Financing public expenditure: Role and cost of non-tax revenue of financial repression

تمويل النفقات العامة: دور وتكلفة الإيرادات غير الضريبية للقمع المالي

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Abstract

Financial repression has long been as considered an implicit tax granted to the authorities in the form of government revenues. However, if financial repression generates important implicit revenues for the government, it must be admitted that these benefits come have a cost that governments often ignore. This article discusses the role and cost of non-tax revenues of financial repression in financing public expenditure. Two types of non tax revenues involved in public debt are considered, which constitute a budgetary constraint of government is: the income from financial repression and the inflationary tax. Using annual data, a VAR model is constructed to estimate the impact of these revenues on Algerian public expenditures. The results indicate that effect of the income from financial repression and the inflationary tax is negative on short-term public expenditures. Extending the VAR model to the VEC model allows long-term analysis. The empirical estimate of the VEC model indicates that the inflation tax has a positive effect on total government expenditure while the effect of income from financial repression is negative on total government expenditure. Based on the results of the estimation, the causality tests, the impulse analysis and the theory of the implication of the public finances in the financial repression, the main conclusion is that at short run, public expenditure are financed in large part by revenues non tax of financial repression. But in the long run, these benefits generated by financial repression translate into a higher cost in terms of public spending.

Keywords*:*financing public expenditure; cost of non-tax revenues of financial repression; public debt; income from financial repression; inflationary tax; VAR; VEC

JEL Codes: C50**;** E42; E52; G32

ملخص :

لطالما اعتبر القمع المالي ضريبة مالية ضمنية تمنح للسلطات في شكل إيرادات حكومية لتمويل الدين العام. ومع ذلك، إذا كان القمع المالي يولدحتما إيرادات ضمنيةمعتبرة، يجب الاعتراف بأن هذه الفوائد لها تكلفةالتي غالبا ما تتجاهلها الحكومات. يناقش هذا المقال دور وتكاليف الإيرادات غير الضريبية للقمع المالي في تمويل الإنفاق العام. نعتبر نوعين من الضرائب الضمنية مع الدين العام تشكل قيود الميزانية التي تواجهها الحكومة : ضريبة التضخمو دخل القمع المالي. باستخدام بيانات سنوية ,يتم إنشاء نموذجالانحدار الذاتي(VAR) لتقدير تأثير هذه الإيرادات على النفقات العامة في الجزائر. تشير النتائج إلى أن تأثير دخل القمع المالي والضريبة التضخم سلبي على النفقات العامة في المدى القصير. إن تمديد نموذج VAR إل نموذج أشعة تصحيح الخطأ (VEC) يسمح بالتحليل على المدى طويل . تشير التقديرات التجريبية لنموذجVEC)(إلى أن ضريبة التضخم لها تأثير إيجابي على إجمالي الإنفاق الحكومي في حين أن تأثير الدخل من القمع المالي سلبي على إجمالي الإنفاق الحكومي. بناء على نتائج التقدير ، اختبارات السببية ، تحليل اثر الاستجابة ونظرية تورط المالية العامة في القمع المالي ، الاستنتاج الرئيسي هو أن الإنفاق العام في الجزائر يتم تمويله بجزء كبير بالإيرادات غير الضريبية الناتجة عن القمع المالي فى المدى القصير. لكن على المدى الطويل تتحول هذه الفوائد الناتجة عن القمع المالي إلى تكلفة أعلى من حيث الإنفاق العام مقارنتا من الأرباح المولدة

الكلماتالمفتاحية : تمويل النفقات العامة ، تكاليف الإيرادات غير الضريبية للقمع المالي ، الدين العام ,دخل القمع المالي,ضريبة التضخم ,VAR , VEC

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I. Introduction

Developing countries that are faced strong tax evasion with argued deficits often lean towards implicit incomes such as seignorage, the inflation tax and the income from financial repression. **(1)** These taxes are generated in a financial repression policy context and can be an important channel for the financing of public expenditures (Young, 2011). Indeed, most of public finance and development specialists have indicated out that financial repression plays a very significant role in the financing of the state budget in the medium and low-income countries through a low cost of debt (Dooley, 1995). However, the government size is influenced by very specific supply factors such as the fiscal illusion implied by implicit taxes imposed on the financial system and affecting the government budget (Varalakshmi, 2010). The implication of the public expenditure financing approach in the repression of the financial system is true when the public debt growth caused by the fall in interest rates and the increase in inflation rate (Phelps, 1973). This involvement is embodied in the effective use of the inflationary tax and the tax on ratios that require some repressive measures to increase the demand for money (Bencivenga and Smith 1992, Brock 1989). According to Giovannini and De Melo (1993), public revenues from financial repression will indicate the extent to which public finance policies will raise the question of budget adjustment through changes in public spending to form an optimal tax plan**(2)** (Mankiw, 1987). They represent a hidden tax on wealth, which introduces further distortions in the economy and affects the base of traditional taxes. This implies that this advantage can be mitigated by high costs induced by an effort on public spending (Kanat and Sergey, 2016). In a context of public finances, Végh (1989) declares that the inflation tax has a positive impact on the public spending level where, he recognizes the possibility that conventional taxes carry increasing marginal collection costs. As a result, the inflation tax becomes a growing function of public spending when nominal interest rates rise. **(3)** According to Mishkin (2007), a persistent inflationary tax could increase the cost of monetary policy in terms of employment and the cost of fiscal policy in terms of output, which influences the expenditure program. Aizenman and Guidotti (1990) establish a relationship between the collecting costs of public expenditure and the taxes from financial repression combination. By supporting Keynes' theory (1924), they show that these taxes are costly for the government. **(4)** For his part, Friedman (1978) highlights the threat of financial repression against public spending because, according to him, the taxes produced by this policy increase juste the public spending not only because of lower interest rates**(5)** but also because of the increase in the cost of financial intermediation **(6)** (Chari et al, 1995, Roubini and Sala-i-Martin, 1995). Kamps et al (2014) in a study focus on the negative effect of these taxes on private investment that encourages the growth of capitalized expenditures. Minea and Villieu (2006) show that in order to finance public expenditure, the government must choose a relatively high inflation tax, where they show in an endogenous growth model how to optimize the combination of changes in public finances in response to different contexts. public expenditure. In countries where the financial repression policy is adopted, levels of public spending and the rate of inflation are high (Kanat; Sergey, 2016). Indeed, if we consider the Algerian economy, we can see that public expenditure has been increasing since independence in the face of the implicit taxes imposed on financial intermediation, which are estimated in the middle of the 1980s at 11.42% of total revenues and more than 10% of GDP, and which income from financial repression represents a share of 3.44% of GDP with the inflationary tax of 6. 6%**.(7)** On the basis of previous empirical work can one consider that the revenues of the financial repression lead to the increase of public expenditures in Algeria? Or whether, is this expenditure are financed by non-tax revenues of financial repression?

Therefore, the main contribution of this article is to provide empirical evidence from Algerian data of the effect of inflationary tax and income from financial repression on the public expenditure growth. The paper presents a theoretical model that shows that the government uses the financial sector as a means of financing public expenditures. The model assumes that government revenues are collected by imposing the tax such as requirements on the banking sector, the tax on inflation or seignorage and income from financial repression. In this context, the analysis covers 36 years

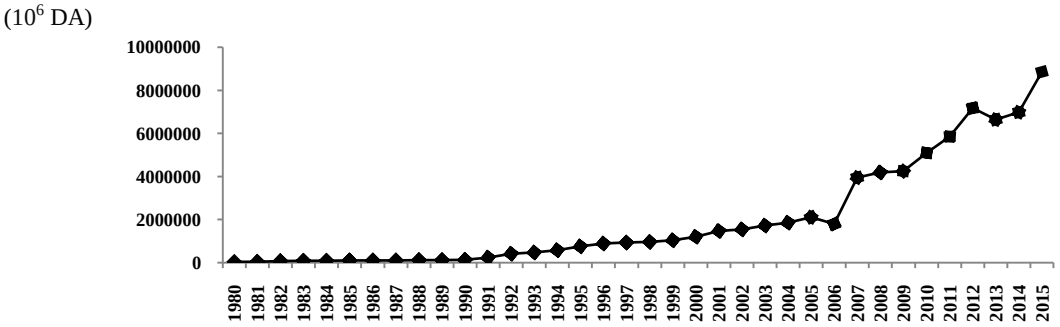
(1980-2015). This choice is explained by methodological and economic reasons. Methodological: the efficiency for any econometric modeling, opts for a greater than or equal observations to 35. Economic: the 90s are marked by financial reforms following the first oil shock of 1986, according to which the consequences have in question the policy of financial repression. The period before and after the financial reforms succeeding the oil counter-shock is important in order to evaluate the influence of revenue from financial repression on public spending. In this context, the paper estimate an autoregressive model (VAR) then Vector error correction (VEC) model which helps to measure the short-term and long-term persistence of the effects that the inflation tax and income from financial repression may have on the growth of public expenditures. Regarding previous empirical work on the cost of financial repression, there is a large range of literature that uses only the dynamics and general equilibrium models(8) and which has mainly focused on the instruments of financial repression such as reserve requirements rate and the nominal interest rate and it does not really investigated the revenue generated by the financial repressive policy which is designed as a profit. After briefly reviewing some of the public expenditures as the cost of financial repression, the rest of the paper is structured as a sequel. Section II presents the trend of public expenditure in Algeria and the financial repression policy exerted by the Algerian state and then deals a systematic analysis of the related behavior of public spending and taxes generated from financial repression in Algeria for the past three decades. We turn to Section III, which presents itself through an empirical analysis, describes the theoretical model, and the methodology. Section IV is Comments on the obtained results.The main conclusions are summarized in section V.

II. Public expenditure trend and the Financial repression policy in Algeria

II.1 Public expenditure trend

Total public expenditure move from 4.40 billion dinars in 1980 to 124 billion dinars in 1989, an average growth rate of 22%. The percentage in GDP thus varies from 28.09% and 39% between 1980 and 1990. The 1990s is marked by a structural change following the first oil shock (1986), which was launched mainly on the national financial system. Financial reforms in the broad sense have been embodied in the decline in the share of public expenditure in GDP from 28.09% in 1980 to 23.71% in 1991. The share of hydrocarbons falls to 7.2%, compared with 15.7% between 1980 and 86, and the sovereign debt crisis emerges. The reform of the monetary system would then rely on a few strong measures aimed at curbing monetary inflation and rebalancing the budget balance by providing a transition from the debt economy to an economy that relies more on the money and capital financial markets. However, this transformation was satisfied only by the reduction of public borrowing. As a result, total public expenditure increases from 476,6 billion dinars in 1993 to 940 billion dinars in 1997, a coefficient of variation of nearly 2.2, which is much lower than that of budget revenue, of which shares in the GDP is 33.6% and 31% between 1993 and 1997. From the millennium period and with the rise in oil prices, the government halts the policy of financial reforms and resumes that of financial repression. As a result, total public spending increases from 1 540 billion dinars in 2000 to 4 191 billion dinars in 2008 and 8 858 billion dinars in 2015. (Fig.1)

Fig.1 Nominal public expenditure trend (1980-2015)



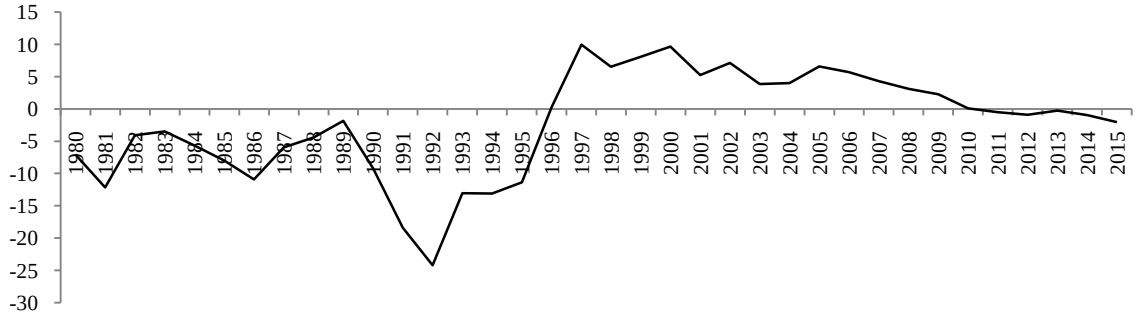
Source: Produced by the authors, from Algerian Ministry of finance data

II.2 Financial repression policy in Algeria

II.2.1 Controlling Interest Rates

Interest rate control constitutes the most frequently cited instrument of financial repression in Algeria (Baba-Ahmed, 2007; Chenntouf, 2008). During the period of the centrally planned economy of monopolization, interest rates were kept low in order to stimulate the development and economic independence in country. Basically, very low deposit rates and lending rates have often resulted in an implicit tax on net savers. Due to the fact that the state had total control over the national banking sector, the main beneficiaries of the repressive interest rate policy were public sector. Borrowing rates on their part is also characterized by a low level for financing low-cost public debt. One of the most significant gains for the Algerian state in such a context was therefore that the cost of sterilization was kept relatively low, causing considerable devaluation of the dinar during the mid-1980s and lasting until the mid-1990s. After the 1994 financial reforms, lending rates and nominal lending rates increased slightly, causing negative real interest rates to move towards positive real rates. (Fig.2)

Fig.2 real interest rate (1980-2015)

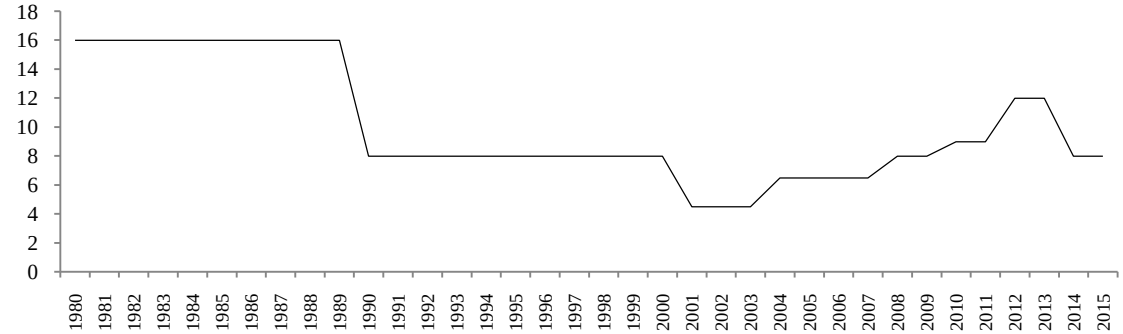


Source: Produced by the authors from Algerian Bank data (BA)

II.2.2 High reserve requirements and directing credit

The policies of reserves requirements and the directing of credit are the policies most answered of financial repression for the case of Algeria, since independence of the country. Research has often shown that public banks in Algeria tend to favor state owned enterprises and focus little on the quality of corporate profitability. Indeed, the public sector is seen as a real driver of the political, economic and social life of the country. A typical example of direct credit control in Algeria is the difficulty faced by private companies to have a bank loan. In addition to directing and controlling the distribution of credit, the Algerian government has long used reserve requirements to repress the financial system. Figure 3 shows the reserve requirement ratios for Algerian banks imposed by the Central Bank during the period 1980-2015.

Fig.3 Reserves requirements rates (%Monetary base)



Source: Produced by the author from Algerian Bank data (BA)

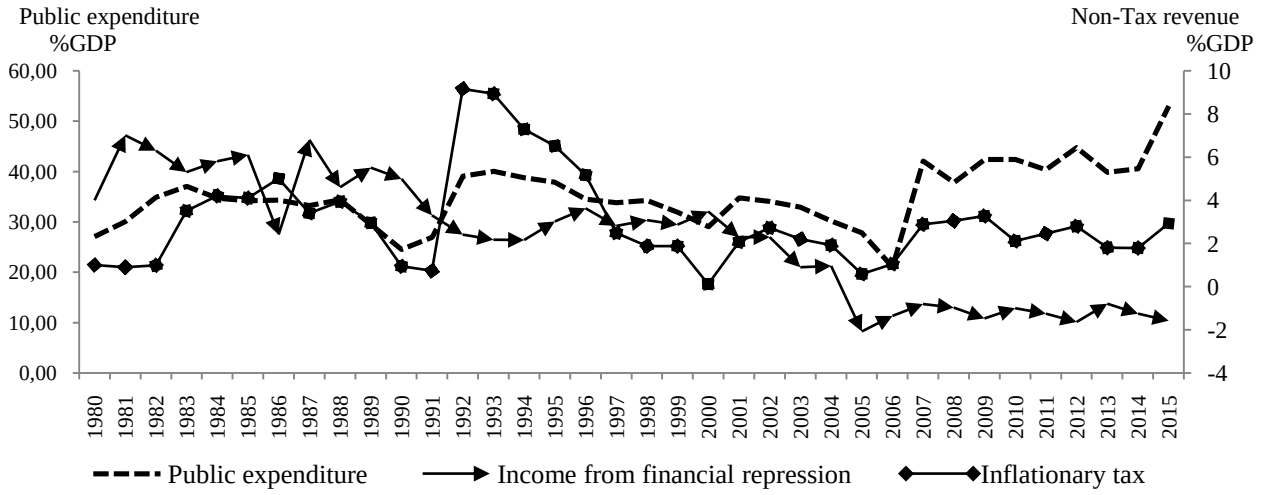
II.3 Public expenditure and non-tax revenue of financial repression: theoretical implication

In order to analyze the financial repression interactions with the public expenditures in Algeria, we presente on the figure.4, the evolution of the income of the financial repression, the inflationary tax and the part of the public expenditure in GDP for the period 1980-2015.

The behaviour of the inflation tax curve and the income from financial repression curve reveal that there are positive and negative correlations at the same time. We can observe that an inverse behaviour between the income from financial repression and public spending. While a similar behaviour between the inflationary tax and public spending. We can approve beforehand that the nature of the financial system changes the size of the budget package.

The graph seems to reveal a limit relationship, as well as the maximization of the inflation tax causes a public spending growth against the maximization of income from financial repression which implies a decline of total public spending**(9).**

Fig. 4 Public expenditure and non-tax revenues from financial repression (1980-2015)



Source: Produced by the author. Note: the values of the tax on inflation and income from financial repression are presented on Appendice.

A recent study shows that it exist a substitution relationship between inflationary tax and income from financial repression (Dermechi, 2017).

Knowing that maximization of the revenue from financial repression requires a null stock of public debt and that the maximization of inflation tax requires a null mandatory reserve rate, we will try to formulate theoretically the equation of public expenditures in function inflation tax and income from financial repression.

We assume that the public debt is determined by; primary debt, interest charges and budgetary balance**(10).**

$$Debt_t = (i+1)Debt_{t-1} - (T_t - G_t) \qquad (1)$$

$Debt_t$: Public debt; i: borrowing interest rate; G_t: public expenditures; T_t: public revenues; $(T_t - G_t)$: budgetary balance.

The money demand function is specified by **(11)**

$$M_t^D = \alpha + y_t + \rho_1 \left({Debt_t}/{y_t} \right) + \rho_2 M_{t-1}^D \qquad (2)$$

$M_t^D$the money demand at t;y_t**:** disposable income

The money supply function is **(12)**

$$M_t^O = \alpha + B_t - (r_t + 1)D_t \quad (3)$$

M_t^O the money supply; B_t: monetary base; r_t: reserve requirements rate; D_t: with deposit account.
The equilibrium interest rate between the money demand and the money supply is defined by **(13)**

$$i_t = \frac{B_t/D_t}{Debt_{t-1}} - \frac{(1+r_t)D_tY_t}{Debt_{t-1}} - \frac{Y_t+T_t+G_t}{Debt_{t-1}} - 1 \quad (4)$$

The function of public expenditures, according to the reserve requirements and public debt stock is given by the equation (5).

$$G_t = \alpha Debt_t - \beta\left({}^{B_t}/_{D_t}\right) + \delta r_t D_t Y_t + \rho(D_t Y_t + Y_t + T_t) \quad (5)$$

The optimization income from financial repression requires a null stock of public debt. The function of public expenditures is specified as well

$$G_t = -\beta\left({}^{B_t}/_{D_t}\right) + \delta r_t D_t Y_t + \rho(D_t Y_t + Y_t + T_t) \quad (6)$$

A negligible public debt leads to higher interest rates, and likelihood that the debt will be unsustainable which leads the public authorities to redefining the public expenditure program.

The equation (6) demonstrates a negative effect of the monetary base on public expenditures (-β). In seigniorage theory, the monetary base has the same effect as the nominal interest rate and the inflation rate. That is how, we approve theoretically that public spending are negatively influenced by the income from financial repression.

The optimization of the inflationary tax leads a null reserve requirements rate, to consequently the public spending function is defined by the equation (7).

$$G_t = \alpha Debt_t - \beta\left({}^{B_t}/_{D_t}\right) + \rho(D_t Y_t + Y_t + T_t) \quad (7)$$

In a context of financial repression, if the reserve ratio is low, the probability of debt is important and sustainable,and stimulates the Government in this respect to spend additional.**(14)** In this way the inflationary tax has a positive effect on the public expenditures through the public debt (α) as shown the above equation.

III. Methodology of empirical analysis

The methodology used in this paper is analogous to that used in the studies presented by Lozano (2008) and Odiyone and Ebi (2013) in which they employed the Vector Autoregressive (VAR) and Vector Error Correction (VECM) models to estimate the relationship between public spending, interest rates and inflation. However, in this present analysis, the focus is on the implicit revenues generated from inflation and interest rates, in order to establish a direct relationship between public expenditure and financial repression. Given that we analysis the financing of public expenditures by non tax revenues, it is more authentic to base a theoretical model on the budget constraint used by Drazen (1985) . **(16)** VAR and VEC models are commonly used as non-structural approaches to modeling the relationship between interrelated time-series of several variables. Both approaches treat every endogenous variable in the system as a function of the lagged values of all other endogenous variables. In this sense, VAR and VEC models are consistent with economic theory and at the same time applicable for economic policy analysis. The theoretical representation of a VAR is

$$X_t = \beta_0 + \sum_{i=1}^{p} \beta_i x_{t-i} + \varepsilon_t$$

X_t is the vector of endogenous variables which includes public expenditure EX (%GDP); the income from financial repression R (%GDP); inflationary tax RF (%GDP); public debt DB

(%GDP); ε_t: random vector with $\varepsilon_t \sim N(0, \Omega)$, Ω covariance matrix of the residues; B_i : parameter matrix. The following step is to test the existence of coinetgartion. The usual approach involves the use of Johansen's method. This technique is the maximum likelihood technique that estimates a first-difference vector auto regression and includes the shifted level of the variables. If the test asserts the existence of cointegration relationships then a vector error correction (ECM) model that combines levels and differences is estimated. A regression model that explains the short-term dynamics of the relationship between the four non-stationary but cointegrated variables. The latter additional regressor is a shifted value of the residues of the cointegration relation where the cointegration equation measures the long-term relationship. However, the error correction model is adopted:

$$\Delta X_t = \beta_0 + \sum_{i=1}^{p-1} \Delta\beta_i x_{t-i} + \pi ECT_{t-1} + \varepsilon_t$$

ECT : error correction term; π: coefficient of the error term; Δ the first difference.

Prior to running the VAR and VEC models, the lag length has to be specified. One way of doing that is selecting the regression with the lowest value of the Akaike Information Criterion (AIC) or the Shwartz Criterion (SC).After performing the regression with different numbers of lags, the best model specification is the one with 5 lags, as shown in the appendix. An extension to the unrestricted VAR model that would be helpful for the question this research is interested to investigate is the impulse response function. This refers to the impact of a known "shock"on the system, which would better assist in the interpretation of dynamic policy analysis. A shock to one variable not only directly affects that variable over time but is also transmitted to all of the other endogenous variables through the lag structure of the VAR. An impulse response function traces the likely response of current and future values of the endogenous variables over time to a unitary exogenous shock in one variable at time t. Adjusting the VAR model to account for the non-stationarity of variables, a VEC model is estimated. The VEC model is a restricted VAR designed for use with non-stationary series that are known to becointegrated. Accounting for this cointegration relationship as an error correction term establishes the causal long-term or equilibrium relationship among a set of variables, while allowing for the evaluation of short-term adjustment dynamics when an unexpected shock results in any variable of the system deviating temporarily from equilibrium (Lozano, 2008). Prior to implementing VECM, a unit root test has been performed for all variables, all of which turned out to be non-stationary or integrated of the first order. The stationarity results are reported in appendix and clearly show that the four variables are integrated of same order. The ADF and ZA tests show that all the variables are stationary of order 1. While the KPSS test indicates that the R, RF variables are stationary at the level. These series contain a drift and some variation as will arise with a stochastic trend then the non-stationary null may seem likely compared to the KPSS test (Burk and Hunter, 2005).The Johansen cointegration test indicated the existence of two cointegrating relationships at the 5% significance level, as shown in appendix.

IV.Comments on the obtained results

Results of the unrestricted VAR model are shown in the appendix. With regards to the equation for the public expenditure, variables in the equation explain 78% of the variance in the budget as a percentage of GDP. It is the most significant equation. In the short term, the income from financial repression, the inflationary tax, and public debt appears to have a significant negative effect on public expenditures. This suggests that, in the short term, the increase in non-tax revenues lead to financing the public debt and leads to lower spending. The public debt equation highlights this interpretation, since the inflationary tax has a negative effect on the debt. In addition, the effect of income from financial repression is positive on the public debt which implies that an increase in revenue from financial repression supports short-term public debt.

The results of the variance decompositionindicated that more than 74% of the variations in public expenditures EX are explained by the inflationary tax RF. The variance proportion of RF variabledecreases to achieve over time a minimum value of 35.53% of the forecast of public expenditures error EX. Income from financial repression R represents 0.26% of the public

expenditures EX variations at the initial time and tends to rise in the long run to reach 26%. On another note, 4.02% of the public expenditure variation is explained by the service of the public debt DB. These results substantiate that changes in the income from financial repression, inflationary tax and debt public formally influence the future level of public spending.

Regarding to the analysis of impulse response, the figure.5 in appendix examines how government spending responds to the shocks of the inflation tax, the income from financial repression and public debt. A standard deviation shock that comes from the inflation tax results in a decrease of up to 2% in public spending. However, this response trend upward in the medium term and long term to reach 8% and 4%, respectively after a slight decline to 1%. The negative impulse response of public expenditure to the shock of a standard deviation that comes from the revenue from financial repression persists in the medium term and long term, excepted a significant rise during the ninth period of 8%. The impulse response of public expenditures to a public debt shock is similar that of a shock produced on the inflation tax.

Results from the VEC model were somewhat different from the unrestricted VAR model results. With regards the public expenditure equation, variables in the equation account for more than 41% of the variance of the public spending. Public expenditure lagged 1 and 4 periods seems to have a significantly negative effect on expenditures. This means that the public expenditure program current is influenced by previous expenditures. Public debt lagged 2 periods has a significant positive effect on public spending at the 5% level . If the stock of debt is large, spending tends to increase. Indeed, if the stock is high, the income from the financial repression is low compared to the inflation tax which is significantly higher to finance the debt on the one hand and the expenses on the other hand. The inflationary tax lagged 4 periods has a significant positive effect on public expenditure through the public debt channel. This suggests that the increase in inflation revenues leads to an increase in public expenditures as a percentage of GDP. The effect of income from financial repression lagged 1 and 4 is respectively positif and negatif on public expenditure (the results are presented in Appendix).

The cointegrating equation results are in Appendix. The equation shows that the long term relationship between public expenditures and the inflationary tax is significantly positive. This implies that the increase in the inflation tax of 1% is associated with an increase in public spending of the 6.25%. The same effect applies in the public debt, where a 1% increase in the latter leads to a 2.62% increase in the public spending. This empirical result supports the theory of optimal seigniorage which suggests that, in the long term, inflation rates and interest rates vary jointly. The impact of the income from financial repression on public spending is negative. An increase in the income from financial repression of 1% is associated with a decrease of more than 2% of public spending. These empirical results support the theory of financial repression. The resulting increase in income from financial repression translates into lower debt public, which causes long-term interest rates to rise and makes debt unsustainable insofar as it is not compensated for by reduced inflation tax, which leads government to choose a public spending lower as a precautionary measure (Garcia 1997).

The negative effect of the inflation tax on public spending is only instantaneous. In fact, the inflation tax is determined by the inflation rate, nominal interest rate and compulsory reserve ratio. This result could be interpreted in the long term by the increase of money supply which encourages private investment and causes the government's disengagement in terms of investment spending (Agénor and Montiel. 1996). But this decrease is instantaneous. Rising inflationary tax implies the lower income from financial repression due to a high public debt stock. Under the budget constraint, the government chooses to finance public debt stock by inflationary tax rather than spending more, which explains the causation directionality betweeninflation tax and public debt. **(17)**

The economic intuition of this threshold is as follows: any increase in the tax on inflation is devoted to the non-productive public expenditure which is the debt financing, but simultaneously increases the nominal interest rate, which increases the transaction costs. This latter effect is detrimental to long-term growth because transactions are more expensive (Minea and Villieu,

2006). The increase in nominal interest rates causes the depreciation of income from financial repression in the long term, which implies a larger public debt to be financed and an increase in public spending. The negative response of public spending on the revenue impetus of financial repression cannot be explained outside the dynamics of the inflationary tax. An increase in income from financial repression is associated with a decline in public debt. As a result, the government is not expected to finance the ratio gap for maintaining financial intermediation equilibrium (Fry, 1995), reflecting the decline in public spending. In the long run, the income from financial repression becomes insignificant and leads to an increase in the service of the public debt. The role of the inflation tax at this level is the financing of the public debt (return to the initial situation). The increase in public spending is equivalent to four times the diminished share produced by a shock on the inflation tax. This observation attests to the idea that the inflation tax and the income from financial repression are substitutable and are more costly in terms of public expenditure. The argument of involvement is determined by the government's choice of the form of financial repression it wants to adopt (Dermechi, 2017). Transmission of the effects of the inflationary tax and income from financial representation via public debt has a very significant impact on the level of total public expenditure.

V. Conclusion

Based on public finance perspective of financial repression, this paper discusses the role in financing and cost of non tax revenues from financial repression on public expenditure in Algeria. This paper estimates Vector Autoregressive and Vector Error Correction models to analysis the significance impact of non tax revenues on public epxnediture. Results obtained from the VAR model are somewhat different from those obtained from the VEC model. However, the VEC model is expected to give more reliable results given the non-stationary nature of the variables. The combination of short-term VAR and VEC models results shows that the financing of total public expenditure depends on the substitution relationship between inflationary tax and income from financial repression. If the public debt is large, it will be financed by the inflation tax. As a result, the income from financial repression is low and spending will fall in the short term. The relative choice of maximizing the inflation tax or the income from financial repression derives from the form of financial repression that the government designates. In the combination context of the financial repression policy with an inefficient tax system and the budgetary constraint that productive and unproductive public expenditures are financed by implicit financial taxes, this analysis explained in detail that there is a causal relationship between the implicit taxes of financial repression and public spending, and has also pointed the direction of causality. The results provide strong evidence that when a connection is made between the revenue from financial repression and the inflation tax, at long run the effect is reflected in the rise in unproductive public spending

Footnote

(1) According to Laffer Curve, the maximized seigniorage revenue needs to correspond to a certain degree of inflation, and therefore seigniorage is also usually called inflation tax

(2) As discussed by Giovannini and De-Melo (1993), there are potential complementarities between income from financial repression and inflation tax because: (i) inflation implies low real interest rates for savers; (ii) negative real interest rates on savings increase the demand for money, ie the inflation tax.

(3) According to Végh, optimizing the inflation tax is independent of public spending and is determined by the nominal borrowing rate.

(4) In Keynesian economic literature, the financial repression tax is the form of taxation that governments find the most costly in dealing with tax evasion.

(5) In economic theory, the relationship between public spending and the interest rate is reversed. For example, the financial crowding out effect of falling interest rates leads to an increase in money demand, hence public spending (Buiter, 1977).

(6) A high inflation rate devalues the reserve requirement tax, which widens the gap between the deposits cost and the loan cost. The argument implies that an increase in inflationary tax can lead to higher public spending.

(7) Giovannini and De Melo (1993).

(8) See: Alm and Buckley 1998; Kriwoluzky, Müller and Scheer 2017

(9) According to a recent study conducted by us, optimizing the inflation tax implies a minimizing the revenue from financial repression, it is the full role of the substitution effect due to particularly the financial intermediation level that the Algerian government wishes to maintain (Dermechi 2017).
(10) Mankiw. G.N. La dette publique; partie V: les débats de politique économique, (2005).
(11) Teigen (1964) and Cagan (1965).
(12) Demetriades and Luintel (1997)
(13) The B/D variable traducts the influence of the treasury circuit" on bank liquidity and hence in the money supply
(14) According to F. Garcia (1997), the inflation tax is used for the financing of the public debt. However, public debt is a growing function of the inflation tax.
(15) After the first oil shock (1986) in Algeria, the international monetary fund (IMF) imposed a structural reform mainly on the financial sector (the decrease of public debt, the decrease inflation rate,...,etc). The implementation of its recommendations starts from the 1990s.
(16) According to the budget constraint of Drazen (1985), the government finances its budget : 1-Through direct and indirect tax revenues; 2-increasing the stock of public debt, hence, the revenue from financial repression; 3- increasing the real stock of the central bank money, hence, inflationary tax. In order to eliminate the cost of tax revenues collection, we suppose that government have only base of non-tax revenues . However, although the increase in income from the financial reperession can be generated as a result of lower borrowing rates, therefore the introduction of the public debt as the third variable is required.
(17) The causation direction is determined through the results of Granger causality (see Appendix).

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APPENDIX

Table.1 Descriptive statistics and data source

Variables	Period	Mean	Std. Dev	Max	Min	Data source
R	1980-2015	2,73	2,29	7	-1,64	(%GDP). Calculated by the author
RF	1980-2015	3,05	2,19	9,15	0,10	(%GDP). Calculated by the author
EX	1980-2015	0.35	0.06	0.53	0.21	(%GDP) Algerian Ministry of Finance (Statistical retrospective 1963 – 2015). DGPP/DRI. 2016;
DB	1980-2015	0.37	0.28	0.79	0.07	(%GDP) Algerian Ministry of Finance (Statistical retrospective 1963 – 2015). DGPP/DRI .2016

Table.2 Stationarity test results

Variables	ADF					
	Model 6		Model 5		Model 4	
	Level	Difference	Level	Difference	Level	Difference
EX	-3.285	-6.866*	-2.851	-6.541*	0.444	-6.606*
R	-3.204	-5.240*	-5.240	-10.505*	-1.422	-10.329*
RF	-2.879	-5.399*	-2.879	-5.400*	-1.371	-5.545*
DB	-1.102	-5.028*	-1.102	-5.028*	-2.651	-5.456*

Variables	KPSS		ZA		Decision at 5%
	Level	Difference	Level	Difference	
EX	0.121	0.065*	-3.792	-7.922**	I(1)
R	0.069*	-	-4.490	-7.474**	I(1)
RF	0.096*	-	-4.776	-8.913**	I(1)
DB	0.137	0.087*	-3.577	-5.817**	I(1)

*The null hypothesis of unit root is rejected at the 5% threshold. **: the null hypothesis of the existence a unit root in the presence of the break is rejected at the 5% threshold. The critical value of ZA at the 5% threshold is -5.08 (Zivot and Andrews, 1992).

Table .3 The optimal lag length according to AIC and SH criterions

VAR Lag Order Selection Criteria
Endogenous variables: EX DB RF R
Exogenous variables: C
Date: 02/15/18 Time: 18:11
Sample: 1980 2015
Included observations: 29

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-92.09169	NA	0.008876	6.627013	6.815605	6.686078
1	-72.06514	33.14738	0.006817	6.349320	7.292283	6.644644
2	-46.79162	34.86003*	0.003860	5.709767	7.407100	6.241350
3	-32.54603	15.71927	0.005265	5.830760	8.282463	6.598603
4	-7.472366	20.75062	0.004248	5.204991	8.411064	6.209093
5	18.72230	14.45223	0.004130*	4.501910*	5.462353*	5.742271*
6	86.78389	18.77561	0.004982	4.911456	5.626269	6.388076

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table.4 Non- tax revenues of financial repression in Algeria (1980-2015)

	Income from financial repression (%GDP)	**Inflation tax (%GDP)**	**Income from financial repression (% total revenue)**	**Inflation tax (% total revenue)**
1980	4,00	1,00	10,62	2,66
1981	7,00	0,90	18,59	2,39
1982	6,30	0,99	16,73	2,63
1983	5,30	3,50	14,08	9,30
1984	5,80	4,20	15,40	11,15
1985	6,10	4,10	16,20	10,89
1986	2,40	5,00	6,37	13,28
1987	6,80	3,40	18,06	9,03
1988	4,60	3,93	12,22	10,43
1989	5,50	2,95	14,61	7,83
1990	4,99	0,94	13,25	2,49
1991	3,30	0,73	8,76	1,94
1992	2,40	9,15	6,37	24,31
1993	2,17	8,93	5,76	23,72
1994	2,16	7,28	5,74	19,33
1995	3,01	6,52	7,99	17,32
1996	3,62	5,16	9,61	13,71
1997	2,81	2,47	7,47	6,57
1998	3,07	1,87	8,15	4,97
1999	2,86	1,87	7,60	4,98
2000	3,48	0,11	9,24	0,29
2001	2,29	2,07	6,08	5,49
2002	2,29	2,72	6,08	7,22
2003	0,89	2,20	2,36	5,85
2004	0,96	1,91	2,55	5,08

2005	-2,08	0,58	-5,53	1,54
2006	-1,36	1,05	-3,61	2,78
2007	-0,81	2,88	-2,15	7,64
2008	-0,97	3,04	-2,58	8,08
2009	-1,48	3,26	-3,93	8,67
2010	-1,00	2,11	-2,66	5,60
2011	-1,25	2,46	-3,32	6,53
2012	-1,64	2,80	-4,36	7,43
2013	-0,80	1,80	-2,12	4,77
2014	-1,26	1,78	-3,35	4,74
2015	-1,58	2,92	-4,20	7,77

Source: calculated by the author. For more details see (Dermechi, 2017)

Table.5 Wald test results

Test Statistic	Value	df	Probability
F-statistic	5.066	(3,11)	0.0191*
Chi-square	15.198	3	0.0017*

.* The null hypothesis cannot rejected at 5%.

Table. 6 Johansen Cointegration Test results

Cointegration tests	Trace Test		Maximum Eigenvalue Test	
Null hypothesis	Trace Statistic	Critical value 5%	Max-eigen Statistic	Critical value 5%
C = 0	137.886	63.876*	83.254	32.118*
C > 1	54.632	42.915*	30.362	25.823*
C > 2	24.270	25.872	14.103	19.387
C > 3	10.166	12.517	10.166	12.517

Notes: C indique le nombre de vecteurs cointégrateurs.* statistical significance at the 5 % level, critical values are tabulated from Johansen and Juselius (1990).

Table.7 Granger causality test

null hypothesis	Obs	F-statistic	Probability
DB does not Granger cause EX	30	0.27026	0.9238
EX does not Granger cause DB		0.23665	0.9414
RF does not Granger cause EX	30	2.88043*	0.0424
EX does not Granger cause RF		0.63492	0.6757
R does not Granger cause EX	30	2.74843*	0.0496
EX does not Granger cause R		1.51931	0.2308
R does not Granger cause DB	30	0.44572	0.8110
DB does not Granger cause R		2.88043*	0.0423
RF does not Granger cause DB	30	2.06004*	0.0116
DB does not Granger cause RF		1.38883	0.2727
R does not Granger cause RF	30	0.86008	0.5254
RF does not Granger cause R		0.85072	0.5312

*significant at the 5%

Table.8 The variance decomposition results

Period	SE	RF	DB	R	EX
1	28.02	74.16774	4.021812	0.268211	48.54224
2	30.91	54.95696	3.726693	0.321916	40.99443
3	31.01	48.15495	4.774057	0.446376	46.62461
4	33.16	39.22023	4.123616	10.47214	46.18402
5	35.91	39.41714	4.356666	10.39107	45.83512
6	36.10	37.73364	1.327110	12.10517	45.83768

7	38.22	42.57529	3.140859	20.08599	34.19786
8	40.15	41.64902	18.54177	17.02494	27.09297
9	42.26	38.78954	18.54177	18.58697	24.08172
10	43.39	35.53683	16.66241	26.06414	21.73662
Cholesky Ordening RF DB R EX					

Fig.5 Impulse response of EX to chocks

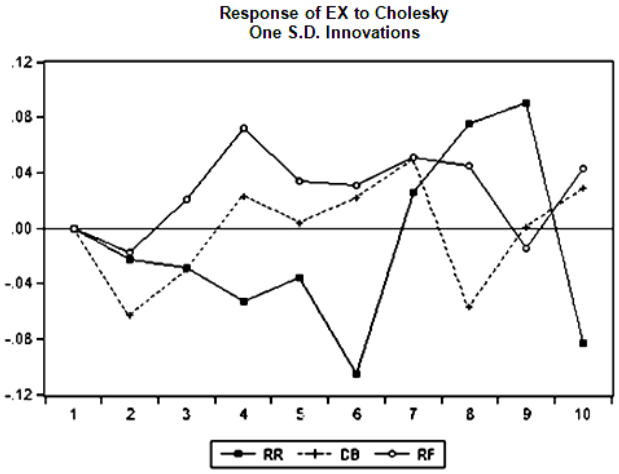

Table.10 Vector Autoregression Estimation Results

	EX	R	DB	RF
EX(-1)	-1.599121 (0.55786)	-12.70164 (6.62423)	1.472697 (1.01520)*	-20.93652 (12.4540)*
EX(-2)	-1.022556 (0.48733)	-3.791157 (5.78669)**	0.821799 (0.88684)**	-16.77589 (10.8793)**
EX(-3)	-0.412303 (1.92532)	-3.712217 (5.05042)**	-0.135010 (0.77400)**	-5.204711 (9.49512)
EX(-4)	-0.552803 (0.40768)	-16.48116 (4.84095)	-0.160688 (0.74190)**	-11.54674 (9.10130)
EX(-5)	0.505422 (0.35163)	-0.539828 (4.17543)**	0.323464 (0.63991)**	1.661822 (7.85009)
R(-1)	-0.001643 (0.01221)**	-0.407641 (0.14498)	0.002415 (0.02222)**	-0.573782 (0.27258)
R(-2)	-0.000327 (0.01432)**	0.191885 (0.17001)**	0.002675** (0.02606)	-0.543926 (0.31963)
R(-3)	0.021720 (0.01379)	0.450339 (0.16370)	0.002810 (0.02509)	0.610932 (0.30777)
R(-4)	-0.001098 (0.01250)**	0.255165 (0.14838)	-0.010515 (0.02274)	0.741917 (0.27897)
R(-5)	-0.037451 (0.01693)	-0.232892 (0.20106)**	0.029085 (0.03081)	-0.072456 (0.37801)
DB(-1)	-0.183062 (0.21355)**	4.290512 (2.53575)	1.079109 (0.38862)	-18.68745 (4.76738)
DB(-2)	1.015874 (0.45924)	18.84774 (5.45314)	-0.368324 (0.83572)	25.24995 (10.2523)
DB(-3)	0.380498 (0.45852)**	7.657457 (5.44461)**	-0.517333 (0.83442)	20.34861 (10.2362)
DB(-4)	-0.427249 (0.43891)**	-13.98216 (5.21180)	0.160496 (0.79874)	-4.075178 (9.79852)
DB(-5)	-0.174178 (0.39208)**	3.643919 (4.65572)**	0.397943 (0.71351)	-6.804632 (8.75306)
RF(-1)	0.076517 (0.01966)	0.857688 (0.23350)	-0.035233 (0.03578)	1.392508 (0.43899)
RF(-2)	0.022333 (0.01541)**	0.519243 (0.18294)	-0.029270 (0.02804)	0.374458 (0.34393)
RF(-3)	0.025711 (0.01418)	0.308596 (0.16838)	-0.001252 (0.02580)	0.611920 (0.31656)
RF(-4)	0.003986 (0.01287)**	0.829304 (0.15288)	0.010791 (0.02343)	0.104971 (0.28742)

RF(-5)	-0.013200 (0.01153)**	-0.047907 (0.13692)**	-0.000438 (0.02098)	-0.007834 (0.25743)
C	1.310682 (0.32936)	8.212921 (3.91095)	-0.761101 (0.59937)**	17.95281 (7.35284)
R-squared	0.828115	0.692827	0.781368	0.569981
Adj. R-squared	0.783067	0.638394	0.681937	0.645888
F-statistic	2.189816	28.83386	2.68343	6.731654

**significant at the 5%

Table.11 Vector Error Correction Model Results

Error Correction:	D(EX)	D(R)	D(DB)	D(RF)
D(EX(-1))	-1.687448 (0.518942)**	13.78451 (13.0549)	-1.036254 (0.68113)**	-34.51903 (18.3125)
D(EX(-2))	-1.736984 (0.797926)	13.51183 (11.9819)	-0.483866 (0.62515)	-15.01902 (16.8074)
D(EX(-3))	-0.556741 (0.405682)	11.53670 (11.6672)	-0.380350 (0.60873)	-2.367847 (16.3659)
D(EX(-4))	-53.56139 (18.26728)**	2.609328 (8.82156)	-0.471922 (0.46026)	0.558710 (12.3743)
D(R(-1))	25.11054 (12.49234)	12.63214 (10.26610)	0.632210 (0.96234)**	1.662030 (0.82963)
D(R(-2))	-8.474262 (11.09136)**	-0.668566 (0.24810)	0.010819** (0.01294)	-0.186584 (0.34802)
D(R(-3))	21.01828 (21.32715)**	-0.229282 (0.34827)	-0.000422** (0.01817)	-1.011066 (0.48853)**
D(R(-4))	-0.493843 (0.477739)	0.249156 (0.39273)	-0.005306 (0.02049)	-1.146401 (0.55089)**
D(DB(-1))	-0.162890 (0.373238)	0.297253** (0.29071)	-0.014787 (0.01517)	-0.734625 (0.40778)**
D(DB(-2))	-2.283071 (1.233303)	3.906245** (5.49746)	0.145047 (0.28683)	-22.17307 (7.71145)
D(DB(-3))	8.011927 (3.287600)	16.27121 (8.26893)	-0.354135 (0.43143)**	-10.78161 (11.5991)
D(DB(-4))	2.010793 (2.010197)**	17.10004 (7.98887)	-0.300676 (0.41682)	-9.657926 (11.2062)
D(RF(-1))	1.004099 (3.997207) **	3.601872 (7.08619)	-0.221525 (0.36972)**	-1.735488 (9.94000)
D(RF(-2))	-2.015852 (1.111314)	-0.835959** (0.37210)	0.024700 (0.01941)	0.842960 (0.52195)
D(RF(-3))	4.003028 (2.957274)	-0.529658** (0.33160)	0.006935 (0.01730)	0.046860 (0.46515)
D(RF(-4))	-2.023391 (1.225451) **	-0.468126 (0.29684)	0.000518 (0.01549)	0.004894 (0.41639)
C	5.001461 (2.001131)**	1.573327 (0.91913)	-0.089262 (0.04796)**	-2.705428 (1.28929)
@TREND(80)	0.002123 (0.00235)	-0.054727 (0.03695)	0.002784 (0.00193)	0.055910 (0.05183)
R-squared	0.771885	0.761511	0.561881	0.749117
Adj. R-squared	0.728016	0.349574	-0.194869	0.315772
F-statistic	2.225970	1.848613	0.742492	1.728687

**significant at the 5%

Table.12 Estimating a cointegrating regression of EX

Cointegrating equation : D(EX)=C(1)*(EX(-1)+2.6230550335*DB(-1) 2.13699829*R(1)+6.25574401*RF(1)+0.214539845*@trend(80)+9.1635257)+ C(2)*(R(-1)+1.62929181017*DB(-1)-1.2100221974*RF(-1)+0.178693704128@TREND(80)-2.1362383622 + C(3)*D(EX(-1))+C(4)*D(EX(-2))+C(5)*D(EX(-3))+C(6)*D(EX(-4)+C7*D(DB(-1))+C8*D(DB(-2))+C9*D(DB(-3))+C10*D(DB(-4))+C11*D(R(-1))+C12*D(R(-2))+C13*D(R(-3))+C14*D(R(-4))+C15*D(RD(1))+C16*D(RF(2)+C17*D(RF(3))+C18*D(RF(-4))+C19+C20*@trend(80)

	Coefficient	Std.Error	t-Statistic	Prob.
C(1)	-0.414635**	1.225445	-2.955566	0.0120
C(2)	-1.000785	0.370578	-2.700603	0.1929
C(3)	-1.687448**	0.518942	-3.251706	0.0069
C(4)	-1.736984	0.797926	-2.176873	0.0502
C(5)	-0.556741	0.405682	-1.372357	0.1951
C(6)	-53.56139**	18.26728	-2.932094	0.0126
C(7)	25.11054	12.49234	2.010075	0.0675
C(8)	-8.474262**	11.09136	-0.764041	0.0459
C(9)	21.01828	21.32715	0.985518	0.3438
C(10)	-0.493843	0.477739	-1.033709	0.3130
C(11)	-0.162890	0.373238	-0.436424	0.6670
C(12)	-2.283071	1.233303	-1.851183	0.2385
C(13)	8.011927	3.287600	2.437014	0.9673
C(14)	2.010793**	2.010197	0.018377	0.0019
C(15)	1.004099**	3.997207	0.250625	0.0285
C(16)	-2.015852	1.111314	-1.810995	0.1758
C(17)	4.003028	2.957274	1.352630	0.7549
C(18)	-2.023391**	1.225451	-1.651139	0.0037
C(19)	5.001461**	2.001131	2.502315	0.0033
C(20)	0.002123	0.002353	0.902274	0.3862
R-squared		0.771885		
Adjusted R-squared		0.728016		
F-statistic		2.225970		

**significant at the 5%.