The impact of monetary policy on economic growth of Algeria

أثر السياسة النقدية على النمو الاقتصادي في الجزائر

BOUCHETARA Mehdi
bouchetara_mehdi2002@yahoo.fr
Tlemcen University

DR BENDAHMANE Med el Amine
med-amin8586@live.fr
Tlemcen University

Abstract:
This research paper focuses on the impact of monetary policy on GDP. GDP definitely is affected by the state's monetary policy. Research papers by various authors have been studied in this context to prove the hypothesis and after a thorough analysis using regression analysis technique, it was observed that the relationship between the two exists. The data of Algeria from 1990 to 2012 have been used to get the conclusion. The study proved that monetary policy significantly affects the GDP of an economy obviously various unknown factors also affect GDP. The growth of the money supply has a huge impact on GDP. The research study can also be used for development projects for the growth of the economy, improving the quality of household production, the underground economy, health and life expectancy, environmental, political immunity.
key words:
Monetary policy, Gross Domestic Product, Inflation, Money supply, Oil, Algeria .

Résumé:
Cet article de recherche se concentre essentiellement sur la relation empirique entre la croissance et l'inflation. Ce dernier sans aucun doute est affecté par la politique monétaire de l'État. Les documents de recherche de divers auteurs ont été étudiés à cet égard à prouver l'hypothèse et après une analyse approfondie en appliquant la technique d'analyse de régression, on a observé que la relation entre les deux existe mais négative. Les données de l'Algérie à partir de 1990 au 2012 ont été utilisées pour entraîner la conclusion. L'étude prouve que l'inflation affecte considérablement le PIB d'une économie, évidemment divers facteurs inconnus affecte également le PIB. La croissance de la masse monétaire a un impact énorme sur le PIB. L'étude de recherche peut en outre être utilisé pour des projets de développement pour la croissance de l'économie, l'amélioration de la qualité, de la production des ménages, l'économie souterraine, la santé et l'espérance de vie, l'environnement, l'immunité politique et de la justice ethnique.

MOTS CLÉS: politique monétaire, le produit intérieur brut, l'inflation, la masse monétaire.

Introduction:

Monetary policy is to regulate the development of the money supply according to objectives such as price stability, or the revival of economic activity (Faugère 1994). In practice, some central banks monetary policy revolve around a single final objective (price stability) of intermediate objectives (rules of change in the money supply) and instruments (rates interest and reserve requirements).

Monetary policy can affect production, employment and the general level of prices through the overall expense.

The review of the economic literature highlights not only theoretically but also empirically, a debate on the relative effectiveness of these policies, as regulation of economic activity instruments.

Theoretically, outside the most recent contributions of the current rational expectations and theories of endogenous growth, the debate has long opposed and especially the so-called Keynesian and monetarist those called.

According to the theory of rational expectations, developed in the United States from the 1970's, no action of economic policy (monetary and fiscal) is able to act effectively on economic activity, unless contains an element of surprise. The premise of this school are as:

* Expectations are rational.

* The markets for goods and assets are continuous and simultaneous balance.

The theory of rational expectations implies that economic agents correctly anticipate all relevant variables and they are fully aware the functioning of the economy, particularly the effects of economic policy decisions. However, this school of thought conceives through recent theories of endogenous growth, the possibility of state intervention when the economy is in a situation of suboptimal equilibria (the accumulation of human capital, implementation public infrastructure and services, research and innovation diffusion).

The debate between the Keynesian and monetarist was mainly located in the context of the analytical framework of the Keynesian general equilibrium income determination (output) and the interest rate ensuring the simultaneous equilibrium in the market for goods and services and the money market in closed economy.

Keynesian analysis, by challenging the assumptions of the quantity theory of its classic predecessors, relating to full employment and the constancy of the velocity of circulation of money, shows the balances of under-employment, using a fiscal stimulus action and / or

money. The monetarist approach, whose holding Milton Friedman, 3 supports the short term, changes in the quantity of money can have temporary real effects because of the initial price rigidity. Moreover, fiscal policy is ineffective mainly due to its risk of eviction. However, long-term, under the assumption of price flexibility and labor market, changes in the money supply have no effect on the general price level. Production and employment are not affected.

This analytical closed economy framework has been enriched by the work of Mundell (1962) and Fleming (1962) who built the external constraint and the international mobility of capital. Under the assumption of sticky prices and wages, they have shown that in an open economy, the fiscal multiplier effect is reduced and fiscal policy can not be effective in the fixed exchange rate regime, with some capital mobility. By cons, monetary action is ineffective except in flexible exchange rate regime, regardless of the degree of capital mobility.

Beyond the theoretical side, Keynesian and monetarist theories have mostly fueled many empirical studies, particularly in the Federal Reserve Bank of St. Louis (Andersen and Jordan, 1968; Keran, 1969; Andersen and Carlson, 1970). In particular, Andersen and Carlson (1970) developed and estimated a model known as the St. Louis model name which expresses the change in the total current expenditure based on changes in the money supply and public expenditure .

On the basis of econometric studies, some authors have achieved results that validate rather Keynesian theory of the superiority of the effects of fiscal policy over monetary policy. Of these studies, together include the model developed by the Federal Reserve and the Massachusetts Institute of Technology. Simulations from FR / MIT model show that not only the impact of monetary policy on economic activity is much lower than that suggested by the studies of Andersen- Jordan, but also that the effects of the policy money are much slower than those of fiscal policy.
Chowdhury (1988) applied the St. Louis equation to six European countries: Austria, Belgium, Denmark, Holland, Norway and Sweden. The results show that the impact of monetary policy on economic activity was higher in three countries (Denmark, Norway and Sweden), while fiscal policy was more efficient in Belgium and Holland. The results for Austria were not satisfactory.
Except for studies such as that of Darrat (1984) and Chowdhury (1986), including for most Latin American countries, most recently that of Bynoe (1994) on African countries, little

work concerned developing countries. These studies used a modified version of the St. Louis equation, incorporating nominal exports, to reflect the degree of openness and the high dependence of these countries in international trade. Darrat (1984) and Chowdhury (1986) found that fiscal policy had larger effects that monetary policy in the countries studied.

Empirical studies:

This article Consists test econometrically the effectiveness of monetary policy in Algeria, to see what kind of relationship between economic growth, monetary policy and incomes of oils. The methodology for this test is the model Cointegration .

By analyzing the behavior of variables, we see that they are non-stationary, but they all have an upward trend over the whole period. That leaves point to a possible cointegration between variables. It is therefore essential to focus on the order of integration of the series. For this, we will apply the Augmented Dickey Fuller test on each series, that is to say, GDP, MASS, OIL, INF.

1. Econometrically, the first step in the estimation of a model is to study the stochastic characteristics of the component variables. If these characteristics (that is to say, its expectation and variance) are changing over time, the series is considered non-stationary forcing to work with the model of cointegration (Granger [1986], Johannsen [1988]) to avoid falling into the trap of spurious regressions.

Table 1: Results of the stationarity tests

1ST DIFF	N° Delay	t-Statistic	1% level	5% level	10% level
GDP	0	-5,006323	-3,788030	-3,012363	-2,646119
MASS	0	-4,547036	-3,788030	-3,012363	-2,646119
INF	0	-4,504081	-3,788030	-3,788030	-2,646119
OIL	0	-4,528171	-3,788030	-3,788030	-2,646119

The results of stationarity, t-static is below critical values 1%, 5%, 10% for all variables in our study so they are integrated of order 1, so there is a risk of cointegration; and since the first condition of coitegration is reached by going to the second step.

2. Cointegration test: According to Granger, the cointegration test is used to test the long equilibrium relationships between several variables. So we will test the equilibrium relationship between GDP, INF, MASS, OIL. This presence equilibrium relationship between these variables is often verified through statistical procedures, the most used are those which Engle and Granger (1987) and Johansen (1988, 1991).
According to the Dickey Fuller stationarity test performed on our various pre-selected variables, they are all integrated of order 1 that's mean, they are all I (1). This justifies the use of cointegration test Engle and Granger. This order of integration justifies the presence of a long-term relationship that relates a common stochastic trend. Check this through two approaches: the approach of Engle and Granger and the Johansen.

Cointegration test of Engle and Granger:
The cointegration hypothesis will be tested on the variables GDP, INF, MASS, OIL, in Algeria which are integrated of order 1. A linear combination of these variables is:

$$GDPt = \alpha_0 + \alpha_1 INF_{1t} + \alpha_2 MASS_{2t} + \alpha 3 OIL_{3t} + \varepsilon_t$$

The α = vector (α1, α2, α3) is called cointegration vector. This test contains two stages, the first is an estimate by the method of ordinary least squares long-term model. The second consists of an ADF test on the residuals εt.

1. First Step: Estimation by ordinary least squares method of long-term model:

The estimates are presented in the tables below:

Table 2: OLS Estimation

Dependent Variable: PIB

Method: Least Squares

Date: 01/31/15 Time: 11:06

Sample: 1990 2012

Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2076.103	959.4333	-2.163884	0.0434
MASS	46.85287	18.62591	2.515467	0.0210
OIL	158.0310	37.71772	4.189833	0.0005
INF	13.00749	18.45574	0.704794	0.4895

R-squared	0.732313	Mean dependent var	2628.220
Adjusted R-squared	0.690047	S.D. dependent var	1320.610
S.E. of regression	735.2292	Akaike info criterion	16.19501
Sum squared resid	10270677	Schwarz criterion	16.39249
Log likelihood	-182.2426	Hannan-Quinn criter.	16.24468
F-statistic	17.32613	Durbin-Watson stat	0.274691
Prob(F-statistic)	0.000011		

The table above shows us that the model is globally significant with:

R^2 = 0,732313

The income variable coefficients of hydrocarbons, the money supply are significant, while those for inflation are not.

2. Second step: Testing Augmented Dickey Fuller residue

For the cointegration relationship is accepted, residues (εt) arising from the previous regression to be stationary. We make the test Augmented Dickey Fuller under the following assumptions:

A1. Unit roots on εt residues (Not cointegration).

A2 . No Root Unit on εt residues (cointegration).

The equation εt residues, is represented as follows:

$$\varepsilon_t = GDP_t - \alpha_0 - \alpha_1 MASS_{1t} - \alpha_2 OIL_{2t} - \alpha_3 INF_{3t}$$

Null Hypothesis: D(RESID) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic based on SIC, MAXLAG=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.450909	0.0205
Test critical values:	1% level	-3.788030	
	5% level	-3.012363	
	10% level	-2.646119	

*MacKinnon (1996) one-sided p-values.

According to Table: The value calculated in absolute value is greater than the critical value at the 5%:

Calculated value = | -3,450909 | > Value critical (threshold 5%) = | *-3,788030* |

Then the assumption residue stationarity is accepted. So we can conclude that there is a long-term equilibrium relationship between GDP, money supply, OIL revenues and the index of consumer prices. These variables generate DS type of process (differency Stationnary) that involve a clash at a given time is reflected to infinity on future values of the series; the effect of shocks is permanant.

3. Johansen Cointegration Test:

In 1991 and 1995, Johansen has proposed a multivariate approach based on the maximum likelihood method. It is used to check a series cointegration rank test cointegration. Hypothesis testing is as follows:

A1: No cointegration (cointegrating rank is zero)

A2: Cointegration (rank greater than or equal to 1 cointegration)

LR:likelihood ratio (Likelihood Ratio)

CV: Critical Value (critical value)

The assumptions of cointegration is accepted if IT is greater than CV. It is rejected otherwise.

Sample (adjusted): 1993 2012

Included observations: 20 after adjustments

Trend assumption: Linear deterministic trend

Series: PIB MASS OIL INF

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.948143	104.0172	47.85613	0.0000
At most 1 *	0.768839	44.83205	29.79707	0.0005
At most 2 *	0.382912	15.53923	15.49471	0.0492
At most 3 *	0.254886	5.884370	3.841466	0.0153

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The test results, we show that variables GDP, OIL, MASS, INF, are cointegrated at the 5% level. The null hypothesis of no cointegration is rejected because the trace test indicates four (4)cointegration equation.
The existence of cointegration relationship justifies the adoption of an error correction model (Engle and Granger 1987). Thus, we infer that the gross domestic product, the money supply, Oil income and consumer price indices follow parallel developments in the study period.

4. Error correction model:

The use of the error correction model shows the common cointegrating relationship (the common trend) and deduce the interactions between variables. Estimate the error correction model according to the representation of Hendry model, following by the least squares method in one step:

$$\mathbf{D(GDP_t) = \beta_0 + \beta_1 D(MASS_t) + \beta_2 D(OIL_t) + \beta_3 D(INF_t) + \beta_4 D(GDP_{t-1}) + \beta_5 (MASS_{t-1}) + \beta_6 (OIL_{t-1}) + \beta_7 (INF_{t-1}) + \varepsilon_t}$$

D: is the first difference operator defined by D (X) = Xt - Xt-1
The coefficients β1, β2 and β3, are the short-term dynamics and β5 coefficients β6 and β7 characterize the long-term equilibrium. The coefficient β4 is the error correction coefficient, it should be lower than unity and negative. Error correction coefficient indicates the speed of adjustment of the endogenous variable of gross domestic product (GDP) to return to the long-term equilibrium following a shock. The coefficient β0 represents the constant of the model.
Short-term elasticities are: β1, β2, β3

Long-term elasticities are: : $-\frac{\beta 5}{\beta 4}, -\frac{\beta 6}{\beta 4}, -\frac{\beta 7}{\beta 4}$

The results of the estimation of the error correction model using ordinary least squares, are shown in Table:

Dependent Variable: D(PIB)

Method: Least Squares

Date: 02/01/15 Time: 19:42

Sample (adjusted): 1991 2011

Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-128.2365	530.8275	-0.241578	0.8129
D(MASS)	42.57659	21.02285	2.025253	0.0639
D(OIL)	160.8232	41.48891	3.876293	0.0019
D(INF)	-14.25202	14.23218	-1.001394	0.3349
PIB(1)	0.273316	0.111538	2.450439	0.0292
MASS(1)	-6.071999	11.22449	-0.540960	0.5977
OIL(1)	-21.46025	26.22041	-0.818456	0.4278
INF(1)	6.125023	11.69928	0.523538	0.6094

R-squared	0.710012	Mean dependent var	137.7596
Adjusted R-squared	0.553865	S.D. dependent var	450.0060
S.E. of regression	300.5740	Akaike info criterion	14.53160
Sum squared resid	1174482.	Schwarz criterion	14.92951
Log likelihood	-144.5818	Hannan-Quinn criter.	14.61795
F-statistic	4.547069	Durbin-Watson stat	2.589112
Prob(F-statistic)	0.009098		

Analysis of the results shows that the term error correction associated with the restoring force β4 respects the starting condition, that is to say negative and less than unity.

Coefficient GDP-1 B4= 0.273316

So there is a catch to the equilibrium value, that is to say, an error correction mechanism: The long-term imbalances between the gross domestic product, the money supply, hydrocarbon revenues, the index of consumer prices compensate so that the series have similar developments. The value of R2, show a good explanatory power of the model.

R^2= 71%

The β4 represents the rate at which any imbalance between the desired and actual levels of gross domestic product is resorbed in the year following any shock. It corresponds to the automatic stabilizers of the economy. This means, an automatic increase in resources (money supply and government spending), an automatic reduction of taxes when economic conditions deteriorate.

In Algeria, the adjustment of the imbalance between the actual and desired level of gross domestic product is 27%. Although this value is too low to fully stabilize imbalances but in case of shocks on macroeconomic variables, the stabilization process continues and tends towards the long term. Which is explained by the volatility of key macroeconomic aggregates.

5. Analysis of short and long-term elasticities:

Short and long-term elasticities for analyzing the impact of cyclical fluctuations on variable behavior.

- Short-term elasticities:

Money supply, income hydrocarbon and the index of consumer prices generate short-run elasticities that are interpreted as follows:

* The short-run elasticity of GDP with respect to the money supply is β1 = 42.57, this implies that in the short term, if the money supply increased by 0.1 points, while the gross domestic product increases 42.57 points. Gross domestic product is sensitive to changes in the money supply.

* The short-term elasticity of gross domestic product compared to revenues of hydrocarbons is β2 = 160.8232, this implies that in the short term, if oil revenues were up 0.1 points, gross domestic product fell by 160.82 points. Hydrocarbon revenues have a positive impact on GDP. So hydrocarbon revenues have no negative impact on the economy.

* The short-run elasticity of GDP with respect to inflation β3 = -14.25, this means that if inflation increases by 0.1, GDP fell by 14.25 pionts Use of Seigniorage, was not a carrier

policy good solution, because inflation has reached unprecedented proportions, which had a negative effect on GDP.

- Long-term elacticities:

* The long-run elasticity of GDP with respect to the money supply $\frac{\beta 5}{\beta 4} = -\left(\frac{-6.071999}{0.273316}\right) =$ 22.216039, this implies that in the long term, if the money supply increased by 0.1point, while gross domestic product increased by 22.21 points. The effects of revenue increases on economic growth in the long term.

* The long-run elasticity of GDP to total expenditure $-\frac{\beta 6}{\beta 4} = -\left(\frac{-21.46025}{0.273316}\right) = 78.518088$, this implies that in the long run, if oil revenues increased 0.1point, while GDP increased by 78.51 unit.

* The long-run elasticity of GDP with respect to inflation

$-\frac{\beta 7}{\beta 4} = -\left(\frac{6.125023}{0.273316}\right) = -22.41004$, This implies that in the long term, if inflation increases by 0.1 points, while GDP fell by 22.41 points.

Conclusion:

Monetary policy for all countries plays a key role in the overall economic growth. Monetary policy in Algeria was largely favorable to the goal of promoting economic growth and price stability. To achieve this objective, target monetary aggregates (the growth of broad money as an intermediate target and reserve money as an operational target) in accordance with the objectives of growth and inflation Real GDP set by the government.

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