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# Information Asymmetry and Inflation Targeting

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**Abstract:** This study analyzes the targeting policy of the Central Bank of West African States (BCEAO) and its preferences. By choosing to depart from a strictly quadratic reaction function, the article adopts a framework to test the nature of monetary authority's preferences. Using a panel estimate with different estimators, the article concludes that the BCEAO's preferences are asymmetric and this result is robust both to estimation methods and measures of the output gap used. It also appears that such preferences are an element associated with strengthening the central bank's credibility.

***Keywords:*** inflation; monetary policy; asymmetric preferences; credibility; time inconsistency

***JEL Codes:*** E52; E58; O55

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## 1. Introduction

Inflation targeting is an announcement policy for the central bank to publish inflation forecasts in the form of intervals for a fixed horizon (Miller and Stiglitz 2010). Since the 1990s, this objective has indeed taken precedence over any other objective of monetary policy, such as targeting the interest rate or targeting the quantity of money. The targeting of inflation is therefore a solution to the inflationary bias resulting from discretionary monetary policy. Indeed, since the work of Taylor (1993), several studies on monetary policy rules have shown that inflation targeting regimes are a solution to the inflationary bias (Svensson 2003, Woodford 2003).

However, the effectiveness of inflation targeting policy requires the credibility of the decisions of the monetary authority, which must act in complete transparency, because transparency, through expectations, helps to stabilize the economy. Walsh (2009) defines transparency as the ability of the public to monitor information and its use by the central bank. From a theoretical point of view, the inflation targeting policy thus solves two problems:

1) Temporal incoherence (Kydland& Prescott, 1977) because central bank inflation expectations may not coincide with those of private agents (households and firms);

2) The credibility of the central bank can then be undermined when it fails to meet the initially announced monetary policy objective (Barro and Gordon, 1983).

Recourse to temporal incoherence stems from the assumption that the Central Bank has an incentive to surprise economic agents by creating surprise inflation. However, in the literature (Blinder, 1997, Vickens, 1998, Walsh, 1999), no communication strategy is associated with dynamic inconsistency since a priori, the Central Bank's announcements are not credible.

Transparency thus plays a fundamental role: firstly, on the incentives that the central bank faces, and secondly, it allows the public to monitor the conduct of monetary policy. These indirect effects have a direct effect on the economy because the Central Bank influences the expectations of economic agents (Helling 2002, Svensson 2008, Boivin 2011). Transparency then makes it possible to strengthen the credibility of the Central Bank on the objectives by providing the public with projections of the shocks that hit the economy. The announced target therefore represents a clear objective against which the public can judge the performance of the Central Bank. However, the search for macroeconomic stability through an inflation targeting policy is likely to fail due to the presence of asymmetric information. Therefore, two effects are likely to occur: (1) Information asymmetry can, in an inflation targeting regime, be at the root of the inflation bias which is increased by the financial stability bias. In fact, anti-selection amplifies the risks of instability on the financial markets because the price is no longer a perfect signal of the assets value (de Grauwe, 2009); (2) The asymmetric information, in a situation of uncertainty, undermines the credibility of Central Bank, since moral hazard reinforces the mistrust of private agents vis-à-vis the monetary authorities (Cúrdia& Woodford, 2010).

The lack of transparency increases the asymmetry of information between private agents and the Central Banker. This amplifies uncertainty about future monetary policy actions, leading to a loss of control of the economy and increased macroeconomic volatility (Minegishi & Cournede, 2010).

In this context, the question is whether inflation targeting can reduce time inconsistency in order to strengthen the credibility of central bank under uncertainty. The rest of the article is structured as follows: the second part presents the targeting of inflation as a rule and learning factor of the agents, the third part presents the coordination of expectations and the reduction of uncertainties; part four presents the modelwhile the fifth presents the results and discussions and the final part concludes.

## 2. Inflation targeting as a rule and agent learning factor

Targeting inflation can be interpreted as a rule in three different ways (Kuttner, 2004). In its most general form, it can be described as a monetary policy rule or reaction function that allows the nominal interest rate to be set according to the difference in the current inflation rate $\Pi_t$ at its target $\Pi_T$. In practice,

inflation targeting is said to be flexible (Svensson, 1997) because the reaction function also takes into account economic activity. A definition of inflation targeting requires that the rule be optimal in the sense that it sets the inflation rate so as to minimize the central bank's loss function (Svensson, 1997). In the macroeconomic model, Rudebusch & Svensson (1999) show that this type of rule reflects central bank policy. For Geraats (2002), the announcement of a target strengthens the political transparency of the central bank. More generally, inflation targeting does not only require disclosure of inflation target. It imposes greater transparency on the decision-making process of monetary policy. Walsh (1999) defines transparency as the public's ability to monitor information and its use by the central bank. Transparency must also be understood as economic transparency, ie the provision of useful economic information to limit the asymmetry of information between agents and the central bank, particularly with regard to data and models used and forecasts (Geraats, 2002).

Apprenticeship is generally introduced by assuming that agents do not know the true model of the economy but must estimate its parameters (Sargent, 1999). The literature that has focused on the introduction of these learning dynamics for monetary policy analysis has not focused on the role of target advertising or transparency in general. It aims to assess what forms of rules allow agents, and under what conditions, to learn the true model of the economy and form anticipations compatible with, in other words allow convergence towards equilibrium in rational expectations (Evans & Honkapohja (2001), Bullard & Mitra (2002)).

The Orphanides & Williams model (2005) illustrates how targeting inflation facilitates agent learning and allows for better macroeconomic stabilization. In this model, they assume an economy characterized by a supply function reflecting the degree of persistence of the shock. They compare three mechanisms of agent expectations and obtain two major results. On the one hand, the stabilization of the economy is better when agents form rational expectations. This result is due to the fact that learning introduces a positive autocorrelation of inflation and prolongs the response of inflation to shocks. This mechanism introduces a bias. Central bank must take this effect into account by reacting more strongly to the differences in inflation at its target that is to say at the expense of stabilizing the product. On the other hand, disruptions related to learning are more limited when the central bank announces its target. In this case, the central bank can get closer to performance under rational expectations at the price of a less strong reaction to inflation. In other words, under apprenticeship, the central bank stabilizes inflation at a lower cost in terms of stabilization of the product when it announces its target. This result is obtained because the announcement of the inflation target reduces the uncertainty on the estimated model of the agents and facilitates their learning of the true model of the economy.

In addition, Orphanides & Williams (2007) incorporate the learning of monetary authorities into this model. The central bank does not know the value of natural interest and unemployment rates and must estimate them by an econometric algorithm. The conclusions of Orphanides& Williams (2005) are then reinforced: the performance of the monetary policy is deteriorated compared to the case with rational expectations because of the combined effects of the estimation errors of the central bank and the agents.

In a similar context, in which agents and the central bank imperfectly know the model of the economy and resort to econometric learning to estimate it, Dennis & Ravenna (2008) show that if a change in the target of inflation is not communicated to the public, macroeconomic stabilization may deteriorate significantly. Other work highlights the contribution of the transparency of an inflation targeting regime, not strictly limited to the announcement of the target, in an adaptive learning context. Brzoza-Brzezina & Kot (2008) use a New Keynesian model in which agents estimate the dynamics of macroeconomic variables with a VAR model. They show that the publication of the central bank's output projections and future interest rates reduces information asymmetry between the central bank and agents and improves macroeconomic stabilization.

## 3. Expectations' Coordination and Reduction of Uncertainties

The model developed by Demertzis, Marcellino, & Viegi (2008) describes how agents' knowledge of the target makes it possible to coordinate their inflation expectations. Monetary policy is modeled as a game between agents and the central bank in the framework of analysis developed by Bacharach (1993). In the model, the central bank has a quadratic loss function with an equivalent weight on inflation and the output gap. Demertzis & Viegi (2009) show that the announcement of a target allows the central bank to anchor expectations on its target, which reduces the variability of inflation in three configurations:

First, supply shocks must be moderate in size, or the central bank will not be able to deliver the target inflation rate and lose credibility. This result fully supports the strategies followed by several early warning inflation targeting countries (notably New Zealand or England) to announce a target once a disinflation process has begun. When the economic environment is very stable or very unstable, the inflation targeting regime does not perform significantly better if the target is not announced.

Secondly, public information must be sufficiently noisy, otherwise the announcement of the target is superfluous.

Third, if the initial credibility of the central bank is strong, the credibility / success loop can kick in and anchor expectations on the target. These results support Walsh's (2009) assessment of inflation targeting: in developed countries, where public information is of good quality, it appears that the macroeconomic effects of inflation targeting are at least non-existent while

the contribution of inflation targeting seems much less debatable in emerging countries.

Transparency on central bank's objective tends to reduce inflation volatility by better coordinating inflation expectations of agents. Several other works address the coordinating role of central bank information, in particular transparency on analysis (shock forecasts) and on decisions (interest rate projections). In these models, this form of transparency influences firms' pricing behavior by limiting uncertainty about central bank equities.

Transparency on decisions and macroeconomic analysis has been the most developed in recent years among central banks (Geraats, 2009). It reduces the uncertainty of agents on the economy and thus makes monetary policy more understandable for them. However, disclosure of central bank information is not necessarily beneficial because agents incorporate this information into their expectations, which in turn can cause more macroeconomic variability.

Studies on the central bank's forecast earnings benefit are based on micro-based models (Walsh, 2007). In these models, firms in monopolistic competition set their prices according to the expected relative price. In the case where they have heterogeneous information, they are confronted with the higher-order uncertainty in which the adjustment times do not come from adjustment cost, but from the heterogeneity of the information that drives the firms to set different prices. It is on the adjustment period that information given by central bank can have a coordinating effect. Hellwing (2002) shows that the announcement of an inflation target eliminates the higher order uncertainty, which hides the general level of the future price. Adjustment times are then limited. On the other hand, supply shocks can have very persistent effects in the event of uncertainty. If the central bank makes public its forecasts on supply shocks, agents' expectations can be better coordinated on the potential product and supply shocks are much less persistent. Other studies have similar effects (Hellwing, 2004), Walsh (2006 & 2009) and Morris & Shin (2002) (Cornand and Heineman, 2008).

## 4. The Model

Since Barro& Gordon (1983), the modeling of the central bank's preferences was done through a symmetric quadratic loss function. Such a loss function is based on the principle of certain equivalence that illustrates the insensitivity of the monetary authorities to uncertainty since they behave as if their universe were tainted with certainties (Kobbi, 2016). This principle implies that the central banker attaches the same importance to a recession as to a positive difference in production. It appears that such an assumption is difficult to sustain since central banker is more down to the recession than to a positive gap of the same magnitude. As a result, symmetric loss functions are inappropriate for modeling central bank preferences. According to Brainard (1967), the precautionary principle is that the central bank integrates

uncertainty into its decision-making process and adopts more cautious behavior. In this sense, Cukierman (2000) introduces the loss function of the central bank of asymmetric preferences towards output gaps. Similarly, Ruge-Murcia (2003) models asymmetric preferences for inflation differentials on the assumption that positive deviations from inflation are more expensive than negative ones.

The article borrows the same methodological framework as that developed by Surico (2003). Indeed, this author develops a model based on a rather general specification since in the absence of a rigorous theoretical foundation, any non-quadratic specification would be unsatisfactory given the wide variety of possibilities available.

The evolution of the state variables is captured by the following two equations:

$$\Pi_t = \theta E_t \Pi_{t+1} + k y_t + \varepsilon_t^s \tag{1}$$

$$y_t = E_t y_{t+1} - \varphi(i_t - E_t \Pi_{t+1}) + \varepsilon_t^d \tag{2}$$

With $\Pi_t$ the level of inflation, $y_t$ the output gap and captures movements in the marginal costs associated with variations in excess demand. Equation (1) is a function in which each firm adjusts its price with a constant probability for any given period and regardless of the time elapsed since the last adjustment. Equation (2) is a version of the standard Euler equation of consumption combined with the relevant market assumption. The output gap is a positive function of its expected value and a negative function of the real interest rate $i_t - E_t \Pi_{t+1}$. $\varepsilon_t^s$ and $\varepsilon_t^d$ are respectively cost and demand shocks.

The objective of the central banker is to choose a level of interest rate at the beginning of the period, subject to available information at the end of the period. The central banker's program is as follows:

$$\underset{\{i_t\}}{Min}\ E_{t-1} \sum_{\tau=0}^{\infty} \delta^t L_{t+\tau} \tag{3}$$

With δ the discount factor and L is the loss time function whose specification is as follows:

$$L_t = \frac{e^{\left[\alpha(\Pi_t - \Pi^*)\right]} - \alpha(\Pi_t - \Pi^*) - 1}{\alpha^2} + \lambda\left[\frac{e^{(\gamma y_t)} - \gamma y_t - 1}{\gamma^2}\right] + \frac{\mu}{2}(i_t - i^*)^2 \tag{4}$$

λ and μ represent the central bank's aversion coefficients to fluctuations in output around its potential level and interest rate level fluctuations around its target level. This specification allows for deviations from the quadratic objective in that policy makers can differentially treat positive and negative deviations of target variables from their baseline values.

Starting from the assumption that the monetary authority chooses the level of its rate in a discretionary way, the problem of the central banker is to minimize the following quantity:

$$-E_{t-1}\left(\frac{e^{\left[\alpha(\Pi_t-\Pi^*)\right]}-\alpha(\Pi_t-\Pi^*)-1}{\alpha^2}\right)+\lambda E_{t-1}\left(\frac{e^{(\gamma y_t)}-\gamma y_t-1}{\gamma^2}\right)+\frac{\mu}{2}(i_t-i^*)^2+F_t$$

$$\text{Subjectto: } \Pi_t = ky_t + f_t \text{ and } y_t = -\varphi i_t + g_t \text{ avec } F_t \equiv E_{t-1}\sum_{\tau=1}^{\infty}\delta^\tau L_{t+\tau}$$

$$f_t \equiv \theta E_t \Pi_{t+1} + \varepsilon_t^2 \text{ and } g_t \equiv E_t y_{t+1} + \varphi E_t \Pi_{t+1} + \varepsilon_t^d$$

These different constraints reflect the fact that the central bank can not directly manipulate expectations. So the first order condition of this problem is:

$$-E_{t-1}\left(\frac{e^{\left[\alpha(\Pi_t-\Pi^*)\right]}-1}{\alpha}\right)k\varphi - E_{t-1}\left(\frac{e^{(\gamma y_t)}-1}{\gamma}\right)\lambda\varphi + \mu(i_t-i^*)=0 \tag{5}$$

Equation (5) represents the analytical solution to an optimal policy rule. It implicitly describes a general reaction function according to which the central bank moves the key rates as the optimal, potentially non-linear, response to the evolution of the economy (Surico, 2003). Because of this, the conventional linear form is a specific case. The linearization of the exponential terms of equation (5) by means of a Taylor order 1 expansion around $\alpha = \gamma = 0$ allows to have the reduced form of the following policy rule:

$$\begin{aligned}&-k\varphi E_{t-1}(\Pi_t-\Pi^*)-\lambda\varphi E_{t-1}(y_t)-\frac{\alpha k\varphi}{2}E_{t-1}\left[(\Pi_t-\Pi^*)^2\right]-\frac{\lambda\varphi\lambda}{2}E_{t-1}(y_t^2)+\\&\mu(i_t-i^*)+e_t=0\end{aligned} \tag{6}$$

Where $e_t$ is the residue of Taylor's development. In order to have a form to test empirically, we replace the expectations of inflation and the output gap by their current values and we obtain a linear expression in coefficient:

$$i_t = const + c_1\Pi_t + c_2 y_t + c_3\Pi_t^2 + c_4 y_t^2 + v_t \tag{7}$$

With $const \equiv i^* - c_1\Pi^* - c_3(\Pi^*)^2$

$$c_1 \equiv \frac{k\varphi}{\mu} - 2c_3\Pi^*;\ c_2 \equiv \frac{\lambda\varphi}{\mu};\ c_3 \equiv \frac{\alpha k\varphi}{2\mu};\ c_4 \equiv \frac{\lambda\varphi\gamma}{2\mu} \text{ and}$$

$$v_t = -\left\{\begin{matrix}c_1(\Pi_t - E_{t-1}\Pi_t) + c_2(y_t - E_{t-1}y_t) + c_3\left[\Pi_t^2 - E_{t-1}(\Pi_t^2)\right]\\ + c_4\left[y_t^2 - E_{t-1}y_t^2\right]\end{matrix}\right\} + \frac{e_t}{\mu}$$

**Table 1:** estimation results

| *Variables* | *Random Effects* | | *Fixed Effects* | | *MG* | | *DynamiquePanel* | |
|---|---|---|---|---|---|---|---|---|
| | *(1)* | *(2)* | *(3)* | *(4)* | *(5)* | *(6)* | *(7)* | *(8)* |
| **Inflation** | 0.166*** | 0.164*** | 0.164*** | 0.167*** | 0.241*** | 0.177** | -0.017 | -0.030 |
| | (0.058) | (0.058) | (0.062) | (0.062) | (0.064) | (0.070) | (0.021) | (0.018) |
| **Output (HP Filter)** | 0.000* | | 0.000* | | 0.000 | | 0.000* | |
| | (0.000) | | (0.000) | | (0.000) | | (0.000) | |
| Inflation Square | -0.015** | -0.015** | -0.014* | -0.015* | -0.026*** | -0.016* | 0.005** | 0.005** |
| | (0.007) | (0.007) | (0.008) | (0.008) | (0.009) | (0.010) | (0.002) | (0.003) |
| **Output Square(HP Filter)** | **-0.000**** | | **-0.000**** | | **-0.000**** | | **0.000***** | |
| | (0.000) | | (0.000) | | (0.000) | | (0.000) | |
| **Output (without trend)** | | 0.000 | | 0.000 | | -0.000 | | 0.000*** |
| | | (0.000) | | (0.000) | | (0.000) | | (0.000) |
| **Output Square (without trend)** | | **-0.000**** | | **-0.000**** | | **0.000** | | **-0.000**** |
| | | (0.000) | | (0.000) | | (0.000) | | (0.000) |
| **L.Rate** | | | | | | | 0.998*** | 0.836*** |
| | | | | | | | (0.003) | (0.055) |
| **AR (1)** | | | | | | | -2.642*** | -2.61*** |
| **AR (2)** | | | | | | | 2.4 | 0.375 |
| Observations | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| $R^2$ | | | 0.105 | 0.092 | | | | |

Standard-Deviations in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

### *4.1. Data*

This article analyzes the monetary policy of the Central Bank of West African States (BCEAO) whose monetary policy choices affect eight countries (Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo). For reasons of data availability, Guinea Bissau is not included in the estimate. The data come from the World Bank database and cover the period from 1996 to 2015, i.e. twenty observations on seven countries.

### *4.2. Estimations and Robustness*

The estimation of equation (7) leads to the BCEAO reaction function. The advantage of the function expressed by equation (7) is that it makes it possible to test the existence of asymmetrical preferences through the simultaneous meaning of parameters C3 and C4.

Inflation is measured through the Consumer Price Index (CPI) and the potential level of GDP is measured by two methods. A first one is to use the Hodrick and Prescott (HP) filter to extract the cyclical component of the GDP and a second method which consists to use the GDP without its trend component, ie the residual of the estimate GDP on a constant and the quadratic form of the trend.

In order to test the robustness of the results, we adopt an estimation approach using various techniques. Thus, we first used the estimators in fixed effect and in random effect. Then we move to error correction estimation with the use of the MG (Mean Group) estimator. Finally, we adopt a dynamic panel estimate. The variable to be explained in all estimates remains the BCEAO interest rate.

## 5. Discussion of Results

All estimates except (6) show that the squared parameters of inflation and output gap are simultaneously significant. This brings to two essential conclusions. The first is that the BCEAO's targeting policy is based on asymmetrical preferences. The second conclusion is that the evidence of asymmetric preferences is robust to both the estimation method and the measure of the output gap adopted in this paper. Indeed, as Surico (2003) notes, the arguments for an optimal monetary policy without commitment seem to be similar to the current practice of many central banks, which seldom bind their hands in the course of future actions.

Although modeling in the preference approach is not yet fully accepted as a framework for analyzing monetary policy decisions, there is a growing tendency in the literature to move away from strictly quadratic preferences. In this sense, Orphanides & Wilcox (1996) propose the so-called opportunistic approach to disinflation. In their model, the weights attributed to inflation and stabilization of production are not independent. Policymakers with these preferences place more emphasis on stabilizing output when inflation is low

but higher on inflation when inflation is above target. The results of Nobay & Peel (2003) show that in asymmetric preferences, many of the existing results on the temporal coherence problem are no longer needed.

When the loss function of the central banker is asymmetric, changes in the volatility of inflation and / or unemployment affect inflation at equilibrium. This suggests that shifting macroeconomic volatility may be a significant source of observed inflation trends (Doyle & Falk, 2010). Because an important factor in monetary policy is the extent to which policymakers are opposed to inflation in relation to their aversion to declining production. Their preferences are their private information and this has implications for their behavior (Sibert, 2002). But asymmetry can take many forms.

Aguiar & Martins (2005) distinguish three types of asymmetry: the precautionary demand for expansions of production, the demand for precaution for price stability and the asymmetry of smoothing of interest rates. They find evidence of a precautionary demand for price stability in the preferences revealed by the monetary authority. This type of asymmetry is in line with the European Central Bank's definition of price stability and the priority given to credibility by the monetary authority. Such evidence of asymmetrical preference seems to be better linked to the conduct of the monetary policy of the BCEAO, which remains largely in line with the European Central Bank.

According to Kobbi (2016), these asymmetric preference formulations are readily flexible enough to reflect the precautionary principle. Thus, a central bank is expected to have a precautionary demand against the recession from when it will be more downgraded to a negative output gap than a positive gap of the same magnitude. Similarly, a central bank is indicative of a precautionary demand for price stability if it approves a strong aversion to positive inflation differences than negative ones. Starting from the fact that the first objective of the BCEAO is price stability, it is logical to postulate that it has a great aversion to inflation rates higher than their target value.

What is furthermore to be considered is the issue of time inconsistency and inflationary bias. Balaban & Vinttu (2014), in defining the dynamic incoherence of monetary policy as an ex post deviation from the ex ante scenario of the plans formulated when they should be implemented, these authors note that dynamic incoherence stems from the fact that monetary policy makers choose to pursue short-term goals that lead to missed long-term goals. Our results show that the BCEAO's preferences are asymmetrical in its inflation targeting policy. It is important to know if this helps to strengthen the credibility of the monetary authority.

The results of Chesang & Naraidoo (2014) show that the asymmetric aversion of the central bank for the stabilization of inflation largely explains the fluctuations of inflation and that the monetary authorities seem to penalize inflationary rather than deflationary pressures. Overall, the deflationary bias of the central bank would allow a relatively stable tradeoff in output and

inflation, which could be useful for economic stability. It is then possible to think that the configuration of the conduct of monetary policy of the BCEAO is an element of reinforcement of its credibility.

## 6. Conclusion

This article has analyzed the targeting policy of the BCEAO through its preferences. In contrast to the traditional quadratic function approach, we take a more general analytical framework that offers the opportunity to rigorously test the nature of preferences. Using a fairly varied methodology to test the robustness of the effects obtained, two main results emerge. The conduct of the BCEAO's monetary policy is based on asymmetrical preferences and it is possible that such evidence contributes to strengthening its credibility. This has the effect of controlling the inflationary bias.

## Note

1. For example, the publication of supply shock expectations may (positively) affect inflation expectations, making it more difficult to stabilize inflation around its target (Cukierman (2001)).

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