (Hodrick and Prescott 1997) or (ii) a linear and quadratic trend (Clarida et al. 1998) in the Taylor rule estimations. All omitted results are available on request.

as explanatory variables. Following the persuasive evidence by Clarida (2012), we model the real interest rate as time-varying variable based on 10 year real government bond returns. All variables are observables and, consequently, both specifications are estimated using OLS.⁸

Estimation of the models obviously requires a 60 months initialisation period. Consequently, all estimations actually commence five years after the month in which the current IT was officially adopted (see Table 1). Finally, we have to emphasise that we are analysing ex post if past credibility losses are feeding back in today's reaction function and we are not evaluating monetary policy decisions in real time (Orphanides 2001).⁹

4 Results

In this section, we show the empirical results for the two specifications presented in the previous section. Table 2 sets out the results for the theoretically-derived reaction functions employing the inflation gap and the credibility indicator. Based on our theoretical considerations in section 2, we expect significant and positive reactions to the inflation gap and the credibility indicator.

Table 2: Reaction function with inflation gap and credibility indicator

	AUS		CAN		NZ		SWE		UK	
Real Int. Rate	1.623	***	1.205	***	1.472	***	1.390	***	1.802	***
Infl. Gap	1.899	***	1.422	***	1.819	***	1.848	***	1.844	***
Cred. Loss	0.659	***	0.350		2.319	***	0.996	***	0.959	**
R^2	0.328		0.317		0.501		0.507		0.662	
σ	0.766		1.163		0.959		1.075		0.758	
Observations	129		108		132		132		135	
Stand. Errors	N/W		N/W		N/W		N/W		N/W	

Notes: The dependent variable is the central bank target rate. A significance level of 1%, 5% and 10% is indicated by ***, **, and *. White (1980) standard errors are used if heteroskedasticity was detected ("White"). Newey and West (1987) standard errors are used if autocorrelation was detected ("N/W").

The so-called Taylor principle holds for all five countries as a one percentage point increase in the inflation gap is associated with a raise of the nominal interest rate by more than one percentage point. More interestingly, the credibility loss indicator is (highly) significant in all countries with Canada being the only exception. This implies that central banks adjust their target rate in a non-linear fashion. Positive

⁸As part of our robustness test, we estimate both specifications using the Generalized Method of Moments estimator with lags of the right-hand side variables as instruments. The results (available on request) and our conclusions are virtually unchanged.

⁹Real-time data is not available for all five countries over the full sample period.

deviations from the inflation target over the past five years require a target rate raise in addition to the reaction to current inflation. The theoretically-derived reaction function performs considerably well in explaining the evolution of central banks' target rates. For instance, the R^2 ranges from 31.7 percent in Canada up to 66.2 percent in the UK.

However, central banks usually adjust their target rates gradually to changes in macroeconomic conditions and react to changes in output, too. To accommodate these empirical findings, we estimate a standard Taylor rule with interest rate smoothing and incorporate the credibility loss term. Table 3 provides the results.

Table 3: Joint specification

	AUS		CAN		NZ		SWE		UK	
IR Smoothing	0.888	***	0.951	***	0.907	***	0.881	***	0.916	***
Real Int. Rate	0.165	***	0.043	**	0.125	*	0.175	***	0.128	***
Infl. Gap	0.151	**	0.070	**	0.164	*	0.316	***	0.176	***
Output	0.040	***	0.037	***	0.020	**	0.033	***	0.073	***
Cred. Loss	0.099	***	0.135	*	0.167		0.153	**	-0.148	*
Long-Run Coefficients										
Real Int. Rate	1.477	***	0.869	**	1.342	*	1.469	***	1.516	***
Infl. Gap	1.354	**	1.416	**	1.760	*	2.645	***	2.091	***
Output	0.359	***	0.759	***	0.218	**	0.278	***	0.871	***
Cred. Loss	0.884	***	2.739	*	1.798		1.282	**	-1.758	*
R^2	0.963		0.975		0.936		0.885		0.979	
σ	0.148		0.182		0.345		0.342		0.157	
Observations	129		108		132		132		135	
Stand. Errors	N/W		White		White				N/W	

Notes: The dependent variable is the central bank target rate. The long-run coefficients can be found by setting $i_t = i_{t-1}$ in the estimation equation. A significance level of 1%, 5% and 10% is indicated by ***, **, and *. White (1980) standard errors are used if heteroskedasticity was detected ("White"). Newey and West (1987) standard errors are used if autocorrelation was detected ("N/W").

The results indicate a high degree of interest rate smoothing, in particular in Canada where only 4.9 percent of interest rate changes are attributed to changes in the other contemporaneous explanatory variables. The coefficients for the inflation gap carry over from the theoretically-derived reaction functions, i.e. they are significant and in accordance with the Taylor principle. In case of SWE, we even observe an increase in the reaction to the inflation gap compared to the results in Table 2. Furthermore, all five central banks react significantly to changes in output. These coefficients are smaller than one which is also in line with the recommendations by Taylor (1993). The credibility loss term is significant and positive in three countries (AUS, CAN and SWE) which implies that it conveys information that goes beyond the inflation

gap. However, the coefficient is significantly negative in case of the UK. One could interpret this counter-intuitive reaction to past deviations from the inflation target as the Bank of England ignoring the necessary adjustment to credibility losses. A rule of thumb out of sample prediction applied to the current situation in the UK would then imply a rise in inflation expectations after December 2008 which is eventually reflected in the recent pick-up of inflation rates up to 5.2 percent in September 2011. In general, deviations from the inflation target in the past feed back into today's interest rate setting even if we allow for interest rate smoothing and control for output growth. This implies that a deterioration in credibility forces central bankers to undertake larger interest rate steps (*ceteris paribus*): In addition to the "normal" reaction to current inflation they have to deal with inflation expectations being above or below the target value. An extra non-linear response to past inflation deviations is required to restore inflation expectations consistent with the inflation target. The influence of past credibility losses on today's reaction function is quite meaningful. In terms of size, we find an economically relevant impact. The long-run coefficients indicate a reaction from 88 bps in Australia to 274 bps in Canada. Thus, central bankers have to pay a high price for over- or undershooting the target.

5 Concluding remarks

In this paper we systematically evaluate how central banks respond to inflation deviations from target. We present a stylized New Keynesian model in which agents' inflation expectations are sensitive to inflation deviations from target. To (re-)establish credibility, optimal monetary policy under discretion is shown to set higher interest rates today if average inflation exceeded the target in the past. Moreover, policy responds non-linearly to past inflation gaps. This is reflected in an additional term in the central bank's optimal instrument rule, which we refer to as the "credibility loss".

Augmenting a standard Taylor (1993) rule with the latter term, we provide empirical evidence for the interest rate response for a sample of five IT economies. We find that past deviations from the inflation target are feeding back into the reaction function and that this influence is economically meaningful. A deterioration in credibility *ceteris paribus* forces central bankers to undertake larger interest rate steps.

Our results have important policy implications. Blinder (2000) emphasises that for maintaining central bank credibility it is important that agents actually believe in the inflation target. Thus, the announcement of a specific numerical inflation target has to be matched by deeds, i.e. monetary policy has to ensure that the target is fulfilled. If a central bank fails to meet its target over a prolonged period it has to pay a price for its credibility loss. In case of inflation being above target, the central bank has to react not only to the current inflation gap. An additional increase in

the target rate is required to reduce inflation expectations and to restore credibility. The losses in credibility are of particular relevance in the context of current discussions about exit strategies from historically low, crisis-induced monetary policy rates. In particular, the Bank of England could face problems with their interest rate setting in the near future as inflation rates have been above the target for quite some time (4 percent and more during 2011), even during a period of low output growth rates, i.e. the ongoing economic and financial crisis. These figures-which might be a consequence of past credibility losses (see section 4)-imply that the Bank of England has to raise interest rates by more than the current inflation gap to bring down inflation expectations and to re-establish the credibility of its inflation target. If inflation remains above target, keeping monetary policy at historically low rates for some additional time could even worsen the central bank's credibility problem. We have shown that sustained off-target inflation episodes are causing a deterioration in credibility and, therefore, are feeding back into the central bank's reaction function. However, our sample countries are mature economies and do not face severe deflation or inflation problems. Central banks in emerging market IT countries arguably have had a lower degree of credibility in the first place. Investigating these countries and thereby explicitly addressing their disinflation periods could be an interesting task for future research.¹⁰

¹⁰The IT episodes in other economies are, at the time of writing, too short for this type of analysis.

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