

The Fiscal-Monetary Policy and Economic Growth in Algeria: VECM Approach

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Abstract—The objective of this study is to examine the relative effectiveness of monetary and fiscal policy in Algeria using the econometric modelling techniques of cointegration and vector error correction modelling to analyse and draw policy inferences. The chosen variables of fiscal policy are government expenditure and net taxes on products, while the effect of monetary policy is presented by the inflation rate and the official exchange rate. From the results, we find that in the long-run, the impact of government expenditures is positive, while the effect of taxes is negative on growth. Additionally, we find that the inflation rate is found to have little effect on GDP per capita but the impact of the exchange rate is insignificant. We conclude that fiscal policy is more powerful than monetary policy in promoting economic growth in Algeria.

Keywords—Economic growth, fiscal policy, monetary policy, VECM.

I. INTRODUCTION

IN developing countries, monetary and fiscal policies are both commonly accorded prominent roles in the pursuit of macroeconomic stabilization. But the relative effectiveness of these policies has been a serious debate between the Keynesians and the monetarists. The monetarists think that monetary policy is more powerful than fiscal policy while the Keynesians believe that fiscal policy exerts greater impact on economic activity [1].

The influence of fiscal and monetary policies on growth has generated a large volume of empirical studies with mixed findings using cross sectional, time series and panel data [2]. Fiscal and monetary policies are generally believed to be associated with growth, and more precisely, fiscal policy is held that appropriate fiscal measures in particular circumstances can be used to stimulate economic development and growth [3].

In many empirical studies, which test the fact of theoretical models, the results differ greatly; this can be traced to the estimation techniques or maybe to the variable choices. At the same time, one problem is that most studies do not take into consideration the structure of both taxation and expenditure in the test of the effects of fiscal policy, where they focus on the one side of government activity ignoring the other [4]. As in the study of Kneller et al. [5], which showed that in the construction of any model, without accounting for both sides of the budget (taxation and expenditure), it is possible to fall in substantial biases of the coefficient estimates.

Additionally, some researchers think that monetary policy is effective only in the case of developed economies which are characterized by well developed money and financial markets; because an intended change in monetary variables will cause movement of many variables in the monetary sector. But a number of economists have suggested that a monetary policy could be more effective in developing countries [6]. This suggestion can be explained as follows: the volume of financial assets, such as industrial bonds and readily marketable shares, is generally very limited in developing countries, therefore, an increasing money supply will be transmitted directly to the real asset markets, and means any change in money supply directly impinges on expenditures [7].

According to a report of the International Monetary Fund [8], in recent times Algeria's economic growth has been retracted in spite of the high oil prices and the availability of large hydrocarbon resources. Over the period from 1995 to 2010, GDP growth has been relatively low, less than 4% per year on average, causing low growth of per capita GDP (about 2.1% annualized over the period of 2000-2011). The hydrocarbon sector grew slowly over the period 1992-2011, with a negative impact on real GDP growth. Moreover, non-hydrocarbon growth has been the driving force of overall growth, but is largely dependent on performance in the hydrocarbon sector. The acceptable growth in the nonhydrocarbon sector (3.4% on average over the last decade) supported overall growth. However, this effectiveness was enhanced by the widespread transfer of resources (hydrocarbon revenues from high international prices) to the non-hydrocarbon sector by way of public spending.

Algerian economic growth needs to be bolstered and diversified. The country lags behind other economies in the region imposes faster growth in the non-hydrocarbon sector for reducing the dependency on hydrocarbon revenues. In addition, the state must provide satisfactory employment opportunities for the young and growing population.

Recently, the number of studies testing the effect of fiscal policy compared to that of monetary policy has increased. This can be due to the efficacy of fiscal policy in combating economic turbulences and downturns which were faced by a number of both developed and developing countries [9].

II. RELATED EMPIRICAL STUDIES

Ajayi [10] estimated the variables of fiscal and monetary policies using ordinary least square technique and beta coefficients. He found that the impact of monetary policy is larger and more predictable than fiscal policy influences in

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Nigeria. The study suggested that more attention must be given to monetary actions in Nigeria.

Batten et al. [11] examined the relative effectiveness of fiscal and monetary actions in six industrialized countries covering the UK, the US, Canada, France and Germany. They employed the St. Louis approach and concluded that while monetary actions have a significant and permanent effect on nominal GNP growth; fiscal actions exert statistically insignificant and lasting influence.

Chowdhury [12] tested the relative effectiveness of the two policies in Bangladesh by using the ordinary least square (OLS) technique. He adopted a modified St. Louis equation in estimating monetary and fiscal policies variables. He concluded that fiscal actions exert greater impact on economic activity in Bangladesh than monetary actions.

Olaloye et al. [13] estimated a slightly modified form of the basic St. Louis equation using monthly data for the period 1986 to 1991 in Nigeria. They concluded that fiscal policy exerts more influence on the economy than monetary policy.

Ajisafe et al. [1] examined the relative efficacy of monetary and fiscal policies in Nigeria, using cointegration and error correction estimation techniques. They found that monetary policy rather than fiscal policy exerts a great impact on economic activity.

Ali et al. [14] tested the effects of fiscal-monetary policy on economic growth in South Asian countries. The autoregressive distributed lag model was employed. They concluded that monetary policy is more powerful than fiscal policy in supporting economic growth in South Asian countries.

Khosravi et al. [3] examined the influence of fiscal policy and monetary policy on growth in Iran, using the autoregressive distributed approach to cointegration. They found that the impact of exchange rate and inflation on economic growth is negative, and the variable of government spending has a significant positive effect on GDP growth in Iran.

Huseyin et al. [9] found that both monetary and fiscal policies have significant effects on growth in Turkey. But, the more effective tool in stimulating economic growth is monetary policy. These findings suggest that both policies significantly influence growth; they should be used jointly but in an efficient manner.

III. MATERIALS AND METHODS

Description of data: The data sets used for this analysis is the annual series of the selected relevant macroeconomic variables from 1970 to 2014. The data for exchange rate and inflation rate will be used as monetary policy variables. Data for general government final consumption expenditure and net taxes on products will be used as fiscal policy variables. Data for gross domestic product per capita will be used as growth the variables. The data were obtained from The World Bank [15].

Model specification: Following the previous empirical studies, it is possible to specify our empirical model in the following manner:

$$Y_t = f(EXPD_t + TAX_t + CHG_t + INF_t) \quad (1)$$

The linear form for (1) is specified as follows:

$$LGDP_{CP} = \alpha_0 + \alpha_1 LEXPD + \alpha_2 LTAX + \alpha_3 INF + \alpha_4 CHG + e_t \quad (2)$$

where, α_0 is the constant and $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ are the coefficients to be estimated and e_t is a normally distributed error term with zero mean and variance equal to 0. LGDPCP is the natural log of Gross Domestic Product per capita, LEXPD is the natural log of government expenditure, LTAX is the natural log of net taxes, CHG is the official exchange rate and INF is the inflation rate.

The variables GDP_{CP}, EXPD, and TAX are incorporated into the model in their natural logs while CHG and INF remain in their original form. This is to assure homogeneity of the variables and to aid interpretation of results. Lutkepohl et al. [15] illustrate that constructing a model for the logs is likely to be advantageous, because there is a more stable variance in the log series than the changes in the original series.

Estimation techniques: As we wanted to test the relationship among fiscal-monetary policy and economic growth variables, we used a vector error correction model (VECM) techniques which identify an adjustment for the short run dynamic model to the long run equilibrium relationship [16]. But a condition is required, that the VEC model contains just individual series with the same order of integration, which means an existence of cointegration.

Unit root tests: The using of time series data for the analysis needs first test for stationary properties. Hence, to examine the time series property of the variables which appear in the model, both Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests were employed to check whether each data series is integrated and has a unit root.

VAR cointegration test: The long-run equilibrium relationships between economic variables appeared in the literature as cointegration [17]. To test the question of cointegration, the Johansen procedure will be used; which explicit procedures for testing the number of cointegrating vectors.

IV. RESULTS AND DISCUSSION

Unit root tests: The unit root tests, such as Augmented Dickey-Fuller [18] and Phillips-Perron [19] tests are used to determine the order of integration for variables series. The results of which are summarized in Table I. For the ADF and PP test, the null hypothesis of non-stationary is rejected if the t-statistic is less than the critical t-value.

The results of the ADF and PP tests indicate that all variables possess unit roots at their levels, since each reported t-statistic is not smaller than their respective critical values.

TABLE I
ADF AND PP TESTS

Variables	ADF t-statistic				PP t. statistic			
	Constant and trend	Constant	none	1 st difference	Constant and trend	Constant	none	1 st difference
LGDPCP	-2.156070	-2.519240	/	-4.737591	-2.210626	-2.234998	/	-4.986016
LEXPDP	-1.910246	-1.926438	/	-4.766962	-2.044086	-1.726603	/	-4.910494
LTAX	-3.186913	-2.865055	/	-6.804256	-3.142446	-2.607719	/	-6.667233
CHG	-2.543099	/	/	-3.918068	-1.873338	-0.167400	1.195471	-3.413878
INF	-2.145285	-2.036759	-1.377544	-6.281500	-2.221673	-2.132939	-1.395429	-6.282767
critical values (5%)	-3.515523	-2.929734	-1.948495	-2.931404	-3.515523	-2.929734	-1.948495	-2.931404

TABLE II
VAR LAG ORDER SELECTION CRITERIA

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-224.3222	NA	1.832552	14.79498	15.02627	14.87038
1	-62.22852	261.4415	0.000271	5.950227	7.337957*	6.402592
2	-30.86566	40.46821*	0.000206	5.539720	8.083891	6.369056
3	-2.916320	27.04775	0.000251	5.349440	9.050052	6.555747
4	47.44234	32.48946	0.000123*	3.713398*	8.570451	5.296676*

* indicates lag order selected by the criterion

TABLE III
COINTEGRATION TEST (LINEAR DETERMINISTIC TREND); LAGS INTERVAL (IN FIRST DIFFERENCES): 1 TO 3

Unrestricted Cointegration rank test (trace)				
Hypothesized No of CE (s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.781037	121.9480	69.81889	0.0000
Atmost 1 *	0.626465	74.86357	47.85613	0.0000
Atmost 2 *	0.532048	44.33655	29.79707	0.0006
Atmost 3 *	0.461258	20.79547	15.49471	0.0072
Atmost 4 *	0.050959	1.621389	3.841466	0.2029

Trace test indicates 4cointegrating eqn (s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level;

TABLE IV
COINTEGRATION TEST (LINEAR DETERMINISTIC TREND); LAGS INTERVAL (IN FIRST DIFFERENCES): 1 TO 3

Unrestricted cointegration rank test (maximum eigenvalue)				
Hypothesized No of CE (s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.781037	47.08444	33.87687	0.0008
Atmost 1 *	0.626465	30.52703	27.58434	0.0203
Atmost 2 *	0.532048	23.54107	21.13162	0.0225
Atmost 3 *	0.461258	19.17409	14.26460	0.0077
Atmost 4 *	0.050959	1.621389	3.841466	0.2029

Max-eigenvalue test indicates 4cointegrating eqn (s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level;

TABLE V
LONG-RUN COINTEGRATING EQUATION

Cointegrating Eq:	DLGDPCP(-1)	DLEXPDP(-1)	DINF(-1)	DCHG(-1)	DLTAX(-1)	C
	1.000000	-1.845549	-0.009436	-0.007156	1.265138	0.023392
		(0.22819)	(0.00358)	(0.00441)	(0.26816)	
		[-8.08788]	[-2.63941]	[-1.62129]	[4.71788]	

Standard errors in () & t-statistics in []

Cointegration test: whether in Johansen cointegration procedure [20] or estimation of a VAR system, in its unrestricted or restricted Vector Error Correction (VEC) forms, it requires the choice of an optimal lag length. Lag length were selected using information criteria and the best lag length are found to be four (minimum Akaike information criterion) that meet the mathematical stability condition.

Both the ADF and PP tests confirmed that the series are integrated, thus satisfying the initial assumption for cointegration analysis. The results of the trace and maximum

eigenvalue test statistics were presented in Tables III and IV. The p-values at the 5% level of significant indicate that the hypothesis of no cointegration among the study variables can be rejected. Also, both trace test and maximum eigenvalue test indicate four cointegrating equations at the 0.05 level of significant. So, it is concluded that there exists a long-run equilibrium relationship between growth and the fiscal-monetary policy variables in Algeria.

Results from VEC model: With the existence of cointegrating vectors, an economic interpretation of the long-

run Fiscal-Monetary policy and growth equation can be obtained by estimating the vector error correction model.

The long-run relationships: We have these long-run relationships as:

$$LGDP_{CP} = 1.84LEXP_{D} - 1.26LTAX + 0.0094INF + 0.0071CHG - 0.023 \quad (3)$$

The conclusions that we can extract from these long-run relationships, which are related to the long-run impact of monetary and fiscal policy on economic growth in Algeria, are as follows:

In this study, we find that all using variables are statistically significant, except the variable of the official exchange rate, where both government expenditure and the inflation rate have positive contribution, while net taxes on products has a negative impact on GDP per capita.

In (3), if there is an increase of government expenditure by 1.0%, there will be growth of about 1.84% of GDP per capita. While with a decrease of net taxes by 1.0%, the estimated long term coefficient showed that there will also be a decrease of 1.26% in GDP per capita. The inflation rate is found to have little effect on GDPCP, whereas for every 1% growth in inflation rate, GDPCP grew by about 0.0094%. This finding implies that Algeria depends mainly on government expenditure to stimulate economic growth and this is due to the structure of the country's economy which is characterized as a yield economy that depends on hydrocarbon revenues. Moreover, it is clear that taxes on products have a marked negative impact on GDPCP; this finding suggests that Algeria should from time to time make a reasonable decrease in taxes on products.

The speed of adjustment coefficient (-0.773239) with t-statistic (-1.98191) is statistically significant in the cointegration equation. The error correction coefficient exhibits that the average adjustment is 77.3% in the cointegration equation. It means that 77.3% adjustment to the short run disequilibrium shows a tendency of improvement Algeria's economic growth.

V.CONCLUSION

We evaluated the long run and short run dynamic relationship of the Algerian economy in a VEC Model system by estimating monetary policy, fiscal policy and economic growth variables.

The estimated long-term coefficient for government expenditure showed that for every 1.0% increase in government expenditure, there will be growth of about 1.84% of GDP per capita, which is found to be statistical significant, and if there is decrease of net taxes by 1.0%, the estimated long term coefficient showed that there will also be decrease of 1.26% in the GDPCP. The inflation rate and official exchange rate estimates were found to have little effect on GDPCP, and the effect of the official exchange rate is found to be insignificant; whereas for every 1% of growth in the inflation rate, GDPCP grew by about 0.0094%. In the cointegration equation, the error correction coefficient shows

that the average adjustment to the short run disequilibrium is 77.3%. So, we can say that there is a tendency of improvement in the Algerian economic growth.

We find that the Algerian economy is determined mostly by government expenditure. It can be seen that from the findings that the fiscal policy variables of government expenditure and net taxes on products have dominant long-run effects on the economy, but the impact is negative from taxes. From these results it is clear that fiscal policy exacted greater impact on the Algeria's economic growth.

Generally, both fiscal and monetary policy variables may contribute to economic growth in the short and long term. These findings suggest that Algeria should give more attention to monetary policy tools in stimulating economic growth, especially with the decreasing of petrol prices.

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