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# Strategically reported inflation expectation: a cheap-talk approach

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## Abstract

We study the strategic relationship between a central bank and a biased economic agent (forecaster) responsible for reporting the economy's inflation expectation to the former. Through a simple cheap-talk model, we show that the possibility of informative communication between the above players increases as: (i) the forecaster's bias decreases; (ii) the degree in which expectations affect current inflation increases; and (iii) the uncertainty about the true value of the inflation expectation - measured by its variance - increases. Our analysis is a first step towards a deeper comprehension of the strategic relationship between central banks and those responsible for reporting inflation expectation.

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# 1 Introduction

Inflation expectations are an essential input for monetary policy. However, central banks do not observe economy's actual expectations before implementing their policies. Instead, they resort to two main sources, namely survey-based measures and market-based measures. The former is built based on expectations periodically reported by a set of agents to the monetary authority. Those agents are usually financial institutions which have technical departments specialized in forecasting (e.g. commercial and investment banks). The latter may be understood as market prices for inflation protection (e.g. inflation-linked swaps).

In this note, we explore communication issues that arise when central banks rely on survey-based measures. In particular, we are interested in investigating the consequences for the communication between a central bank and a survey respondent (henceforth forecaster[1]) – someone who reports the inflation expectation to the monetary authority – when the latter is biased, that is, when there are incentives to report it strategically. By applying a simple cheap-talk model based on the standard version by Crawford and Sobel (1982), we show that, in addition to the magnitude of the bias, the degree in which expectations affect current inflation and the uncertainty about the true inflation expectation – measured by the variance of its distribution – are determinants of the informativeness of the communication equilibria. In particular, the more the expectation affects the current inflation and the larger the uncertainty about its true value, the more informative the communication in equilibrium. Despite our simple framework, the analysis developed here is a first step towards a deeper comprehension of the strategic relationship between central banks and those responsible for reporting inflation expectation.

But are forecasters really biased? What are the forecasters' incentives to report their expectations strategically? Because central banks consider those agents expectations in their monetary policy formulation, they give them power to affect the economy's interest rate. Consider, for instance, a commercial bank that has a portfolio composed of assets indexed to the interest rate. Given that the bank knows the monetary authority's behavior, it may decide to report inflation expectation higher than what it really forecasts in order to make the central bank reply with a higher interest rate, which in turn would benefit the commercial bank.

Financial institutions may also prefer higher interest rates because of other reasons. For instance, environments of low interest rate coupled with fierce banking competition may limit possibilities of loans and deposits' pricing, putting pressure on the operating margin and negatively affecting banks' profitability (Trujillo-Ponce, 2013). In fact, there is a vast empirical literature providing evidences of the positive impact of the economy's interest rate on commercial banks' profits worldwide (Bourke, 1989; Claeys and Vennet, 2008; Demirguç-Kunt and Huizinga, 1999; García-Herrero et al., 2009; Molyneux and Thornton, 1992; Rover et al., 2011; Staikouras and Wood, 2003; Vinhado and Divino, 2011). Although those institutions can also benefit from high inflation and output[2] –

[1] As it is possible to see in the section 2, in our model, the agent responsible for reporting the inflation expectation to the central bank is not a true forecaster, given that he observes the true expectation with precision (certainty). Thus, there is no forecast to be performed. We choose to call that agent a forecaster, however, because in the real world most of the survey respondents are financial institutions that forecast the inflation expectation and then decide what value to report.

[2] Revell (1979) shows that inflation's effects on profits depend on how both wages and other operational costs are affected. Further, Perry (1992) concludes that inflation's impact on profits depends on how price increases are anticipated by banks. The positive relationship between inflation and banking profitability

variables that can be affected by their reports as well –, the interest rate channel seems to be prevalent, such that our model explores only the effects of this variable.

The paper is organized as follows. Section 2 presents our cheap-talk model and studies conditions under which both two-step and $n$-step informative communication happens in equilibrium. Section 3 concludes by analyzing the model's limitations and suggesting some extensions.

# 2 Model and main results

A central bank wants the current inflation rate $\pi$ to be as close as possible to its exogenous target $\pi^*$. Formally, its utility function is given by $U_{CB} = -(\pi - \pi^*)^2$. The only instrument of monetary policy it can use to achieve its goal is the interest rate $i$, which affects current inflation through the simple Taylor Rule $\pi = a\pi^e - bi$, where $\pi^e$ is the inflation expectation and $a, b > 0$ are parameters. Parameter $a$ may be interpreted as the degree in which expectations affect the current inflation, and $b$ may be understood as a measure of the monetary policy effectiveness. Observe that we can rewrite the central bank's utility as $U_{CB} = -(i - i_{CB}(\pi^e))^2$, where $i_{CB}(\pi^e) = (a\pi^e - \pi^*)/b$ is the interest rate target (its bliss point).

Inflation expectation is not observed by the central bank. Instead, the only source of information about this variable is a forecaster, namely a private economic agent (e.g. a commercial bank or a private financial institution), who reports $\pi^e$ before the monetary policy is implemented ($i$ is chosen). Based on the reasoning presented in section 1, we assume that forecaster's utility is given by $U_F = -[\pi - (\pi^* - \Delta)]^2$, where $\Delta > 0$ measures his bias towards a lower inflation rate. In fact, by rewriting his utility as $U_F = -(i - i_F(\pi^e))^2 = -[i - (i_{CB}(\pi^e) + \Delta/b)]^2$, where $i_F(\pi^e) = (a\pi^e - \pi^* + \Delta)/b$, we can observe that the forecaster's optimal interest rate is higher than central bank's. Thus, the forecaster may report an inflation expectation higher than the actual value in order to make the central bank implement a higher interest rate.

For the sake if simplicity, let us consider only the case of non-negative expectations, such that $\pi^e \in [0, \bar{\pi}]$. When we use the Taylor Rule and rewrite the problem only in terms of the interest rate, we have $i_{BC}(\pi^e) \in [-\pi/b, (a\bar{\pi} - \pi^*)/b]$. We follow the standard model of Crawford and Sobel (1982) by assuming that the sender's type is uniformly distributed over $[-\pi/b, (a\bar{\pi} - \pi^*)/b]$, and the message and action spaces are also $[-\pi/b, (a\bar{\pi} - \pi^*)/b]$. In the next two sections we study the possibility of informative communication within this setting.

## 2.1 Two-step equilibrium

Suppose that all types in the interval $[-\pi/b, x)$ send one message while those in $(x, a\bar{\pi}/b - \pi^*/b]$ send another. This means that a forecaster whose type lies in the first interval reports an inflation expectation different than the one reported by another forecaster whose type lies in the second interval. Thus, by receiving a message from types in

is also confirmed by empirical literature (Alexiou and Sofoklis, 2009; Athanasoglou et al., 2008). Finally, low level of economic activity may make loans portfolio worse off, bringing credit losses, increasing banks reserves and so decreasing the sector's profitability. Moreover, a good economic performance increases the demand for credit by households and firms as well as improves the solvency of borrowers, such that there exists a positive impact on banking profit (Albertazzi and Gambacorta, 2009; Athanasoglou et al., 2008; Trujillo-Ponce, 2013).

$[-\pi/b, x)$ and $(x, a\bar{\pi}/b - \pi^*/b]$, the central bank will believe that the forecaster's type is uniformly distributed in $[-\pi/b, x)$ and $(x, a\bar{\pi}/b - \pi^*/b]$, respectively, such that his optimal actions (the optimal interest rates) will be $i_1 = (-\pi^*/b + x)/2$ and $i_2 = [x + (a\bar{\pi} - \pi^*)/b]/2$. It is a well-known result (see, for example, Crawford and Sobel, 1982) that, for a two-step equilibrium to exist, $x$ must satisfy

$$x + \frac{\Delta}{b} = \frac{1}{2}\left\{\frac{1}{2}\left(x - \frac{\pi^*}{b}\right) + \frac{1}{2}\left[x + \left(\frac{a\bar{\pi} - \pi^*}{b}\right)\right]\right\},$$

which implies that $x = (a\bar{\pi} - 2\pi^* - 4\Delta)/(2b)$. Given that $i_{BC}(\pi^e) \in [-\pi/b, (a\bar{\pi} - \pi^*)/b]$, $x$ must be higher than $-\pi/b$, which implies the result detailed in the following proposition.

**Proposition 2.1** *There exists a two-step equilibrium if an only if* $\Delta < a\bar{\pi}/4$.

One of the interpretations of the above result is quite standard: for given $a, \bar{\pi} > 0$, the two-step equilibrium exists only if the forecaster's bias is sufficiently low. If, instead, we have $\Delta \geq a\bar{\pi}/4$, then the preferences of the central bank and the forecaster are too dissimilar to allow even this limited communication. Observe, however, that the higher $a$ the higher the upper bound below which the bias must lie to allow communication. This means that the larger the degree in which expectations affect current inflation, the higher the possibility of informative communication. Given that $a$ may also be thought of as the marginal impact of $\pi^e$ on $\pi$, the more the current inflation depends on the expectation, the more likely the communication between the central bank and the forecaster.

**Corollary 2.2** *The higher the central bank's uncertainty about the true value of the inflation expectation, the higher the possibility of informative communication.*

First, observe that, because the assumption that $\pi^e$ is uniformly distributed over $[0, \bar{\pi}]$, it is the case that $Var(\pi^e) = \bar{\pi}^2/12$. Thus, for given $\Delta, a > 0$, we can substitute $\bar{\pi} = \sqrt{12 \cdot Var(\pi^e)}$ into the above upper bound and conclude that the higher $Var(\pi^e)$, the higher $\Delta$ can be without exceeding the threshold $a\bar{\pi}/4 = a\sqrt{12 \cdot Var(\pi^e)}/4$. An increase in the uncertainty about the true value of $\pi^e$ increases the need for informative communication, such that a higher bias is now "tolerated" in equilibrium.

Finally, observe that the upper bound $a\bar{\pi}/4$ is independent of the monetary policy effectiveness $b$. When the problem is expressed in terms of the interest rate, changes in $b$ affect the forecaster's bias $\Delta/b$ as well as the length of the support $[-\pi/b, (a\bar{\pi} - \pi^*)/b]$. While the first effect fosters informative communication, the latter decreases the uncertainty about the true $i_F(\pi^e)$, which reduces the need for communication. Because of the simple setting of the model – in particular, the linearity of the Taylor rule and the assumption that the $\pi^e$ is uniformly distributed –, the total effect is null.

## 2.2 $n$-step equilibrium

To characterize an $n$-step equilibrium, we repeatedly apply the observation that the step $[x_{k-1}, x_k)$ is $4\Delta/b$ longer than the previous one $[x_{k-2}, x_{k-1})$. Let $d$ be the length of the first step, then we must have

$$\begin{aligned} d + \left(d + \frac{4\Delta}{b}\right) + \cdots + \left(d + (n-1)\frac{4\Delta}{b}\right) &= \left(\frac{a\bar{\pi} - \pi^*}{b}\right) - \left(-\frac{\pi^*}{b}\right) \\ nd + n(n-1)\frac{2\Delta}{b} &= \frac{a\bar{\pi}}{b}, \end{aligned} \tag{2.1}$$

where we use the fact that $\sum_{i=1}^{n-1} i = n(n-1)/2$. Now, observe that, for any $n > 0$, (2.1) is increasing in $d$. Thus, for any $n$ such that $n(n-1)2\Delta/b < a\bar{\pi}/b$, there exists $d > 0$ that solves (2.1). Given the constraint that the length of the first step must be positive, the largest possible number of steps in such an equilibrium, $n(\Delta, a, \bar{\pi})$, is the largest value of $n$ such that $n(n-1)2\Delta/b < a\bar{\pi}/b$.

**Proposition 2.3** *In a $n$-step equilibrium, the largest possible number of steps in such an equilibrium, $n(\Delta, a, \bar{\pi})$, is the largest integer less than*

$$\frac{1}{2}\left[1 + \sqrt{1 + \frac{2a\bar{\pi}}{\Delta}}\right]. \tag{2.2}$$

The upper bound (2.2) is the largest root of the equation $n(n-1)2\Delta/b - a\bar{\pi}/b = 0$. It is straightforward to see that the $n$-step equilibrium presents characteristics similar to the two-step's: $n(\Delta, a, \bar{\pi})$ is increasing in both $a$ and $\bar{\pi}$ – and therefore in $Var(\pi^e)$ – and decreasing in $\Delta$. This means that a more informative communication is more likely to occur as the degree in which expectations affect current inflation and the uncertainty about the true inflation expectation increase, and as the bias of the forecaster decreases. In fact, as $\Delta \to +\infty$ or $a \to 0$ (or $Var(\pi^e) \to 0$), there is no possible informative communication (the only equilibrium is the babbling one). By contrast, when the preferences of the central bank and the forecaster are very similar or the expectation has a negligible effect on the current inflation (or there is little uncertainty), the communication can be very informative as the central bank is able to partition the support of $\pi^e$ into many parts. Finally, once again the model's simple setting implies that the possibility of communication is independent of the monetary policy effectiveness.

# 3 Concluding remarks

Through a standard cheap-talk model, we study the strategic relationship between a central bank and a biased economic agent responsible for reporting the economy's inflation expectation to the former. We show that the possibility of informative communication between the above players increases as: (i) the forecaster's bias decreases; (ii) the degree in which expectations affect current inflation increases; and (iii) the uncertainty about the true value of the inflation expectation – measured by its variance – increases. We also find that the effectiveness of the monetary policy does not affect communication, which is explained by our simple setting (linear Taylor rule and uniform distribution assumptions). Despite of its simple framework, our model is a first attempt to explore the important strategic interaction between monetary authority and inflation forecasters.

There are several promising extensions of this basic model. First, survey-based measures collect information from a large number of forecasters, which suggests the need for a framework that includes many (heterogeneous) players (in line with studies such as Gilligan and Krehbiel, 1989 and Krishna and Morgan, 2001). In this context, the strategic relationship among forecasters would be a relevant input in the central bank's decision process. Second, the analysis would be richer if dynamics were included in the model, such that reputation could be studied (in accordance, for instance, with, Sobel, 1985, Benabou and Laroque, 1992 and Morris, 2001). A dynamic framework would also allow to explore how central bank can, over time, give incentives for forecasters to tell the true.

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