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Empirical Estimation of Fiscal Multipliers in MENA Oil-Exporting Countries with an Application to Algeria

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Empirical Estimation of Fiscal Multipliers in MENA Oil-Exporting Countries with an Application to Algeria

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Abstract

At a time when Algeria must undertake considerable fiscal consolidation to restore sustainability, the issue of fiscal multipliers has come to the fore. This paper estimates short-term and long-term fiscal multipliers for Algeria applying several econometric methodologies, including Local Projection Methodology and Vector Autoregressive Models, and using both Algeria-specific and panel data. The paper also explores asymmetries related to the sign of the output gap as well as the direction of spending. The results suggest that (i) average fiscal multipliers for Algeria are generally moderate and below unity; (ii) the impact of public spending shocks is more important when the output gap is negative; (iii) fiscal spending multipliers are significantly larger during spending contraction than expansion; (iv) procyclicality in public spending does not appear to affect output, except for capital spending cuts when the output gap is negative; and (v) while multipliers associated with countercyclical public spending can be sizeable, a contraction in current spending does not materially affect non-oil GDP.

JEL Classification Numbers: E32, E62, C51, H30

Keywords: Fiscal policy; State-dependent multipliers; Output gap; Spending direction; Algeria; Structural Vector Autoregressive Model; Local Projection Methodology.

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I. INTRODUCTION

The high oil prices that persisted until mid-2014 allowed for the accumulation of external and fiscal surpluses in many oil-exporting countries, which subsequently came under pressure as oil prices declined (International Monetary Fund (IMF), 2016). In Algeria, as in other oil exporters in the Middle East and North Africa (MENA) region, lower oil prices have reduced government revenues and limited the government's capacity to sustain high levels of spending. Given the central role of the State and the economy's insufficient diversification, the fiscal consolidation needed to preserve fiscal sustainability and restore external balances could significantly weigh on economic activity.[1] Hence, the potential impact of such consolidation on growth and employment needs to be well assessed in order to calibrate the appropriate size of fiscal adjustment.

There are only a few empirical studies that estimate the size of fiscal multipliers in MENA. They often do not take into account the heterogeneity of the response of output to fiscal shocks depending on the output gap and the direction of spending. Consequently, the estimated fiscal multipliers represent "average multipliers," reflecting a range of economic situations that prevailed during a given sample period. In this context, this paper uses a variety of econometric tools to contribute to the existing literature in two dimensions: first, it estimates Algeria-specific multipliers and provides a framework for estimating multipliers in other MENA countries; second, the paper explores several potential asymmetries (i.e., non-linearities) in the response of output to public spending shocks—notably those related to the output gap and the direction of government spending.

Average multipliers for Algeria appear to be below unity, in line with the moderate spending multipliers found in developing and emerging countries, while the average multiplier effect of current spending is marginal. We also find that the impact of public spending shocks on output is larger when the output gap is negative, and spending multipliers are significantly larger during spending contraction than expansion. Moreover, procyclicality in public spending does not appear to affect output, except when cutting capital spending during recessions. Finally, while multipliers associated with countercyclical public spending can be sizeable, a contraction in current spending does not materially affect non-oil GDP.

The rest of the paper is organized as follows. Section II reviews the existing literature on fiscal multipliers. Section III discusses the data and the empirical strategy. Section IV and V present the results and the robustness checks. Section VI concludes.

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[1] During the oil price boom of 2004-14, Algeria was able to accumulate large fiscal savings and international reserves. However, the country did not undertake the necessary structural reforms to overcome the shortcomings in its growth model. The economy remained overly dependent on hydrocarbon revenues (69 percent of total revenues) and public spending was the main growth engine. Over the period 2000-2015, government spending represented 49 percent of non-oil GDP (16 percent for capital expenditures and 33 percent for current expenditures).

II. LITERATURE REVIEW

Empirical studies on the size of fiscal multipliers for MENA oil exporters are limited, mainly due to the lack of high-frequency data and long-time series. The existing literature has so far found that fiscal multipliers are small, except for those associated with capital expenditures.

Senhadji and Espinoza (2011) provide estimates of fiscal multipliers for Saudi Arabia using a Vector Autoregressive model (VAR) estimated with annual data covering 1975-2009 and applying a Choleski orthogonalizing identification strategy. They find that the short-term multiplier is equal to 0.2, 0.5, and 0.1 for total, capital, and current expenditures, respectively. In the long term, the multiplier reaches a maximum of 1.0 for capital expenditures. Senhadji and Espinoza also estimate fiscal multipliers for Gulf Cooperation Council (GCC) countries using simple panel models and find that the short-term fiscal multiplier ranges from 0.2 to 0.3 for total and capital expenditures, and from 0.2 to 0.4 for current expenditures. In the long term, the spending multiplier ranges from 0.4 to 0.7 for total expenditures, 0.6 to 1.1 for capital expenditures, and 0.3 to 0.7 for current expenditures. More recently, Cerisola et al. (2015) estimate fiscal multipliers for different categories of spending using annual data for 19 MENA countries covering the period 1990–2008. The sample is divided into sub-groups according to regional and economic classifications and to economic fundamentals. Different methodologies are used, including a Panel VAR with a sign restriction and the Bucket approach. The fiscal multiplier for MENA oil exporters is estimated to be 0.4 for current spending and 1.0 for capital spending.

An emerging theoretical and empirical literature has argued that the size of fiscal multipliers tends to vary over time and across countries (Baum et al., 2012; Delong and Summers, 2012; Blanchard and Leigh, 2013; Huidrom et al., 2016). Hence, ignoring these asymmetries could result in a biased estimation of fiscal multipliers (Dell'Erba et al., 2014; Riera-Crichton et al., 2015; Canzoneri et al., 2016). In that regard, Ilzetzki et al. (2011) show that the impact of government expenditure shocks depends crucially on key country characteristics, such as the level of development, the exchange rate regime, openness to trade, and public indebtedness. The structure of deficit financing (domestic versus external) can also have important implications for the effects of government spending on output (Shen, Yang, and Zanna, 2018).[2] Using quarterly data from 1960 to 2007, they estimate a Panel Structural VAR (PSVAR) for 44 countries at different stages of development. They find that (1) government consumption multipliers are larger in industrial countries than in developing countries, which have weaker institutional frameworks and suffer from a higher degree of corruption; (2) countries with a fixed exchange

[2] Since the onset of oil price shock, several oil exporters in the MENA region turned to external financing of their fiscal deficits. External financing increases the resource envelope of the economy, mitigating the private sector crowding out effects of government spending and pushing up the output multiplier. The same external financing, however, tends to appreciate the real exchange rate and as a result, traded output can respond quite negatively, reducing the overall output multiplier.

rate regime tend to have large fiscal multipliers, as the exchange rate does not play any role in smoothing the impact of shocks, while multipliers tend to be close to zero in economies with a flexible exchange rate regime, and (3) countries with greater openness to trade have lower fiscal multipliers, as a larger fraction of the fiscal expansion is diverted to the rest of the world through higher imports. Tagkalakis (2008) explores the effect of fiscal shocks on private consumption during recessions and expansions, using annual data of 19 OECD countries from 1970 to 2002. The analysis shows that in the presence of binding liquidity constraints for households, public spending is more effective in boosting private consumption during recessions than expansions. Similarly, Auerbach and Gorodnichenko (2012) find that the size of fiscal multipliers depends on the position in the business cycle, with fiscal multipliers being larger during periods of economic slack. Spending multipliers are found to be not different from zero during expansions and become much larger (up to 2.0) during recessions (due to weaker labor markets, more biding liquidity constraints for economic agents, and less crowding out effects on private investment). Bachmann and Sims (2012) find that the confidence of households and private firms is a critical factor in the transmission of fiscal shocks to economic activity.

A growing literature has shown that spending direction matters and that there are asymmetries in the effect of positive and negative spending shocks. Abiad et al (2014) finds that increased public infrastructure investment, including for emerging market and developing economies, raises output in both the short and long term, particularly during periods of economic slack and when investment efficiency is high. Riera-Crichton et al., (2015) show that the fiscal multiplier associated with increases in government spending is larger than with decreases in government spending in OECD countries. By contrast, Barnichon and Matthes (2016) find that the multiplier associated with a negative shock to government spending is above 1, while the multiplier associated with a positive shock is substantially below 1.

III. Data and Empirical Strategy

III.1 Average Multipliers: Linear Specification

In this section, we investigate the effect of a public spending shock on the dynamics of output in Algeria. We focus on non-oil GDP rather than total GDP because activity in the oil sector is largely driven by conditions in international oil markets, and other exogenous shocks or structural changes (e.g., discovery of new fields). The lack of high-frequency data represents the main constraint to using VAR models to analyze the impact of fiscal policy shocks. While annual data for Algeria are available for the period 2000-2015, quarterly data are only available for the period 2008-2015. To estimate a robust VAR model, it is recommended to have at least fifteen years of quarterly data. Therefore, the unavailable quarterly data are extrapolated based on the seasonality observed during the period for which data is available. While, this extrapolation method omits possible structural changes in spending behavior, anecdotal evidence shows that the seasonal pattern of public spending remained stable over the sample period. We also used the Denton methodology (Denton, 1971; Bloem et al., 2001), and found that the data generated is very

similar to that obtained using historical seasonality.[3] All variables are log-transformed and deflated using the consumer price index[4], except for non-oil GDP, which is deflated with the GDP deflator.

The fiscal multiplier corresponds to the change in the real non-oil GDP in response to a fiscal shock. The impulse responses of the output variable to the fiscal policy shocks are estimated using a Structural Vector Autoregressive Model (SVAR) linking Algeria's non-oil GDP to government spending. The variables are first differenced to make them stationary; thus, the impulse responses are used to derive elasticities. The reduced-form VAR is defined by the following dynamic equation:

$$\boldsymbol{Y_{it} = A(L,q)Y_{t-1} + X_t + U_t} \qquad (\mathbf{1})$$

Where Y_{it} is the vector of endogenous variables that includes quarterly total expenditures **(g_t)** and non-oil GDP **(x_t)**, $A(L,q)$ is an autoregressive lag polynomial in the operator L for q quarters, X_t a set of controls, and U_t is the vector of reduced-form innovations.

The reduced-form innovations of government spending and non-oil GDP can be expressed as a linear combination of the endogenous variables g_t and x_t, and the structural shocks e_t^g and e_t^x we want to identify:

$$\boldsymbol{g_t = b_1 x_t + e_t^g}$$

$$\boldsymbol{x_t = b_2 g_t + e_t^x}$$

We seek to estimate the discretionary fiscal shock e_t^g, and the response of real non-oil GDP (b_2), but without further restrictions, the above system does not allow us to identify this shock. A key concern with the SVAR methodology in this model is the reverse causality between non-oil GDP and government spending. Therefore, we need an identification approach that isolates the direct effect of the fiscal shock on non-oil GDP. Public expenditures react automatically to the business cycle through automatic stabilizers. They also respond to the cycle in a discretionary way; for instance, a countercyclical policy may entail raising tax rates and cutting spending when the output gap is positive.

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[3] Data were not generated for the 1990s. Covering this period, during which Algeria experienced violent social unrest that resulted in a singnficant contraction of ouptut and destruction of public capital stock, can result in biased estimations.

4 We follow Senhadji and Espinoza (2011) and Ilzetzki et al. (2011) by deflating all fiscal variables using the Consumer Price Index.

(continued…)

There is no consensus in the literature on how to best identify such shocks or to extract the exogenous component from observed fiscal outcomes. Following the existing literature, we use the methodology proposed by Blanchard and Perotti (2002), which relies on the contemporaneous exogeneity argument. The way shocks are structured implicitly assumes that causality between spending and output runs from government spending to non-oil output. It also reflects that fiscal policy is generally not flexible enough to react within a quarter (three months) to economic activity. Therefore, the contemporaneous response of fiscal policy to output (b_1) is 0. Once the reduced-form of the VAR and the coefficients are estimated[5], we compute the impulse responses of non-oil GDP to a government spending shock and the fiscal multipliers.

Fiscal multipliers can be measured in several ways. Generally, they are obtained by multiplying the impulse response function (IRF) values by the mean value of the ratio of real non-oil GDP to the government spending indicator (Y/G). Two multipliers are calculated with this specification: the impact multiplier for the first 4 quarters, and the multiplier at horizon h, which is the cumulative multiplier over 10 quarters.

Impact multiplier = $\frac{\Delta Y(t)}{\Delta G(t)}$

Multiplier at horizon h: $\frac{\Delta Y(t+h)}{\Delta G(t)}$

III.2 State-Dependent Multipliers: Non-Linear Specification

In order to analyze the non-linearity of the response of output to a fiscal shock, we run a panel estimation using the Local Projection Methodology (LPM) applied to MENA oil-exporting countries. The dataset was compiled from different sources and contains annual data for the period 2000 to 2015[6]. The series for non-oil GDP, imports and exports of goods and services come from the Word Economic Outlook dataset (April 2016). Gross debt and public spending data, including total, current, and capital expenditures, are obtained from the Regional Economic Outlook of the Middle East and Central Asia Department dataset (April 2016). Crude oil prices in

[5] A series of tests are applied to the VAR model. The stability condition is respected as all unit roots are inside the unit circle. The choice of the number of lags is made on the basis of the autocorrelation function of the reduced-form VAR residuals and the likelihood ratio tests. The number of lags is set to four quarters since it provides serially uncorrelated residuals. The Portmanteau autocorrelation test performed on the residuals also confirmed that all residuals are uncorrelated.

[6] The sample includes Algeria, Bahrain, Iran, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, and Yemen. Due to poor data quality, Libya is excluded from the sample. While all countries in the sample share the common feature of insufficient diversification and the predominance of the state in the economy, Iran has the particularity of being subject to international sanctions over the sample period, which may introduce some bias in the estimations of average multipliers.

(continued…)

US dollars are taken from the International Financial Statistics.[7] The output gap, which is the difference between actual and potential non-oil GDP[8] is used to approximate the impact of spending shocks depending on the state of the business cycle.

To estimate the impulse response to a public spending shock, we follow the single-equation approach proposed by Jorda (2005) and Stock and Watson (2007). The LPM relies on running a separate regression for each horizon (h) and then constructing the impulse response function. It has the advantage of allowing non-linearity in the response function that may be impractical in a multivariate VAR context, and does not impose the dynamic restrictions implicitly assumed in the VAR methodology.

Using the LPM, we first estimate the following basic linear regression model with time and country fixed effects. The multipliers provided by this specification will serve as a benchmark to be compared with the state dependent multipliers. The accumulated impulse response of the output is estimated for each horizon:

$$\Delta \boldsymbol{Y}_{i,t+h} = \boldsymbol{\alpha}_{i,h} + \boldsymbol{\beta}_{i,h}\Delta \boldsymbol{FPI}_{i,t} + \boldsymbol{\delta}_{i,h}\boldsymbol{X}_{i,t} + \boldsymbol{\gamma T} + \boldsymbol{\mu}_{i,t+h} \qquad \text{h=0, 1, 2, 3, 4 and 5} \qquad (2)$$

Where $\alpha_{i,h}$ is the country fixed effect, $Y_{i,t}$ the logarithm of real non-oil GDP for year t and country i, and $FPI_{i,t}$ the logarithm of a cyclically adjusted fiscal policy indicator consisting of total expenditures, capital expenditures, and current expenditures. $X_{i,t}$ is a vector of control variables including crude oil prices, a dummy for the sign of the output gap, a trade openness indicator, an Arab spring dummy, and a public debt dummy. T is a time trend and $\mu_{i,t+h}$ is the idiosyncratic error term.[9]

We use cyclically adjusted fiscal indicators to identify the discretionary fiscal shocks. Leaving aside variations of the fiscal variables induced by business cycle fluctuations, this identification strategy removes the effect of automatic stabilizers and isolates the discretionary fiscal policy. We follow Escolano's methodology (2010) to calculate the cyclically adjusted spending indicators.

The accumulated impulse response function is obtained with the LPM from the estimation of a different equation for each horizon. The IRF values are obtained directly from the $\beta_{i,h}$ estimated

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[7] See Appendix I for a complete description of the variables and sources.

[8] There are several methods used in the literature to estimate the potential output including multivariate filters, the production function approach, and the use of band-pass filters. We follow some previous papers in the literature by applying the latter approach (Hodrick-Prescott filter) to calculate the non-oil GDP trend which is then used as a proxy for potential non-oil GDP (see for instance Riera-Crichton et al., (2015)).

[9] The model was also estimated with nominal variables and including inflation. The results are qualitatively similar to our findings presented in the text.

(continued…)

coefficients. As with the SVAR, spending multipliers are then constructed by multiplying the IRF values by the mean value of Y/G alternatively for MENA oil-exporting countries and for Algeria. The basic linear specification is modified to compute the state-dependent multipliers according to the different states of the economy.

As a first step, an interactive dummy D_{it}^{R} is included in the linear specification to capture the varying effects of spending shocks depending on the output gap.[10] This dummy equals 1 when the output gap is negative and 0 otherwise:

$$\Delta \boldsymbol{Y_{i,t+h}} = \boldsymbol{D_{it}^{R}}\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) + \left(\mathbf{1} - \boldsymbol{D_{it}^{R}}\right)\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) + \boldsymbol{\delta_{i,h}X_{i,t}} + \boldsymbol{\gamma T} + \boldsymbol{\alpha_{i,h}} + \boldsymbol{\mu_{i,t+h}} \quad (\mathbf{3})$$

As a second step, the following model is estimated to test the relevance of asymmetries in the output response to a fiscal consolidation or to a fiscal expansion.

$$\Delta \boldsymbol{Y_{i,t+h}} = \boldsymbol{D_{it}^{ED}}\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) + \left(\mathbf{1} - \boldsymbol{D_{it}^{ED}}\right)\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) + \boldsymbol{\delta_{i,h}X_{i,t}} + \boldsymbol{\gamma T} + \boldsymbol{\alpha_{i,h}} + \boldsymbol{\mu_{i,t+h}} \quad (\mathbf{4})$$

An interactive dummy D_{it}^{ED} is included in the linear specification to estimate the state dependent multipliers. This dummy equals 1 when there is a negative discretionary public spending shock (cyclically-adjusted expenditure growth <0) and equals 0 when there is a positive discretionary public spending shock (cyclically-adjusted expenditure growth>0).

Finally, model (5) below is estimated to differentiate between the effects of the output gap depending on the spending direction:

$$\begin{aligned}\Delta \boldsymbol{Y_{i,t+h}} = {} & \boldsymbol{D_{it}^{R}D_{it}^{ED}}\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) + \boldsymbol{D_{it}^{R}}\left(\mathbf{1} - \boldsymbol{D_{it}^{ED}}\right)\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) \\ & + \left(\mathbf{1} - \boldsymbol{D_{it}^{R}}\right)\boldsymbol{D_{it}^{ED}}\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) + \left(\mathbf{1} - \boldsymbol{D_{it}^{R}}\right)\left(\mathbf{1} - \boldsymbol{D_{it}^{ED}}\right)\left(\boldsymbol{\beta_{i,h}}\Delta \boldsymbol{FPI_{i,t}}\right) \\ & + \boldsymbol{\delta_{i,h}X_{i,t}} + \boldsymbol{\gamma T} + \boldsymbol{\alpha_{i,h}} + \boldsymbol{\mu_{i,t+h}} \quad (\mathbf{5})\end{aligned}$$

Where the indicator D_{it}^{ED} is equal to 1 when discretionary government spending is contracting and 0 otherwise. D_{it}^{R} is equal to 1 in periods of negative output gap and 0 otherwise. From equations (1) to (5), we obtain an estimate of the accumulated IRF for each horizon. The impact multiplier, which is the first-year multiplier, and the cumulative multiplier over 3 and 5 years are then computed.

Table 1 shows that on average, MENA oil-exporting countries faced slightly more episodes of negative output gap (54 percent of the time over the sample) than episodes of positive output gap

[10] A possible future work would be to deepen the analysis by capturing the magnitude of the output gap or the spending shock.

(46 percent) during the sample period. However, there were more episodes of spending increases (70 percent) than episodes of spending decreases.

Table 1: Output Gap and Government Spending Directions		
Output gap	**Output gap > 0** 46%	**Output gap < 0** 54%
Government spending	**Increase** 70%	**Decrease** 30%
Source: Author's calculations, data for MENA oil-exporting countries from 2000 to 2015.		

Table 2 combines the output gap with the government spending directions to highlight how often the countries in the sample have undertaken procyclical or countercyclical policies during the period under study. It suggests that, on average, MENA oil-exporting countries increased spending when the GDP gap was negative and vice-versa in 54 percent of the time. Otherwise, government spending is either declining in bad times, i.e., when the output gap is negative, (15 percent), or increasing in good times, i.e., when the output gap is positive, (31 percent).

Table 2: Public Spending and the Position in the Cycle			
		Government spending	
		Decrease	Increase
Position in the business cycle	Output gap >0	15%	31%
	Output gap <0	15%	39%
Source: Author's calculations.			

IV. RESULTS

IV.1 Average Multipliers: Linear Specification

Table 3 presents the average multipliers estimated using the SVAR model on Algeria's quarterly data (specification 1), alongside the estimated multipliers for Saudi Arabia (Espinoza and Senhadji, 2011) for comparison purposes. The impact and the long-run multipliers for total spending are statistically different from 0 and are 0.3 and 0.4, respectively. These multipliers below unity indicate that the increase in output is lower than the initial increase in spending. They are also in the same range as the multipliers previously computed for other countries in the region like Saudi Arabia.

Table 3: Algeria's Cumulative Multipliers Using SVAR				
	Algeria SVAR		Espinoza and Senhadji (2011) (Saudi Arabia)	
Total Expenditures	4 quarters	10 quarters	4 quarters	12 quarters
	0.3**	0.4**	0.2**	0.5**
*Statistical significance at 10%, **Statistical significance at 5%, ***Statistical significance at 1%.				

Table 4 shows the multipliers obtained from the LPM using a sample of MENA oil-exporting countries (specification 2). The impulse responses (Figure 1) derived from this specification are used to calculate average multipliers for MENA oil-exporting countries including Algeria. The results for total spending are broadly in line with those previously obtained from the SVAR model. The multipliers for Algeria also appear to be similar to the average multipliers for MENA oil-exporting countries.

With the LPM, we are able to distinguish the impacts of capital spending from those of current spending over 1, 3, and 5 years. Surprisingly, Algeria's multipliers for total spending are lower than the multipliers for current and capital expenditures taken separately. However these multipliers remain consistent with earlier findings including Espinoza and Senhadji (2011) who also assessed the total spending multipliers to be lower than those for current and capital expenditures taken separately.

For current expenditures, the impulse response function graph shows that the fiscal policy shock is more effective in the short run as the multiplier becomes progressively less significant in the long run. Conversely, the impact of capital spending on non-oil GDP is significant and increases over time.

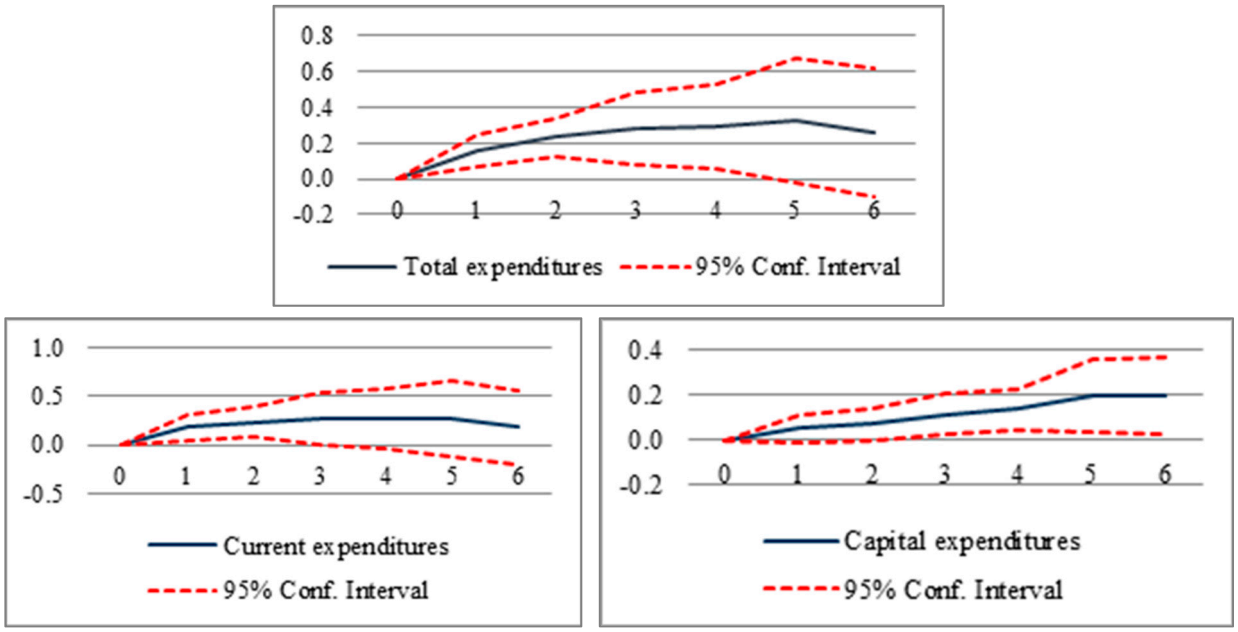
Table 4: Cumulative Average Multipliers Using LPM

Fiscal Policy Indicator	Algeria			MENA Oil-Exporting			Espinoza and Senhadji (2011): GCC		Cerisola et al. (2015): MENA Oil Exporters
	1 Year	3 Years	5 Years	1 Year	3 Years	5 Years	1 Year	3 Years	3 Years
Total Expenditures	0.3***	0.5***	0.6*	0.3***	0.5***	0.6*	0.2-0.3	0.4-0.7	
Current Expenditures	0.6***	0.8**	0.8	0.4***	0.6**	0.6	0.2-0.4	0.3-0.7	0.4
Capital Expenditures	0.3*	0.7**	1.2**	0.5*	1**	1.8**	0.2-0.3	0.6-1.1	1

*Statistical significance at 10%, **Statistical significance at 5%, ***Statistical significance at 1%

There are some small differences between Algeria and other MENA oil-exporting countries that can be explained by the differences in their composition of public spending. In Algeria, current expenditures represent 33 percent of non-oil GDP while the regional average is 44 percent between 2000 and 2015. Conversely, the share of capital spending averaged 16 percent of non-oil GDP over the same period in Algeria, which is higher than the average for MENA oil-exporting countries. Additionally, Algeria's investment efficiency is weaker than in other oil exporters in the region and well below the global average (IMF, 2016), implying that capital spending multipliers for Algeria can be below the average multipliers for the region.

Figure 1: Impulse Response Function: Linear Model for Algeria



IV.2 State-Dependent Multipliers: Non-Linear Specification

In this section, the average multipliers provided by the linear specification are considered as benchmarks and are compared to the state-dependent multipliers corresponding to: a positive or a negative output gap, an increase or a decrease of government spending, and finally the combined effects of both the state of the business cycle and the direction of government spending. The estimated impulse responses resulting from equations (1) to (5) are presented in Appendix IV.

IV.2.1 Output Gap Dependent Multipliers

Table 5 presents the spending multipliers depending on whether the output gap is negative or positive (specification 3).[11] The multipliers appear to be generally significant when the output gap is negative while in most cases they are not when the output gap is positive. These results suggest that a positive spending shock has no impact on non-oil GDP when the latter is above potential. One explanation of this result could be that increasing expenditures when the economy operates above its full capacity is likely to crowd out private investment, reducing the impact of increased public spending on output. By contrast, increasing total spending while the output gap is negative

[11] The literature offers other empirical approaches to assess how fiscal multipliers vary with the position in the cycle, such as by estimating a Threshold Structural Vector Autoregressive model that endogenously identifies different regimes corresponding to booms and busts (Farrazi, Morley and Panovska, 2015). We couldn't apply this approach due to data limitations, as it requires a large balanced panel.

would have a significant and positive effect on output in both the short and the long run. As households face larger liquidity constraints, increasing public spending could help lift these constraints and improve the responsiveness of private consumption to fiscal stimulus. Moreover, some MENA oil-exporting countries experienced high levels of unemployment over the sample period, hence, any crowding out of private sector activities due to an increase in government spending would be limited, implying higher fiscal multipliers when the output gap is negative. Another explanation of the result could be that the efficiency of public spending would increase, and hence fiscal multipliers, when government's resources become more scarce, which triggers efforts to better monitor budget execution and project selection.

For current expenditures, the multiplier is statistically significant only in the short term independently of the output gap. For capital expenditures, the size of the multiplier increases over time and reaches a peak of 1.4 after 5 years. Therefore, a negative shock on capital spending will have a negative and persistent effect on output. Overall, these findings reveal that the linear (i.e., average) multipliers mainly reflect the effect of the fiscal policy shock on output during bad times. Consequently, the average multiplier provided by the basic linear estimation could be misleading.

These results are consistent with the findings of Auerbach and Gorodnichenko (2012) for the United States and Riera-Crichton et al., (2015) for OECD countries. They found large differences in the size of spending multipliers depending on the position in the business cycle, with fiscal policy being considerably more effective during recessions. However, the spending multipliers for MENA oil-exporting countries are much smaller. For instance, the multipliers of total expenditures for OECD countries range from 0.7 to 1.25 when the output gap is negative.

Table 5: Cumulative Multipliers Depending on the State of the Business Cycle

Fiscal policy indicator	Model	Algeria			MENA oil-exporters		
		1 year	3 years	5 years	1 year	3 years	5 years
Total expenditures	*Linear*	*0.3***	*0.5***	*0.6**	*0.3***	*0.5***	*0.6**
	Output gap<0	0.3***	0.4***	0.5*	0.3***	0.4***	0.4*
	Output gap>0	0.2**	0.5	0.4	0.2**	0.4	0.4
Current expenditures	*Linear*	*0.6***	*0.8***	*0.8*	*0.4***	*0.6***	*0.6*
	Output gap<0	0.6**	0.7	0.5	0.4**	0.5	0.3
	Output gap>0	0.4**	0.5	0.3	0.3**	0.4	0.2
Capital expenditures	*Linear*	*0.3**	*0.7***	*1.2***	*0.5**	*1***	*1.8***
	Output gap<0	0.4*	0.7**	1.4**	0.6*	1.1**	2.1**
	Output gap>0	0.2	0.8	1.4	0.3	1.2	2.1

*Statistical significance at 10%, **Statistical significance at 5%, ***Statistical significance at 1%

IV.2.2 Fiscal Multipliers and Expenditure Direction

In addition to the business cycle effects, fiscal multipliers may depend on the direction of fiscal spending. In Table 6, we display the response of output to a discretionary positive or negative shock on government spending. The results support the hypothesis that decreasing total spending has a large negative and significant effect on output. The multipliers associated with total expenditures decrease are significant and increase over time while the effect of a total expenditure increase is not statistically significant. More specifically, increasing current spending will only have significant impact on output while increasing capital spending positively affects output after five years. Besides, a fiscal contraction consisting of reducing current or capital spending is costly as it could lead to a significant contraction on output; with the multiplier for capital spending reaching 2.4 after 5 years. These conclusions broadly hold for other MENA oil exporting countries. These results highlight the fact that using average multipliers may lead to an underestimation of the impact of fiscal adjustment on the economy, as the spending decrease multipliers are higher than the average multipliers from the linear model. Overall, the asymmetries identified here show that in Algeria, a fiscal expansion will have limited effects on non-oil GDP while a fiscal adjustment can be costly for the economy, particularly if the adjustment is based on a contraction in capital spending. These findings are similar to those of Barnichon and Matthes (2016) for OECD countries. They showed that the asymmetry in the size of the multiplier is explained by the asymmetric response of investment. Indeed, a government spending shock lead to lower investment no matter the sign of the shock, as investment is crowded-out following an expansionary spending shock, and is not crowded-in following a contractionary spending shock. Therefore, a deepened analysis of the main transmission channels, including among others investment, consumption, inflation, and interest rates would help explain our findings.[12]

Table 6: Cumulative Multipliers Depending on the Direction of Public Spending

Fiscal policy Indicator	Model	Algeria			MENA oil-exporting		
		1 year	3 years	5 years	1 year	3 years	5 years
Total expenditure	*Linear*	*0.3***	*0.5***	*0.6**	*0.3***	*0.5***	*0.6**
	Expenditure decrease	0.6***	1.2**	1.5*	0.6***	1.1**	1.4*
	Expenditure increase	0.2	0.4	0.5	0.2	0.4	0.4
Current expenditures	*Linear*	*0.6***	*0.8***	*0.8*	*0.4***	*0.6***	*0.6*
	Expenditure decrease	0.9***	1.4**	1.2	0.6***	1**	0.9
	Expenditure increase	0.7**	1.0	1.0	0.5**	0.7	0.8
Capital expenditures	*Linear*	*0.3**	*0.7***	*1.2***	*0.5**	*1***	*1.8***
	Expenditure decrease	0.6**	1.3***	2.4**	1**	1.9***	3.6**
	Expenditure increase	0.1	0.7	1**	0.2	1	1.5**

*Statistical significance at 10%. **Statistical significance at 5%. ***Statistical significance at 1%

[12] This question could be addressed in a future work.

IV.2.3 Fiscal Multipliers and Cyclicality of Public Spending

After having investigated the dependency of fiscal multipliers to the output gap, we further assess their size and significance depending on whether government spending is increasing or decreasing when the output gap is negative or positive. During the period under consideration, there were 121 episodes of countercyclical spending policies and 103 episodes of procyclical spending policies in MENA oil-exporting countries. In Algeria, there were 17 and 9 episodes, respectively.

The results presented in Table 7 and Figure 2 show that increasing spending in good times does not have a significant effect on non-oil GDP. This could be due to crowding-out effects on private consumption and investment as well as low spending efficiency when the economy operates at full capacity.[14] Therefore, private consumption and investment decrease, which may offset the positive effect on output of increasing public spending. These findings hold both for current and capital expenditures. However, when reducing spending in bad times, the impact multipliers are all positive and significant, showing that during recessions the government's decision to reduce public spending has a negative effect on non-oil GDP in the short term. Moreover, a contraction of capital spending durably affects output, the multiplier reaching 2.0 after five years. Therefore, when the immediate priority is to bring the government finances back to a sustainable path, fiscal consolidation should give priority to reducing current spending in order to limit the negative impact on output.

[14] The relevant literature has mixed views on the impact of public investment efficiency on multipliers. Abiad *et al*. (2014) claims that the level of efficiency matters for growth and the fiscal multiplier. On the opposite, Berg *et al*. (2018) claims that increases in public investment spending in inefficient countries do not generally have a lower impact on growth than in efficient countries, and argue that improvements in efficiency overtime increase the growth payoff of public investment expansions.

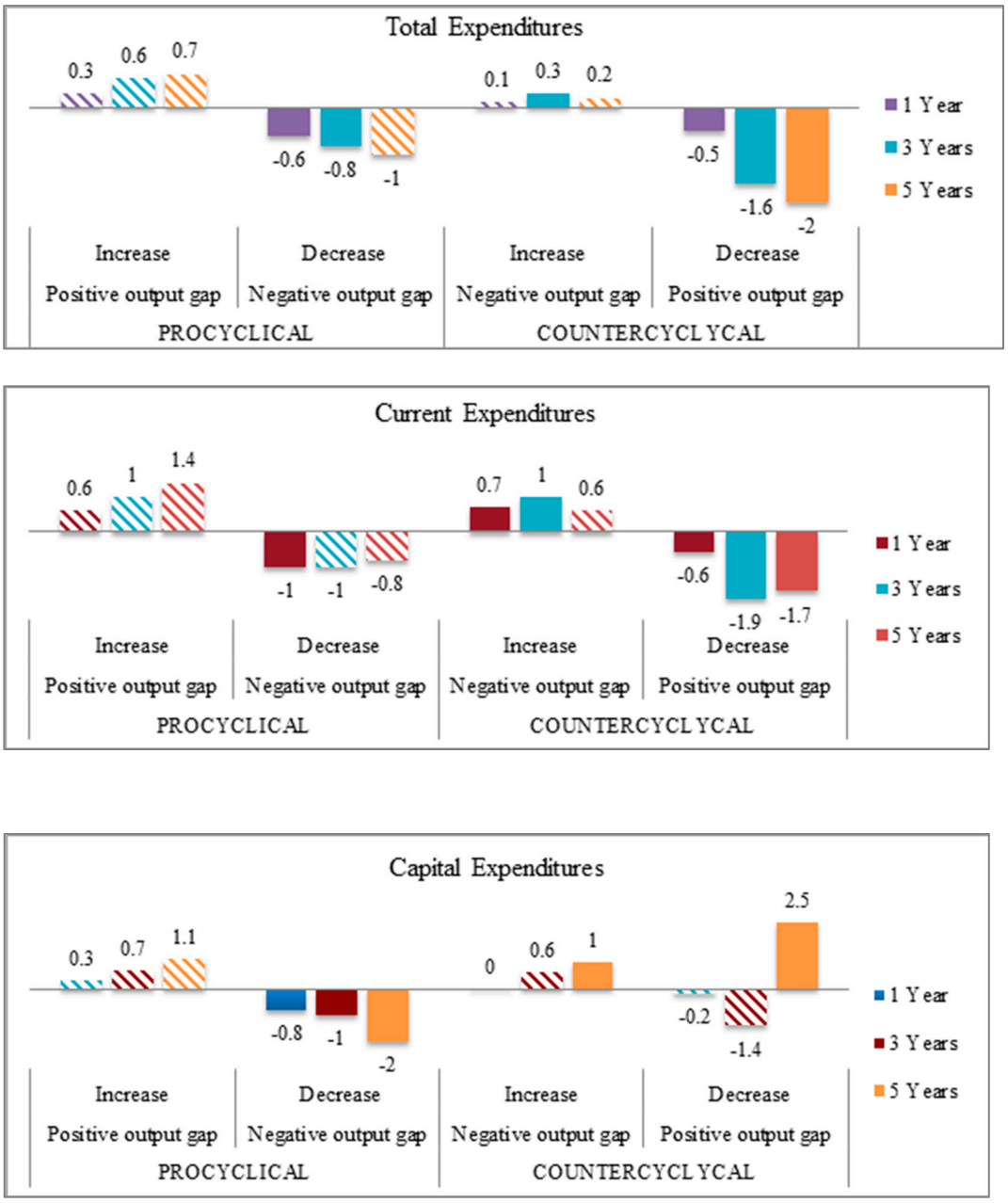
Regarding the impact of a countercyclical fiscal policy on output, the multipliers also depend on whether the government undertakes a fiscal expansion during bad times or a fiscal contraction during good times. During bad times, an increase in total spending has a mixed effect on output as the multiplier is not significant in the short run, becomes significant after 3 years and later reverts to non-significance after 5 years. For current spending, while the short and medium-term multipliers are significant, the impact on output dissipates in the long run. Conversely, increasing capital spending when the output gap is negative is only effective in the long run, although the multiplier is only significant at 10 percent. The multipliers are quite different in the case of a contractionary fiscal policy during good times. We find more consistent multipliers across the different fiscal policy indicators. Surprisingly, a reduction in public spending when the economy is at full capacity has a contractionary and sustained effect on non-oil GDP. The multipliers are sizeable for both current and capital expenditures, highlighting that any contractionary fiscal policies when the economy is operating above its potential need to be appropriately calibrated to limit the negative impact on output.

Table 7: Fiscal Multipliers and Cyclicality of Public Spending

Fiscal policy indicator	**Model**			**Algeria**			**MENA oil-exporting**		
	Cyclicality	Output gap	Expenditure shock	1 year	3 years	5 years	1 year	3 years	5 years
Total expenditures	Procyclical	-	-	0.6***	0.8**	1	0.6***	0.8**	1
		+	+	0.3	0.6	0.7	0.3	0.5	0.7
	Countercyclical	-	+	0.1	0.3***	0.2	0.1	0.3***	0.2
		+	-	0.5***	1.6***	2*	0.4***	1.4***	1.8*
Current expenditures	Procyclical	-	-	1**	1	0.8	0.7**	0.7	0.5
		+	+	0.6	1	1.4	0.5	0.7	1
	Countercyclical	-	+	0.7**	1*	0.6	0.5**	0.7*	0.5
		+	-	0.6***	1.9***	1.7*	0.4***	1.4***	1.2*
Capital expenditures	Procyclical	-	-	0.8**	1***	2***	1.2**	1.6***	3***
		+	+	0.3	0.7	1.1	0.4	1.1	1.6
	Countercyclical	-	+	0	0.6	1*	0	0.9	1.4*
		+	-	0.2	1.4	2.5*	0.3	2.1	3.8*

*Statistical significance at 10%. **Statistical significance at 5%. ***Statistical significance at 1%

Figure 2: Summary of State-Dependent Multipliers for Algeria [/1]



[1/] A dashed bar means the multiplier is not statistically significant.

V. ROBUSTNESS CHECKS

The results appear to be quite robust across alternative specifications of the model.[15] In this section, we conduct additional robustness tests, first by estimating a Panel Structural Vector Autoregression Model (PSVAR), and second, by testing the sensitivity of the results to additional control variables. Finally, we consider an alternative identification of the discretionary shock (Corsetti et al. (2012)) used in the LPM estimation.

V.1 PSVAR Estimation

We start by estimating a bi-variate PSVAR[16] model for MENA oil-exporting countries over the period 2000 to 2015 using the following system of linear equations:

$$\Delta Y_i = \alpha_i + \sum_{k=1}^{k} C_k \, \Delta Y_{i,t-k} + \delta_i X_{i,t} + \mu_{i,t}$$

Where $Y_{i,t}$ is the logarithm of a vector of endogenous variables comprising government spending (total, capital and current) and non-oil GDP for year t and country i. $X_{i,t}$ is a vector of exogenous variables including oil prices, an output gap dummy, a trade openness indicator, an Arab Spring dummy, and a public debt dummy. The number of lags is set to 1 year since it provides serially uncorrelated residuals. In order to identify the discretionary shock, we use the Choleski orthogonalizing identification strategy ordering government spending before non-oil GDP.

For MENA oil-exporting countries, the estimated fiscal multipliers range from 0.3 to 0.6 for total expenditures, 0.2 to 0.3 for current spending, and 0.7 to 1.4 for government investment spending (Table 8), and confirm the previous findings. For Algeria, the multipliers are in the same range as those from the SVAR and LPM estimates. They are below unity and reach a maximum of 1.0 for capital expenditures in the long-term.

Table 8: Average Multipliers Using PSVAR

Fiscal policy indicator	Algeria			MENA oil-exporters		
	1 year	3 years	5 years	1 year	3 years	5 years
Total expenditures	0.3**	0.5**	0.6**	0.3**	0.5**	0.6**
Current expenditures	0.2**	0.4**	0.4**	0.2**	0.3**	0.3**
Capital expenditures	0.5**	0.9**	1.0**	0.7**	1.3**	1.4**

*Statistical significance at 10%, **Statistical significance at 5%, ***Statistical significance at 1%

[15] The Bucket Approach methodology, presented in appendix III, is also used to test the robustness of our findings.

[16] The model is estimated using Abrigo and Love (2015) stata package.

V.2 Additional Control Variables

In this section, we test the robustness of the LPM results to the inclusion of additional variables. Starting with the basic model (specification 2*),* with no control variable, regressors are progressively added to test the sensitivity of the results. Table 9 confirms the previous findings, as they don't change significantly under the different specifications.

Table 9: Robustness to the Controls Variables

Fiscal Policy Indicator	Basic model without any control		Basic + oil price		Basic + oil price + Arab Spring		Basic + oil price, Arab Spring + Business cycle		Basic + oil price, Arab Spring + Business cycle + debt		Basic model with all controls	
	1 Year	*3 Years*	*1 Year*	*3 Years*	*1 Year*	*3 Years*	*1 Year*	*3 Years*	*1 Year*	*3 Years*	*1 Year*	*3 Years*
Total Expenditures	0.4***	0.5*	0.4***	0.7**	0.3***	0.6**	0.3***	0.6**	0.3***	0.6**	0.3***	0.5***
Current Expenditures	0.6***	0.7	0.6***	1*	0.6**	0.9*	0.6**	0.9*	0.6**	0.9*	0.6***	0.8**
Capital Expenditures	0.4*	1**	0.4*	0.9**	0.3*	0.8**	0.3*	0.8**	0.3*	0.8**	0.3*	0.7**

*Statistical significance at 10%. **Statistical significance at 5%. ***Statistical significance at 1%

V.3 Corsetti et al. Identification Method

With the LPM, we used cyclically adjusted indicators in order to isolate the discretionary fiscal shocks. In this section we consider another identification strategy to make sure that the shocks are well identified. Following the two-stage estimation strategy developed by Corsetti et al., (2012), we assume in the first step that government spending is related to its own first lag, the first two lags of non-oil GDP, a trend dummy, and a constant. The residual derived from this specification is meant to capture unexpected discretionary policy changes. In the second step, the estimated fiscal shock is used to gauge the effect of government spending on output using the LPM. Table 10 presents the multipliers derived from this new identification strategy and the multipliers are in the same ranges as in the previous models.

Table 10: Spending Multipliers Using the Two-Stages Procedure

Variable	Algeria			MENA oil-exporting		
	1 year	3 years	5 years	1 year	3 years	5 years
Total expenditures	0.2***	0.4***	0.6**	0.2***	0.4***	0.5**
Current expenditures	0.5***	0.7*	0.9	0.3***	0.5*	0.6
Capital expenditures	0.3**	0.6***	1.2***	0.5**	1***	1.8***

*Statistical significance at 10%. **Statistical significance at 5%. ***Statistical significance at 1%

VI. CONCLUSION

Following the collapse in oil prices, there is a growing need in the MENA region to better understand the economic impact of fiscal adjustment. This study contributes to the existing literature on fiscal multipliers in MENA oil-exporting countries by providing the first estimation of average spending multipliers and state-dependent multipliers for Algeria. While the findings confirm standard estimates of average fiscal multipliers in the region, they also suggest that these averages hide substantial differences under different economic circumstances.

The findings suggest that Algeria-specific average multipliers are moderate and in line with the multipliers in developing and emerging countries. The short-term average multiplier for total expenditures is around 0.3, and in the long term the multiplier ranges from 0.4 to 0.6.

The asymmetries in the response of output to a spending shock are significant. More specifically, the impact of a public spending shock is more important when the output gap is negative. Procyclical fiscal policy in Algeria does not appear to affect output, except for cutting capital spending during recessions. By contrast, multipliers associated with countercyclical fiscal policies can be sizeable. Cutting current spending does not materially affect non-oil GDP.

These results highlight the fact that average multipliers usually found in the literature may underestimate the impact of fiscal adjustment on output. When designing fiscal consolidation programs, the position of the economy in the business cycle and the asymmetric effects of fiscal consolidation and fiscal expansion should be considered. Finally, the estimations for MENA oil-exporting countries provide a framework that could be used to calculate country-by-country fiscal multipliers, using the approach presented here for Algeria.

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APPENDICES

Appendix I: Description of Variables and Data Sources		
Variable	**Description**	**Source**
Non-Oil GDP	Log difference of real non-oil GDP	IMF's WEO database
Total expenditures	Log difference of general government real total expenditures	IMF's REO database
Capital expenditures	Log difference of general government real capital expenditures	IMF's REO database
Current expenditures	Log difference of general government real current expenditures	IMF's REO database
Cyclically adjusted fiscal indicators	The logarithm of a fiscal policy indicator (total expenditures, capital expenditures, and current expenditures), cyclically adjusted using Escolano's (2010) methodology	Author's calculations based on IMF's REO database
Output gap dummy	The output gap is the difference between actual and non-oil GDP trend. This dummy equals 1 when the output gap is negative and 0 otherwise	Author's calculations based on IMF's WEO database
Trade openness	Sum of exports and imports to GDP	IMF's WEO database
Arab spring dummy	Dummy variable that takes 1 since 2011 and 0 otherwise	Author's calculations
Public debt	Dummy variable that takes 1 if general government gross debt is above 60% of GDP	IMF's REO database
Crude oil prices	Crude oil prices in US dollars	IFS database

Appendix II: Summary of Average Multipliers							
Fiscal Policy Indicator	**Algeria**		**MENA Oil-Exporting**		**Espioza And Senhadji (2011): GCC**		**Cerisola & Al. (2015): MENA Oil-Exporting**
	1 Year	**3 Years**	**1 Year**	**3 Years**	**1 Year**	**3 Years**	**3 Years**
Total Expenditures	0.3	0.4-0.5	0.3	0.5	0.2-0.3	0.4-0.7	
Current Expenditures	0.2-0.6	0.4-0.8	0.2-0.4	0.4-0.6	0.2-0.4	0.3-0.7	0.4
Capital Expenditures	0.3-0.5	0.7-0.9	0.5-0.7	0.9-1	0.2-0.3	0.6-1.1	1

Appendix III: The Bucket Approach[17]

Using the bucket approach developed by Batini et al. (2014), this section assesses fiscal multipliers by only relying on Algeria's economic fundamentals. This methodology is generally used when data availability is limited. It can shed light on the extent to which multipliers derived from empirical methods are in line with theoretical economic fundamentals.

The impact fiscal multipliers are calculated in three steps:

1. **First step:** assign scores (1 or 0) to the country based on certain structural characteristics according to identified thresholds.

    - Trade openness indicator: A value of **zero** is assigned to this indicator when the ratio of imports to domestic demand is less than 30 percent on average over the past five years, as is the case for Algeria.

    - High labor market rigidities: this indicator receives a value of **one** since the labor market is highly regulated in Algeria.

    - The size of automatic stabilizers measured by the ratio of public spending to nominal GDP is greater than 40 percent. Therefore, a value of **zero** is assigned to this indicator.

    - Fixed or quasi- fixed exchange rate regime: Algeria has a de jure exchange rate arrangement managed float and a de facto exchange regime classified as other managed arrangement with no preannounced path for the exchange rate. A score of **zero is given** to this indicator.

    - Low/safe public debt level: The gross government debt ratio is below 40 percent of GDP. Therefore, this indicator receives a score of **one.**

    - Effective public expenditure management and revenue administration: Public expenditure management is inefficient, according to the IMF, 2016.Therefore, we assign a score of **zero**.

Appendix III.1: Scoring Based on Structural Characteristics

Structural Characteristic	Algeria
Relatively closed	0
Rigid labor markets	1

[17] The model estimated in this section could be extended to include some structural characteristics, such as the sign of the output gap, or other relevant features for MENA oil-exporting countries, including the type of financing, the degree of oil dependence, and the size and integration of financial markets.

Small automatic stabilizers	0
Fixed exchange rate regime	0
Safe government debt	1
Effective expenditure/revenue management	0
Total score	**2**

2. **Second step:** sum the scores to determine the likely level of the first-year multiplier (low, medium, or high) in "normal" times. The score assigned to Algeria is 2. According to the Bucket approach methodology, countries with total scores between 0 and 3 can be assumed to have low multipliers ranging between **0.1-0.3.**

3. **Third step:** scale up or down the range assigned through the scoring method depending on some conjunctural characteristics.

    - Negative output gap: both the lower and upper bound should be increased by 60 percent, which gives a range of **0.2-0.5**.

    - Positive output gap: both bounds should be decreased by 40 percent, yielding a range of **0.1-0.2**.

Appendix III.2: Derivation of First-Year Spending Multiplier Using the Bucket Approach

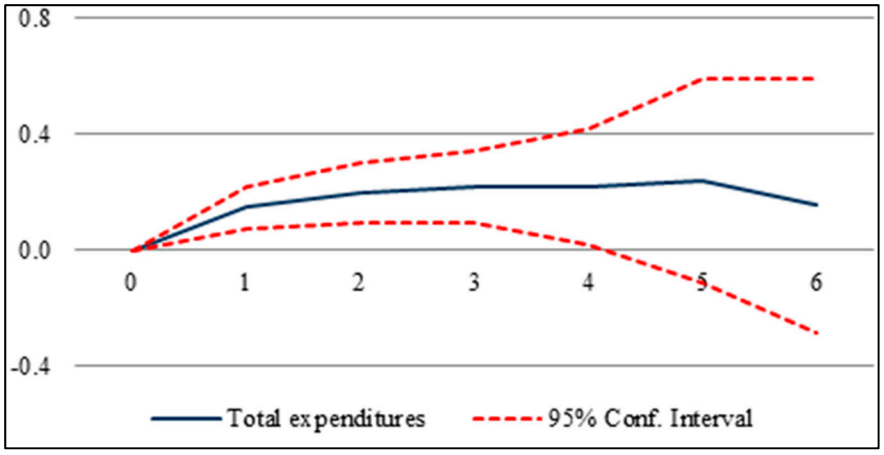
	Score	Normal times	Positive output gap	Negative output gap
Algeria	2	0.1-0.3	0.2-0.5	0.1-0.2

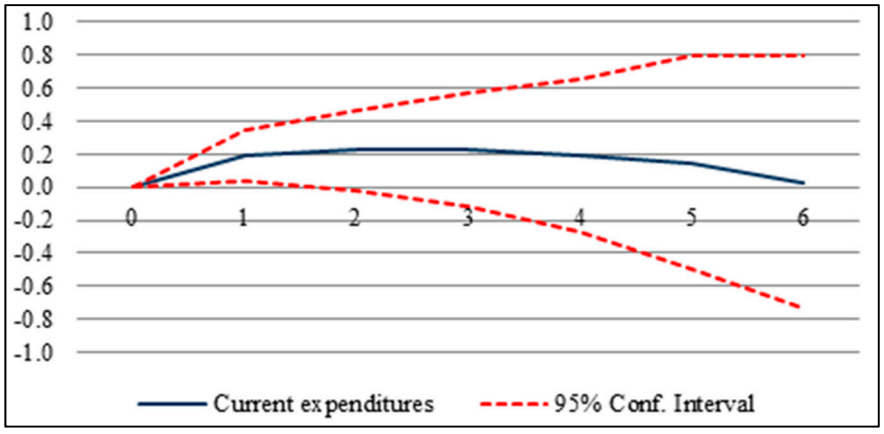
Considering the results provided by the SVAR, PSVAR, and the LPM, the buckets approach multipliers confirm the robustness of the empirical estimations for the first-year multiplier.

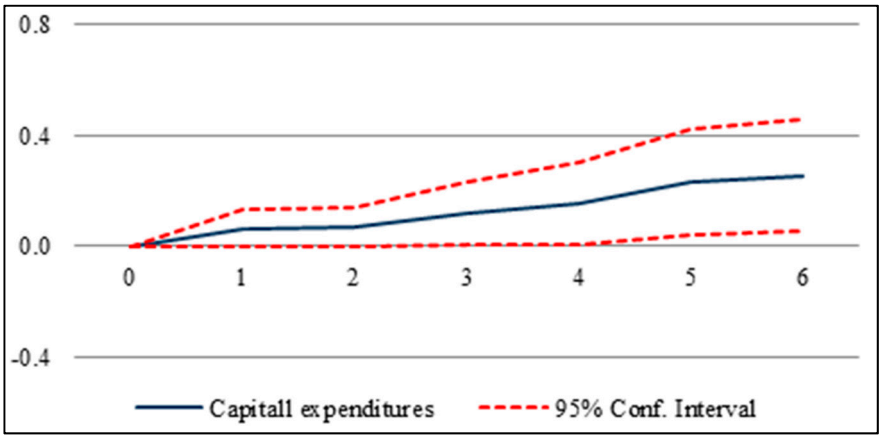
Appendix IV: Impulse Response Function of the Non-Linear Model

A. Output Gap Dependent Multipliers Using LPM

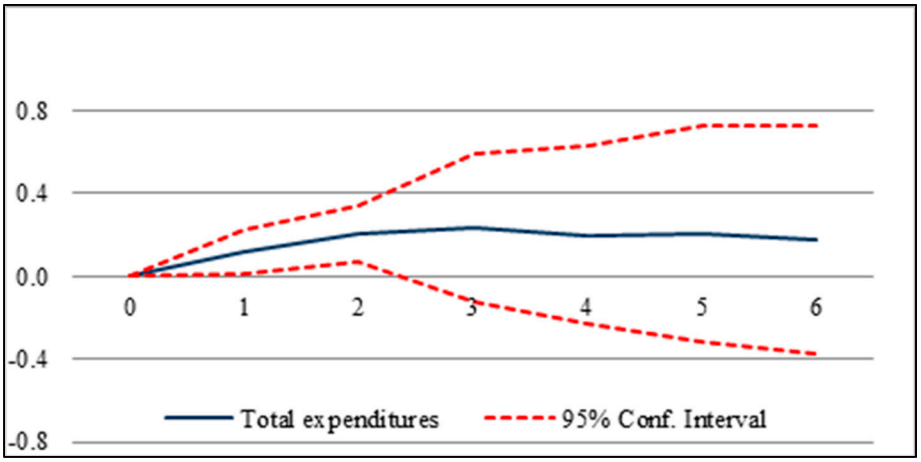
- Negative output gap

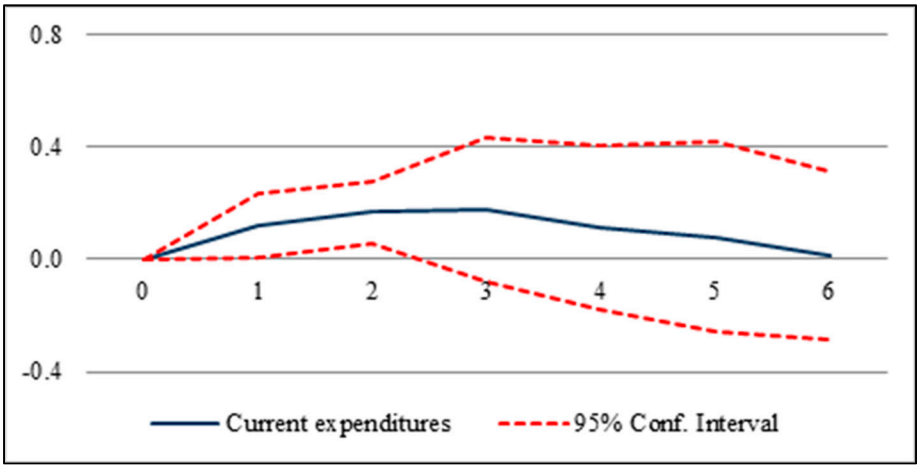


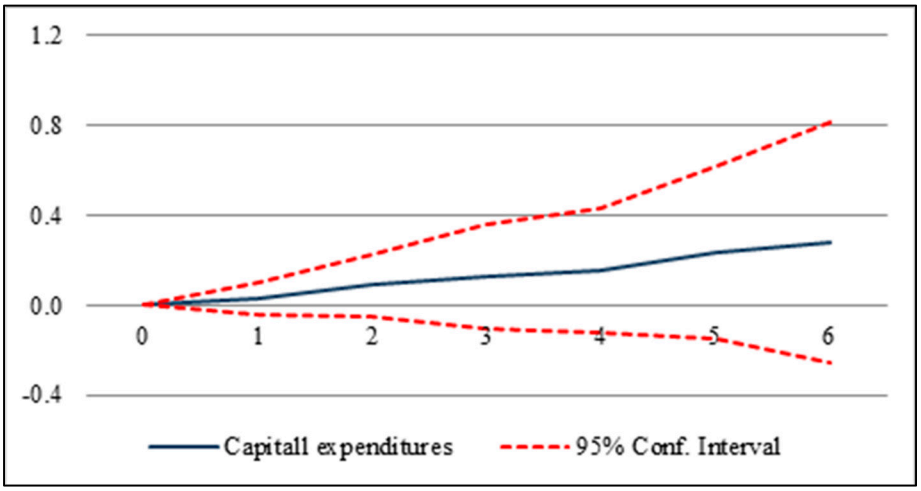




- Positive output gap

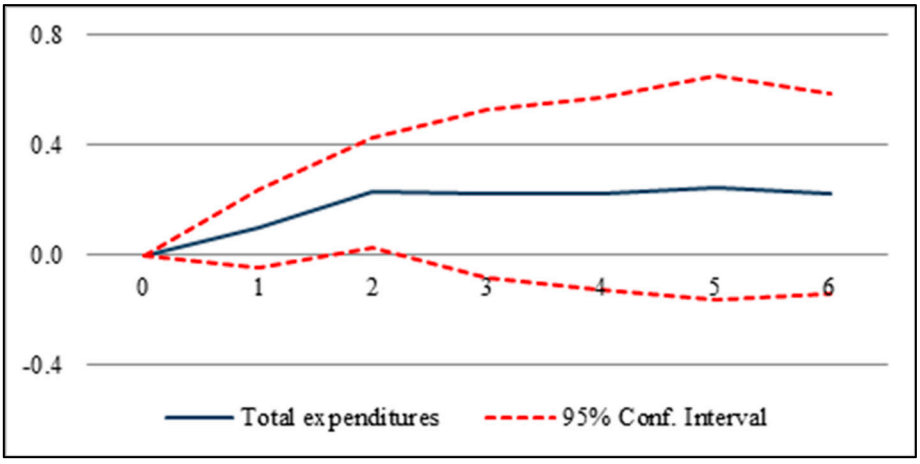


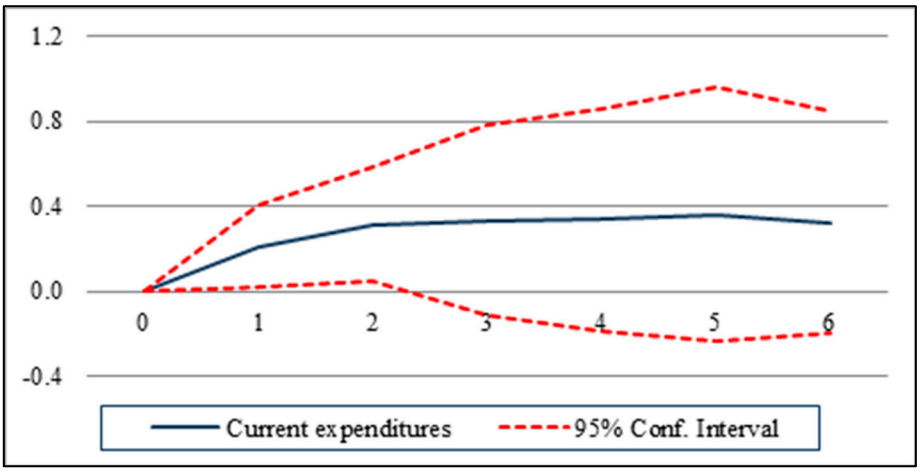


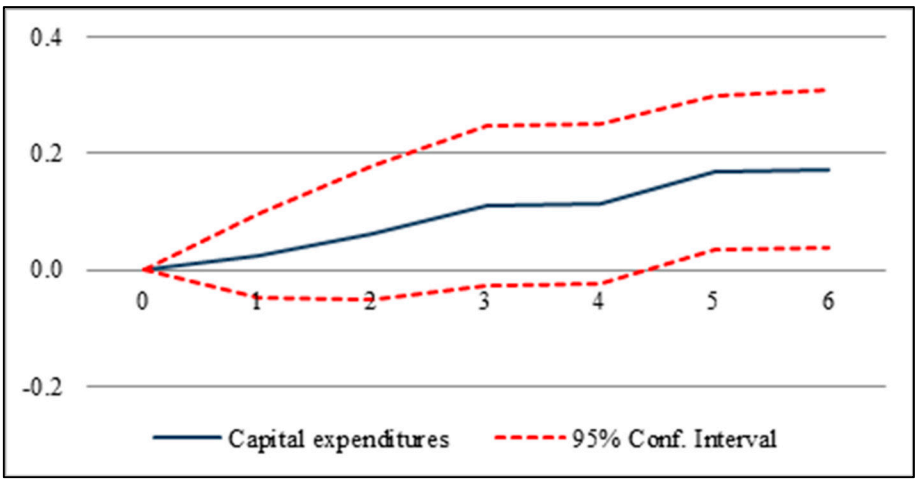


B. Expenditure direction effect using LPM

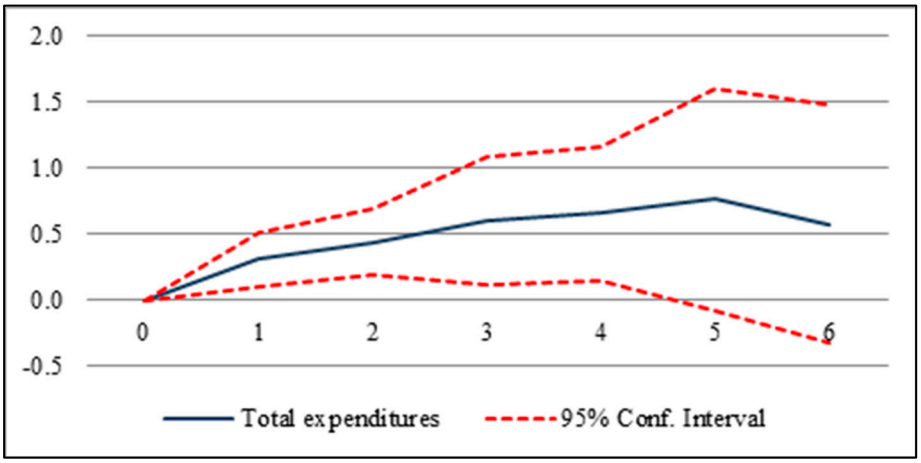
- Expenditure increase

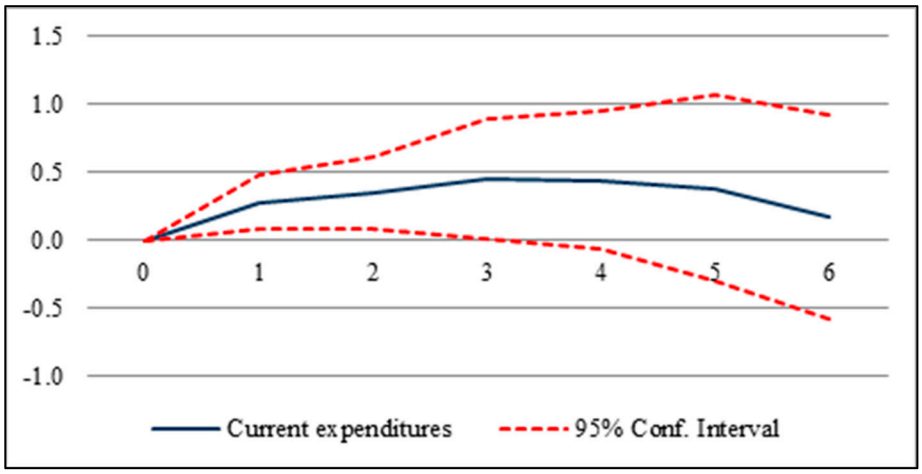


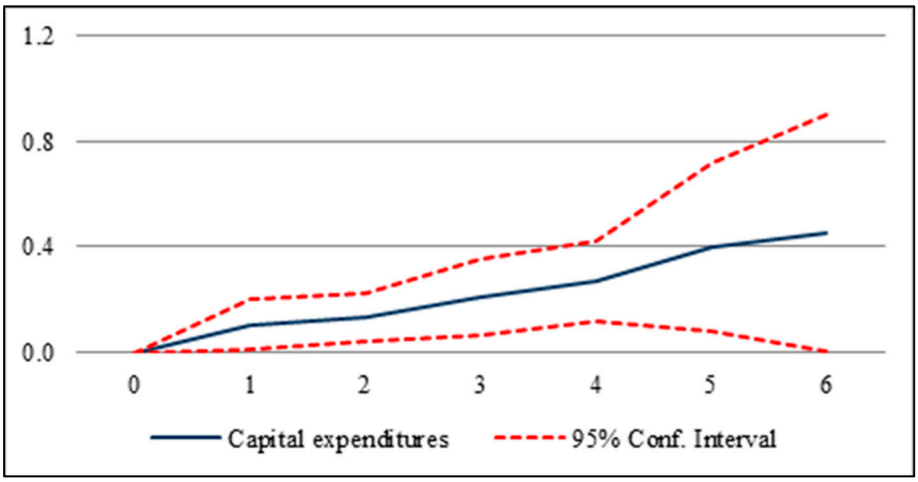




- Expenditure decrease

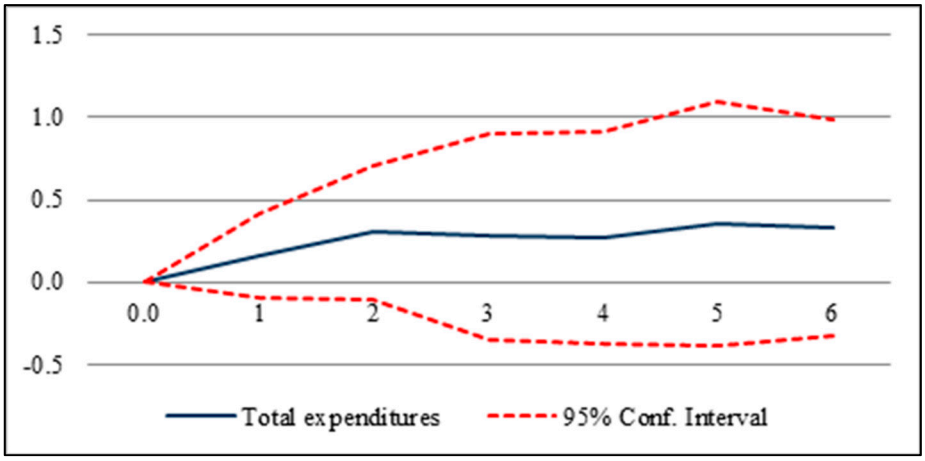


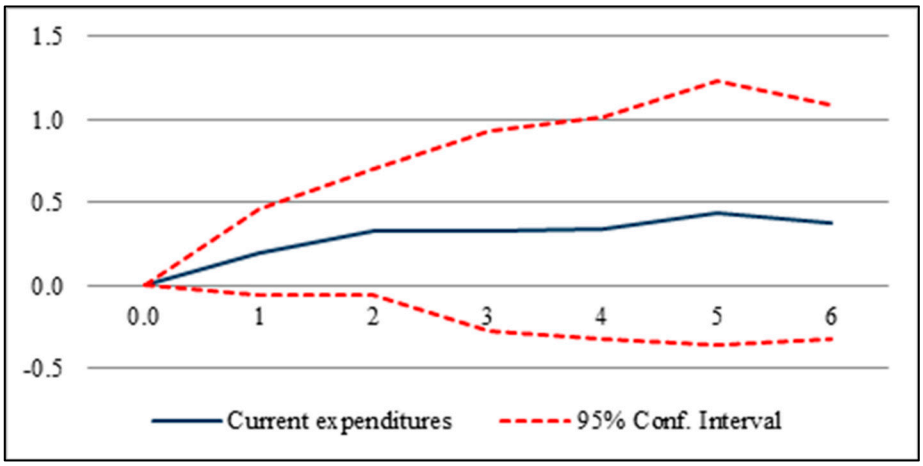


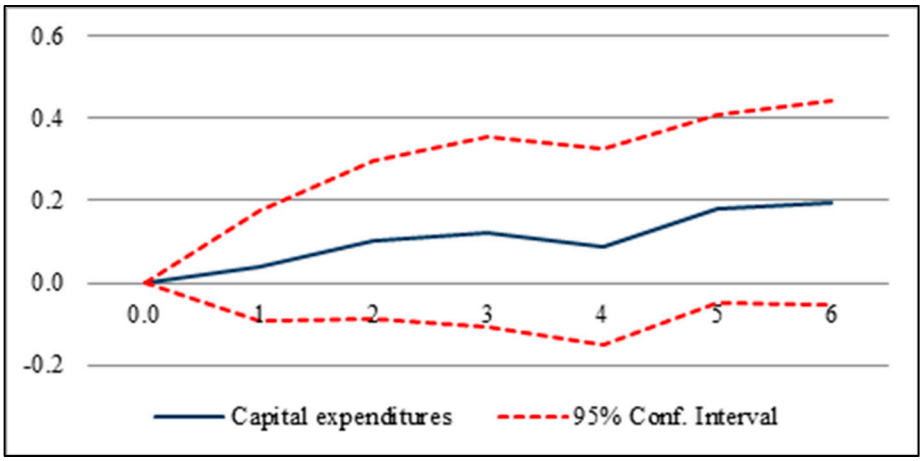


C. Procyclical and countercyclical policies

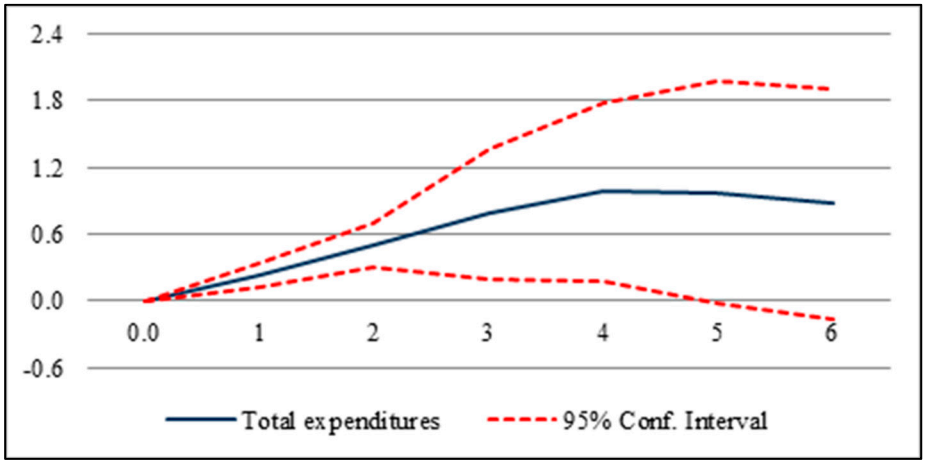
- Positive output gap with expenditure increase

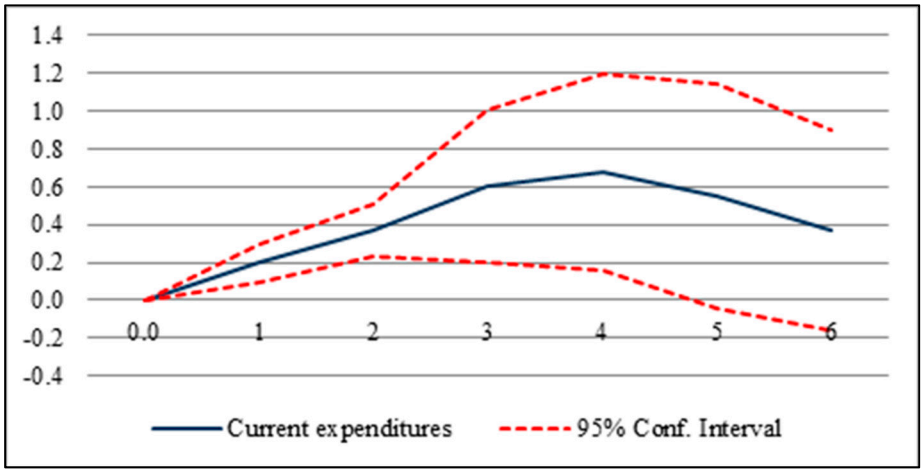


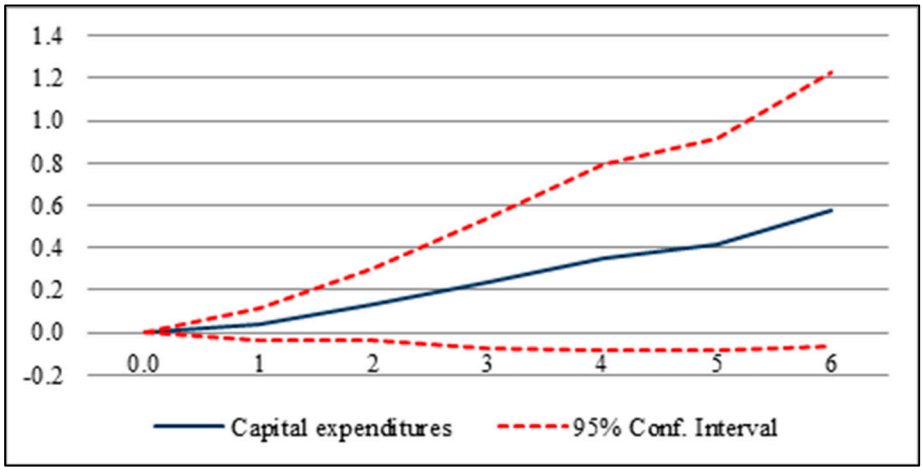




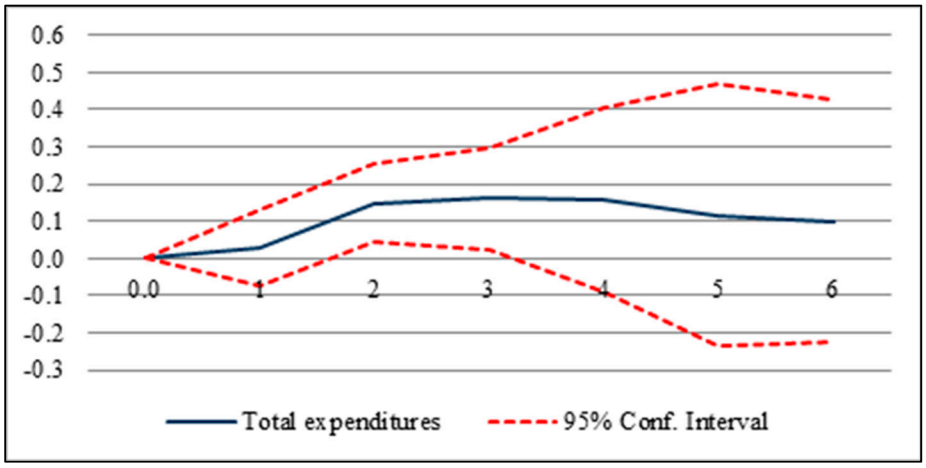
- Positive output gap with expenditure decrease

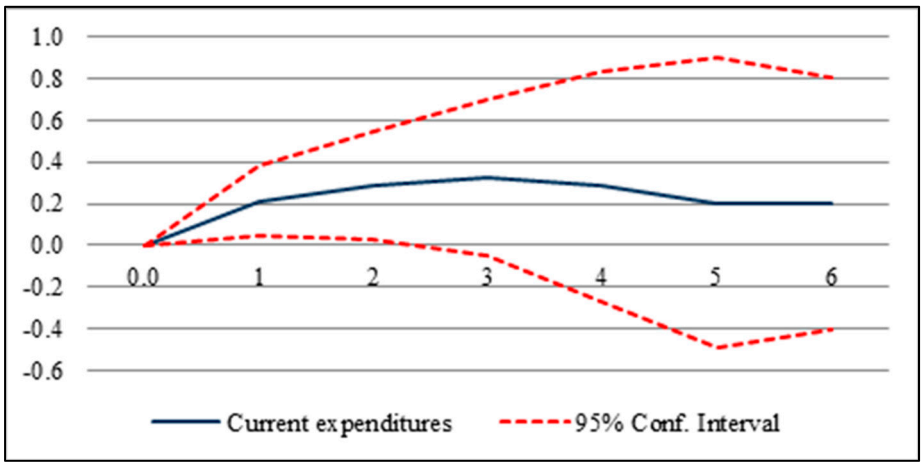


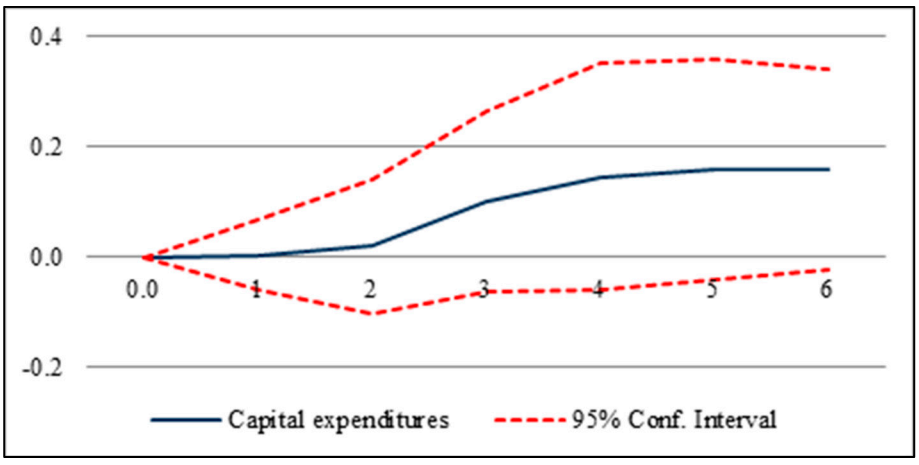




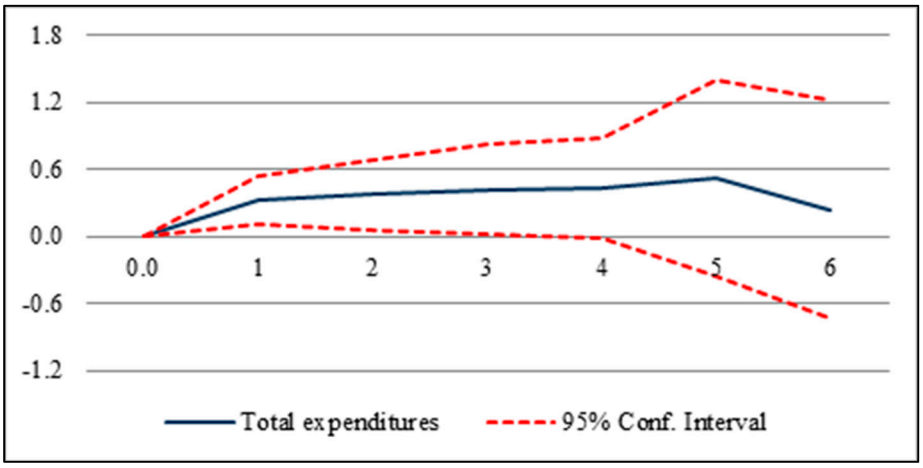
- Negative output gap with expenditure increase

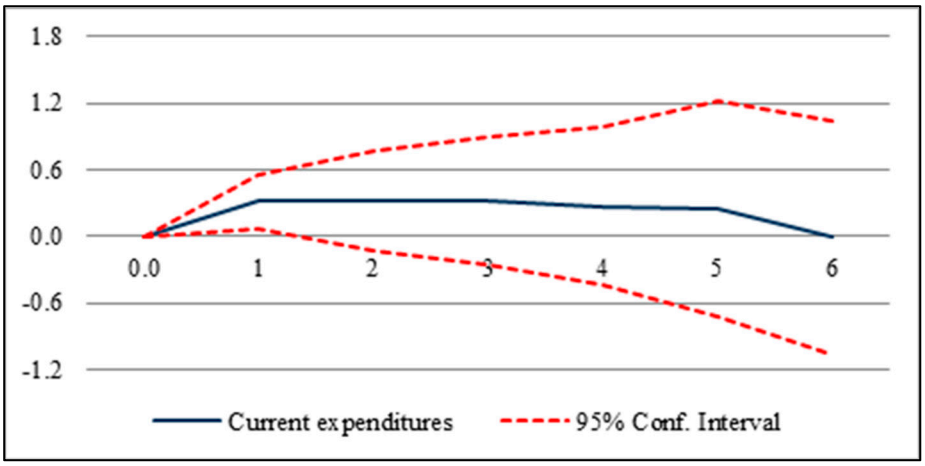


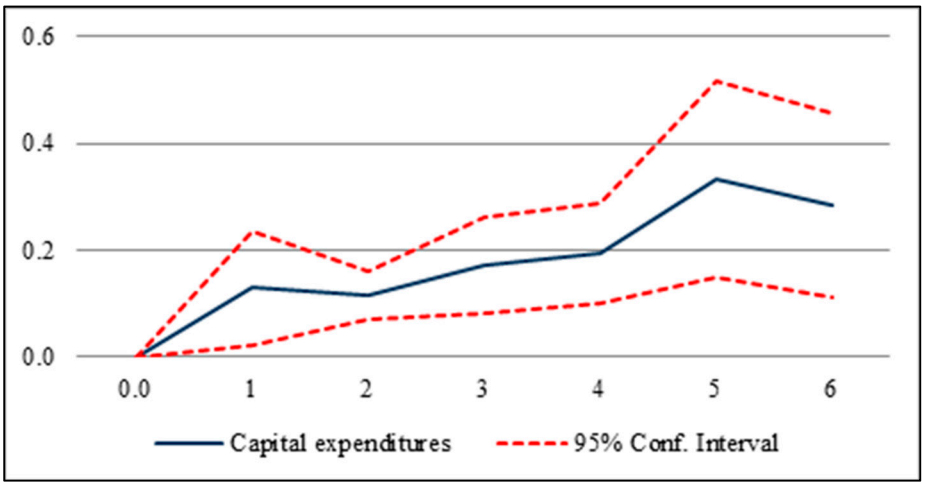




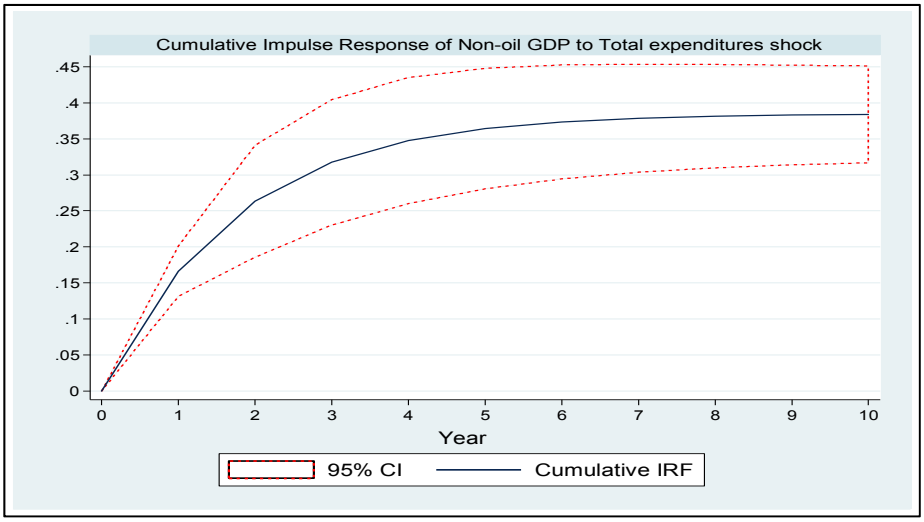
- Negative output gap with expenditure decrease

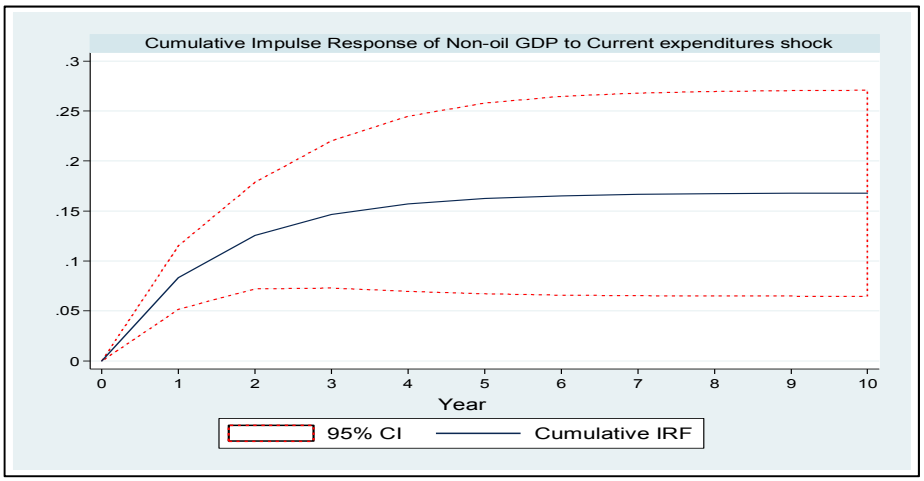


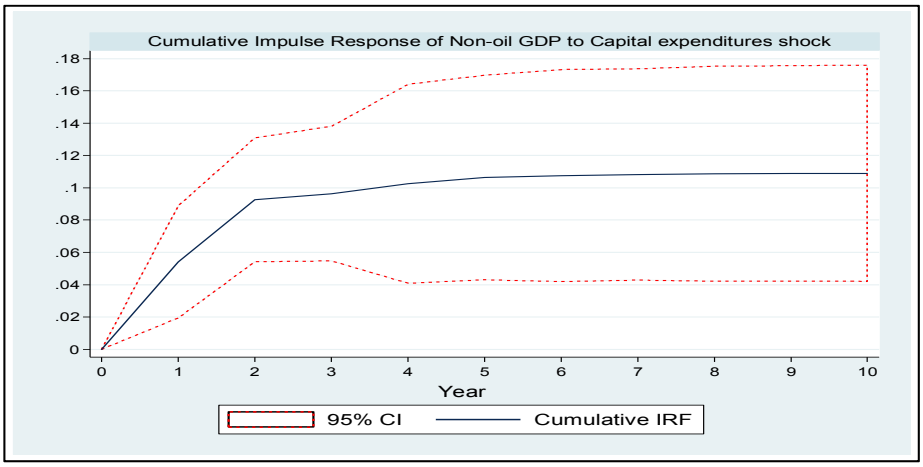




Appendix V: Impulse Response Function from PVAR Estimates







Appendix VI: Impulse Response Function from LPM with Corsetti et al. Identification