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# CONTRIBUTION OF THE BCEAO'S MONETARY POLICY TO PRICE STABILITY IN MALI FROM 1970 TO 2009

**Ibrahima Diallo***

*Teacher – Researcher,
Faculty of Economic Sciences and Management of the University of Social Sciences and Management of Bamako (FSEG/USSGB), Banankoro-SENOU
Email id: man.diallo@hotmail.com

## ABSTRACT

*This paper empirically analyses the contribution of the BCEAO's monetary policy to price stability in Mali over the period 1970 – 2009. In terms of methodology, we used an error correction model (ECM). In general, the results show a relative inefficiency of the BCEAO's monetary policy on price stability in Mali. In addition, an increase in the import price index leads to an increase in the general price level in the short and long term. Similarly, the general price level in Mali remains sensitive to changes in the money supply in the short run, and the effect increases significantly in the long run. Thus, an improvement in the transmission mechanisms of monetary policy in Mali is essential.*

**KEYWORDS:** *Monetary policy, price stability, key rates, BCEAO, Mali.*
*JEL classification: E5, E19, E31.*

## 1. INTRODUCTION

Monetary policy is the regulation of the money supply according to objectives such as price stability or the stimulation of economic activity. In practice, central banks structure their monetary policy around a single final objective (price stability), intermediate objectives (e.g. rules for the evolution of the money supply) and instruments (interest rates and reserve requirements).

The purpose of monetary policy is to influence the economic and financial environment which, in turn, influences the actions of the monetary authorities, obliging the latter, in order to remain effective, to adapt to changes in this environment.

The interactions of monetary policy and its context occur at two levels. First, the relationship between monetary policy and the real and financial economic environment. Second, the role of monetary policy in the overall economic policy.

In the WAEMU zone, the evolution of monetary policy conducted by the Central Bank of West African States (BCEAO) can be divided into four main stages: the conduct of monetary policy between 1962 and 1975, the reform of money and credit policy, the reorganisation of monetary management rules and the implementation of the new monetary management system.

The BCEAO has opted for an inflation rate of less than or equal to two per cent as the main

objective of WAEMU monetary policy. This choice stems from the CFA franc's peg to the euro, as this target is the one adopted by the European Central Bank (ECB). However, in a fixed exchange rate regime with free movement of capital, it is impossible for the BCEAO to have a monetary policy that is permanently different from the anchor zone, i.e. the Euro zone, in accordance with the teachings of Mundell's triangle of incompatibilities.

This institutional attachment, inherited from the cooperation agreements between France and the WAEMU, therefore constrains the BCEAO in its ability to choose its monetary policy objective. Indeed, in a fixed exchange rate regime, inflation contributes to the progressive deterioration of external accounts and to the overvaluation of the exchange rate, thus weakening the parity between currencies, due to the loss of competitiveness that it generates. As a result, the two per cent inflation target adopted by the BCEAO, which is identical to that of the European Central Bank, seems imperative in view of the constraints imposed by the existence of a fixed exchange rate between the two zones. The adoption of such an inflation target may indeed seem overly restrictive for economies in underdeveloped countries (such as those of the WAEMU countries, including Mali) which would need seven per cent GDP growth to achieve the Millennium Development Goals (MDGs), particularly the goal of halving poverty (Nubukpo, 2007).

Over the period 1970 – 2009, Mali's economic situation has been difficult. It was marked by the Ivorian crisis, which disrupted the economy in September 2002; the surge in oil prices and the fall in gold production in 2003. On the other hand, the invasion of locusts in 2004 and the poor rainfall of the 2004 – 2005 agricultural season. In addition, the year 2008 was marked by global economic crises (oil, food and financial). In Mali, these were characterised by an increase in the cost of production factors and consumer goods.

Despite the persistence of the global crises, a genuine effort to control prices has enabled an average inflation rate (measured by the annual variation in the consumer price index in Bamako) of 1.7% to be achieved between 2002 and 2006. However, the average inflation rate was 9.2% in 2008 compared to 1.4% in 2007.

The analysis of these statistics on the economic situation in Mali shows a high volatility of the inflation rate. This calls into question the main objective of the monetary policy conducted by the BCEAO, which is price stability, in order to preserve the internal and external value of the currency.

To resolve the problem, we asked the following question: What was the impact of the monetary policy of the Central Bank of West African States (BCEAO) on the general price level in Mali from 1970 to 2009?

Given that in the WAEMU zone the same monetary policy instruments are applicable to all member countries, the effects of this policy differ according to the structure of the economies of the Union. It is therefore necessary to assess the impact of the BCEAO's monetary policy on the general price level in Mali. It is in this perspective that this work is carried out. Given that one of the priorities of the BCEAO is price stability and the fight against inflation, the monetary authorities of the BCEAO will be able to use the results of this work for planning purposes and, above all, for monetary forecasts.

The fundamental objective of this work is to determine the contribution of the BCEAO's monetary policy on the inflation rate in Mali during the period 1970 – 2009. More specifically, to achieve the general objective, it is necessary to evaluate the contribution of the BCEAO's monetary policy in Mali on the inflation rate. In the course of this work, we seek to verify the following hypothesis: a positive shock on the key interest rates of the BCEAO results in a negative effect on the general price level in Mali.

In addition to this introductory section, the rest of the paper is structured as follows: literature review; methodology and basic theoretical model; estimation of the model and interpretation of the results; conclusion.

## 2. Theoretical Model and Methodology

### 2.1. Theoretical model

In order to carry out an overall assessment of the effects of monetary policy on the general price level in Mali, we have drawn on the work of Nubukpo (2002); the model of Kahn et al. (1991) and that of Moser (1995). Indeed, the main determinants of inflation in West Africa have been the subject of several studies, namely those of Doe et al. (1997); Samba (1998) for the WAEMU countries; Moser (1995) for Nigeria and Sowa (1996) for Ghana.

The impact of changes in key interest rates on the inflation rate can be evaluated using the inflation model derived from the Kahn et al. model (1991), developed by Moser (1995) and taken up by Nubukpo (2002). Indeed, Moser (1995) derives an inflation equation which constitutes the reduced form of a structural model applied to the case of Nigeria. The model presented below does not include among the explanatory variables, variations in the nominal exchange rate, insofar as the parity between the CFA franc and the euro is fixed. Moreover, it is inspired by the work of Nubukpo (2002) and is much more explicit than the model of Kahn et al. (1991) and that of Moser (1995); the determinants of the money supply, by making it depend on variations (D) of the central bank's key interest rates (money market rate (IM) and repo rate (IPS)) and real GDP.

However, it should be borne in mind that there is a hierarchy between these rates in the sense that the repo rate should logically be set higher than the money market rate. This suggests the possibility of a strong complementarily between the two key interest rates.

The consumer price (IHPC), written in log – linear form, is assumed to depend: on the one hand on the cost of domestic goods (IPD) and on the other hand on the cost of imported goods (IPM) expressed in CFA francs:

$$\log IHPC = \alpha\left(\log IPD\right) + \left(1-\alpha\right)\left(\log IPM\right) \quad (1)$$

avec $0<\alpha<1$

Consequently, the domestic price depends on the tensions existing on the money market and the goods and services market. To this end, it will be a function, on the one hand, of the money supply $\left(M^{s}\right)$ and demand $\left(m^{d}\right)$ and, on the other hand, of the output gap (difference between actual output (PIBR) and potential output (PIBR*)):

$$\log IPD = \beta_1\left(\log M^{s} - \log m^{d}\right) + \beta_2\left(\log PIBR - \log PIBR^{*}\right) \quad (2)$$

Avec $\beta_1, \beta_2 \geq 0$

The money supply, in turn, depends on the central bank's key interest rates, namely the money market rate (IM) and the repo rate (IPS) and on real GDP:

$$M^{s} = G\left(\underset{(-)}{IM}, \underset{(-)}{IPS}, \underset{(+)}{PIBR}\right) \quad (3)$$

$$M^{s} = -b_1 IM - b_2 IPS + b_3 \log PIBR \quad (4)$$

Avec $b_1, b_2, b_3 > 0$

The demand for money depends on the real income of economic agents (GDPR)[1]:

$$m^{d} = F\left(\underset{(+)}{PIBR}\right) \quad (5)$$

[1] Such a formulation favours the transactional part of money demand, due to the embryonic nature of financial markets in sub – Saharan countries, which justifies the omission of the lending rate in the money demand function. Moreover, the BCEAO monetary programme uses the same formulation (Fisher equation).

$$m^d = b_4 \log PIBR \quad (6)$$

Avec $b_4 > 0$

Substituting equations (4) and (6) into equation (2) gives :

$$\log IPD = \beta_1 \left( -b_1 IM - b_2 IPS + b_3 \log PIBR - b_4 \log PIBR \right) + \beta_2 \left( \log PIBR - \log PIBR^* \right) \quad (7)$$

Equation (7) can be integrated into equation (1) to give :

$$\log IHPC = \alpha\beta_1 \left( -b_1 IM - b_2 IPS + b_3 \log PIBR - b_4 \log PIBR \right) + \alpha\beta_2 \left( \log PIBR - \log PIBR^* \right)$$
$$+ \left(1 - \alpha\right) \log IPM \quad (8)$$

Or again:

$$\log IHPC = -\alpha\beta_1 b_1 IM - \alpha\beta_1 b_2 IPS + \left( \alpha\beta_1 b_3 + \alpha\beta_2 - \alpha\beta_1 b_4 \right) \log PIBR$$
$$-\alpha\beta_2 \log PIBR^* + \left(1 - \alpha\right) \log IPM \quad (8.1)$$

By differentiating equation (8.1) the evolution of the inflation rate will follow the following function:

$$D\left(\log IHPC\right) = H\left( D(\underset{(-)}{IM}), D(\underset{(-)}{IPS}), D(\log \underset{(?)}{PIBR}), D(\log \underset{(-)}{PIBR^*}), D(\log \underset{(+)}{IPM}) \right) \quad (9)$$

In summary, the key interest rates used (the money market rate and the repo rate) are assumed to be negatively related to the evolution of the general price level, following the standard results of Keynesian and monetarist theories. Potential output, as aggregate supply, is also assumed to be negatively related to inflation (Moser, 1995). Indeed, the non – negligible share of agricultural production in the composition of aggregate supply in sub – Saharan countries and the deflationary impact on food goods generally exerted by a good agricultural season justify the hypothesis of an inverse relationship between aggregate supply and inflation.

However, the absence of infra-annual statistical series on potential output in Mali has led to the removal of this variable (potential GDP) from the estimates. Real GDP is likely to reflect a "demand effect" within the equation. The expected sign of this variable is indeterminate, as the value of its parameter depends on the relative evolution of money supply, money demand and the supply shock. The imported share of inflation is also a potential explanatory variable insofar as an increase in the price of imported products is reflected in domestic prices, particularly as a result of mark – up behaviour on the part of importers (Nubukpo, 2002).

### 2.2 Methodology

In order to assess the impact of the BCEAO's monetary policy on price stability in Mali, we used error correction models (ECM). Indeed, error correction models are appropriate for studies on economic policy or macroeconomic variables in general. Moreover, ECMs are dynamic models that incorporate both short – term and long – term changes in variables. To this end, they make it possible to identify the impulses responsible for short – or long – term imbalances in the various macroeconomic variables.

For this research we used second – hand data. They come from the PROMES (Macro econometric and simulation projection) database of the Central Bank of West African States (BCEAO). They cover the period 1970 – 2009.

For the estimations, the variables were expressed in logarithm and estimated using an error correction mechanism (ECM). However, if the variables are not stationary at level, we will proceed to cointegration tests. Indeed, the two-step method of Engle et al. (1987) is relevant in the case of large samples. On the one hand, this method has as a prerequisite the determination of the

number of cointegrating relationships; on the other hand, it has as a possible consequence the use of a vector error correction (VEC) model, in case of existence of cointegrating relationships >1.

However, in the context of this work carried out on a fairly small sample, the one-step method of Hendry (1986) is a priori suitable. Due to the small sample size, the use of a vector error correction model may pose a problem of degrees of freedom. Based on previous work and on the specificities of the Malian economy, we have chosen the following econometric model:

$$D(\log(PIBR)) = b_1 D((\log IHPC)) + b_2(IPS) + b_3(IM) + b_4 D((\log MM)) + b_5 D((\log CE)) + C + \varepsilon_t \quad (10)$$

With PIBR: Real Gross Domestic Product

IHPC: Harmonised Index of Consumer Prices

IPS: Repo rate

IM: Money market rate

MM: Money supply

CE: Credit to the economy

C: Constant

$\varepsilon_t$ : Error term.

**3. Estimation and interpretation of the results**

We will proceed to the study of the stationarity of the series. If the series are non-stationary, it is legitimate to be interested in their order of integration. To this end, we apply the tests of Dickey et al (1981) Fuller augmented on the LPIBR, LMO, LCE, LMM, IPS, IM and LIHPC series.

Indeed, the study of the stochastic process representative of macroeconomic variables requires the analysis of stationarity. This is subject to the following conditions:

- The average must be constant and independent of time: $E(Y_t) = E(Y_{t+s}) = v \quad \forall t$ et $\forall s$.

- The variance must be finite and independent of time;

- The autocovariance function depends on the time difference s: $Cov(Y_t \quad , \quad Y_{t+s}) = \gamma(s)$

- The different variables composing the $Y_t$ process must fluctuate around their average, which regularly returns to their long term equilibrium value.

- The dynamic mechanisms defined by the term $\varepsilon_t$ must generate stationary dynamics.

The increased unit root test of Dickey et al (1981), which makes it possible to determine the degree of stationarity (order of integration), consists in testing the significance of the coefficient $Y_{t-1}$ of the following model:

$$\Delta Y_t = \rho Y_{t-1} - \sum_{j=2}^{p} \phi_j \Delta Y_{t-j+1} + \varepsilon_t \quad \text{où} \quad \rho = (\phi - 1)(1 - \theta_1 - .... - \theta_{p-1}) \quad \text{and}$$

$$Y_t = (LPIBR_t \quad LIHPC_t \quad LMM_t \quad LCE_t \quad IPS_t \quad IM_t \quad IPM_t)'$$

The hypotheses of the Augmented Dickey Fuller test are:

$H_0$ : $\rho = (\phi - 1)(1 - \theta_1 - .... - \theta_{p-1}) = 0 \Leftrightarrow \phi = 1$ (Unit Root: non – stationary)

$H_1$ : $|\phi| < 1$ (Non Unit Root: stationary).

If the value of ADF Test Statistic is less than the value of Critical Value (or if PROB is less than 5%) then we accept the hypothesis H1: the series X is stationary.

If the value of ADF Test Statistic is greater than or equal to the value of Critical Value (or if PROB is greater than or equal to 5%) then we accept the hypothesis H0: the X series is non – stationary. The results obtained by applying the ADF test at the 5% threshold are summarised in Table 1 below.

**TABLE N°1: STATIONARITY TEST (ADF) ON THE LEVEL VARIABLES AT THE 5% THRESHOLD (AKAIKE CRITERION)[2]**

| Variables | Calculated value | Critical value | Number of delays | Stationarity | Constant | Trend | Conclusion |
|---|---|---|---|---|---|---|---|
| **LCE** | 3.21 | -1.95 | 0 | No | No | No | **No stationary** |
| **LIHPC** | 3.81 | -1.95 | 0 | No | No | No | **No stationary** |
| **LPIBR** | -1.43 | -3.53 | 0 | No | Yes | Yes | **No stationary** |
| **LMM** | 5.93 | -2.62 | 0 | No | No | No | **No stationary** |
| **IPM** | -2.31 | -3.53 | 1 | No | Yes | Yes | **No stationary** |
| **IPS** | -2.46 | -2.93 | 0 | No | Yes | No | **No stationary** |
| **IM** | -2.53 | -3.55 | 1 | No | Yes | Yes | **No stationary** |

Source: Author's calculations

The results of the test show that, at the 5% threshold, for none of these variables, the null hypothesis of the presence of a unit root can be rejected: the variables are not stationary in level. To this end, we conducted the ADF test on the variables in first difference. The main results are summarised in table N°2 below. The analysis of the results of the stationarity tests allows us to conclude that the series are stationary in first difference at the 5% threshold. In other words, they are integrated of order 1 or I(1).

**TABLE N°2 : STATIONARITY TEST (ADF) ON FIRST DIFFERENCE VARIABLES AT 5% THRESHOL**

| Variables | Calculated value | Critical value | Number of delays | Stationarity | Constant | Trend | Level of integration | Conclusion |
|---|---|---|---|---|---|---|---|---|
| **LCE** | -5.30 | -3.53 | 0 | Yes | Yes | Yes | I(1) | **Stationary** |
| **LIHPC** | -3.41 | -1.95 | 0 | Yes | Yes | No | I(1) | **Stationary** |
| **LPIBR** | -5.82 | -2.94 | 0 | Yes | No | No | I(1) | **Stationary** |
| **LMM** | -5.00 | -2.94 | 0 | Yes | No | No | I(1) | **Stationary** |
| **IPM** | -6.28 | -3.61 | 0 | Yes | Yes | No | I(1) | **Stationary** |

[2]For the ADF test, the critical values tabulated by Dickey – Fuller [1979] were used to determine the presence of a deterministic trend and/or a constant.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **IPS** | -8.35 | -1.95 | 0 | Yes | Yes | Yes | I(1) | **Stationary** |
| **IM** | -4.22 | -3.54 | 1 | Yes | Yes | Yes | I(1) | **Stationary** |

Source: Author's calculations

Formally, the presence of an equilibrium relationship between these variables is tested using statistical procedures, in this case those of Engle et al. (1987) and Johansen (1991; 1995). The term cointegration was introduced by Granger in (1981). The cointegration test allows us to verify the long-term equilibrium relationships that exist between the variables LCE, LIHPC, LPIBR, LMM, IPM, and IPS. A linear combination of these variables is written as :

$$LIHPC_t = \beta_0 + \beta_1 IPM_{1t} + \beta_2 IPS_{2t} + \beta_3 IM_{3t} + \beta_4 LPIBR_{4t} + \beta_5 LMM_{5t} + \mu_t \quad (11)$$

The vector $\beta = (\beta_1 \quad \beta_2 \quad \beta_3 \quad \beta_4 \quad \beta_5)'$ is called the cointegrating vector.

The cointegration test is carried out in two steps. First, we estimate the long – run model by the ordinary least squares method. Second, we apply an ADF test on the residual $\mu_t$ .The stationarity of the residual $\mu_t$ from this regression remains the main condition for the cointegration relationship to be accepted. It will be tested using the Dickey et al (1981) augmented test under the following assumptions:

$H_0$: Unit Root on the residue (Non – Cointegration) ;

$H_1$: Non Unit Root on the residue (Cointegration).

The residual equation is represented as follows:

$$\mu_t = LIHPC_t - \beta_0 - \beta_1 IPM_{1t} - \beta_2 IPS_{2t} - \beta_3 IM_{3t} - \beta_4 LPIBR_{4t} - \beta_5 LMM_{5t} \quad (12)$$

We apply the method of Johansen (1991; 1995). This method is a multivariate approach based on the maximum likelihood method. It is used to check the cointegration of the LPIBR, LMM, IPS, IM, IPM and LIHPC series by a cointegration rank test. The hypothesis test is as follows:

$H_0$: Non – cointegration (cointegration rank is zero) ;

$H_1$: Cointegration (cointegration rank greater than or equal to 1).

The cointegration hypothesis is accepted if LR (Likelihood Ratio) is greater than CV (Critical value). It is rejected otherwise.

Under the hypothesis of an optimal lag specification due to the relatively small number of observations, the Johansen cointegration test shows us a single cointegrating relationship following the trace and maximum eigenvalue statistics at the 5% threshold. Therefore, we can assert the existence of a single cointegration relationship between the variables and use an error correction model (ECM). We propose to estimate the error correction model in accordance with Hendry's (1986) representation of the model by the one – step least squares method.

To this end, based on the specificities of the Malian economy and drawing on previous work, we have adopted the following inflation model:

$$D(\log(IHPC)) = a_1 D(IPM) + a_2 D(IPS) + a_3 D(IM) + a_4 D((\log PIBR)) + a_5 D((\log MM)) + a_6 \log(IHPC_{-1}) + a_7 \log(IPM_{-1}) + a_8 (IPS_{-1}) + a_9 (IM_{-1}) + a_{10} \log(PIBR_{-1}) + a_{11} \log(MM_{-1}) + C + \mu_t \quad (13)$$

With the following theoretical signs:

$a_1 > 0$, $a_2 < 0$, $a_3 < 0$, $a_4$?, $a_5 > 0$, $a_6 < 0$, $a_7 > 0$, $a_8 < 0$, $a_9 < 0$,$a_{10}$?,$a_{11} > 0$

In this expression, the coefficients $a_1$ to $a_5$ characterise the short – term dynamics, while the

coefficients $a_6$ to $a_{11}$ allow the derivation of the long – term equilibrium behaviour of the inflation rate. The coefficient $a_6$ is the error correction coefficient, it must be less than unity and negative. The error correction coefficient indicates the speed of adjustment of the endogenous variable Y to return to the long term equilibrium following a shock. The coefficient represents the model constant, $\mu_t$ is the error term.

The short – run elasticities are : $a_1, a_2, a_3, a_4$ et $a_5$.

The long – run elasticities are : $-\frac{a_7}{a_6}, -\frac{a_8}{a_6}, -\frac{a_9}{a_6}, -\frac{a_{10}}{a_6}$ et $-\frac{a_{11}}{a_6}$.

The results of the estimation can be summarised as follows:

$$\mathrm{D(LIHPC)} = \underset{}{0,0006}D\left(\underset{(1,41)}{IPM}\right) + \underset{(0.04)}{0,0003}D\left(IPS\right) + \underset{(0,60)}{0,0070}D\left(IM\right) + \underset{(0,19)}{0,0490}D\left(LPIBR\right) + \underset{(2.62)}{0,3037}D\left(LMM\right)$$

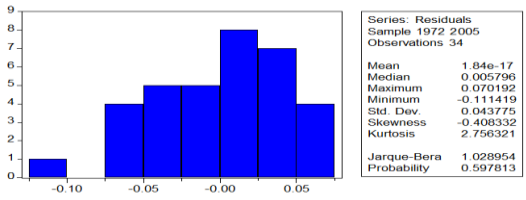
$$\underset{(-2,78)}{-0,4649}\,LIHPC_{-1} + \underset{(1,15)}{0,0004}\,IPM_{-1} - \underset{(-0,11)}{0,0009}\,IPS_{-1} + \underset{(0,79)}{0,0049}\,IM_{-1} - \underset{(-1,96)}{0,0006}\,LPIBR_{-1} + \underset{(2,36)}{0,2670}\,LMM_{-1} + \underset{(2,88)}{0,9464}$$

$R^2 = 0,599, R^2 adj = 0,399, DW = 1,646, \Pr ob(F - statistic) = 0,013$, The numbers in brackets are the student t's.

The results of the regression of the inflation equation show that the error correction term associated with the recall force $a_6$ is negative (-0.465) and is significantly different from zero at the statistical threshold of 5% (the Student's t is greater than 1.96 in absolute value). In other words, there is an error correction mechanism: in the long term, the imbalances between the inflation rate, the import price index, the BCEAO key rates (repo rate, money market rate), the money supply and real gross domestic product compensate each other so that the series have similar evolutions. The value of $R^2$ = 60% illustrates a good explanatory power of the model. The Ramsey RESET test gave probabilities higher than 5%, hence the correction model is well specified. The CUSUM and CUSUM SQUARE tests showed that the model is structurally and punctually stable, as the curve does not cut the corridor.

**TABLE N°3: SUMMARY OF MODEL STABILITY TESTS**

**Jarque – Bera Test**




**Chow Breakpoint Test: 1994**

| | | | |
|---|---|---|---|
| F-statistic | 1.008577 | Probability | 0.501909 |
| Log likelihood ratio | 26.96625 | Probability | 0.007814 |

**White Heteroskedasticity Test**

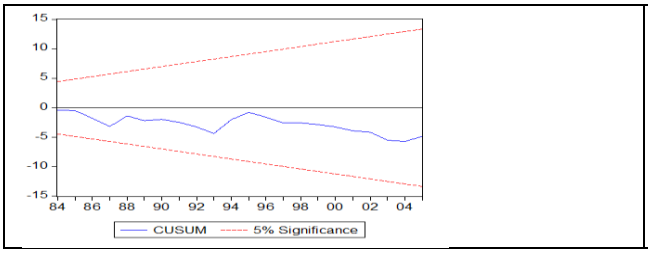
| | | | |
|---|---|---|---|
| F-statistic | 1.054814 | Probability | 0.483359 |
| Obs*R-squared | 23.06622 | Probability | 0.397999 |

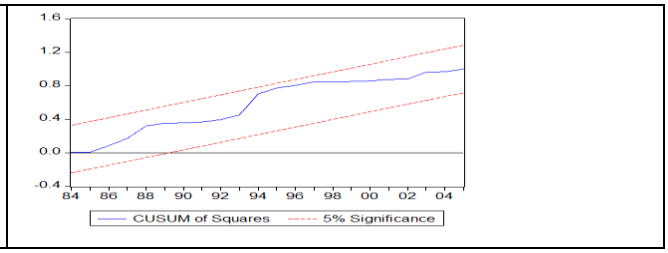
**Ramsey RESET Test**

| | | | |
|---|---|---|---|
| F-statistic | 2.120018 | Probability | 0.146207 |
| Log likelihood ratio | 6.537295 | Probability | 0.038058 |

**CUSUM Test**

**CUSUM Squares Test**






Source: Author's calculations

The coefficient $a_6$ represents the speed at which any imbalance between the desired and actual levels of the inflation rate is absorbed in the year following any shock. It adjusts 46% of the imbalance between the desired and actual levels of the inflation rate. This 46% is low to stabilise the fluctuations of the Malian economy. This may explain the volatility of prices.

### 3.1. Analysis of short – term elasticities

The import price index, the BCEAO's key rates (repo rate, market rate), real gross domestic product and the money supply have a short – term impact on the dynamics of the harmonised consumer price index.

Indeed, the short – term elasticity of the harmonised consumer price index in relation to the import price index is $a_1$ = 0.0006, which implies that in the short term a 10% increase in the import price index leads to a 0.06% increase in the general price level. This result is in line with economic theory because an increase in import prices often leads to an increase in the general price level in the short term.

The short term elasticity of the harmonised consumer price index with respect to the repo rate is $a_2$ = 0.0003, which implies that in the short term if the repo rate increases by 10% the general price level increases by 0.03%. In effect, the repo rate has a significant impact contrary to the expected direction in the short term. This result is in line with that obtained by Nubukpo (2002). The author concludes that the repo rate has a significant impact contrary to the expected direction, both in the short and long term, in the Union and in all countries except Benin and Niger.

The short – term elasticity of the harmonised consumer price index with respect to the money market rate is $a_3$ = 0.0070, which means that in the short term if the money market rate increases by 10% the general price level increases by 0.07%. In effect, the money market rate has a significant impact contrary to the expected direction in the short run. This result is contrary to that obtained by Nubukpo (2002) for the case of Mali. However, it is in line with the conclusions of the same author for the case of Niger. The author concludes: "With the exception of Niger, an increase in the money market rate causes a significant decrease in inflation in all WAEMU countries".

The short – run elasticity of the harmonised consumer price index with respect to real gross domestic product is $a_4$ = 0.0490, which implies that in the short run if Mali's real gross domestic product increases by 10%, then the general price level increases by 0.49%.

The short – run elasticity of the harmonised index of consumer prices with respect to the money supply is $a_5$ = 0.3037, which implies that in the short run if the money supply in Mali increases by 10%, then the general price level increases by 3.04%. The general price level remains sensitive to changes in the money supply. This is consistent with classical theory. According to the classics: an increase in the money supply results in an increase in prices (inflation) and not in output.

### 3.2. Analysis of long – term elasticities

The import price index, the BCEAO's key rates (repo rate, market rate), real gross domestic product and the money supply have a long-term impact on the dynamics of the harmonised consumer price index. The elasticities generated can be interpreted as follows:

Indeed, the long – term elasticity of the harmonised price index with respect to the import price index is: $-\frac{a_7}{a_6}=-\left(\frac{0,000437}{-0,464878}\right)=0,0009$ which implies that in the long run a 10% increase in the import price index leads to an increase in the general price level of 0.009%. This result is in line with economic theory because an increase in the import price index often leads to an increase in the general price level in the long term.

The long – term elasticity of the harmonised price index with respect to the repo rate is: $-\frac{a_8}{a_6}=-\left(\frac{-0,000922}{-0,464878}\right)=-0,0020$ this means that in the long term if the repo rate increases by 10% the general price level falls by 0.02%. This is consistent with economic theory. When the central bank increases the key interest rates, the commercial banks will pass on the increase in their interest rates. This leads to a decrease in the volume of loans and therefore a decrease in prices.

The long – run elasticity of the harmonised consumer price index with respect to the money market rate is: $-\frac{a_9}{a_6}=-\left(\frac{0,004890}{-0,464878}\right)=0,0105$ this implies that in the long run a 10% increase in the money market rate results in an increase in the general price level of 0.10%.

The long – term elasticity of the harmonised index of consumer prices in relation to real gross domestic product is: $-\frac{a_{10}}{a_6}=-\left(\frac{-0,000588}{-0,464878}\right)=-0,0013$ this means that in the long term a 10% increase in gross domestic product results in a decrease in the general price level of 0.013%.

The long – run elasticity of the harmonised consumer price index with respect to the money supply is: $-\frac{a_{11}}{a_6}=-\left(\frac{0,266979}{-0,464878}\right)=0,5743$ this implies that in the long run, if the money supply increases by 10%, then the general price level increases by 5.74%. The effects of the money supply on the general price level increase significantly in the long run. This result corroborates the one obtained by Kahn et al (1991). Their work shows that an increase in the money supply, following a reduction in the central bank's key interest rates, results in an increase in the general price level in the economy, all other things being equal. This result is consistent with the teachings of the quantitative theory of money.

## 4. CONCLUSION

The inflation model equation suggests that the variables that explain the process of short and long term dynamics of the general price level in Mali are: the import price index, the BCEAO key rates (repo rate, money market rate), real gross domestic product and money supply. These variables explain 60% of the movements in the general price level in Mali. This percentage shows that other factors can explain the variation of the general price level in Mali (see Nubukpo (2002)). The author concludes that the cereal deficit in the Sahel is generally considered to be one of the main factors behind the price increase. Indeed, it should be recalled that theoretically, the non-monetary determinants of inflation are cost – push inflation, demand – pull inflation and imported inflation. Apart from cost-push inflation and demand-pull inflation, which do not appear explicitly in the equation used in this study, it should be noted that the possibility of imported inflation (MPI) is taken into account.

Generally speaking, the relative ineffectiveness of the BCEAO's key rate policy on price stability in Mali highlights the need to consider other levers likely to increase the effectiveness of monetary policy.

- The need to evaluate the impact of the financial structure to ensure an efficient transmission of

monetary impulses, which will allow a search for more compliant alternatives for financing economic activities;

- The use of financial innovations and the connection of the different compartments of the financial market to ensure the effectiveness of the policy of key rates in regulating liquidity in Mali.

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