The Effectiveness of Monetary Policy Indicators in Inflation Targeting An empirical Study Using the ARDL Model for Algerian economy During 1990-2018

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Abstract:
    Through this paper, we have tried to include a empirical study on the effectiveness of monetarypolicy indicators in inflation targeting in Algeria during 1980-2018 usingthe ARDL model, where findings show a common integration of study variables. In addition, there is a correlation between monetary policy variables and long-term and short-term inflation rates.
Keywords: Inflation, Monetary Policy, interest rate, Algeria, ARDL Model
JelClassificationCodes: E4, E5

1. INTRODUCTION

    During the 1980s, the Algerian economy experienced structural reforms as a result of the decision to abandon the oriented economy and the trend towards a liberal economy. It liberalized its foreign trade, opened up to the outside world and opened up the offer of investment to foreigners, a transformation in the Algerian economy.

    Poses major challenges in adapting to these developments by abandoning old methods of running the national economy, despite reforms that Algeria had begun to implement, it had not been able to find solutions to economic imbalances, and It had been one of the most significant problems causing them.

    Despite several attempt sat circumstantial treatment, these reforms were accompanied by an average inflation rate of 18.56% As a median for

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the 1990s to (%) as an average for the (2000-2018) period, overall price levels have continued to rise annually This is due to the evolution of economic variables and fiscal and monetary policies among themselves.

1-1- Search problem:

Through the above, the following problems may beraised:

How much did monetary policy variables contribute to inflation targeting in Algeria during the period 1990-2018?

1-2- Research hypotheses:

Total indicators of a monetary nature are the most important determinants of inflation in Algeria;

There is a long-term relationship between monetary policy variables and inflation in Algeria.

1-3- Importance of research:

The study is important in that it addresses the impact of monetary policy indicators on the phenomenon of inflation in Algeria.

1-4- Research methodology:

In order to answer the problem at hand, we used the descriptive curriculum by describing previous schools' view of the variables affecting inflation.

and the analytical and experiment al approach, in order to build the standard model according to the self-regression methodology of the slow time gaps ARDL.

2. The contribution of monetary policy to inflation targeting.

The question of the relationship between inflation and monetary policy indicators has been the subject of discussion among many economists as to whether or not the relationship exists between them and their nature, as well as the trend of causality, this debate and the attraction of ideas for the search for ideas have intensified This debate and the attraction of ideas to search for the best economic policy that could solve the economic crisis of 1929 has intensified, so that theories have been taken up. Economic theories have essentially addressed the impact of monetary policy on inflation through the correlation between the evolution of money supply and prices, where it is considered to be Cash school leaders are a

purely monetary phenomenon, giving great importance to the amount of money in circulation as a price-level determinant with regard to the taking into account the effect of the change in real income and the change in demand for money as an explanation for the overall rise in the price level, This proposition is more realistic and valid compared to classical and Keynesian theory (Frank & Bernanke, 2007).

This school focuses on the relationship between the monetary mass and the general level of prices. Monetary theory to explain inflation has relied on the theory of the amount of money put forward by classical economists, giving them new explanations and developments, the school's leaders see inflation as a result of the imbalance between the supply of and demand for money, In other words, any increase in the money supply will inevitably lead to a rise in the price level, with a correlation between the increase in the overall price level and the growth in the amount of money in circulation (Slavin, 2002).

With the beginning of the 1990s, the first inflation-targeting experiments began as a monetary policy management system in an increasing number of developed countries Starting in 1990, Canada in 1991, and then in the United Kingdom in 1992, followed by other industrialized countries, Australia and Sweden in 1993. Achieving low and stable inflation rates in these countries has encouraged a number of developing countries to adopt policy, such as Chile and Poland, 1999.

Inflation targeting was defined as a monetary policy system characterized by the public announcement of the official target of areas or a quantitative target for the rate of inflation for one or more periods of time, with the apparent recognition that long-term reduction and stabilization of inflation is the primary objective of policy Long-term inflation stability is the primary objective of monetary policy (Morón&Winkelried, 2005). The Inflation Targeting Framework includes four main elements (Heenan, Marcel, & Scott, 2006):

- Explicit delegation of price stability control to the Central Bank as a primary monetary policy objective and a high degree of operational

autonomy;

- Explicit delegation of price stability control to the Central Bank as a primary monetary policy objective and a high degree of operational autonomy;
- explicit quantitative inflation targets;
- Central Bank accountability for performance in achieving inflation target, primarily through high-transparency requirements of strategy mainly through high-transparency requirements for policy strategy and implementation;
- A policy approach based on forward-looking assessment of inflationary pressures; Taking into account a wide range of information.

These elements reflect both theory and experience that suggests that central banks cannot consistently pursue and achieve multiple objectives, such as reducing inflation and Unemployment, using one basic means - the policy-determined interest rate - also recognizes that monetary policy can be used in These elements also recognize that, in the long run, monetary policy can affect nominal rather than real variables (which are adjusted for inflation). High inflation harms growth and equitable income distribution, and expectations and credibility have a significant impact on the effectiveness of monetary policy. (Bean, 2004).

3. Methodology and analysis of the results of the standard study.

3.1 Model used:

(Pesaran, Smith, &Yongcheol, 2001) developed a methodologythatallows more integrated variables such as I (0) and I(1) to becombined. Not all variables are required to be stable at the samelevel, However, the only condition for the application of thismethodologyisthat the time seriesshould not be I-class II I(2) integrated. The study model canbewritten in final form as follows:

$$\Delta LCPI = \alpha_0 + \sum_{i=0}^{p-1} \beta_{1i} \Delta LCPI_{t-1} + \sum_{i=0}^{q_1-1} \beta_{2i} \Delta LTAUCH_{t-1} + \sum_{i=0}^{q_2-1} \beta_{3i} \Delta LTAUINT_{t-1} + \sum_{i=0}^{q_3-1} \beta_{4i} \Delta LMM$$
$$+ \phi_1 LCPI + \phi_2 LTAUCH + \phi_3 LTAUINT + \phi_4 LMM + u_t$$

Where they represent:

Δ First differences;

μ The errorlimit for the first model;

α_0 Expresses the constant in the twomodels;

$\phi_i \forall i = 1,2,....,4$ Represents the flexibility of the study variables and reflects the   long-termrelationshipbetween   the   dependent   variable   and otherindependent variables in the model;

$\beta_i \forall i = 1,2,....,4$ Expresses   the   short-termrelationshipbetween   the dependent variable and otherindependent variables in the model.

3.2 Microscopic test time series:

Time series data is one of the most important data used in applied studies, . Especially those that rely on the construction of regression models to estimate the economic relationship, and these studies assume that the time series used are stable. That's because the absence of estrangement leads to standard problems, such as the problem of pseudo-decline, when we say about the time chain that it's stable if it has a fixed arithmetic medium and time-independent variation (Terence, 2015), that is, it meets the following conditions. That is, it meets the following conditions (Gourieroux&Monfort, 1990):

- ▪ Stability of average values over time $\mathrm{E}(x_t) = \mu, t \in Z$;
- ▪ The   contrast   must   be   over   and   fixed   over   time $V(x_t) = \delta_x^2 = \gamma_0 < +\infty, t \in Z$;
- ▪ The difference between two values of the same variable is independent of time $\mathrm{cov}(x_{ti}, x_{t\pm h}) = \gamma_h, t \in Z, h \in Z$.

In other words, the time series is stable if it is free of the General Direction Vehicle and the Quarterly Vehicle, nor in any time change (Bourbonnais, 2015)

In 1988(Phillips &Perron, 1988) he introduced a test to detect the existence of the root of unity, which enables the distinction between stable and non-stable time series.Which makes it possible to distinguish between stable and unstable time series, as this test has taken into account how to

deal with variation. In this test, consideration was given to how to deal with error variation using an unmarked correction of test statistics (Dickey & Fuller, 1981); In order to overcome the problem of self-association between errors, the Phillips &Perron test differs from the Dickey-Fuller test.) In the sense that it does not contain slow values of differences, and allows for an average not equal to zero and a linear direction of time, it is based on the same formulas as models However, it is based on the same formulas as the **Dickey-Fuller test models This test shall be conducted in accordance with the following steps:**

- Estimating the base models of the Dickey-Fuller test by the small squares method and calculating the accompanying statistics, where $\hat{\varepsilon}_t$ represents the gateways;
- Short-term variation estimation, which is the arithmetic average of the two gates;

$$\hat{\sigma}^2 = \frac{1}{N} \sum_{t=1}^{T} \hat{\varepsilon}_t^2$$

- Estimate of long-term variation extracted through common variations of previous models;

$$s_t^2 = \frac{1}{N} \sum_{t=1}^{N} \hat{\varepsilon}_t^2 + 2 \sum_{i=1}^{l} \left(1 - \frac{i}{l+1}\right) \sum_{t=i+1}^{N} \hat{\varepsilon}_t \hat{\varepsilon}_{t-i}$$

- In order to estimate the long-term variation, it is necessary to determine the number of delays based on the total number of observations;

$$l \approx 4(N/100)^{2/9}$$

Phillips & Perron statisticmeasurement :

$$t_{\hat{\phi}_1}^* = \sqrt{k} \times \frac{(\hat{\phi}_1 - 1)}{\hat{\sigma}_{\hat{\phi}_1}} + \frac{N(k-1)\hat{\sigma}_{\hat{\phi}_1}}{\sqrt{k}}$$

and

$$k = \frac{\hat{\sigma}^2}{s_t^2}$$

Compares thisstatisticwith the critical value of the MacKinnon table.

The results of the unit root tests of the standard model used using Phillips &Perron data are at a moral level of% 1, 5, 10% for variables: Consumer Price Index (LCPI), Real Exchange Rate (LTAUCH), Real

Interest Rate (LTAOINT), Cash Block (LMM).

The results of the estimate were as follows :

Table 01: Phillips &Perron results for variables

Microscopic time seriesstudyatlevel						
Decision	**Prob**	**PP_{tab}**			**PP_{cal}**	variables
		%10	**%5**	**%1**		
significantlyunstableover all trend	0.003	-3.225	-3.580	-4.323	-4.834	*LCPI*
Stable	0.000	-2.625	-2.971	-3.689	-5.932	*LTAUCH*
Unstable	0.164	-1.609	-1.953	-2.650	-1.334	*LTAUINT*
significantlyunstableover all trend	0.009	-3.225	-3.580	-4.323	-4.343	*LMM*
MicroscopicStudy of Time Seriesat First Difference						
Decision	**Prob**	**PP_{tab}**			**PP_{cal}**	variables
		%10	**%5**	**%1**		
Stable at 5%	0.039	-1.609	-1.953	-2.653	-2.061	*LCPI*
Stable	0.001	-1.609	-1.953	-2.653	-3.385	*LTAUINT*
Stable	0.000	-1.609	-1.953	-2.653	-7.828	*LMM*

Source: Prepared by researchers based on the output of Eveiws9

Through the results of the time series stability test table, which shows us that the premise of noth that there is a root for unity cannot be rejected, for everyone (LCPI, LTAUINT, LMM) That is, these time series are unstable at the level where the calculated values were lower than the critical values extracted from a table. MacKinnon is at an indicative level (1%), (5%), (10%), while it is accepted for the real exchange rate variable (LTAUCH) That is, the chain is stable at the level where the calculated value was lower than the critical values extracted from a table. MacKinnon is at an indicative level (1%), (5%), (10%), and on an examination of each (LCPI, LTAUINT, LMM) At the first difference it turns out that the infinitesimal hypothesis for the first differences can be rejected meaning that it is stable after taking the first differences. Thus the stability of the time series brings us the requirement to use the self-regression model of slow time gaps (ARDL).

3-3- Joint integrationstudy:

Common integrationmeansthattherecanbe a long-term balance betweenunstable time series, That is, the long-termproperties of time seriescanbematched, allowing for traditionalcommonintegration tests as a test (Engle& Granger, 1987) used in onlytwo-variable models, a test (Johansen, 1988) used in multi-variable models has the potential to test the existence of a commonintegration of integrated time series of only the samedegree. Therefore (Pesaran, Smith, &Yongcheol, 2001) developed a methodologythatallows more integrated variables such as I (0) and I (1) to becombined not all variables are required to be stable at the samelevel, as the overallsignificance of the model must betested by a statistical F. the overallsignificance of the model must betested by a non-standard distribution Wald (statistical F) and comparedwith a scheduled and calculated F by such a party thatthere are twocritical values (minimum I(0) bound value, upper I(1) bound value) as:

- The minimum value assumes that all variables are stable fromlevel I (0) and if the calculated value of F islessthan the value of the upperlimit, i.e., thereis no commonintegration of variables;
- The value of the upperlimit assumes the stability of variables at the first difference I (1) and if the calculated value of F The calculationisgreaterthan the value of the upperlimit. This meansacommonintegration of variables and a long-termequilibriumrelationship;
- If the calculated F value isbetween the cap value and the floor value, the results are not specified.

After the *Wald* joint integration test, the resultswere as follows:

Table 02: Wald test results for commonintegration of variables

ARDL Bounds Test		
Date: 02/20/20 Time: 20:15		
Sample199:0 2018		
Included observations: 25		
NullHypothesis: No long-runrelationshipsexist		
Test Statistic	Value	k
F-statistic	11.39401	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound

10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

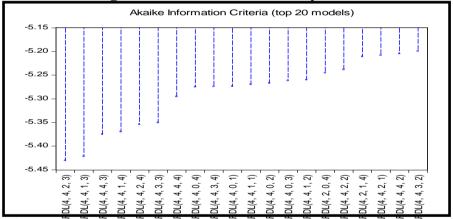**Source: Prepared by researchersbased on the output of Eveiws9.**

From the above table we note that the F (11.39401) statistical value of the *Wald* test isgreaterthan the I(1) bound for each (%) moral score, (2.5%), (5%), (10%), fromwhichwereject the hypothesisthatthereis a equilibriumbetween long-termstudy variables.

3-4- Model estimation:

Beforeconducting the model assessment, the optimal delayperiodshouldbedetermined in accordance with the AIC standard, where the resultsshowedthat the best slowing model is ARDL (4.4.2.3), thisisillustrated in the following figure:

Figure 01: Results of the delay model

Source: Prepared by researchers based on the output of Eveiws9.

Wew ill therefore measure the parameters in the long term, with the following gresults:

Table 3: Long-TermParameterCapabilities

Long Run Coefficients			
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LMM	0.259600	0.076854	3.377809	0.0097
LTAUCH	0.233767	0.161208	1.450098	0.1851
LTAUINT	0.078338	0.087938	0.890840	0.3990
C	-3.949340	1.742842	-2.266034	0.0532

Source: Prepared by researchersbased on the output of Eveiws9.

From the table above, we note that all variables have a direct relationship to the inflation rate, as well as statistical demorality for both the real exchange rate and the real interest rate, which means that variables have no effect on inflation in the long term, either for a variable of the cash mass, a significant statistic would beat the level of 5%, indicating a long-term impact on inflation, from this wew ill beassessing the error correction model for the *ARDL* model where the resultswere as follows:

Table 04: Results of the error correction model estimate

ARDL Cointegrating And Long RunForm				
Dependent Variable: LCPI				
Selected Model: ARDL(4, 4, 2,3)				
Date: 02/20/20 Time: 20:29				
Sample199:0 2018				
Included observations: 25				
CointegratingForm				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	0.226363	0.187580	1.206753	0.2620
D(LCPI(-2))	-0.323670	0.171447	-1.887869	0.0957
D(LCPI(-3))	0.344545	0.148272	2.323732	0.0486
D(LMM)	0.006035	0.077011	0.078361	0.9395
D(LMM(-1))	-0.133069	0.078612	-1.692732	0.1290
D(LMM(-2))	0.080532	0.072055	1.117646	0.2962
D(LMM(-3))	-0.170931	0.068509	-2.495017	0.0372
D(LTAUCH)	-0.009456	0.092831	-0.101864	0.9214
D(LTAUCH(-1))	-0.052947	0.061502	-0.860907	0.4143
D(LTAUINT)	0.049603	0.031062	1.596928	0.1489
D(LTAUINT(-1))	0.000886	0.035639	0.024850	0.9808
D(LTAUINT(-2))	0.048949	0.030952	1.581469	0.1524
CointEq(-1)	-0.494459	0.078025	-6.337218	0.0002
Cointeq = LCPI - (0.2596*LMM + 0.2338*LTAUCH + 0.0783*LTAUINT-3.9493)				

Source: Prepared by researchers based on the output of Eveiws9.

The error correction coefficient represents an attraction towards long-terme quilibrium, and from the table above we note that it has a negative signal (-0.4944), i.e. the correction velocity That is, the long-term correction velocity is 49.44% and is statistically significant at 5% and evenat 1%, which means that the model is stable and there's a long-term relationship between the variables in the model, so the rate of inflation is

expressed in the real exchange rate, the monetary mass with us is vast and the real interest rate has a common integration. From the results produced by the error correction model, we note that they are not very different from the results of the long-term model, as we note that the effect of the real exchange rate has a direct relationship with the inflation rate in the short term, which corresponds to economic theory, the relationship between the monetary mass and the inflation rate is a direct one in the short term. This is also consistent with economic theory, and for the wage mass, it has an inverse relationship with the rate of inflation, and it is atodds with economic theory.

4. CONCLUSION

Inflation is one of the most important macroeconomic problems facing many countries in the world, developed and developing alike this is because of the significant negative effects of this phenomenon on the economy as a whole, and therefore the treatment or mitigation of inflation is a key objective. Through this research paper, by applying the self-regression model of slow ARDL time gaps, this research paper produced the following results:

- There is a common integration of study variables, namely, the general level of prices, the real exchange rate, the real interest rate and the monetary mass. That is, they follow almost similar behavior;
- Estimates of the long-term ARDL model showed that independent variables have a direct relationship to the consumer price index (CPI) expressed by inflation This is consistent with economic theory, but statistically it is unethical, other than the variable of the monetary mass;
- In the short term, we found that the real interest rate and the cash mass are directly related to the consumer price index, which is a statistically moral relationship. We also found that the first delay of the CPI has a positive and moral impact on the CPI as for the real exchange rate, its relationship is counterproductive and it is contrary to economic theory and, in addition, the relationship is statistically

unsignificant.

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