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Send correspondence to:
Abderrahim Chibi
Faculty of Economics and Management, Tlemcen University, Algeria
chibirahim @yahoo.fr

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Abstract

This paper estimates the effects of fiscal policy on Algerian economic activity using a Markov Switching Vector Autoregressive (MSVAR) model. We find evidence of asymmetric effects of fiscal policy across regimes, defined by the state of the business cycle (two situations: recession and boom). The results show small positive government spending and revenue multipliers in the short term in both regimes. In addition, fiscal policy shocks have a stronger impact in times of economic stress than in times of expansion, which confirm and consolidate the hypothesis of asymmetric effects. However, the impact of government spending is stronger than the impact of public revenue in recession periods. On the other hand, fiscal policy decision-makers interact with an Anti -Keynesian view (procyclical), as they raise revenue and expenditure in the case of boom and vice versa in the case of a recession.

JEL Classifications: E32, E62

Keywords: Fiscal policy, economic activity, nonlinear effect, MSVAR model.

ملخص

تقدر هذه الورقة آثار السياسة المالية على النشاط الاقتصادي الجزائري باستخدام نموذج ماركوف لتحويل المتجهات والانحدار الذاتي (MSVAR). نجد أدلة على الآثار غير المتماثلة للسياسة المالية عبر الأنظمة المحددة من قبل الدولة من دورة الأعمال (حالتين: الركود والازدهار). تظهر النتائج مضاعفات إيجابية صغيرة للإنفاق والإيرادات الحكومية على المدى القصير في كلا النظامين. بالإضافة إلى ذلك، فان صدمات السياسة المالية لها تأثير أقوى في أوقات الشدة الاقتصادية مما كانت عليه في أوقات التوسع، والتي تؤكد وترسخ فرضية الآثار غير المتماثلة. ومع ذلك، فإن تأثير الإنفاق الحكومي هو أقوى من تأثير الإيرادات العامة في فترات الركود. من ناحية أخرى، يتفاعل صناع القرار في السياسة المالية مع وجهة نظر ضد Keynesian (مسايرة للاتجاهات الدورية)، لأنها تزيد الإيرادات والنفقات في حالات الازدهار والعكس صحيح في حالة ركود.

1. Introduction

Despite the large literature on the impact of monetary policy on economic activity, fiscal policy has received less attention and its importance for economic stabilization has been typically neglected. The recent financial turmoil has, however, revived the interest of academia, central bankers and governments on the stability role of fiscal policy[1], who have tried to find some empirical evidence, which could lead to a consensus on the nature of the impact of fiscal policy on economic activity, and, thus this would be helpful to discriminate among competing theories.

From a theoretical point-of-view, Keynesian theory suggests that a reduction in government expenditure has a negative effect on private demand and therefore on output. Contrary, neoclassical theories (which are based on rationale expectations, Ricardian equivalence, and credibility or signal effect) argue that fiscal contractions makes room for an expansion of the private sector and thus have a stimulating effect on the economy (non- Keynesian or Anti - Keynesian effects). The recent literature discusses that both theories might be right at different times, as the asymmetric response of the economy to fiscal policy shifts as a result of whether the country is in boom or depression times.

In this context, the extent discretionary fiscal policy is heavily used in recessions to stimulate aggregate demand, but the key empirical question is how the effects of fiscal shocks vary over the business cycle. The answer is not only interesting to policymakers in designing stabilization strategies but it can also help the economics profession to reconcile conflicting predictions about the effects of fiscal shocks across different types of macroeconomic models. In particular, the question as to whether a tax-cut policy stimulates real activity more than a government spending shock, has fueled years of discussion between Keynesian and classical economists. The interest for this issue has been renewed with the current financial crisis. In the face of a severe recession, policymakers are trying to establish whether fiscal stimuli should remain similar to those implemented in the pre-crisis period or whether they should be specific to this recession period.

Empirical studies could be distinguished by the approach chosen to identify fiscal policy impact. Four main identification approaches have been used to date: the recursive approach, the structural approach, the sign restrictions approach, and the event study approach. But what can be seen from all these approaches, however, is that they often fail to clarify the asymmetric responses (nonlinear). This would explain the nature of the effects of fiscal policy depending on the state of the business cycle (recession or boom). Thus, these different approaches have tried to answer many fundamental questions that could be formulated as follows:

- Is the impact of fiscal policy in economic activity symmetric in all circumstances? Or is it different in bad or critical times (recession) than it is in the good times (boom)?
- Are direct spending policies more efficient than tax-cut policies to increase GDP during recessions?
- How do fiscal policy decision-makers react to the fluctuations of the business cycle? Do they apply conjunctural fiscal policies with a Keynesian (countercyclical), non- Keynesian (acyclical) or Anti –Keynesian (procyclical) view?

As far as Algeria is concerned, the transition from fiscal austerity policies under the structural adjustment program to expansionary fiscal policies has been expressed by the high volume of public spending which has risen from 28.19% of GDP in 1996 to 43% in 2009. However, the growth rates achieved remains very weak compared with the value of investments that have been injected during all these past years. In this regard, total expenditure of public investment

[1] In fiscal policy, there are two different approaches to stabilize the economy: automatic stabilizers and discretionary policy. Both approaches focus on minimizing fluctuations in real GDP but have different means of doing so.

exceeded 10% of GDP (equivalent to almost 432 billion dollars), to achieve only an amount of 4.7% average annual growth between 2001 and 2012, which reveals an imbalance according to purely economic measures (loss of about 5% of the value of the economy), which could be explained by the absence of a strong productive industrial sector, and the weak effectiveness of the public sector (crowding-in effects).

The main objective of this paper is to shed light on this prevailing situation in Algeria by providing some explanations of the above situation, on one hand, and, to try to take into account the recent evidence for the non-linear effects of fiscal policy on the another hand. We will be using a MSVAR (Markov-Switching Vector Autoregressions) model to propose an alternative way of measuring the impact of fiscal policy on output growth dynamics within the nonlinear approach (two situations: boom and recession). Our data includes quarterly time series over the period from 1970 to 2011 for the three variables (government revenue, government spending and real GDP). The advantage of such an approach is that it separates periods of low growth from periods of high output growth allowing the probabilistic structure of the transition from one regime to the next be a function of fiscal variables. The model, therefore, measures the impact of fiscal policy for different situations of the economy.

The remainder of this paper is organized as follows: section two deals with the theoretical foundation of the effects of fiscal policy on economic activity, whereas a descriptive analysis of fiscal policy performance in Algeria is presented in section three. Detailed empirical evidence is presented in section four. Section five focuses on the methodology used as well as the main results. The last section proposes some conclusions and recommendations for decision-makers.

2. Theoretical Issues

To achieve its economic objectives, the government may use a set of measurements relating to expenditure and revenue state, all these actions constitute the fiscal policy. The central issues with fiscal policies are how a fiscal expansion or a fiscal tightening acts on output. Fiscal expansion increases the budget deficit[2] while fiscal tightening reduces deficits. Fiscal expansions are based on increases in government expenditures and/or tax reductions. Fiscal contractions involve cuts in expenditure and/or an increase of taxes.

Looking at the short-term ***demand side effects*** of fiscal policies, we can distinguish between traditional Keynesian effects and non-Keynesian effects, a conjecture which was proposed in the 1990s. In the ***traditional Keynesian view***, fiscal expansions have a multiplier effect of above one; contractions would therefore reduce output. The multiplier for expenditures is higher than for taxes [3]. However, fiscal expansions involve crowding out effects since they lead to higher interest rates, which reduces investment and thus reduces the output effect [4]. In the opposite case of a fiscal contraction, one may therefore observe a crowding in effect. The reduction of government spending leads to a reduction of interest rates and therefore, higher investment which diminishes the contractionary effect of fiscal tightening. In an open economy, the size of fiscal multipliers will depend primarily on whether the exchange rate is flexible or fixed.

[2] In resource rich countries fiscal deficit can be covered by resource revenues (full-fledged sovereign wealth fund).

[3] Intuitively it is not difficult to see why, the change tax enters spending decisions through consumption and consumption is dependent on the MPC. Whereas as G affects spending decisions directly, it is an injection into the economy that does not have to work through some indirect source to have an effect on the economy. In the traditional Keynesian cross-model, we have:

$\Delta Y/\Delta G = 1/(1 - MPC) > \Delta Y/\Delta T = -MPC/(1 - MPC)$ as the MPC is between 0 and 1. If a spending increase is matched by a tax increase, the resulting "balanced budget multiplier" is exactly one. In other hand, the multiplier is smaller for proportional income (and consumption) taxes than for lump-sum taxes. When there are both lump sum and proportional taxes, the multiplier effect of changes in either type of tax is the same as for proportional taxes alone.

[4] When prices and wages are sticky, higher debt that is caused by deficit financed tax cuts or spending increases adds to aggregate demand, leading income and output to increase. However, the deficits reduce public saving. If private saving and capital inflows do not increase enough to fully offset government borrowing, interest rates rise over time. Consequently, investment is crowded out, and capital and output eventually decline, negating the short-run expansionary benefits.

With a flexible exchange rate, capital inflows attracted by higher domestic interest rates appreciate the exchange rate. With perfect capital mobility, there is complete crowding out and so fiscal policy is ineffective. With a fixed exchange rate, a fiscal expansion will produce a smaller increase in interest rates than in a closed economy, and with perfect capital mobility fiscal policy is very effective because the money supply will increase to ensure that domestic interest rates will not rise at all (i.e., domestic and foreign interest rates will remain the same). In both cases however – closed and open economy - the multipliers are greater than, or in the extreme case equal to zero; they never turn negative.

In the short run, due to a positively sloped aggregate supply curve, output follows aggregate demand changes[5]. This is what Elmendorf and Mankiw (1998) call a "conventional view" of fiscal policy (Siwińska and Bujak 2003: 7).

In ***neo-Keynesian*** models with flexible prices, expansions lead to higher prices that reduce the money supply and raise interest rates with the consequence that crowding out offsets the positive output effect. With fiscal contractions, in contrast, crowding in offsets the negative output effect. Deficit reductions reduce prices and interest rates and, thus, improve the conditions for investment. In an open economy with capital mobility, higher interest rates attract capital from abroad. If exchange rates are flexible, the currency appreciates and crowding out is complete with rigid prices, but less with flexible prices since the appreciation lowers prices. A fiscal contraction, in contrast, leads to a lower interest rate and a depreciation of the currency, offsetting the contractionary effect of fiscal policy either fully with rigid prices or partly with flexible prices. If exchange rates are fixed, and prices rigid, capital inflows will prevent interest rates from rising, preventing crowding out. Fiscal expansions and contractions then have a strong positive or negative output effect. With price flexibility these effects are again reduced (Gabriele Tondl 2004: 7).

In contrast to the traditional Keynesian effects there are non-Keynesian effects, which are based on rationale expectations, Ricardian equivalence, and credibility:

If individuals shave ***rationale expectations***, a continuous fiscal expansion leads them to expect a continuous rise in interest rates, which discourages investment and may lead to negative multipliers. Similarly, with a credible fiscal consolidation individuals will expect a constant reduction of interest rates, which encourages investment and may significantly reduce the negative output effect of contractions and even turn it into a positive effect. Furthermore, when expenditures are reduced, individuals expect a reduction of future taxes, which increases their lifetime income (wealth) and leads to an increase of present consumption (Alesina and Ardagna 1998). Expectations may also in some cases lead to noncontractionary effect of a tax increase. If consumers consider that a tax increase implies a regime shift, they consider this as a one for all event and expect no more future wealth reducing tax increases and therefore keep consumption unchanged (Alesina and Perotti 1997).

In the case of ***Ricardian equivalence*** (Barro 1974), - which is closely linked to the concept of expectations-, if the government reduces taxes, the knowledge that governments have a fiscal constraint and are bound to rules (Maastricht convergence criteria) causes individuals to expect future tax increases which would reduce their wealth. Consequently, they would reconsider their lifetime consumption, increase savings for future consumption and reduce present consumption. Tax cuts will therefore not lead to an increase of consumption. In contrast, as indicated in the previous paragraph, with a reduction of government expenditures, individuals expect future taxes to decrease, which should increase present consumption.

[5] To the extent that the AS curve in the IS-LM-AS model is upward sloping, the multiplier can vary from relatively large (the AS curve is flat and there is a great deal of slack in the economy; i.e., in a recession) to relatively small (the AS curve is steeply upward sloping and the economy operates at full capacity; i.e., in an expansion).

The ***credibility*** argument stresses that governments which signal a credible consolidation of the budget, i.e. if the effort is large enough and continuous, or – even better – backed by rules such as the convergence criteria, interest rate premia would diminish and the reduced interest rates would stimulate investments. By such, the contractionary effects of budgetary consolidation can be prevented and fiscal contractions can become expansionary.

This state of the art has been somewhat challenged in the early 1990's, as none of these theories – neither Keynesian nor PILCH/Ricardian - could explain the phenomenon first described in a seminal paper by Giavazzi and Pagano (1990:81), who analyzed the effects of fiscal policy in Denmark and Ireland in, respectively, 1982 and 1987-89[6] and concluded that these were "…the two most striking cases of expansionary (fiscal) stabilizations in Europe". Since then, some economists have tried to explain this apparent paradox. Below, we sketch the most influential models that explain the so-called ***non- Keynesian effects*** (or anti-Keynesian effects i.e. a negative fiscal multiplier): the models by Blanchard (1990), Bertola and Drazen (1993), Sutherland (1997) and Perotti (1999). All four models are neoclassical (i.e. based on PILCH) and each holds that expectations of future fiscal policy changes can give rise to nonlinear consumer behavior.

Blanchard's (1990) model is based on the notion, that the larger the tax rate, the larger are the distortions in the economy. He assumes a critical level of taxation t^*, such that distortions caused by taxes, which exceed this level, imply a decrease in output. Consequently, there is also an associated critical level of debt d^* that implies, through the government budget constraint, a future tax rate above the critical level t^* and a lower output.

If consumers anticipate that this critical level of debt d^* will be reached, then a fiscal consolidation that stabilizes or lowers debt value, allows the economy to escape from the highly distortionary tax trap. Thus expected permanent income is higher and consumption rises. In other words: today's tax increase, which does not exceed the critical value t^* allows a larger future increase that would exceed t^* and hence lower output to be avoided. As a result, fiscal consolidation in "bad fiscal times" can be good news and raise consumption.

Blanchard notes, that if consumers have a constant probability of death (are not Ricardian), then "in normal times" i.e. when the economy is far from the critical debt level, despite a neoclassical structure of the model, fiscal policy will have Keynesian effects. The model thus shows, that consumers behave in a non-linear fashion – in "normal times" they behave in a Keynesian way (provided they have finite horizon), in "bad times" their behavior is reversed, which gives rise to non-Keynesian effects.

The model of Bertola and Drazen (1993) analyzes the effects of public expenditure. It assumes that government spending follows a random walk with positive drift. To satisfy budget constraint, government is forced, at some points in time, to discretionary lower expenditure. The model assumes that these fiscal stabilizations are triggered by unique levels of government spending g^* or g^{**}, which are viewed as critical: the lower value g^* triggers a stabilization (a decrease of spending to a new level g) with probability p^*, which is less than one. If g^* is surpassed then at a higher value g^{**} stabilization occurs with probability equal to one. In "normal fiscal times", i.e. far from g^*, an increase in public expenditure usually lowers private consumption, because infinitely lived consumers correctly recognize that today's increase in public spending means increased future taxation and a lowering of their permanent income. However, the offset in consumption expenditure is not of equal size to the increase in the deficit, because agents know that sometime in the future the increase in government spending

[6] In Denmark, between 1983 and 1986, a boom in private consumption and investment accompanied a reduction in the full-employment surplus of 7.2 percent of GDP. In Ireland, between 1987 and 1989, a similar cut in the full-employment surplus (5.7% of GDP) was also accompanied by higher growth. Shortly afterwards, in a symmetrical pattern, the Swedish (scal ?) expansion of the early 1990s was associated with a sharp contraction in economic activity.

must be reversed. Hence, in general, despite the classical character of the model, fiscal policy has weak Keynesian effects.

More interesting is the behavior of consumption around the "trigger values" of government spending. When government spending approaches g^*, a discrete cut to g is possible but not certain (note, that this possibility has been included in consumers' estimate of permanent income). If the trigger value is reached and public spending is not cut, than consumption falls discretely, as consumers revise their expectations of permanent income (see Graph 1: movement from point A to C). Thus a non-linearity of the model emerges – consumption falls significantly and discretely, when government spending increases by a small amount, provided that a fiscal retrenchment was expected, but did not materialize. Another nonlinearity is present around the second "trigger value", i.e. when the level of public expenditure is close to g**. Agents know that stabilization will certainly take place soon and so they increase their consumption, anticipating lower value of future taxes. When the stabilization does take place consumption is already higher (at a level corresponding to the smaller public spending – thus a large cut in government spending leaves consumption unchanged (see Graph 1: a movement from point D to B in Graph 1) – there is a nonlinearity in consumption behavior, but aggregate demand still falls.

The model developed by Sutherland (1997) has a similar spirit to Bertola and Drazen's model, but contrary to the latter, its results depend crucially on the assumptions of finitely lived consumer. Sutherland's model assumes, that the government implements restrictive fiscal policy, in form of a large tax hike, when public debt reaches critical levels. At low values of debt the probability of fiscal contraction is very low, thus a fiscal transfer from the government to households produces a Keynesian effect, as the probability that the future necessary increase in taxes will fall on the current consumer is low. The higher is the debt value, i.e. the closer it is to the trigger point of fiscal stabilization, then a further increase in fiscal deficit causes consumption to fall, as consumers know that there is a high probability that the stabilization – a large tax increase - will take place during their lives and that the future income loss will be much higher than today's government transfer. Again, non-linear consumer behavior gives rise to non-Keynesian effects. This effect diminishes, when consumers have infinite lives - in that case the results are Ricardian.

Another influential model has been developed by Perotti (1999) which assumes that some consumers are not homogenous: one group is rational and forward looking, while the other group is either liquidity constrained or myopic, thus the consumption function of the latter group is purely Keynesian. Perotti (1999) focuses on the response of private consumption to a government spending shock and concludes that it reacts positively when the debt-to-GDP or deficit-to-GDP ratios are low, i.e. during "normal times", and negatively during "bad times", characterized by either a high debt-to-GDP ratio or consecutive quarters of high deficit-to-GDP ratio. He also implicitly assumes that an increase in government expenditure stimulates pre-tax income, while taxes dampen it. The distortions caused by taxes increase in a non-linear fashion, as taxes enter the output function raised to the second power. Because policymakers do not smooth taxes out, future taxes are expected to be larger than today's. Perotti (1999) therefore argues that when the PDV of future government financing needs is low, fiscal policy will exert the usual Keynesian effects due to the reaction of liquidity constrained consumers (provided that the fiscal action is unexpected). When however the PDV of financing needs is high, it is possible that the unexpected fiscal policy will have perverse effects, because the PILCH consumers expect a future perverse change in income (Siwińska and Bujak 2003: 13).

Giavazzi, Jappelli and Pagano (2000) focused on the non-linear effect of fiscal policy on private consumption and found that a significant reduction in the deficit is the correct policy to achieve an expansionary effect.

In addition, there is a ***supply-side channel*** at work (Alesina and Ardagna 1998; Alesina et al. 2002). According to the labor market view, cuts in government employment or transfer payments may increase employment in the private sector and stimulate the economy when it is near its full employment level. Also, higher wages in the government sector put an upward pressure on the business sector wages and increase unit labor costs. This is equivalent to a negative supply shock, leading to a contraction of output. In open economies with a flexible exchange rate regime, reduced labor costs, resulting from a fiscal restriction, increase the competitiveness of the companies and raise the net export.

The supply-side channel operates in both competitive and unionized labor markets, although in a different manner (Ardagna 2007). An increase in public employment or government wages in the competitive labor markets leads to a fall in private sector employment. As was noted earlier, this results in a real wage increase and a decline in profits, investments, and thus output, in the business sector. With unionized labor markets, an increase of public employment, wages of public sector employees or unemployment benefits raises unions' wage claims in the private sector, boosts wages, and reduces profits and investments. The final result is the same a negative relationship between government spending, specifically its wage component, and the short-run GDP growth. (Vladimirov and Neycheva 2009: 52)

It is worth noticing (Giudice et al. 2003) that the theoretical (and empirical) literature reviewed here suggests that the non-Keynesian effects stemming from the demand side should be triggered by a different set of factors than the non-Keynesian effects operating through the supply side. For the former the crucial features of fiscal policy are the ones that influence agents' expectations of future policy changes, such as initial fiscal conditions (the level of debt, the level of government expenditure) or size of fiscal adjustment. The supply side effects depend almost entirely on the composition of fiscal policy changes, that is on relative magnitude of spending cuts (increases) as opposed to tax increases (cuts) and on structure of these changes.

Furthermore, Hemming et al. (2002) suggest that the impact of fiscal policy on economic activity can also depend on ***institutional factors*** such as: inside and outside lags, political economy considerations or factors, and level of development.

3. Fiscal Policy Performance in Algeria

Public expenditure has played an important role in economic development In Algeria since it's independence in 1963 and, more recently after the extraordinary oil windfall of the early 2000s. This can be seen through the permanent and significant increase in government spending as a ratio of GDP, which reached 43 percent of GDP in 2009, as against 22 percent of GDP in 1963, representing an increase of about 95 percent. In this context, There are three main reasons for this high rate of public spending: first, the doctrinal determinant by which we mean the inevitability of economic structure changing from socialism to a market economy, second, the social determinant by which we mean the rise of pressure demand on public services, and third, the financial determinant by which we mean the financial convenience resulting from the hydrocarbon sector, especially during a period of economic boom (see figure 1 and 2 in appendix). Government spending has moved strongly with hydrocarbon production. The correlation coefficient between the annual change in government expenditure and the one-year lagged change in hydrocarbon GDP is about 0.75. [7] In addition, Algeria's fiscal stance has been heavily influenced by hydrocarbon prices (see Figure 3 in appendix). The nonhydrocarbon primary deficit (NHPD) and spending have been highly correlated with oil price during the past 15 years, widening during good times and contracting in bad times.

[7] IMF Country Report No: 05/50 (2005,6).

Within the same context, The spike in oil prices at various times over this decade, has led to a tremendous increase in the country's foreign exchange reserves, which reached more than $188 billion at the end of September 2012. Due to rising oil prices from the beginning of 2000s, the Algeria's hydrocarbon revenue reached 2905 billions of dinars in 2010, as against 425.9 billions of dinars in 1998 (Figure 03). Government spending has also experienced a huge increase over the recent oil windfall, rising from 85906.60 DZD Million in June of 1995 to 944172.20 DZD Million in 2011 (Figure 04). Another notable feature of the structure of government spending (see Table 2 and 4 in appendix) is the increasing level of capital expenditure, which has surged from 7.5 percent of GDP in 1998 to 19.5 percent in 2009.

As a result of the oil windfall, the Algerian government has pursued a very expansionary fiscal policy, through the implementation of a series of substantial public investment programs (2001-2004, 2005-2009, and 2010-2014). Between 2001 and 2004, the government implemented the first public investment program (Economic Recovery Program), worth about DA 525 million (US$7 billion), followed by a second program known as Complementary Plan for Growth Support (Programme Complémentaire de Soutien à la Croissance) for 2005-2009, with initial allocation of DA 4,203 billion (roughly US$55 billion), which has increased to about DA 8,705 billion (approximately US$114 billion) in late June 2006 (World Bank 2007). In mid 2010, the Algerian government has announced the third public investment program for 2010-2014 with an investment amounting to 21.214 billion Algerian dinars (around US$286 billion).

However, the substantial public investment efforts lunched by the government have enabled Algeria to maintain respectable levels of economic growth since 2002. Based on staff estimates, the steady-state multiplier of public investment in Algeria is estimated to be around 1.3. The tax revenue multiplier is set to ½ [8]. Because of the lack of a longer time series for Algeria, the elasticity of investment with respect to the real nonhydrocarbon output for Algeria is calibrated to around 0.19, in line with the work done on Central African oil-wealthy states[9].

In parallel, unemployment rate fell by half in five years, from 30 percent in 2001 to 15.3 percent in 2005 and 9.8 percent in 2013. The share of employment is dominated by the private sector, whose share was about 58.8% in 2013, but female employment is characterized by a greater concentration in the public sector (61.2% of total female employment). (See Table 5 and figure 4 in appendix). Since 1996, there has been an annual inflation rate decrease from 22 percent to 4.5 percent in 1997 and 4 percent in 2012. Due to the significant accumulation of its foreign exchange reserves, at the end of 2006, acceleration of advance payments enabled the government to reimburse more than USD 10.5 billion of their external debt. These repayments brought a substantial reduction in Algeria's external debt from USD 17.19 billion in 2005 to less than USD 5 billion at the end of 2012 (see Table 3).

As shown in the table above, large public investment in all sectors of the economy has helped to achieve significant growth rates, and contributed to reduction in unemployment during this decade, however, compared to the volume of investment during this same period, the contribution of public investment to economic growth seems lower than expectations for the country. Algeria has invested an average annual rate of 10 percent of GDP to receive less than 4.5 percent as an average annual rate of growth between 2001-2007. This poor contribution of public expenditure in economic growth confirms that not all the investments undertaken in Algeria in this period were productive, and also confirms that Algeria loss more than 5 percent of the value of it's economy annually.

However, the rates of growth of different sectors of the domestic economy support this point of view about the poor overall performance of the Algerian economy (Table 4), due to the poor

[8] MCD staff estimates.

[9] Based on Tabova and Baker "Non-oil Growth in the CFA Oil-Producing Countries: How Is It different?" in *Oil Wealth in Central Africa: Policy for Inclusive Growth,* eds. Akitoby and Coorey, 2012..

performance of investment expenditure in Algeria, and to a number of structural weaknesses, including the small size of a productive industrial basis outside the hydrocarbon sector.

The recent oil windfall has helped the Algerian hydrocarbon sector to reach high growth rates. However, the good performance of this sector remains closely linked to Algeria's oil and gas reserves, rise of world oil prices, and high hydrocarbon exports (represented nearly 98 percent of total exports in 2010). This characteristic makes the existence of the effect of government expenditure multiplier in the hydrocarbon sector difficult.

Algeria's agricultural sector witnessed the most volatile growth rates; severe droughts explain the significant drop in agricultural growth rates in 2000, 2002 and 2008. The agricultural sector grew by nearly 17 percent in 2003, and more than 10 percent in 2011, which may be due to improved weather condition. For this reason, we can't accept the government expenditure multiplier effect in this sector.

As shown in the Table 4, the Algerian manufacturing sector features one of the lowest rates of growth compared to other sectors of the economy, even if it is the most important in terms of creating employment and promoting exports outside hydrocarbon. The overall decline in Algeria's manufacturing is consistent with the Dutch disease hypothesis, but this effect was not through the influence of the real exchange rate primarily, but other factors contributed to the decline in the manufacturing sector, first: this sector was sheltered from external competition because of the restrictions and high tariffs imposed on imports during the central economic planning period, but the subsequent liberalization of external trade exposed it to foreign competition, second : this sector was heavily dependent on imported raw materials, equipment, and spare parts .We reject the effect of government expenditure multiplier in this sector.

The construction and public works sector, which is strongly influenced by government expenditure, has performed better during the period 2000-2012. This sector represents 8 percent of total GDP in 2009; with a growth performance of more than 12 percent as compared to 9 percent in 2007 .The sector's driving force was housing construction, with the construction of one million social housing units, and the road construction of the East-West-Highway. The main features of this sector sustain an eventual effect of government expenditure multiplier.

The services sector is also strongly influenced by the high rates of growth in other sectors of the economy, especially in construction. The growth in this sector more than doubled from 3.14 percent in 1999 to 7.8 percent in 2008, and its share of total GDP reached more than 20 percent. Strong growth in services was pulled by growth in the public administration services. Given this trend, the government expenditure multiplier effect can exist in this sector.

As shown above, the growth rates attained seem far from the expectations of government expenditure multiplier effect, owing to the absence of the multiplier effect in both agricultural and manufacturing sectors. As a result, the expansionary fiscal policy undertaken by the government via public expenditure increases in recent years has limited effects on the growth of non-hydrocarbon sectors.

With regard to the enormous financial resources allocated to the different sectors of the economy under the public investment programs for 2001-2014, the Algerian economy is still poorly diversified, and the contribution of the non-oil sector to total GDP remains weak, compared to the hydrocarbon sector. Thus, the government expenditure multiplier effect tends to be nonexistent in the main productive sector, particularly in agriculture and manufacturing.

Moreover, the fiscal policy that the state has adopted by increasing public spending in order to increase national production (supply) did not have any effect to serve this purpose, and this is simply due to the weakness of the productive apparatus and the limited abilities. Despite the magnitude of the financial resources allocated institutions have not been able (TO DO

WHAT?) Lifting of production, led to the lack of multiplier effect of government in this sector, which necessitated transfer of such funds in the creation of infrastructure and increasing imports of goods, where a significant amount of government spending seeps out of the national economy feeds imports, which contributes to a reduction in the value of the multiplier.

In fact, Algerian government must ensure the good quality and efficiency of public expenditure, which plays a key role in the Algerian economy, By Assuring greater transparency in government finance, which are essential for controlling the rapid increase of expenditures. Moreover the government must ensure sound selection of projects to improve the overall effectiveness of public investment program.

4. Empirical Literature

Despite these important theoretical insights and strong demand by the policy process for estimates of fiscal multipliers, there is little empirical research attempting to assess how the size of fiscal multiplies varies over the business cycle. In this context, the literature on fiscal policy multipliers derives strongly diverging results for the effects of fiscal stimuli on economic activity. The methods applied in empirical analyses range from model simulations using different estimation and calibration techniques (such as: the IMF Multimod model, the OECD Interlink or the ESCB New Area Wide Model, dynamic stochastic general equilibrium (DSGE) models and the VAR model to reduce form equation parameter estimation techniques. Surveys of the empirical literature, which can be found in Hemming et al. (2002), Siwińska and Bujak (2003), Spilimbergo et al. (2009), Coenen et al. (2010), and Shafik Hebous (2011) demonstrate the great bandwidth of spending and revenue multipliers.

Apart from differences in the specification of the reduced-form VAR model (including sample period, set of endogenous variables, deterministic terms and lag length), empirical studies could be distinguished by the approach chosen to identify fiscal policy impact. Four main identification approaches have been used to date: first, the recursive approach introduced by Sims (1980) and applied to study the effects of fiscal policy by Fatas and Mihov (2001); second, the structural VAR approach proposed by Blanchard and Perotti (2002) and extended in Perotti (2005, 2007); third, the sign restrictions approach developed by Uhlig (2005) and applied to fiscal policy analysis by Mountford and Uhlig (2005); and, fourth, the event study approach introduced by Ramey and Shapiro (1998) to study the effects of large unexpected increases in government defense spending and also used by Edelberg et al. (1999), Eichenbaum and Fisher (2005), Perotti (2007) and Ramey (2009). But what can be seen from all these VAR-based studies, however, that they often fail to clarify the asymmetric responses (nonlinear responses). This would explain the nature of the effects of fiscal policy depending on the state of the business cycle (recession or boom).

In this context, some DSGE models allow for asymmetric responses that depend on the interest rate by holding the interest rate pegged at zero for a certain period, and comparing the impulse responses when the interest rate is pegged and when it is not. The significant drawback of these models is that they automatically allow the interest rate to adjust and to revert to its "usual" dynamics after a certain (exogenously fixed) number of periods. DSGE simulations yield multipliers that are above 1 only when the interest rate is fixed exogenously. When the interest rate is allowed to increase, the multiplier is well below 1. Almost all of the DSGE models are based on a New Keynesian model with Calvo pricing frictions, and the model allows the interest rate to revert to the "natural" interest rate determined by standard neoclassical first order conditions in the long run. Papa (2005) uses an RBC model with Calvo pricing and fixed interest rates and she finds that output, real wages, and consumption rise, and investment falls, but the magnitude of the responses is very sensitive to the parameterization of the model. Cogan et al. (2009) employ the same model with interest rates that are fixed for 4 periods find a multiplier that is only 0.4. Also, recent findings from DSGE models with some Keynesian

features (e.g., Lawrence Christiano et all. 2009, Gauti Eggertsson 2008, and Michael Woodford 2011), however, suggest that the government spending multiplier in periods with a binding zero lower bound (ZLB) on nominal interest rates (which are recessionary times) could be somewhere between 3 and 5. Intuitively, with the binding zero lower bound, increases in government spending have no effect on interest rates and thus there is no crowding out of investment or consumption, which leads to large multipliers. Of course, our estimates are based on several periods of recession and not just the recent episode during which the ZLB became an important issue.

Regarding the VAR-based studies, Hoeppner and Wesche (2000) test for non-linear effects of fiscal policy on consumption in Germany in a Markov-switching approach. They find two different regimes, with a non-Keynesian regime prevailing around 1972-74, 1979-82 and 1992-93.

More importantly, Tagkalakis (2008) examine the effects of fiscal policy changes on private consumption in recessions and expansions in the presence of binding liquidity constraints. His results showed that fiscal policy is more effective in boosting private consumption in recessions than in expansions. The effect is more pronounced in countries characterized by a less developed consumer credit market. This happens because the fraction of individuals that face binding liquidity constraints in a recession will consume the extra income generated following an unanticipated tax cut or government spending increase.

Again, Wang and Gao (2011) use the Markov-switching model to test the nonlinear effects of government expenditure and taxes on private consumption in China. Their results showed that fiscal policy in China has a significantly nonlinear effect. In years 1978–1980 and 1984– 1997, the effect of government consumption on private consumption is non-Keynesian. During the same periods, the effect of taxes is also non-Keynesian, but the effect is not significant. The effect of government investment is linear but asymmetric.

On other hand, Christophe Schalck (2007) estimates the effects of fiscal policies by using a non-linear structural VAR model (Markov-switching approach). This methodology is applied to Belgium, France, Germany and Netherlands cases. His results showed that reactions to a fiscal shock are different according to the regime that prevails and across countries. In Belgium and in Germany, fiscal policies have non-Keynesian effects in expansion and anti-Keynesian in recession. Conversely, the Netherlands has an anti-Keynesian effect during expansion and non-Keynesian during recession. French policy appears to keep a Keynesian effect, irrespective of the current regime.

As far as France is concerned, Bouthevillain and Dufrénot (2010) estimate time-varying probability Markov-switching models (TVPMS) in order to take into account two budgetary regimes, on the one side periods of severe recessions or depressions (crises), and, on the other side “normal” periods (expansions or moderate recessions). Their results showed that if one considers the aggregate GDP, public expenditure has a stronger impact during crisis and the expenditure multiplier is greater than the tax multiplier. Also, when households are sensitive to the unemployment situation, tax cuts do not increase consumption spending, while transfers play a significant role. On the firms’ side, their results showed that direct taxes changes induce a stimulus effect in the investment rate only during non-crisis periods. A rise in subsidies has a negative influence during crises. Finally, the estimates suggest that employment policies should be asymmetric: fiscal measures aiming at reducing unit labor costs could be efficient in good times, while an increase in public employment is preferable during crisis.

For Germany, Baum and Koester (2011) compared linear and nonlinear approach results, using threshold SVAR, expanding the SVAR approach by Blanchard and Perotti (2002). In a linear benchmark SVAR, the analysis finds that hiking spending yields a short-term fiscal multiplier

of around 0.70, while the fiscal multiplier resulting from an increase in taxes and social security contributions is -0.66. In addition, the threshold model derives fundamentally new insights on the effects of shocks, depending on when in the business cycle they occur, their size and their direction. Most importantly, fiscal spending multipliers are much larger in times of a negative output gap but have only a very limited effect in times of a positive output gap. Discretionary revenue policies, on the other hand, have a generally more limited impact. This underlines that the assumption of a linear influence of fiscal spending on the economy with a multiplier of around 0.7 can give misleading policy implications.

For Malaysia, Sohrab and Zeufack (2012) explore the stabilisation properties of fiscal policy using a model incorporating nonlinearities into the dynamic relationship between fiscal policy and real economic activity over the growth cycle (STAR model). The paper also investigates how output multipliers for government purchases may alter for different components of government spending. The authors find that fiscal policy in Malaysia has become increasingly procyclical over the last 25 years and establish that the size of fiscal multipliers tends to change over the growth cycle. The rise in government (investment) spending, in Malaysian Ringgit, leads to a maximum output multiplier of around 2.7 during growth recessions, and around 2 in normal times. The returns to government spending in Malaysia are greater when the focus is on public investment, as opposed to consumption. Changes in tax policy are less effective in stimulating economic activity than direct government spending. These results provide empirical backing to conjectures in the recent literature implying that procyclicality in fiscal policy reduces the effectiveness of fiscal actions in emerging markets.

For the USA, Auerbach and Gorodnichenko (2010) using regime-switching models (STAR model), find large differences in the size of spending multipliers in recessions and expansions with fiscal policy being considerably more effective in recessions than in expansions. They estimate multipliers for more disaggregate spending variables which behave differently relative to aggregate fiscal policy shocks, with military spending having the largest multiplier. They show that controlling for predictable components of fiscal shocks tends to increase the size of the multipliers in recessions.

Otherwise, Fazzari et al. (2011) estimate the effects of government spending shocks and tax shocks on U.S. economic activity using a threshold vector autoregression (TVAR) model. They find evidence of asymmetry in the effects of fiscal policy across regimes, defined by the state of the business cycle and the nature of the shock. The effects of government spending on output in the low regime are large and persistent, while they are small in the high regime. Consumption increases in both regimes, but the increase is smaller and less permanent in the high regime. Investment increases across regimes, but the increase in negligible in the high regime. Tax cuts have larger short-run effects but smaller long run effects when the economy is in the low regime. In the high regime, tax cuts always have larger effects than spending shocks.

Moreover, Candelon and Lieb (2011) propose to investigate the efficiency of fiscal policy shocks in the United States. To this aim, they used a Threshold Vector Autoregression framework as well as sign restrictions to identify structural policy shocks and evaluate the effect via impulse response functions in each regime. They do not find “Non-Keynesian" effects of fiscal policy, neither in recession nor in expansion, but rather the contrary. A deficit-spending policy seems to be more efficient to stabilize the economy in the short-run than a tax-cut policy. This result holds for both regimes. Nevertheless, the short-run multiplier effects exceed unity significantly only in recession. Although the overall impact is smaller, the tax-cut policy seems to be more effective in times of economic slowdown. While the spending policy boosts output via an increase in consumption, a tax-cut stimulates investment, which then is the major driving force for a rising GDP. The impact on those key variables is stronger in times of recession. Interestingly, crowding-out effects of spending on consumption occur only in

periods of stress. It has nevertheless to be emphasized that this policy advice should be taken with precaution and must not be considered as a carte blanche approval for politicians to run enormous budget deficits.

Contrary to the previous literature, Peren et al. (2013), estimate the magnitudes of government spending and tax multipliers within a Markov regime-switching framework, and identify fiscal policy changes by employing the narrative approach. Their results show that the magnitudes of spending multipliers are larger during periods of low economic activity, while the magnitudes of tax multipliers are larger during periods of high economic activity. Fiscal multipliers get smaller during slowdowns and larger during expansions.

Furthermore, based on a Markov-switching model for the U.S. economy, Peren and Spagnolo (2011) contribute to the literature showing that the relationship between fiscal policy and economic growth may also be non-linear in the short-run. The filter used in the paper manages to separate periods of high and low GDP growth, and their first result implies that failing to take into consideration those non-linear effects may conceal the true effects of fiscal policy on output growth. Furthermore, their results suggest that taxes on household and corporate income (i.e. direct taxes) are much more harmful than taxes on consumption. The policy implication of this particular result is that tax cuts focusing on income and corporate taxes are more effective in stimulating the economy in the short-run.

5. Methodology and Results

5.1 Methodology

To allow for responses differentiated across recessions and expansions, we employ a regime switching vector autoregression model where transitions across states (i.e., recession and expansion).

MS-VAR (Markov Switching Vector Autoregression) models provide a generalized framework of VAR models, which take into accounts changes in regimes s_t. The mean adjusted MS-VAR process of order p and M regimes may be written in the general form as:

$$y_t - \mu(s_t) = A_1(s_t)(y_{t-1} - \mu(s_{t-1})) + ... + A_p(s_t)(y_{t-p} - \mu(s_{t-p})) + u_t \quad (1)$$

Where $u_t \to NID(0, \Sigma(s_t))$ and $\mu(s_t), A_1(s_t), ..., A_p(s_t), \Sigma(s_t)$ are the regime-dependent parameters. A different representation (intercept form) of MS-VAR, is the following:

$$y_t = \nu(s_t) + A_1(s_t)\, y_{t-1} + ... + A_p(s_t)\, y_{t-p} + u_t \quad (2)$$

Where $\nu(s_t) = \mu(s_t)(I - \sum_{j=1}^{p} A_j(s_t))$

The mean-adjusted form (1) and the intercept form (2) of MS-VAR models are not equivalent because they imply different dynamic reactions of dependent variables to a regime shift, Differently from VAR(p) model where both representations are equivalent. More precisely, while in the model (1) a regime change in the mean $\mu(s_t)$ determines an immediate adjustment of dependent variables to new levels, in the model (2) a regime shift causes a smooth and dynamic change of the intercept. The last model seems to be more preferable because it is more plausible that means approach smoothly new levels after a regime shift. In the general MS-VAR specifications all parameters are regime-dependent. However, in the empirical applications it is preferable to consider only some parameters dependent on the state s_t. The fact that parameter may be (or not) regime-dependent determines a lot of MS-VAR specifications.

By following the Krolzig (1998) notation, we could add to the MS (Markov- Switching) notation, the following letters, to specify the regime-dependent parameters: *M* for Markov-

Switching Mean, *I* for Markov-Switching Intercept, *A* for Markov-Switching autoregressive parameters, *H* for Markov- Switching heteroskedasticity (e.g. MSMH-VAR is a Markov-Switching Mean specification with Σ varying).

In all MS-VAR specifications, the unobservable regime s_t is governed by a first order Markov process, which is defined by the transition probabilities:

$$\Pr(S_t = j \,|\, S_{t-1} = i) = p_{ij}, \quad whith: \sum_{j=1}^{M} p_{ij} = 1 \;\forall i \qquad i, j = 1.....M \tag{3}$$

where p_{ij} is the probability that event *i* is followed by event *j* and an element of the transition matrix:

$$P = \begin{bmatrix} p_{11} & p_{21} & . & . & p_{N1} \\ p_{12} & p_{22} & . & . & p_{N2} \\ . & . & . & . & . \\ p_{1N} & p_{2N} & . & . & p_{NN} \end{bmatrix}$$

A crucial characteristic of MSVAR models is that the states are unobservable and, hence, do not necessarily have an obvious interpretation. Also, a given observation cannot directly be associated with any particular regime. Only conditional probabilistic assignments are possible via statistical inference based on past information.

The estimation technique implemented for MS-VAR models, the EM (Expectation-Maximization) algorithm, is discussed in Krolzig (1998) and in Hamilton (1990) for the univariate case. The parameters must be estimated by maximizing a log-likelihood function. The problem is that the FOCs are non linear and consequently do not have a closed solution; it is not possible to solve them analytically. To solve the equations, it can be implemented two steps. Firstly, arbitrary initial values of parameters are defined.

The first step (The Expectation Step) is based on the computation of transition probabilities, which depend on the initial values above mentioned. The second step (The Maximization Step) makes use of the previous probabilities to compute the maximum likelihood estimates of parameters. These two steps are repeated until parameters estimates converge.

Important tools in the context of VAR models are impulse response functions, which permit to simulate the responses of endogenous variables, included in the model, to exogenous shocks. For the MS-VAR models, Ehrmann et al. (2003) have introduced the same tool, the regime-dependent impulse response functions. Different from VAR models, in which it has been assumed that there are not relevant regime shifts, regime-dependent impulse response functions are conditional on the prevailing regime, at the time *t* when the shock occurs, and on the entire horizon length.

The horizon length must reasonably depend on the predicted persistence of the regime prevailing at time *t*. Therefore the horizon length cannot to be longer than the predicted regime duration

As for VAR models, we need to consider the problem of identification in the MS-VAR models. Rewrite the (2) in the following form:

$$y_t = A_{1i}\; y_{t-1} + ... + A_{pi}\; y_{t-p} + B_i \varepsilon_t \qquad i = 1,....,M \tag{4}$$

where *M* is the number of regimes, $\varepsilon_t \to N(0, I)$ and where:

$$\Sigma_i = E(B_i u_t u_t' B_i') = B_i E(u_t u_t') B_i' = B_i I B_i' = B_i B_i'$$

To compute impulse response functions we need to estimate the matrices B_i; but the EM algorithm gives only estimates of variance and covariance matrices Σ_1, ..., Σ_M and not the matrices B_1, ..., B_M. To identify these matrices we have to impose restrictions on the unrestricted model. The identity $B_i B_i' = \Sigma_i$ imposes $K(K+1)=2$ restrictions on B_i because the matrix of variance and covariance is symmetric. For example, we can impose that the matrix B_i is lower triangular (the Cholesky Decomposition of the matrix Σ_i or structural form).

Obviously, the order of variables in the system assumes now a particular importance, so that each variable determines only contemporaneous effects on itself and on variables ordered below it. In our model there are MK^2 impulse response functions corresponding to the reaction of K variables to K shocks in M regimes. Equation (5) defines the reaction (for an horizon length equal to h) of endogenous variables to a one standard deviation shock to the k-th disturbance at time t.

$$\frac{\partial E_t y_{t+h}}{\partial u_{k,t}}\Big|_{s_t=\ldots=s_{t+h}=i} = \theta_{ki,h} \tag{5}$$

Erhmann et al. (2003) demonstrates that impulse response functions are the following:

$$\hat{\theta}_{ki,0} = \hat{B}_i \varepsilon_0 \tag{6}$$

$$\hat{\theta}_{ki,h} = \sum_{j=1}^{\min(h,p)} \hat{A}_{ji}^{h-j+1} \hat{B}_i \varepsilon_0 \qquad h \rangle 0 \tag{7}$$

The equation (6) represents the first impulse response function (at time h=0) and (7) the following ones.

5.2 Data and model specification

To keep the analysis as parsimonious as possible, we include only three variables: government spending G, government revenue T and GDP (Y) [10]. The data is compiled from national office of statistics, Ministry of Finance, WDI and IFS. Moreover, because of the lack of quarterly data for the variables of the study, we have converted the annual data to the corresponding quarterly data using cubic spline interpolation method (see the Appendix for more details). The dataset covers the period from the first quarter of 1970 to the fourth quarter of 2011, providing 168 observations. Our estimations are based on data in difference[11] and in real terms (all three variables are deflated by the GDP deflator with a value of 100 in the year 1980).

In this paper, we prefer introducing regime switches model rather than in a DSGE model, since it is difficult to model slack in the economy and potentially non-clearing markets in a DSGE framework without imposing strong assumptions regarding the behavior of households and firms. In contrast, VAR models require fewer identifying assumptions and thus are tied more easily to empirical reality.

The specification includes a constant and one lag of the endogenous variables according to the Schwarz information criteria. As for the case of linear VAR model, to identify structural shocks we need to transform the matrix of variance and covariance of residuals into an identical one. For this purpose a set of restrictions have to be imposed. In this case we use the Cholesky identification, which consists of ordering the variables from the most exogenous to the most

[10] A five-variable model that contains investment and consumption might allow us to study the transition of policy shocks in the economy in more detail, but estimating a five-variable model is impractical because the number of coefficients in the linearity test and the MSVAR rises in proportion to the number of coefficients in the standard linear model. This affects the size and power of the tests under of the limited data in Algeria. Therefore, the present paper will restrict itself to a three-variable specification and leaves the proposed extension to future work.

[11] Using ADF test, all three variables are I (1) (see table 1 in appendix).

endogenous in the system. The variables are ordered as government revenue, government expenditure, and GDP. Positioning of GDP last in the vector autoregression implies that is can react to all variables.

In order to implement the state-dependent analysis we estimate a MS-VAR model with parameters, which vary across regimes (MSIA-VAR model). We have chosen the MSIA(2)-VAR(1) specification. The choice of this specification derives from the fact that by increasing the number of lags the parameters increases noticeably.

5.3 Estimation

Estimation results of MS-VAR model are reported in Table 5. The non-linear specification is more suitable in this context (AIC and HQ criteria select the non-linear model). More evidence is given by the linearity tests that reject the hypothesis of linearity at 99% level. The high values of transition probabilities p_{11} and p_{22} confirm the presence of highly persistent regimes. The average duration of regime 2 (24.87) gives support to this fact. The low value of ergotic probability indicates that the number of periods, which belong to the regime 1, is relatively small if compared to that of regime 2. In addition, the ergodic probabilities imply that the economy would spend about 29.64% of the time spanned by our sample of data in the first regime (i.e. recerssion)[12]. In contrast, regime 2 has an ergodic probability of about 70.36%. Hence, these transition probabilities reveal the presence of important asymmetries in the business cycle. Another relevant feature of this model lies in the difference in the residual standard errors across different regimes. Regime 1 exhibits a relatively higher standard error (0.0391) than Regime 2 (0.0143), which reflects the view that recessions are less stable than expansions. Figure 5 shows the associated smoothed, filtered, and predicted transition probabilities.

5.4 Response Analysis

In the following subsections, we will present and discuss our estimation results based on impulse response functions (IRF). To estimate the latter, we used a 0.68 confidence interval, over 30 periods.

Through a Figure 6, is clear that when the economy was in the first regime (recession), the positive shock in government revenues estimated at 1% (or Algerian dinar) have a positive significant effect on GDP in the short term with multiplier of 0.907 at the first period. This effect decreases to be nonexistent after three years and half (14 quarter), while, the negative impact will be generated in the long term.

In the second regime (boom), the positive shock in government revenues rises in output by 0.776 at the first period. This effect decreases to be non-existent after a one-year and a half (8 quarter), while, the negative impact will be generated in long term. It concludes that, the size of the multiplier varies considerably over the business cycle situation, and the effect of government revenues in periods of recession is stronger than the impact in periods of boom. Moreover the confidence bands confirm the significance of these effects. This is striking evidence in favor of asymmetries in the mechanism of fiscal policy transmission.

Figure 7 presents estimates for the historical effects of shocks to government spending[13] on output. In the first regime (recession), the positive shock in government spending has a positive significant effect on GDP in the short term with the multiplier of 0.981 at the first period. This

[12] Recessions in this paper are defined as growth contractions. To measure these, we can based on the cyclical component of real GDP and has been extracted by applying the Hodrick–Prescott (HP) filter. The dummy variable DY takes the value 1 when the cyclical component is negative, whereas it is zero otherwise.

[13] We note here that this result only concern the impact of the structure shock in aggregate public expenditure, while results vary the in the case of whether we divide the structure of government spending between consumer spending and investment spending, as the small sample of annual data for these two variables (from 1993 to 2010 alone) prevented the Delve deeper in this study. The same observation can be made about government revenues to divide it into oil revenue and non-oil revenues.

effect is reduced until it reaches the limits of 0.637 at the last period of response. On the other hand, this shock also had a positive effect in the state of boom, where output will rise by about 0.884 at the first period. While this effect decreases in the long run, it will be up to the limits of 0.15 at last period of response. Thus we conclude that the effect of government spending in a recession is stronger than its effect in the booms. We note that the multipliers of government spending less than one, suggesting that certain types of government spending crowd out private investment or consumer spending that would have otherwise taken place. This crowding out can occur because the initial increase in spending may cause an increase in rates or in the price level. Also, the size of the multiplier tends to change relatively quickly as the economy starts to grow after reaching a trough. Thus, the timing of changes in discretionary government spending is critical for effectiveness of fiscal policies.

By combining these results, it is clear that the impact of government spending is stronger than the effect of government revenues in recessions. It also appears that the multipliers of fiscal policy in Algeria are effective in recessions than in boom periods.[14]

As for Figure 8, shows that the decision-makers of fiscal policy in Algeria react to the fluctuations of the business cycle with Anti –Keynesian view (procyclical), since they are raise their spending and revenue in the case of boom and vice versa in the case of a recession. We attributed this to two main reasons: (a) Structural obstacle, embodied by limited access to domestic and foreign financial resources, which is beyond the capacity of the government for fiscal expansion, in periods of crisis and contraction[15]. (b) Institutional blockages prevent fiscal expansion, due to weak institutions, corruption, and disrespect for the execution of contracts. These procyclical fiscal policies indicate the weakness of mechanisms of "Automatic Stabilizers" during economic fluctuations, and justify further bias towards policy not based on fiscal rules, but on the judgments and choices of decision makers (Discretionary Policies).

6. Conclusion

This paper estimates the effects of fiscal policy on Algerian economic activity using a Markov switching Vector Autoregressions (MSVAR) model. We find evidence of asymmetry in the effects of fiscal policy across regimes, defined by the state of the business cycle (two situations: boom and recession). The results show small positive government spending and revenue multipliers in the short term in both regimes. In addition, fiscal policy shocks have a stronger impact in times of economic stress than in times of expansion, which confirm the hypothesis of asymmetric effects. However, the impact of government spending is stronger than the impact of public revenue in recession periods, so a deficit-spending policy seems to be more efficient to stabilize the economy in the short-run rather than a tax-cut policy. On the other hand, fiscal policy decision-makers interact with Anti -Keynesian view (procyclical), as they raise revenue and expenditure in the case of boom and vice versa in the case of a recession. These results confirm conjectures in the literature by providing empirical backing for the idea that procyclicality in fiscal policy reduces the effectiveness of fiscal actions in emerging and developing countries.

It is thus straightforward to recommend spending policy action for government facing a recession phase. It has to be stressed, however, that these results must not be seen as a long run policy advice, since we did not take any debt issue into account. It has nevertheless to be emphasized that this policy advice should be taken with precaution and must not be considered

[14] The simple theoretical framework employed implies that fiscal policy actions will have a positive effect on consumption decisions, if the positive effect on real wages outweighs the negative effect of higher taxation, leading to higher disposable income. The effect on the consumption of the LC types will be bigger in times of recession, because they will face binding liquidity constraints and, hence, they will consume all their disposable income change.

[15] Usually, rich resources countries described have the ability to counter-cyclical fiscal policies because of the magnitude of their cash reserve.

as a carte blanche approval for politicians to run enormous budget deficits. In this context, the Algerian government should:

- Pay close attention to the characteristics of commodity and labor markets to identify the conditions and regimes associated with nonlinear effects.
- Re-orientate public spending through more attention to the areas that encourage productivity growth and improve the efficiency of utilization of production capacity.
- Deepen cooperation between the private and public sector, and the expansion of the establishment joint projects between them, to reduce the crowding out effects.
- Rationalize public spending and redirect expenditures for social transfers and subsidies, so as to achieve the social justice principle.
- Increase attention to non-hydrocarbon revenue within the total revenues, and reduce some tax rates in order to achieve increased financial profitability.

The results can be made more complete by using a larger sample of countries and by using the economic regimes different control modes. Although the analysis with the MSVAR approach adopted here is at an early stage and extended studies which specify higher dimensional VAR models (TAR, STAR), to explicitly consider different types of government expenditure and revenue, and which look at different sub periods could be undertaken. We think that the empirical results from the methodology presented here promises new and deeper insights in business cycle and policy modeling.

On the other hand, these limitations of our analysis should motivate future theoretical work to develop realistic DSGE models with potentially nonlinear features to understand more deeply the forces driving differences in the size of fiscal multipliers over the business cycle, the role of unanticipated shocks for fiscal multipliers in these environments, and implications of levels of government debt for the potency of discretionary fiscal policy to stabilize the economy.

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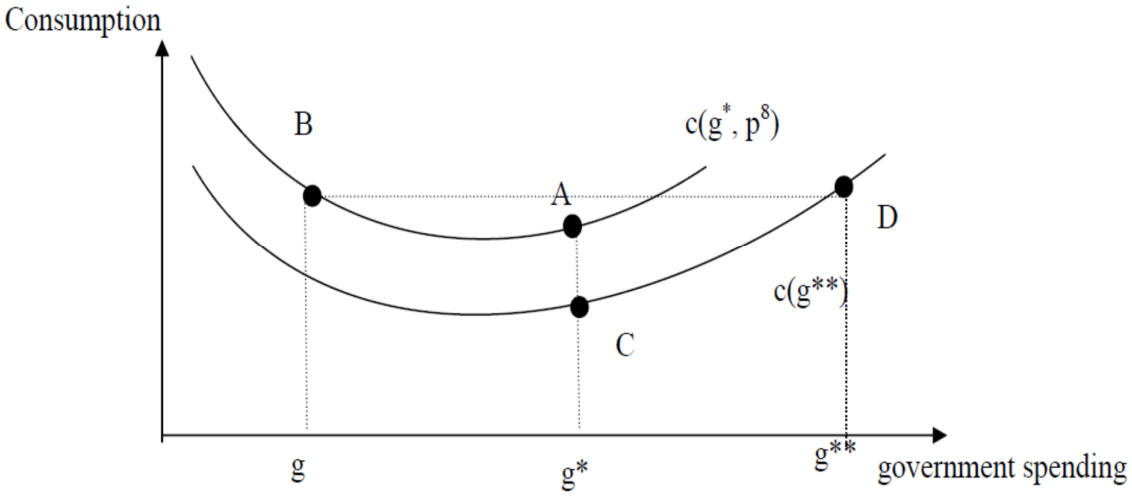
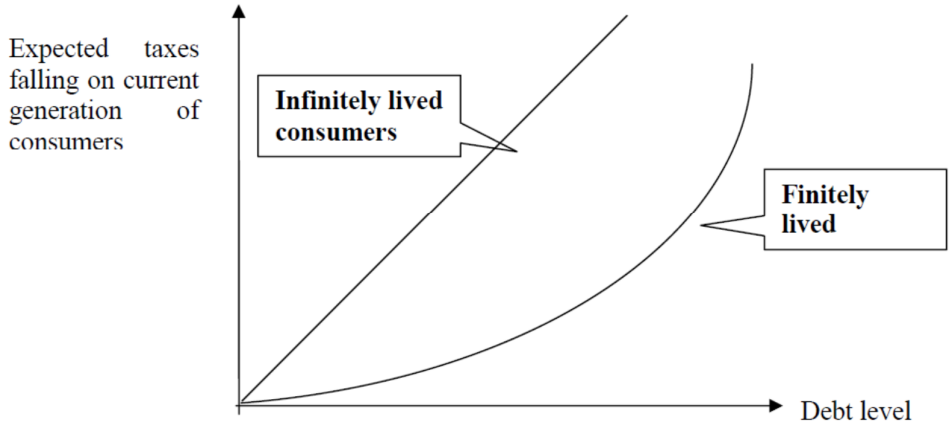
Figure 1: Public Spending and Private Consumption



Source: Bertola and Drazen, (1993), p. 19.

Figure 2: Today's Debt and Expected Taxation



Source: Sutherland, (1997), p. 156

Figure 3: Algeria Hydrocarbon Revenue (1993-2010)

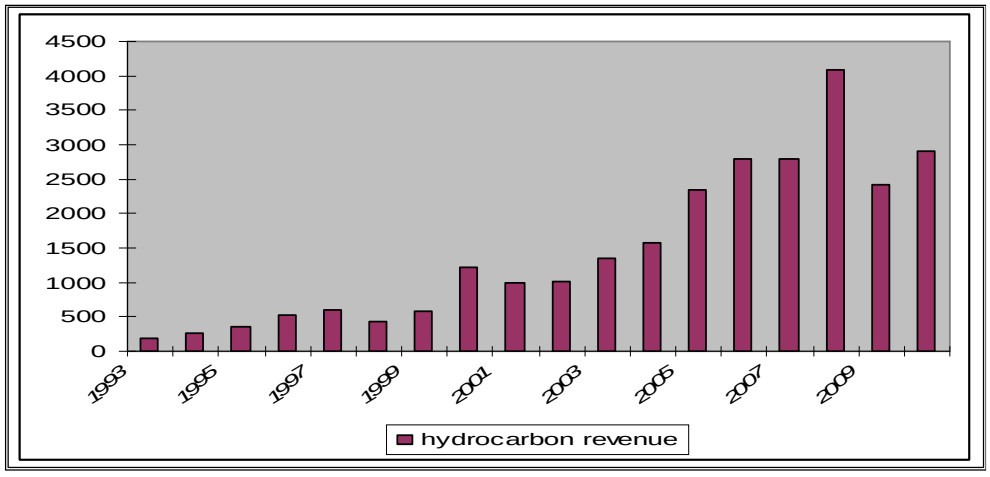


Figure 4: Algeria Government Spending (1995-2011)

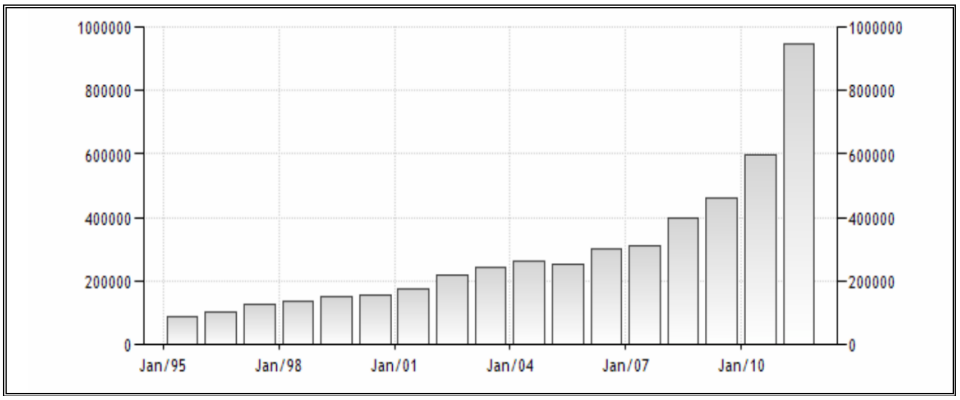


Figure 5: MSVAR: Regime Probabilities. MSIA(2)-VAR(1), 1970 (1) - 2011 (1)

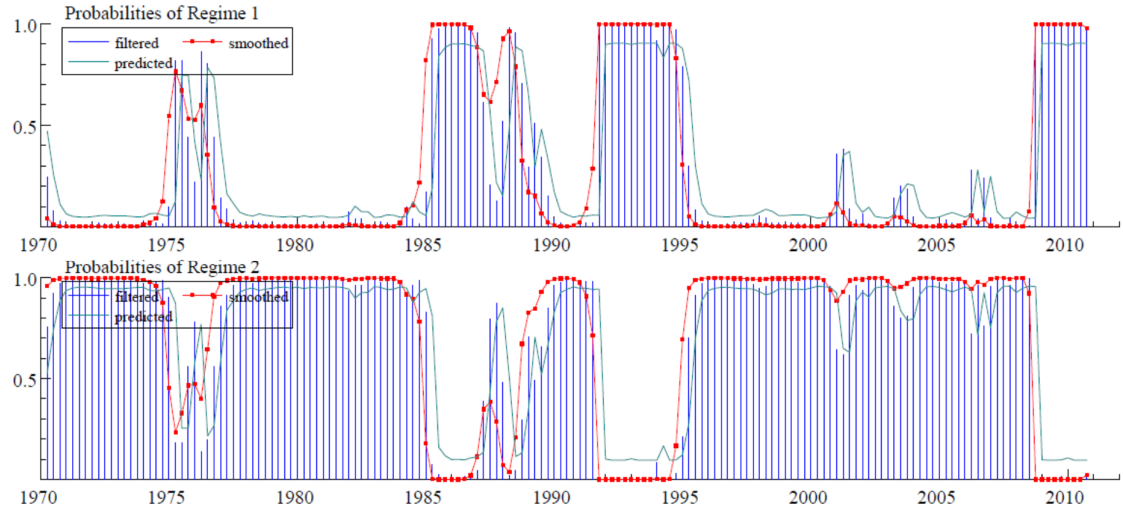


Figure 6: Impulse Response Functions to a unit shock on T

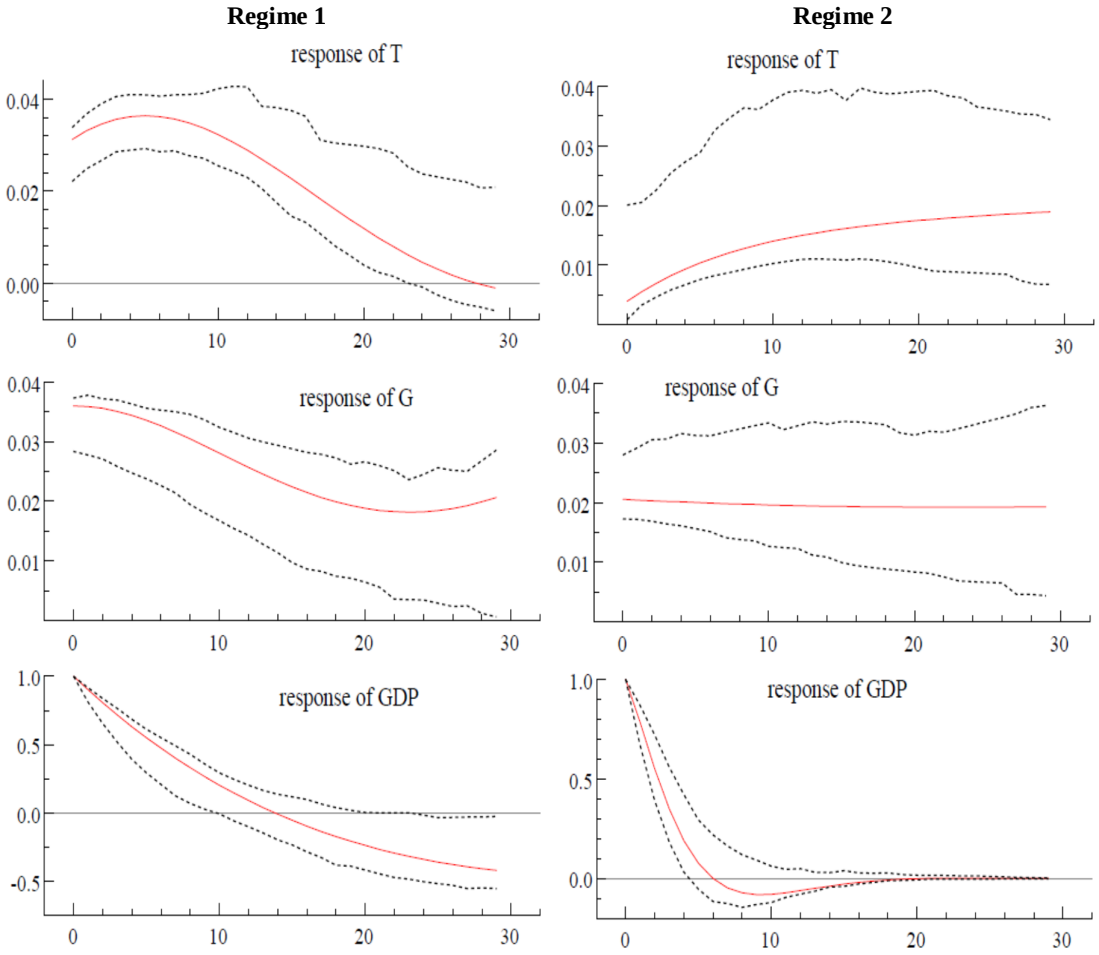


Figure 7: Impulse Response Functions to A Unit Shock on G

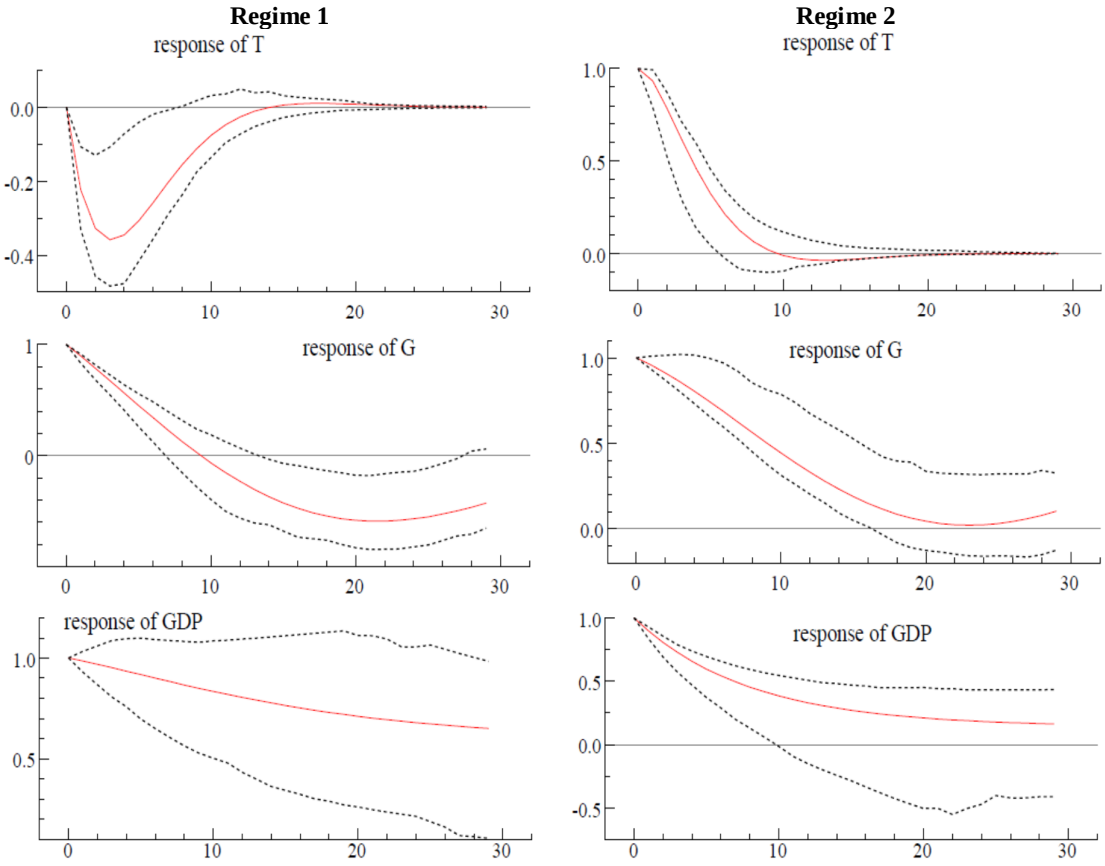


Figure 8: Impulse Response Functions to a Unit Shock on GDP

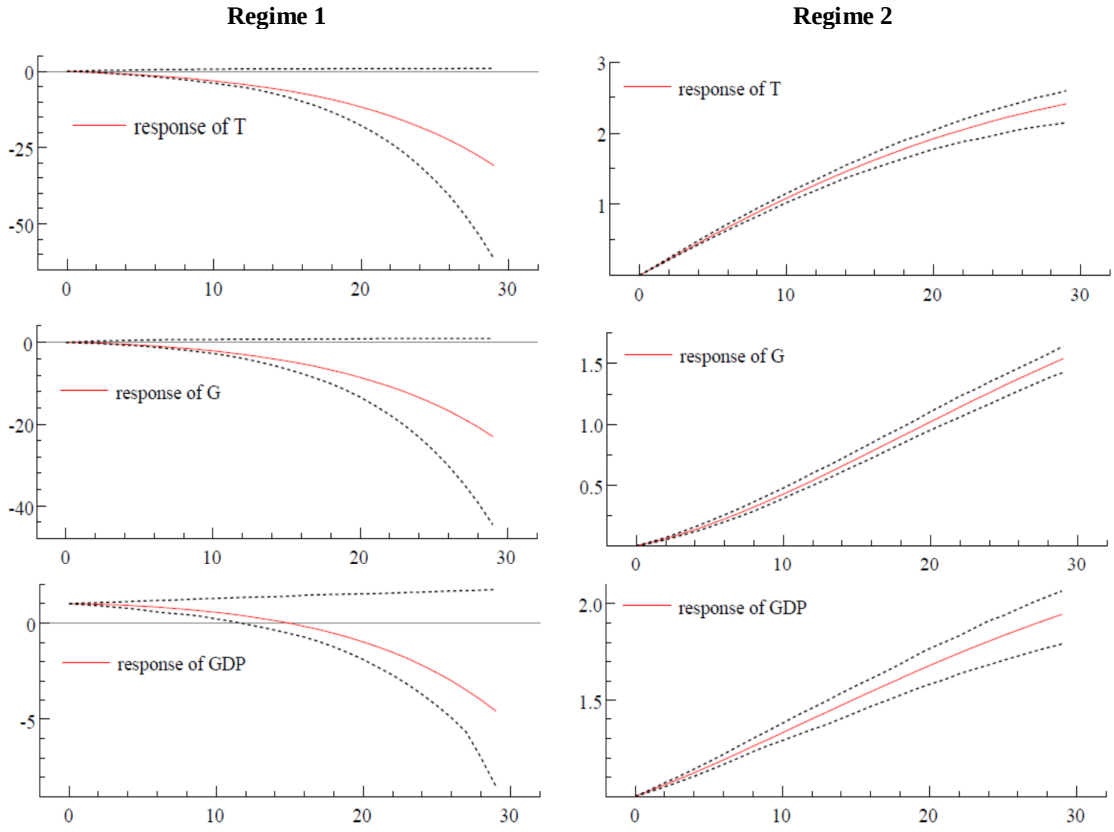


Table 1 : Theoretical Predictions on the Qualitative Response of Key Variables

	Y	C	L^d	L^s	Real wage	Interest rate	Private investment	Trade balance	Real exchange rate
Keynesian: closed economy	+	+	+*	+	−	+	−		
Keynesian: flexible exchange rate	=	+	=	=	=	=	=	−	+
Keynesian: fixed exchange rate	+	+	+	+	−	=	=	=	=
RBC	+	−	=	+	−	+	+	−	+
NK	+	−	+	+	+	+	−	−	+
Separable utility	+	+	=	+	−	+	−	−	−
Deep habits	+	+	+	+	+	=**	−	−	−
Spending reversals	+	+	+	+	+	+	***	−	−

Notes: The sign '+' indicates a positive effect and in the case of the real exchange rate an appreciation whereas the sign '–' indicates a negative effect and in the case of the real exchange rate a depreciation. The sign '=' indicates no effect.
Source: Shafik Hebous (2011: 683).

Table 2: Non-linear effects of fiscal adjustments

Criteria		Level	Outcome
Fiscal framework	Debt/GDP	Low	Keynesian
		High	Non-Keynesian
	Liquidity constraints	Liquidity constrained consumers	Keynesian
		Liquidity unconstrained	Non-Keynesian
	Government consumption/GDP	Low	Keynesian
		High	Non-Keynesian
Characteristics of fiscal impulse	Size	Low	Keynesian
		High	Non-Keynesian
	Composition	Expenditure cut (government wages, employment)	Non-Keynesian
		Tax increase or public investments reduction	Keynesian
	Permanence	Permanent	Non-Keynesian
		Temporary	Keynesian
Economic conditions	Monetary policy	Expansionary	Non-Keynesian
		Tightening	Keynesian
	Macroeconomic environment	Unfavorable (recession, high interest rates)	Keynesian
		Favorable	Non-Keynesian

Source: Vladimirov and Neycheva (2009) : P :53.

Table 3: Algeria: Selected Macroeconomic Indicators, 1999-2011 (in percent)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Growth	3.2	2.2	2.1	4.1	6.8	5.2	5.1	1.8	4.6	2.4	2.4	3.3	2.4
Unemployment	29.2	29.5	27.3	25.9	23.71	17.7	15.26	12.3	11.8	11	10	10	10
Inflation	2.64	0.33	4.22	1.41	2.58	3.56	1.64	2.5	3.5	4.5	5.7	3.9	4.52
External debt	27.99	25.27	22.58	22.82	23.52	22.15	17.19	5.67	5.66	5.58	5.41	5.16	4.4

Sources: International Monetary Fund staff country report, statistical appendix (1998/2004/2006/2009/2012).

Table 4: Algeria: GDP Growth Rates by Economic Sector, 1999-2011

Sectors	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Hydrocarbons	6.1	4.7	1.6-	3.7	8.1	0.9	44.5	15.8	0.7-	2.3-	-37.8	- 3.0	- 3.2
Agriculture	2.7	5-	13.2	1.3-	17	6.41	0.5	4.9	10.4	5.5-	28	4.6	10.5
Industry	1.62	1.4	1.1	2.9	1.4	2.6	11.5	2.8	0.8	4.4	10.3	2.5	2.2
Construction and public works	1.4	4.1	2.8	8.2	5.8	8	4.7	11.6	9.5	9.8	12.7	8.9	3. 0
Services	3.14	2.6	3.1	5.4	5.7	7.7	5.6	-	6.9	7.8	-	7.3	6.1

Source: Ministère des Finances, Le comportement des principaux indicateurs macroéconomiques et financiers, 1999-2011.

Table 5: Estimation Results Using MSIA(2)-VAR(1) Specification

Coefficients		
Regime 1 (recerssion)		
	Y	
C	365.60*	
	(0.079)	
T (-1)	0.69318***	
	(0.224)	
G (-1)	0.84985*	
	(0.163)	
Regime 2 (boom)		
C	50.586***	
	(0.051)	
T (-1)	0.86985***	
	(0.2003)	
G (-1)	0.45576*	
	(0.1148)	
Standard Errors (σ)		
Regime 1	0.0391	
Regime 2	0.0143	
Transition Probabilities Matrix	**Regime 1**	**Regime 2**
Regime 1	0.9046	0.0954
Regime 2	0.0402	0.9598
Regime properties	**Regime 1**	**Regime 2**
Erg. Prob.	0.2964	0.7036
Duration	10.48	24.87
N. Obs	42.3	120.7
Log Lik.	-4810.7540	
LR linearity test	140.9913	

Notes: The (−1) term into parentheses refers to the AR(1) process. Standard errors are in parentheses. ***, **,* denote respectively statistical significance at the 1%, 5% and 10% levels.

Table 6: Fiscal Multipliers

	Spending shock				Revenue shock			
	4 Quarter	10 Quarter	20 Quarter	Maximum	4 Quarter	10 Quarter	20 Quarter	Maximum
Recession	0.927	0.830	0.709	0.987(1)	0.63	0.215	-0.227	0.907 (1)
Boom	0.644	0.384	0.211	0.875 (1)	0.216	-0.08	0.005	0.776 (1)

Notes: The numbers in brackets represent the number of the quarter in which the absolute value of the response amplitude is greatest.

Appendix

What is the fiscal multiplier? (Spilimbergo et al (2009))

The fiscal multiplier is the ratio of a change in output (ΔY) to an exogenous change in the fiscal deficit (Δ*G* is used here as a shortcut, it could be also -Δ*T*) with respect to their respective baselines (often potential output and structural deficit, respectively, even though authors use variations of these concepts). Depending on the time frame considered (usually a quarter or a year), different multipliers are used:

The *impact* multiplier : $\left(\equiv \frac{\Delta Y_t}{\Delta G_t} \right)$

The multiplier at some horizon *N:* $\left(\equiv \frac{\Delta Y_{t+N}}{\Delta G_t} \right)$

The *peak* multiplier, defined as the largest $\left(\equiv \max_N \frac{\Delta Y_{t+N}}{\Delta G_t} \right)$ over any horizon *N*.

The *cumulative* multiplier, defined as the cumulative change in output over the cumulative change in fiscal expenditure at some horizon *N* $\left(\equiv \frac{\sum_{j=0}^{N} \Delta Y_{t+j}}{\sum_{j=0}^{N} \Delta G_{t+j}} \right)$

The cumulative multiplier, which is often the most appropriate measure, is typically larger than the impact or peak multipliers, but is rarely reported. Unless specified differently, this note refers to the impact or the peak multiplier, but its implications are broader.

Cubic spline interpolation method:(Rashid, Abdul and Jehan, Zanaib (2013))

Reviewing the existing literature we find different main strands of time-series econometric techniques for disaggregating observed low-frequency time-series data into higher-frequency data, Such as the Denton (1970) approach, the Chow-Lin (1971) procedures, and the cubic spline interpolation process.

The idea of cubic spline interpolation was primarily based on the engineer's tool that is used to draw a smooth curve, passing through a number of different points of the data. In spline interpolation process, the estimated coefficients on the cubic polynomial are used as weights for each internal. Specifically, the piecewise function $S(y)$ to make n equally spaced internals of the data is expressed as follows:

$$s(y) = \begin{cases} s_1(y) & if \quad y_1 \le y \le y_2 \\ s_2(y) & if \quad y_2 \le y \le y_3 \\ \\ s_{n-1}(y) & if \quad y_{n-1} \le y \le y_n \end{cases} \qquad (1)$$

To define $S\,(y)$ splines we need a total of $4n$ parameters to be estimated, as there are n evenly spaced intervals and four coefficients are required for each interval. These coefficients twist the curve so that it must pass through each of the observations without any interruption. This implies that the curve does not show any breaks in continuity. Specifically, $S_i(\ y)$ is a third degree polynomial function and defined by

$$s_i(y) = \beta_{3i}(y - y_i)^3 + \beta_{2i}(y - y_i)^2 + \beta_{1i}(y - y_i)^1 + \beta_{0i} \qquad for \quad y \in [y_i, y_{i+1}] \qquad (2)$$

Further, two conditions are imposed for each internal in order to get the cubic polynomial interpolation, which must match the values of the low-frequency series at both ends of the interval. These conditions are

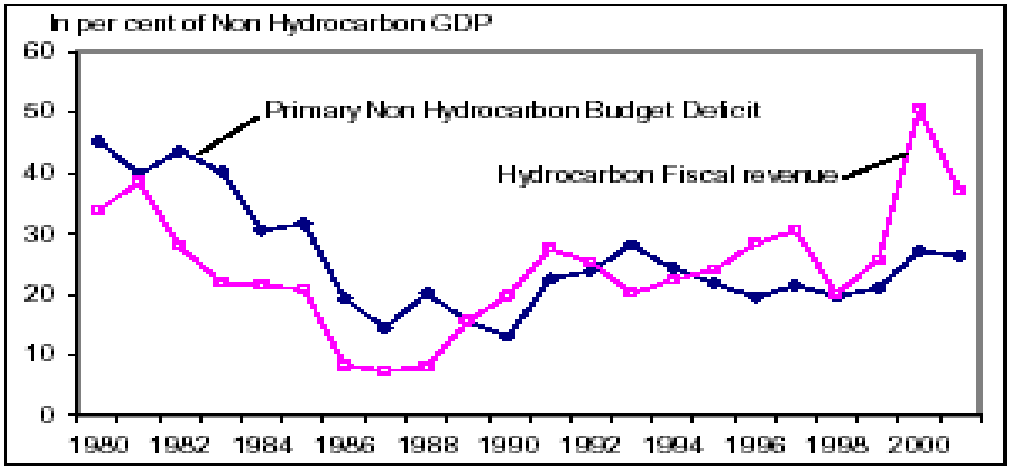
$$s_i(y_i) = x_i \quad , \quad s_i(y_{i+1}) = x_{i+1} \qquad (3)$$

where $x_i$can be obtained from equation (2). These conditions produce a piecewise continuous function, implying that each of sub-functions must joint at the data points at both ends of the interval. For making the curve seamless and smooth across the interval points we further required to impose the assumption of the continuity of the first and second derivatives:

$$s'_{i-1}(y_i) = s'_{i-1}(y_i) \quad , \quad s''_{i-1}(y_i) = s''_{i-1}(y_i) \qquad \forall \quad i = 1,2,...,n-1 \qquad (4)$$

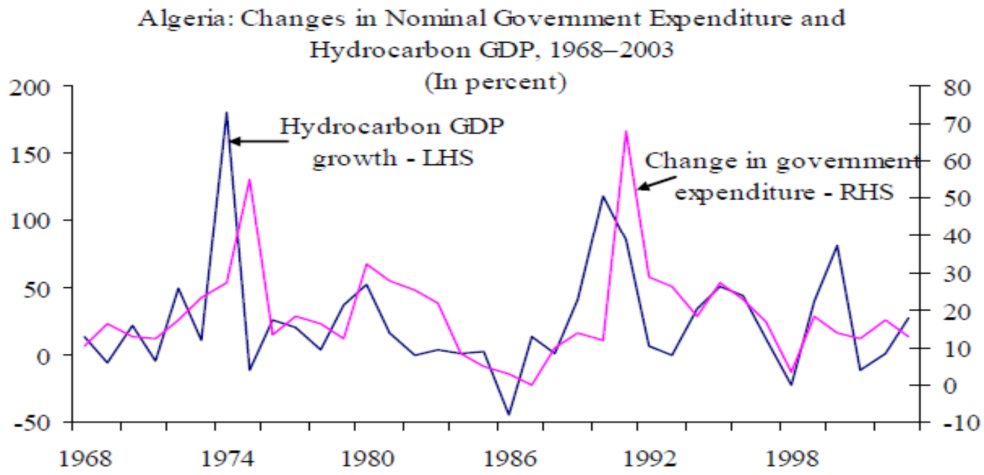
The conditions of the first and second derivatives to be continuous result in the smooth unbroken curve over the intervals, passing through each of the data points over the sample period without exhibiting any erratic behavior.

Figure 1:



Source: Document of The World Bank Group, Report No. 25828-AL. (2003). P: 4.

Figure2:



Source: IMF Country Report No: 05/50 2005: 6.

Figure3: Algeria: Procyclicality of Fiscal Policy

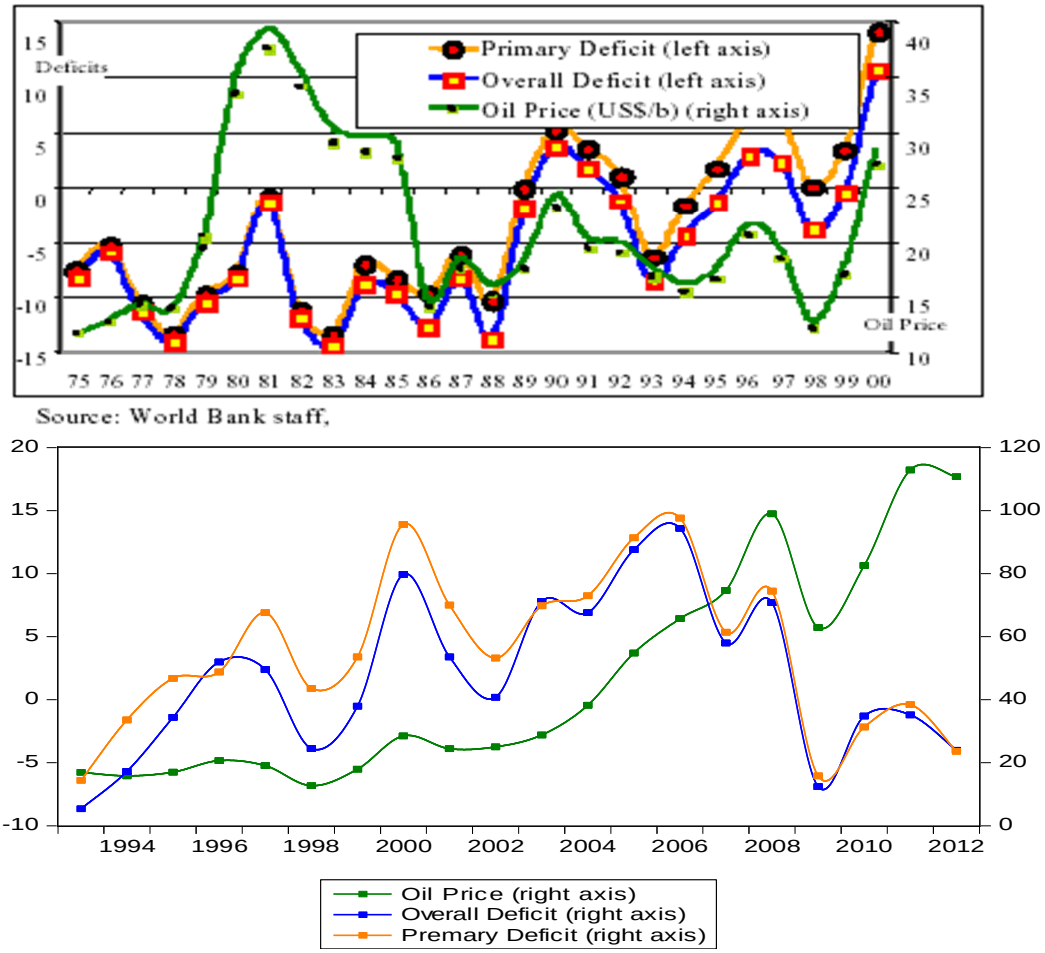


Figure 4: Evolution of the Employed Population by Legal Sector (2004-2013) (in thousands)

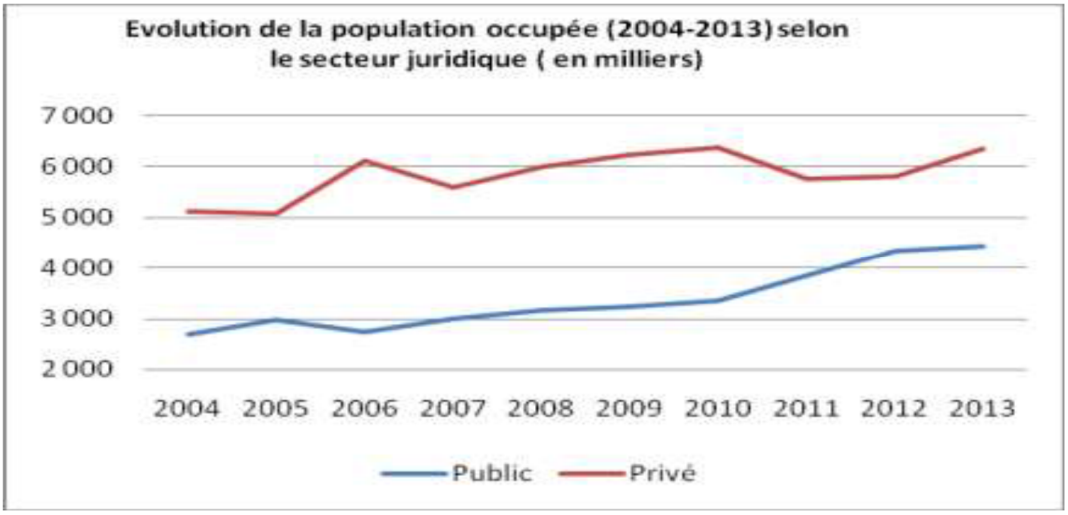


Table 1: Unit Root test (Augmented Dickey Fuller Test)

	Level	First difference
T	1.479574	-6.425538
G	3.861851	-4.411451
GDP	2.827667	-5.299093

Table 2: Structure of Revenue and Public Expenditure in Algeria, 1993-2012 (% of GDP)

	Revenue		Expenditure	
	Hydrocarbon	Nonhydrocarbon	Capital	Current
1993	15.7	11.6	8.7	24.9
1994	17.5	12	8	23.4
1995	18.3	12.3	7.4	22.6
1996	20.8	12.2	7	22
1997	21.8	12.3	2	23.6
1998	15	12.3	7.5	23.5
1999	18.1	11.7	8.2	23.7
2000	29.6	8.9	7.9	20.9
2001	23.6	10.9	8.4	22.7
2002	22.2	13.4	10.2	24.6
2003	25.6	11.3	10.8	21.3
2004	25.6	10.5	10.5	20.3
2005	31.3	9.7	10.8	16.5
2006	32.8	9.9	12	16.8
2007	30.1	9.6	15.5	18
2008	37.2	10	17.9	20.2
2009	24	12.6	19.5	22.5
2010	24.1	12.3	15.1	22.4
2011	27.4	10.5	13.6	26.7
2012	26.4	12.5	14.1	30.2

Source: Statistical appendix (1998/2004/2006/2009/2012/2013): IMF staff country report.

Table 3: Composition of Central Government Revenue in Algeria, 1993-2012 (In billions of dinars)

	Nontax revenues	Customs duties	Registration and stamps	Taxes on goods and services	Taxes on income and profits	Hydrocarbon revenue
1993	9.0	30.0	6.9	54.2	126.1	185
1994	13.3	47.9	6.6	65.9	163.2	257.7
1995	8.9	73.3	6.4	99.9	233.2	358.8
1996	14.6	84.4	9.1	129.5	290.5	519.7
1997	20.2	73.5	10.6	148.1	313.9	592.5
1998	18.9	75.5	11.3	154.9	329.8	425.9
1999	43.6	80.2	12.7	149.7	314.8	588.2
2000	15.4	86.3	16.2	165.0	349.5	1213.2
2001	90.3	103.7	16.8	179.3	398.2	1013.4
2002	112.2	128.4	18.9	223.5	482.9	1007.9
2003	69.7	143.8	19.3	233.9	524.9	1350.2
2004	63.7	138.8	19.6	274.0	580.4	1570.7
2005	89.5	143.9	19.6	308.8	640.5	2 352.7
2006	119.7	114.8	23.5	341.3	720.8	2 799.0
2007	124.1	133.1	28.1	347.4	766.8	2 796.8
2008	136.7	137	33.6	435.2	332	4 088.6
2009	115.9	117	35.8	478.4	462	2 412.7
2010	189.9	190	39.7	515.3	562	2905
2011	283	283	47	573	685	3 980
2012	243	355	58	685	886	4 184

Source: Statistical appendix (1998/2004/2006/2009/2012/2013): IMF staff country report.

Table 4: Composition of Central Government Expenditure in Algeria, 1993-2012 (In billions of dinars)

	Public services	Material and supplies	Mudjahidin s' pensions	Wages and salaries	Interest payments	Current transfers	Capital expenditure
1993	39.9	16.7	10.0	114.9	27.0	73.8	101.6
1994	42.3	18.2	12.8	145.2	41.1	78.5	117.2
1995	55.4	29.4	15.6	179.5	62.2	94.2	144.7
1996	69.9	34.7	18.9	213.3	89.0	115.4	174.0
1997	74.0	43.5	20.0	235.0	109.4	116.5	201.6
1998	75.2	47.5	37.9	258.2	110.8	123.9	211.9
1999	81.9	53.6	59.9	278.1	126.4	166.8	187.0
2000	92.0	54.6	57.7	281.1	162.3	200.0	321.9
2001	114.6	46.3	54.4	315.4	147.5	276.8	357.4
2002	137.6	68.5	73.8	339.9	137.2	334.3	452.9
2003	161.4	58.8	62.7	392.8	114.0	326.1	570.4
2004	176.5	71.7	69.2	442.3	85.2	396.0	646.3
2005	187.5	76.0	79.8	490.1	73.2	520.2	810.6
2006	215.5	95.7	92.5	531.3	70.0	645.6	1 019.0
2007	273.0	93.8	101.6	628.7	85.0	762.8	1 442.3
2008	360.8	111.7	103.0	826.6	61.4	1115.2	1973.3
2009	405.2	112.5	130.7	879.9	37.4	1098.9	1925.8
2010	513.2	121.8	151.3	1193.1	32.5	1195.8	1807.9
2011	130	130	163	1740	38	1.808	1974
2012	135	-	254	1980	42	-	2276

Sources: statistical appendix (1998/2004/2006/2009/2012/2013): IMF staff country report

Table 5: Evolution of the Main Aggregates and Indicators Related to The Labor Market from 2004 to 2013 (in thousands)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Situation dans la profession										
Employeurs & Indépendants	2 472	2 183	2 846	2 516	2 655	2 762	2 847	2963	2882	3117
Salariés Permanents	2 902	3 076	2 901	2 909	3 198	3 136	3 208	3456	3675	3878
Salariés non perm + apprentis	1 785	2 203	2 430	2 680	2 815	3 101	3 250	2978	3396	3562
Aides Familiaux	640	582	692	489	477	473	404	202	217	231
Secteur d'activité										
Agriculture	1 617	1 381	1 610	1 171	1 252	1 242	1 136	1 034	912	1 141
Industrie	1 061	1 059	1 264	1 028	1 141	1 194	1 337	1 367	1 335	1 407
B.T.P.	968	1 212	1 258	1 524	1 575	1 718	1 886	1 595	1 663	1 791
Services	4 153	4 393	4 738	4 872	5 178	5 318	5 377	5 603	6 260	6 449
Secteur juridique										
Public	2 678	2 964	2 746	2 987	3149	3 235	3 346	3843	4354	4440
Privé	5 121	5 080	6 123	5 607	5996	6 238	6 390	5756	5816	6349
Accroissement emploi public (en %)		10,7	-7,4	8,8	5,4	2,7	3,4	14,9	13,3	2,0
Accroissement emploi privé (en%)		-0,8	20,5	-8,4	6,9	4,0	2,4	-9,9	1,0	9,2
Affiliation à la sécurité sociale										
Emploi affilié à la Séc. Sociale	3 774	4 092	4 159	4 322	4 567	4 694	4 856	5227	5922	6211
Non affilié	4 024	3 953	4 709	4 272	4 579	4 778	4 879	4372	4249	4577
% emploi affilié / emploi total (en %)	48,4	50,9	46,9	50,3	49,9	49,6	49,9	54,4	58,2	57,6
Accroissement emploi affilié(en %)		8,4	1,6	3,9	5,7	2,8	3,5	7,6	13,3	4,9
Accroissement emploi non affilié(en %)		-1,8	19,1	-9,3	7,2	4,4	2,1	-10,4	-2,8	7,7