Can Budget Deficits Financing, Crowed Out Private Sector? Comparative Study of the Cases of Iran and Algeria

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Abstract

This paper develops an analysis of budget deficit financing in terms of a crowding out or crowding in effect on the activity of the private sector for the economies of Iran and Algeria as two MENA countries, (because of its economic structures (dependence on oil revenue)) during the period 1970-2012 by using Cointegration and Vector Error Correction approaches. The analysis confirms the existence of a crowding out effect in Algeria and a crowding in effect in Iran.
Keywords: Budget Deficit; Private Sector; Crowding out or Crowding in Effects; Cointegration; VECM (Vector Error Correction Model).

1- Introduction

In developing countries, the principal constraints of the fiscal and macro-economic policies are an inadequate taxation basis, a limited capacity to collect taxes, the dependence with regard to the monetary financing and (in certain cases) of the high levels of the public debt. As, for these countries, unlike the industrialized ones, the possibility of financing public deficits by call to foreign savings is very reduced, and that they have also limited capacities of emission of domestic debt because of the insufficient development of the local financial markets, they are more dependent on the seigniorage than the industrialized countries. At the same time, the high and increasing levels of their national debts exert a pressure on the real interest rates and they frequently involve financial volatility and macro-economic instability.

In the case of Iran and Algeria, oil revenues deeply influence the decisions of the State as regards economic policy. In other words, the State

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can cover its budget expenditure with the oil receipts and, for that; it does not need to set up an effective tax system. Thus, in the field of the public finance, the tax policy is not developed. To manage its finances, the State uses quasi-budgetary instruments which are located apart from the traditional budgetary process and which is thus not easily identifiable. This often causes significant budget deficits and a very high inflation (like that observed during the last three decades). For example, in the case of Iran, the decline in oil prices during 2008, lead to lower fiscal revenues than expected. Therefore, the budget deficit which was already high in 2007 (3.7% of GDP) reached 6.9% of GDP in 2008. Also, in 2008 the government focused on the suppression of energy subsidies. So the government decided to pay these subsidies and therefore increases the budget deficit. Therefore, the budget deficit reached 8.7% of GDP in 2012. In this context, most macroeconomic variables (such as public and private investment) were more strongly influenced by oil revenues. Therefore, public and private investment (in percent of GDP) in 2012, was unable to reach their levels of the early 1970s (Figure 1).
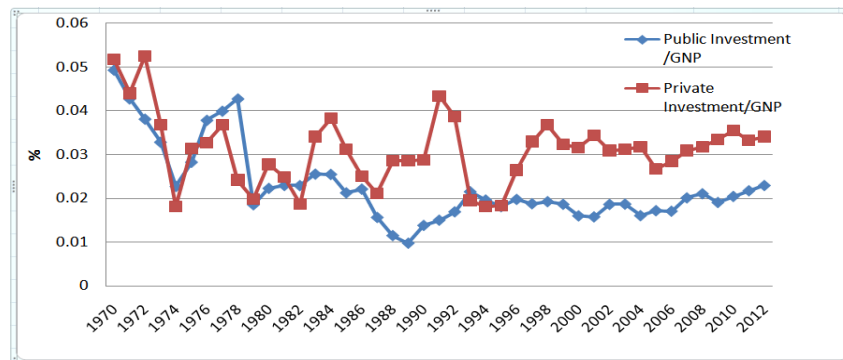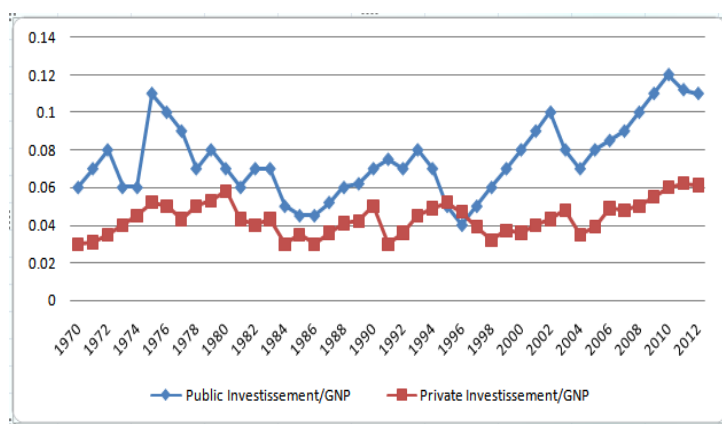

Figure 1: Public and Private Investment as a Percentage of GNP: Case of Iran

Source - Central Bank of I.R of Iran

Algeria after gaining its independence in 1962, adopt a centrally planned economic system and nationalizing most economic activities (for example hydrocarbons and agriculture sectors). The fast growing oil and gas export

revenues were leveraged to finance an import substitution development strategy based on large investments in heavy industry. In parallel, the fall of hydrocarbon prices (for example in 1986) had the dramatic drop in public and private investment (Figure 2).

Figure 2: Public and Private Investment as a Percentage of GNP: Case of Algeria

Source: Central Bank of Algeria

The structure of economy of Algeria, is too vulnerable to oil and natural gas price fluctuations. Also, budget policy has been an important government tool in recent years, giving form to decisions about the use of oil/gas revenue, supporting economic growth and meeting growing social demands and preserving macroeconomic stability. For example, from 2001 to 2004, the government implemented a $7 billion economic revival plan (PSRE) to boost growth and jobs. It set up a revenue regulation fund (FRR) in 2000 to enable the budget to be adapted to oil price fluctuations and drew up a medium-term expenditure framework (MTEF) independent of oil/gas revenue. It reformed taxation to gradually reduce the government's dependence on oil/gas revenue and divert spending to education and health with the aim of preparing the way for economic liberalization by giving people more skills and qualifications. However, oil revenues deeply influence the decisions of the State and private sector activities.

Theoretical and empirical work which treats the budget deficits financing, in the case of countries which do not resort (or cannot resort) to the external financing, retains the sole two possibilities of public financing which are the money creation and the loan on the domestic market of savings. But, for much of emergent or developing countries which follow (or are subjected to) the recommendations of Washington Institutions (the IMF and the World Bank) and which adopted the principle of the independence of the Central Bank[1], the only regular source of financing remains the call to domestic savings. In this direction, that of the public loan, the intervention of the State in the economy can influence the activity of the private sector in terms either of **crowding out effect**, i.e. of an effect of reduction of the private investments, of **crowding in effect**, i.e. an effect of boosting private investments.[2] Indeed, the mode of financing the budget deficit can lead to the one or the other of these two effects. That wants to say that a rise of the budget deficit can influence other macroeconomic variables like the interest rate or the volume of production. One must also consider the influence that have the variations of the bank credit and the capital formation in the public sector on the investment decisions in the private sector.

Iran and Algeria, which knew a strong economic growth during the last three decades and, at the same time, strong periods of instability for as well economic reasons, had to mobilize significant financial resources to finance the rise of their public expenditure and it is very significant to know if this strong dynamics of the public sector had favourable or unfavourable effects on the development of the private sector, in particular with regard to the development of the productive investments in this sector. This is why, in this paper, by taking in account the possible incidences of the net financing needs

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1- Let us recall that the European Union countries which accepted the Treaty of Maastricht, made their Central Banks independent of the government :governments do not have any more right to resort to direct seignior age; one can add that, in spite of the facility of this type of financing for the State, the monetization of the deficit can cause an increase in inflation
2- And thus, finally, of a deceleration or of a boost to economic growth.

financing of the public sector, we devoted ourselves our analysis to the checking of the **crowding out** or **crowding in effect** in the case of the Iranian and Algeria economies during the period 1970-2012.

To this end, our study is organized according to the following articulation:

Second Section is devoted to the definition of the concepts *crowding out* or **crowding in effects,** and also to a synthetic examination of the literature which discusses the terms of this vision or which disputes it; then, the third Section presents a short review of some empirical studies concerning these effects. The fourth and fifth Sections will join together our personal contributions to the analysis: one will initially expose (Section 4) the selected econometric approach and one will specify the sources of the data used; Section 5 will state the main results of our study whose conclusions will be finally briefly summarized in a sixth Section.

We can however indicate that we tried to clarify the factors which can influence private investment and the reactions of this one to the changes in the economic policy applied by the authorities. With this intention, and while following the approach of Blejer and Khan (1984) revisited by Mama *et al* (2002), we estimated a model of investment with flexible accelerator in which the possibility of the *crowding out* effect is estimated through its impact on the speed of adjustment of private investment on its desired level; the public expenditure of investment, the interest rate, the credit to the private sector and the rate of real exchange are the macroeconomic variables which we retained as being the main determinants of these mechanisms of adjustment.

2- Concepts off Crowding out and Crowding in Effects

One can study the **crowding out** or **crowding in effects** in a way more sophisticated in three different ways, by considering the possibilities of

crowding out by the interest rate, the rate of exchange or anticipations[1]. In addition, there is a significant literature concentrated on the relations between budget deficit and private investment, relations which are analyzed in a contradictory way in symmetrical terms of effects either of crowding in or of crowding out. In the theoretical literature, one can, indeed, find three distinct schools of economic thought: that one of the Neo-classics, the Keynesian one and the (we call) "Barro-ricardian" one[2]. Bernheim[3] (1989) briefly presented these schools of thought.

1- The authors of the Neoclassic School retain the assumption according to which, by transferring refunding from the present national debt at the future generations which will have to pay more taxes, the budget deficits financed by loan can boost an increase in the current consumption. This school, reasoning on the assumption of the full employment of the resources, explains that an excessive consumption today causes a reduction in savings and that in order to allow the equilibrium on the national financial markets, the interest rate must increase; consequently, these higher interest rates bring about the fall of the private investment (it is the more usual vision of the crowding out effect).

2- On the contrary, Keynesians, by considering the expansionist effects of the budget deficits, defend the idea of the crowding in effect of public expenditure. They explain why, accordingly, budget deficits, normally, lead to an increase of national production, which encourages private investors to expect a good future of the economy and incites them to invest more (that is the crowding in effect). It is the reason why many Keynesians explain that public deficits do not have reason of crowding out the private investment. Eisner (1989) argues, for example, why the increase in global demand raises

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1- Cf. for Example, Le Page, J. M. (1991), Economie Monétaire, Edition Cujas, pp.159-161.
2- By this "non usual denomination", [they are qualified also as "New Classical" ones], we steer the reader towards a very debatable interpretation, by R. Barro (1989) of Ricardo's thesis on Tax.
3- Bernheim, B D. (1989), "A Neoclassical Perspective on Budget Deficits", *Journal of Economic Perspectives,* Vol. 3, pp.55-72.

the profitability of private investments and involves these investments on a higher level, for any interest given rate.

3- Lastly, with the concept of Ricardian equivalence1, presented by Barro (1989), a certain number of authors consider that an increase in the budget deficits, because of an increase in the public expenditure, must be paid now or will have to be paid later. Thus, financing public expenditure today rather by loan that by tax, will be compensated by an increase in the savings of the households anticipating the payment of the future taxes (which will afford the State to refund these loans); these additional savings cause, simultaneously, that the interest rates and the private investment remain stable. Then the effect of public financing should be neutral (Brittle and Shane (2010)).

It is the first one of these three approaches, however, which seems to dominate in theoretical studies and empirical work, these last years. Indeed, many authors regard the crowding out effect as a significant consequence of the public budget deficit financing, even if, in addition to the already quoted authors, opinions are divided (cf. Eisner (1989), Aschauer (1989a, 1989b), Huixin & Leeper (2010) and Jongwanich (2010)). With the first degree of the analysis, the public loan on the domestic market of savings "crowds out" private borrowers of the access to the whole or a part of this means of financing, and thus reduces the financing capacity of the private sector of the economy. On a more sophisticated analytical level, Bailey (1971), Buiter (1977, 2010), Barro & Redlick (2010), David & Scadding and (1974) studied the relationship between private investment and public expenditure and mainly the crowding out effect which those exert, through several budgetary indicators, by decreasing the capacity of influence of the public sector on the economic activity. Even Yellen (1989) discusses of that in the context of framework of the neo-classic macro-economic model. She concludes that the method that the government chooses to finance its expenditure can affect the level of exports, of consumption and of total investment. In other words, if public expenditure is financed by the issue of titles on the domestic market of savings, rather than by taxes, global

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1- The thesis known as the thesis of the "Ricardian equivalence" is rejected by the majority of the Post-Keynesians; and even Feldstein (1988, 2009) pointed out that the introduction of uncertainty into the model of Barro can destroy this explanation of the "equivalence".

consumption will increase and the future national savings will decrease. Moreover, according to this author, if the economic activity is at the level of full employment of the resources, a higher current consumption implies a reduction of the same amount of the other elements of the global expenditure. Thus, in this body of "neo-classic" assumptions, the public investment "crowds out" necessarily the private investment.

3- A review of Empirical Studies:

Bailey (1971), Buiter (1977, 2010), Buiter and Tobin (1978), David & Scadding (1974), Huixin & Leeper (2010) and Jongwanich (2010) which, we have just seen it, studied, from a theoretical point of view, the relationship between private investment and public expenditure and mainly this "crowding out effect", also justified it from the empirical point of view. Because, the crowding out effect being able to decrease the capacity of influence of the public sector on the economic activity, it is through its "driving belts" (as those which one can find in certain macroeconomic models, as suggested Yellen (1989)) that empirical work tries to identify it.

Thus, some studies, such as Premchand (1984), argue that the budget deficit financing by domestic borrowing, implies an increase in the supply of bonds and to improve the attractiveness of these obligations, the government offers them at a lower price than the bonds traded on the bond market, which leads him to offer higher interest rates. The increase in interest rates, discouraging then the issuance of private bonds and thus reduces private investment.

Conversely, Heng (1997) used a model with overlapping generations (OLG) to provide a theoretical framework for analyzing the crowding-in effect. The author explains that public capital leads to private capital through two channels: first, through its impact on the marginal productivity of labor and savings, and secondly, through the (gross) effects of complementarily or substitutability between public capital and private capital.

Blinder and Solow (1974), in analysis of the debt charges and tax revenue in long run, shows that financing by domestic borrowing has a stronger

crowding-in effect than the financing through money creation. Farmer and plotnikov (2010) studied the effect of an expansionary fiscal policy on output and employment in the economy using Farmer's (2010b) old-Keynesian framework. They find that expansionary fiscal policy increases economic activity and reduces unemployment in the short-run at the cost of reduced consumption.

Buiter (2010), on the other hand, in modeling two-and three financial assets, generalize previous results by reactivating: they show, in particular, the importance of the crowding-in effect is a function of degree of substitution between financial assets constituting the portfolio of the economy, and the dynamic of stabilization of expansionary borrowing implies a set of appropriate adaptive price expectations.

On the side monetarists have highlighted the "arithmetic" and the paradox of money tight. This literature has developed from an article by Sargent and Wallace (1981) who wonder about the consequences of deficit financing through money creation exogenously.

IMF (2013) surveyed the financing of the government deficit in the case of Algeria and suggested resorting to bond financing of the government deficit to contain liquidity injections. Fiscal financing requirements are currently met by drawings on the FRR, which increases liquidity. Greater resort to the domestic capital market would help liquidity management, with limited risks of crowding out private investment, given the high liquidity and very low interest rates (nominal interest rates on three-month treasury bills and two-year bonds stood at 0.54 percent and 1.27 percent respectively, on June 2012). A more active government securities market would also have the advantage of supporting the necessary development of the financial markets.

4-The Methodology and the Data
4-1- The Methodology
Our starting point is the construction of a model of investment with flexible accelerator inspired Blejer and Khan (1984), based on the assumption that

the private capital stock desired, is proportional to the volume of anticipated production Y_t^e.

Or:

$$KP_t^* = aY_t^e \tag{1}$$

The parameter a is constant, while the change in economic conditions may affect the stock of private capital.

Actual capital stock at the end of period t, KP_t, adjusts to its desired value according to the following mechanism:

$$\Delta KP_t = \beta(KP_t^* - KP_{t-1}) \tag{2}$$

In expression (2), net private investment, ΔKP_t, is equal to the increase of the capital stock, $(KP_t - KP_{t-1})$, in period t. Thus, this relation may be deduced:

$$KP_t = \beta KP_t^* + (1 - \beta)KP_{t-1} \tag{2-a}$$

The variable β represents the adjustment coefficient and is as $0 \le \beta \le 1$.

In addition, data on private investment concern gross private investment (IP_t). However, assuming a depreciation of the private capital stock at a constant rate, we can express this gross private investment, as the following sum:

$$IP_t = \Delta KP_t + \delta KP_{t-1}$$

By denoting the lag operator $LKP_t = KP_{t-1}$, IP_t can be written as:

$$IP_t = \left[1 - (1 - \delta)L\right]KP_t \tag{3}$$

From the above expression, we can obtain the expression of the private capital stock, which is given by:

$$KP_t = \frac{IP_t}{\left[1 - (1 - \delta)L\right]} \tag{4}$$

By substituting KP_t and KP_{t-1} from the expression (4) in equation (2a), we obtain:

$$\frac{IP_t}{[1-(1-\delta)L]} = \beta KP_t^* + (1-\beta)\frac{IP_{t-1}}{[1-(1-\delta)L]} \tag{5}$$

This has the following solution.

$$IP_t = [1-(1-\delta)L]\beta KP_t^* + (1-\beta)IP_{t-1} \tag{6}$$

By substituting KP_t^* expression (1) in the expression (6), we obtain:

$$IP_t = \beta a[1-(1-\delta)L]Y^e + (1-\beta)IP_{t-1} \tag{7}$$

or

$$\Delta IP_t = \beta\big[a(1-(1-\delta))LY^e - IP_{t-1}\big] \tag{7-a}$$

To use the expression (7-a), we do not need statistics or information on the capital stock, or on the net investment.

An alternative way to obtain the expressions (6) and (7) is that specify an adjustment function similar to the expression (2) for the desired investment (IP_t^*) as follows:

$$\Delta IP_t = \beta\big[IP_t^* - IP_{t-1}\big] \tag{8}$$

Or as the expression (3)

$$IP_t^* = [1-(1-\delta)L]KP_t^* = a_0[1-(1-\delta)L]Y_t^e \tag{9}$$

By combining expressions (8) and (9), we can obtain an expression analogous to expression (6). To allow private investment to vary according to economic conditions and adapt the previous model to that of the flexible accelerator, we used the approach suggested by Mama *et al*. (2000).

To analyze the effect of the budget deficit and especially that of its financing in terms of crowding out, we may retain the variables that relate to finance the budget deficit. According to these authors, the assumption is that the speed of adjustment is governed by a set of factors that play a role in

terms of macroeconomic stability that is the interest rate, *INT*, public investment, *IG*, the allocations to private sector, *CRPRIV*, and the real exchange rate, *EX*.

The possibility of crowding-out or crowding-in effect is studied through its effect on the speed of adjustment of the actual investment to its desired level. Thus, the adjustment coefficient β can be represented by the following linear specification:

$$\beta = b_0 + \frac{1}{IP_t^* - IP_{t-1}} \left[b_1 INT + b_2 IG + b_3 CRPRIV + b_4 EX \right] \qquad (10)$$

By replacing β by this value in the expression (8), we obtain:

$$\Delta IP_t = b_0 (IP_t^* - IP_{t-1}) + b_1 INT + b_2 IG + b_3 CRPRIV + b_4 EX \qquad (11)$$

Considering the expressions (1) and (3), we can rewrite the expression (11) as follows:

$$IP_t = ab_0 \left[1 - (1-\delta)L \right] Y_t^e + b_1 INT + b_2 IG + b_3 CRPRIV + b_4 EX + (1 - b_0) IP_{t-1} \qquad (12)$$

A hypothesis of adaptive anticipation of global production, to define the anticipated production, was used by Blejer and Khan (1984).

$$\Delta Y_t^e = Y_t^e - Y_{t-1}^e = \lambda \left[Y_{t-1} - Y_{t-1}^e \right] \qquad (13)$$

This can be rewritten as:

$$Y_t^e = \frac{\lambda Y_{t-1}}{\left[1 - (1-\lambda)L \right]} \qquad (14)$$

where λ is the coefficient of anticipation as $0 \le \lambda \le 1$

For econometric estimation, we chose $\delta = 5\%$ and $\lambda = 1$, that is to say $Y_t^e = Y_{t-1}$. This means that the expected output is equal to the output of the previous period. We can rewrite the expression (12) by substituting the relation (14) in this expression.

$$IP_t[1-(1-\lambda)L] = \lambda ab_0[1-(1-\delta)L]Y_{t-1} + b_1[1-(1-\lambda)L]INT$$
$$+ b_2[1-(1-\lambda)L]IG + b_3[1-(1-\lambda)L]CRPRIV \qquad (15)$$
$$+ b_4[1-(1-\lambda)L]EX + (1-b_0)[1-(1-\lambda)L]IP_{t-1}$$

or $\quad IP_t = (1-b_0)IP_{t-1} + HY_{t-1} + b_1 INT + b_2 IG + b_3 CRPRIV + b_4 EX \quad (16)$

also
$$HY_{t-1} = ab_0 \Delta Y_{t-1} = Y_{t-1} - 0.95Y_{t-2}$$

In this work to analyze the influence of fiscal policy on private investment, it is the expression (16) that we used for our econometric study.

4-2- Data and Application of the Method of Analysis

Most of the data are from the electronic version of the database International Financial Statistics (IFS) in 2013 the International Monetary Fund, the electronic version of the database (WDI) 2013 World Bank. The period chosen is 1970-2012.

Then, we based on the method applied by Blejer and Khan (1984), we studied the reactions of private investment to changes in economic policy applied by the Iranian and Algeria governments. For this, we have, using time series econometric techniques such as cointegration and model vector error correction (VECM) to analyze the influence of the budget deficit and especially its financing, to identify crowding out or crowding in effect.

5- The Results of Empirical Study; the Case of Iran and Algeria

Johansen and Juselius provide a unified approach to the estimation and testing the cointegrating relationships. The procedure is particularly useful since: 1) it uses maximum likelihood techniques; 2) it can detect and estimate multiple cointegrating vectors; and 3) it allows us to test restrictions on the cointegrating vector(s).

In order to identify a structural model we undertake the following steps:

- Pre-test all variables to be included in the VAR for the order of integration. It is generally inappropriate to mix variables that are integrated of different orders. Having selected the appropriate variables, we have used the Johansen procedure to obtain the number of cointegrating vectors. This is the tentative number of behavioural or reduced form relations in the model.

- Economic theory may suggest the existence of certain structural relationships that are conform to the results in last step. In order to identify each behavioural relation, one can impose various zero identifying restrictions by running the Johansen procedure with the appropriate variables excluded. If the remaining variables are then found to be cointegrated, the exclusion restriction suggested by the model is deemed to be appropriate. If no cointegrating vector is found, the restriction must be rejected. Additional restrictions suggested by the structural model can be tested using the cointegrating vectors with the imposed zero restrictions.

- The error-correction models using equilibrium errors from both the restricted and unrestricted models can be estimated. Innovation accounting can be used to obtain information concerning the dynamics of the restricted and unrestricted systems.

5-1- The Case of Iran

5-1-1- Stationary Tests

As a first step we integrate the stochastic properties of individual series. We are particularly interested in the order of integration of the different series. Table (1) reports the results of ADF and KPSS unit root tests using different options. It's clear from the table that a unit root hypothesis cannot be rejected for all series. In other words all of series are I(1).

Table 1: ADF Test: The Case of Iran

Tests Variables	ADF		KPSS[1]		Result (Order of Integration)
	Level	1- Difference	Level	1- Difference	
LHY	-3.41 ^{CT}	-4.16 ^{CT**}	0.170 ^{CT**}	01 ^{CT}	I (1)
LCRPRIV	-2.73 ^{C}	-5.42 ^{C**}	0.47 ^{C**}	0.41 ^{C}	I (1)
LIG	-1.75 ^{CT}	-4.1 ^{CT**}	0.15 ^{CT**}	0.06 ^{CT}	I (1)
LINT	-1.94 ^{CT}	-5.85 ^{CT**}	0.149 ^{CT**}	0.11 ^{CT}	I (1)
LEX	-1.82 ^{CT}	-6.19 ^{CT**}	0.18 ^{CT**}	0.08 ^{CT}	I (1)
LIP	-2.9 ^{CT}	-5.4 ^{CT**}	0.163 ^{CT**}	0.05 ^{CT}	I (1)

*, ** denotes 1% and 5% significant level respectively.
C: Constant; CT: Constant and Trend
1-Critical value for KPSS test: 0.146 for Constant and Trend case (CT) and 0.463 for Constant (C).

5-1-2- Model estimation

Equation (17) presents the unrestricted vector error correction model (VECM) of Iran.

We used the Johansen procedure to determine the number of cointegration relationship(s) and the estimation of equation (17).

$$\begin{bmatrix} dLIP \\ dLIG \\ dLHY \\ dLCRPRIV \end{bmatrix}_t = \tau_1 \begin{bmatrix} dLIP \\ dLIG \\ dLHY \\ dLCRPRIV \end{bmatrix}_{t-1} + \ldots\ldots + \tau_k \begin{bmatrix} dLIP \\ dLIG \\ dLHY \\ dLCRPRIV \end{bmatrix}_{t-k+1} +$$

$$\pi \begin{bmatrix} LIP \\ LIG \\ LHY \\ LCRPRIV \end{bmatrix}_{t-1} + LINT + LEX + \varphi DUM + \varepsilon_t \qquad (17)$$

With:
$$\tau_i = \sum_{j=i+1}^{k} -A_j, \ j = 1,2,\ldots,k-1 \text{ et } \pi = A_1 + A_2 + \ldots + A_{k-1} - I$$

d is lag operator and *Dum* represent vector of dummy variables (such as Islamic Revolution dummy for Iran). To estimate the model (17), we must determine the number of lags of the model. In the case of Iran, by comparing the information criteria of Akaike, Hannan-Quinn and Schwartz, a delay of three periods was chosen for model.Likelihood ratio test statistics and their critical values regarding the number of long run equilibrium relationships in the system are presented in annex. Given the results of trace (λ_{trace}) and the maximal eigen value (λ_{max}) test the hypothesis of two cointegrating vectors is accepted. By estimating unrestricted VECM, the two cointegrating vectors[1] (*LIP* and *LIG*) were obtained:

$$LIP = -2.402LHY + 3.281LCRPRIV + 8.159 \qquad (18)$$
$$\quad (-7.208) \quad (7.151) \quad (13.222)$$
$$LIG = -1.574LHY + 1.939LCRPRIV + 7.797$$
$$\quad (-4.009) \quad (3.588) \quad (10.738)$$

-Residual Based Tests

Table (2) shows results of the residual based tests for the cointegration equations. All tests confirm the well behaved residuals in 5% significance level.

Table 2: Residual Tests Results.

Autocorrelation Test: Portmanteau (H_0 : No residual autocorrelation up to lag h)		
Portemanteau	Chi-sq (36)=21.46	P-value =0.16
Autocorrelation Test: Lagrange Multiplicator (H_0 : No residual autocorrelation)		
LM [1]	Chi-sq (16) =19.966	P-value =0.223
LM [4]	Chi-sq (16)=12.086	P-value =0.740
Normality Test: (H_0: residuals are multivariate normal)		
Jarque-Bera	Chi-sq (8)=16.185	P-value =0.06
Heteroskedasticity Test: (H_0 : No residual Heteroskedasticity)		
Chi-sq (399)=161.361		P-value =0.249

The Numbers in Parenthesis are Degrees of Freedom.

1- The General form of this Equation is: $\pi y_{t-1} = \alpha(\beta' y_{t-1} + \mu)$.

In order to identifying each behavioural relation, one can impose various zero identifying restrictions1 by running the Johansen procedure with the appropriate variables excluded.

In our case for identifying the relations, we had to impose 4 restrictions. The first restriction that can be correspond private investment equation, may obtained by imposing the homogeneity of *LIP* and *LHY*; and the second one may correspond public investment equation.

According to the theory, the credit allocated to the private sector can not influence public investment then in second relation, we can exclude this variable. Finally, the two relations are identified by normalization's restrictions. Also, according to exogeneity test, we can exclude the (*LHY*) in both short-term relationships[2]. The results of this test are shown in Table (3).

Table 3: Test of Weak Erogeneity Test

	LIP	**LIG**	**LHY**	**LCRPRIV**
Ch-square	18.01	20.77	**2.35**	16.20
p-value	0.00	0.000	**0.307**	0.000

Exogeneity of the variables are accepted if p-value is superior as 0.05.

After imposing the restrictions, we can rewrite the long-term coefficients, β, as follows:

1- For this purpose, we consider a restriction matrix (*Ri*) with dimensions (*p1*mi*), and *Hi =Ri* is a matrix of dimensions (*p1*si*). *mi* and *si* represent, respectively, the number of restrictions and parameters. Thus, *p1* is the number of variables(*p1=mi+si*) . We can write $\beta i = Hi\varphi i$ which by using *Hi* we can test linear hypotheses on the cointegrating relationships, such as the hypothesis of exact identified. In other words two vectors (*Hi* and *Ri*) are orthogonal (if: *Ri'.Hi = Hi'Ri = 0*). (See: Greene (2000), p: 709).

2- We can impose restrictions A (3,1) = 0, A (3,2) = 0, as we did in Table 4.

$$\begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \\ \beta_{31} & \beta_{32} \\ \beta_{41} & \beta_{42} \\ \beta_{51} & \beta_{52} \\ \beta_{61} & \beta_{62} \end{bmatrix} = \begin{bmatrix} 1 & * \\ * & 1 \\ -1 & * \\ * & 0 \\ * & * \\ * & * \end{bmatrix} \tag{19}$$

Applying these restrictions to long and short-term relationships, we can now estimate the constrained VECM. The results are presented in Table (4).

Now we can choose the first cointegration relationship of this model as long-term relationship between the variables that can influence private investment in Iran. The first cointegration relation is as follows[1]:

$$LIP = 0.726LIG + LHY + 0.858LCRPRIV - 9.434$$
$$\quad (14.415) \qquad\qquad (12.975) \qquad (-11.287) \qquad\qquad (20)$$

The results show a positive relationship between private and public investment. In other words, in the case of Iran since the period 1970-2012, public investment may lead private investment, because the fiscal activities of the Iranian government had a positive effect on private sector activities[2]. In addition, the results of restricted VECM, demonstrate the existence of short-run relationship and adjustment of the variables to the long-term relationship.

The coefficients of first short-run equation (α) are significant except for the credit allocated to the private sector. Thus, they represent the existence of a strong force of the investment on the dynamics of short-term private investment behavior.

In other words, an increase in these variables creates an imbalance situation that brings down these two variables in the following periods.

But it should be noted that the speed of adjustment of these variables is different. This means that the convergence of public investment to the long-run relation is faster than the convergence of private investment.

1- Imposing Restrictions on the Long- Run Equations (LHY = 1) Cause that the Software Cannot Calculate t Statistics.
2- This Result Agrees with Ayadi et al (2004) in the Case of Iran and Tunisia.

Table 4: The Constraint VECM Estimation Results (Case of Iran)

LR Test	Chi-sq (6)=4.299		P-value =0.367	
Restrictions				
B(1,1)=1 ; B((1,3)=-1; B(2,2)=1 ; B(2,4)=0; A(3,1)=0 ; A(3,2)=0				
BETA (transposed)				
LIP	LIG	LHY	LCRPRIV	C
1	-0.726 (-14.415)	-1	-0.858 (-12.975)	9.434 (11.287)
-0.040 (-1.933)	1	0.159 (8.816)	0	-3.153 (-8.901)
ALFA				
ΔLIP	ΔLIG	ΔLHY	ΔLCRPRIV	
-0.028 (-2.05)	-0.109 (-3.867)	0	-1.655 (-1.882)	
-0.130 (-1.909)	-1.054 (-1.724)	0	-0.642 (-2.507)	

The numbers in parenthesis are t-statistics.

5-2- The case of Algeria
5-2-1- Stationarity tests

In the case of Algeria, after the unit root tests, in a first step, we estimated the cointegrating relationship whose existence has been confirmed by this test. In a second step, we estimated VECM.

Table (5) reports the results of ADF and KPSS unit root tests using different options. It's clear from the table that a unit root hypothesis cannot be rejected for all series. In other words all of series are I(1).

Table 5: ADF Tests: The Case of Algeria

Tests Variables	ADF		KPSS		Result (Order of integration)
	Level	1- difference	Level	1- difference	
LHY	-0.64^{CT}	-3.69^{CT**}	0.149^{CT**}	0.127^{CT}	I (1)
LCRPRIV	-2.01^{CT}	-3.6^{CT**}	0.187^{CT**}	0.08^{CT}	I (1)
LIG	-3.41^{CT}	-5.018^{CT**}	0.151^{CT**}	0.131^{CT}	I (1)
LINT	-2.28^{CT}	-4.89^{CT**}	0.168^{CT**}	0.140^{CT}	I (1)
LEX	-3.3^{CT}	-3.84^{CT**}	0.148^{CT**}	0.138^{CT}	I (1)
LIP	-1.05^{CT}	-4.15^{CT**}	0.146^{CT**}	0.133^{CT}	I (1)

*, ** denotes 1% and 5% significant level respectively. C: Constant; CT: Constant and Trend
1-Critical value for KPSS test: 0.146 for Constant and Trend case (CT).

5-2-2- Model Estimation

For the Algeria economy by applying the model (17), we could estimate the unrestricted VECM (assuming the existence of a linear trend in the cointegration relationship, $[\pi y_{t-1} = \alpha(\beta'y_{t-1} + \mu + \lambda t) + \alpha_1\gamma]$). In this model, we used three dummy variables: *DUM89* for the liberalization of economy during (1989-1994) and *DUM04* for the economic revival plan during (2000-2004).

By comparing the information criteria (Akaike, Hannan-Quinn and Schwartz), two delays have been chosen for this model. In addition, Johansen test results confirm two cointegrating vectors for Algeria. The result of these tests is presented in Annex.

The estimation of the vectors are (using unrestricted VECM):

$$LIP = 1.27LHY + 0.006LCRPRIV - 0.03TREND - 8.131 \qquad (21)$$
$$\quad (13.61) \qquad (0.45) \qquad (-2.37)$$

$$LIG = -0.373LHY + 0.016LCRPRIV + 0.055TREND + 8.178$$
$$\quad (-5.013) \qquad (1.37) \qquad (4.86)$$

- Residual based tests

Table (6) shows the results of tests on the residuals. These tests confirm the statistical integrity of the estimate. In other words, they confirm the homoscedasticity of the estimate and the absence of autocorrelation in the residuals of the estimation. Also, the assumption of normality of residuals can not be rejected.

Table 6: Residual Tests Results

Autocorrelation Test: Portmanteau (H_0 : No residual autocorrelation up to lag h)		
Portemanteau	Chi-sq (36)=47.496	P-value =0.09
Autocorrelation Test : Lagrange Multiplicator (H_0 : No residual autocorrelation)		
LM [1]	Chi-sq (36) =36.344	P-value =0.453
LM [4]	Chi-sq (36)=40.465	P-value =0.28
Normality Test : (H0: residuals are multivariate normal)		
Jarque-Bera	Chi-sq (12)=21.459	P-value =0.054
Heteroskedasticity Tests: (H_0 : No residual Heteroskedasticity)		
Chi-sq (230)=246.962	P-value =0.211	

The numbers in parenthesis are degrees of freedom.

Two cointegrating relationships are identified assuming normalization restrictions. Also, according to the test of exogeneity, we can exclude the credit allocated to the private sector in both short-term relationships. Table (7) shows the results of this test.

Table 7: Weak Exogeneity Test Result

	LIP	*LIG*	*DELTALGDP*	*LCRPRIV*
Ch-square	13.936	0.107	49.666	5.237
p-value	0.000	**0.948**	0.000	**0.073**

Exogeneity of the variables are accepted if *p-value* is superior as *0.05*.

The restricted VECM estimation results are presented in Table (8) that can be considered as the basic model.

$$LIP = -0.610LIG + LHY + 1.079LCRPRIV - 0.037TREND - 1.033 \quad (22)$$
$$(-3.452) \qquad\qquad (6.346) \qquad\qquad (-4.124)$$

This relationship shows a negative relationship between private and public investments. This means that a one unit increase in public investment causes a decrease of 0.754 units in private investment. In other words, in the case of Algeria, public investment has *crowded out* private investment. Therefore we can conclude that, during the period 1970-2012, the public investment expenditure of the Algeria government had a negative effect on private sector activities.

Also, the short-term coefficients (α) are significant. But it should be noted that the speed of adjustment of the variables are different.

Table 8: The Constraint VECM Estimation Results (Case of Algeria)

LR Test		Chi-sq (6)=0.620		P-value =0.694	
Restrictions					
B(1,1)=1 ; B(2,2)=1; B(1,3)=-1; B(2,4)=0 A(2,1)=0; A(2,2)=0; A(4,1)=0; A(4,2)=0					
BETA (transposed)					
LIP	LIG	LHY	LCRPRIV	TREND	C
1	0.610 (3.452)	-1	-1.079 (-6.346)	0.037 (4.124)	1.033
0.026 (3.642)	1	-1.732 (-9.024)	0	0.038 (5.589)	4.244
ALFA					
Δ LIP		ΔLIG	ΔLHY	ΔLCRPRIV	
-0.544 (-3.584)		0.00 (0.00)	-1.552 (-6.714)	0.00 (0.00)	
-0.428 (-4.935)		0.00 (0.00)	-0.895 (-6.762)	0.00 (0.00)	

The numbers in parenthesis are t-statistics.

Conclusions

In this study, we sought to estimate the effects of the budget (public) deficits financing on the activities of the private sector. As one already indicated, it is the mode of financing these budget deficits which determines these effects. In other words, if the State moves towards the domestic capital

market to finance its deficit, that can cause *an effect of "crowding out"* or *an effect of "crowding in".* To appreciate these phenomena, within the framework of our work, we endeavoured to analyze these effects of crowding out or of crowding in by the means of two Vector Error Correction Models (VECM), for each country. To construct this type of model, we followed various stages of consistent econometric work in various tests like stationarity tests of the variables, cointegration tests, residual tests, etc. The results of the estimates of our VEC models confirm the existence of an effect of **crowding out** in the case of Algeria and the existence of an effect of **crowding in** the case of Iran.

As previously mentioned, Iran and Algeria are heavily dependent on oil revenue and oil revenues are a major source of government's revenues. Thus, the role of theses governments are strong and are present in all areas and sectors. In Iran, the government has an important role in providing infrastructure. Article 44 of the constitution, emphasized the deposit of economic activity to the private sector. Therefore, in the case of Iran, we can expect that the activities of government crowed in private investment. In the case of Algeria, we can say that government policy in recent decades was in order to limit the activities of the private sector. Therefore, in the case of Algeria, we can expect that the activities of government crowed out private investment.

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