

The Relationship between Exchange Rate and Net Exports in Algeria: Testing for Marshall-Lerner Condition

دراسة العلاقة بين سعر الصرف وصافي الصادرات في الجزائر:
اختبار شرط Marshall-Lerner

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Abstract

The main aim of this paper is to investigate the impact of exchange rate changes on trade balance for Algeria, and how it binds to exports and imports of goods and services through internal and external prices using the well-known the elasticity's approach (Marshall-Lerner Condition). We have estimated an econometric model on Algerian exports and imports for the period 1992 to 2007. In the next step, a model on Algerian net exports has been estimated. The main finding of this study shows that, contrary to imports, exports were not affected by exchange rate changes.

Keywords: Exchange Rate, Marshall-Lerner Condition, Trade Balance, Algeria.

JEL classification : F00, F31, C10.

الملخص:

تلخص هذه الدراسة أثر تقلبات سعر الصرف على الميزان التجاري ومدى ارتباطه بالصادرات والواردات والسلع والخدمات وكيفية تأثيره على الميزان التجاري من خلال الأسعار المحلية والأجنبية المتعلقة أساسا بأسلوب المرونات (شرط Marshall-Lerner)، كما تستعرض هذه الدراسة جانبا من النماذج النظرية لسعر الصرف لأجل الحصول على نموذج قياسي لنمذجة سعر الصرف على الميزان التجاري للجزائر.

وتم تخصيص جزء تطبيقي لهذه الدراسة باستعمال النموذج القياسي لتقدير نموذج الصادرات ونموذج الواردات وبعدها تم تقدير نموذج صافي الصادرات الجزائرية، وأبرزت نتائج الدراسة أن الصادرات لا تتأثر بسعر الصرف على عكس الواردات التي تتأثر به.

كلمات مفتاحية: سعر الصرف، شرط Marshall-Lerner، ميزان تجاري للجزائر.

رموز (JEL): F31, F37, C22, C82.

Introduction

The aim of this study is twofold; it reviews the theories of the economic model regarding trade exchanges, and in light of these theories, the study tends to define the model variables that are applied on the foreign trade (exports and imports), especially the impact of real effective exchange rate (REER) on these variables. To do so, four different models of the trade balance will be considered in order to define one economic model.^[1] The four models are the following:

- a) Income approach of foreign trade through foreign trade multiplier.
- b) Prices approach through exchange rate, i.e. the elasticity's theory.
- c) Assimilation approach is a hybrid of income approach and prices approach.
- d) Mundell-Fleming model.

After defining the model relations in the context of these models, we will follow two distinct approaches namely:

- The traditional approach in the definition of demand behavior of the overall Algerian imports and exports. This approach will enable the estimation of the elasticity of total demand for both imports and exports.
- The modern approach stands on time series analysis in determining the degree of stationary and its co-integration (the economic stationary of time series differs from the statistical stationary). To determine the impact of the exchange rate and especially the real effective exchange rate on foreign trade of Algeria, we referred to unrestricted VAR to estimate the variables during the period 1992-2007.

This paper is structured as follows: section two explores the theoretical background. Section three displays data description. Section four presents results and discussion. Conclusion summarizes and gives some recommendations.

2. Theoretical background

2.1. The foreign trade multiplier approach

Foreign trade multiplier is referred to because it reflects the impact of exports balance on imports. We will attempt to redefine the economic equilibrium in an open economy, and then we will analyze the main types of adjustment based on the concept of foreign trade multiplier.

The general equilibrium equation is written as follows:

$$X - M = Y - C - I$$

$$\frac{dBT}{dI} = -m \frac{dY}{dI} = -m \frac{1}{s + m}$$

where **X**: exports, **M**: imports, **Y**: income, **C**: consumption, **I**: investment, **m**: marginal propensity to imports, and **s**: marginal propensity to saving.

Economically speaking, increasing investment spending will lead to an increase in income, but at the expense of the deterioration of the trade balance with a multiplier $m / (s + m)$. Consequently, $X < M$; however, this is not enough to analyze the relations among the variables of the balance of trade balance in the case of a stable situation (wages, interest rates)

^[2] because prices are flexible, and thus they have an influence on exports, imports and inevitably on the exchange rate. For this reason, we refer to the elasticity's theory.

2.2. Reduction models

There are two distinct mechanisms that explain the return to equilibrium situation of the balance of the current balance of a given country during a period of fluctuations in the exchange rates. They are namely the elasticity's model and the absorption model. In fact, in both cases, the conditions for success to return to the adjustment depend on a number of restrictions.

2.2.1. Elasticity's Model

Before presenting this model, the developments of non-financial variables (goods and services) were used to explain the differences in the trade balance. After that, it was necessary to introduce prices variable and to link the internal prices with the external ones; the concept of the exchange rate appears. This model is well-known "Marshall-Lerner-Robinson Model."

^[3] This approach tends to provide the necessary conditions that allow the exchange rate to change through its effect on the balance of payments and thus on the trade balance.

$$BT = X - M$$

For devaluation to have a positive (direct) impact on the trade balance, it should be:

$$E_X + E_M > 1, \text{ where } e: \text{ the exchange rate.}$$

- The demand elasticity for imports is: $E_M = -\frac{e}{M} \frac{dM}{de}$
- The demand elasticity for exports is: $E_X = \frac{e}{X} \frac{dX}{de}$

2.2.2. Absorption model

If the condition of elasticity is realized, then the trade balance of the country of origin will actually improve; nevertheless, this depends on how the economy reacts to the reduction. In this framework, the "Absorption model" developed by Alexander 1952^[4] focuses on this issue through the reduction's effect on spending behavior in the local economy and services on the trade balance.

$$\begin{aligned} Y &= C + I + (X - M) \\ Y &= A + BT \\ BT &= Y - A \end{aligned} \quad , \text{ where } A \text{ represents the absorption.}$$

Based on this equation, one can point out the following analysis:

A. from the side of income

If the national income is greater than absorption in a given country, i.e. the national income is growing at a rapid pace than absorption, then the trade balance is in a surplus situation and vice versa, i.e. the expenses of the country exceed its production.

B. from the side of Prices

Absorption approach expects that the devaluation will improve the trade balance, except if the national production exceeds absorption.

Combining foreign trade multiplier model with elasticity's model

This model contains two equations that determine the national income on one hand and the exchange rate in terms of the trade balance on the other hand. This model has been developed by Larsen and Metzler (1950),^[5] and it is written as follows:

$$\begin{aligned} BT &= X(e) - eM(e, Y) = 0 \\ Y &= A(Y, e) + X(e) - eM(e, Y) \\ dBT &= \frac{s}{s+m} X(E_X + E_M - 1) \frac{de}{e} \end{aligned}$$

The improvement of trade balance is given by value and not by production immediately after the reduction. It is worth noting that when the elasticity method and absorption power are realized, then the return to equilibrium situation does not happen immediately because there will be a time gap between the devaluation action and the improvement of the trade balance.

2.3. Mundell-Fleming model

The aim of this model - developed by Marcous Fleming (1962) and Rebert Mundell (1963)^[6] - is to analyze how to achieve external equilibrium. Based on this model, the adjustment of the balance of payments can be possible, taking in consideration the two accounts, namely trade balance and capital account. The model assumes that net exports will increase in the short run as a reaction to the decrease of the currency value.

2.3.1. Model variables from the trade balance side

A-Determinants of exports

Y^* : Gross Domestic Product for the rest of the world GDP^*

$REER$: The real effective exchange rate. Foreign supervisors work on the comparison of the prices of goods and services, and thus exports depend on the ratio of internal and external prices, i.e. higher are the domestic prices, lower is the foreign demand for local products.

X : Exports are an increasing function to $REER$. This latter can be written as follows:

$$\begin{aligned} REER &= e \frac{P^*}{P} \\ X &= X(Y^*, REER^+) \end{aligned}$$

where P , P^* are general levels of internal and external prices respectively, and e is the nominal exchange rate (indirect pricing).

B-Determinants of imports

Y : Gross Domestic Product GDP .

$REER$: Local supervisors make comparison of the internal prices with external prices. If this latter increase more than the former, the domestic demand for foreign products will decrease and consequently imports will be reduced.

M : Imports are a decreasing function to $REER$. This can be written as follows:

$$M = M(Y, REER^-)$$

C-The trade balance: $BT = (e, P_X)X - P_X M$

- The first situation: $\frac{dBT}{de} > 0$ in the case of devaluation.
- The second situation: $\frac{dBT}{de} < 0$ in the case of appreciation.

These two cases refer to the so-called *Marshall-Lerner* condition that we attempt to check for the Algerian case.

3. Data description and Model specification

3.1. Data description

For the national statistical data, we referred to the database of the Algerian national office of statistics (ONS).^[7] ^[8] Concerning the international statistical data, we referred to the database of the World Bank.^[9] ^[10]

Figure (1) presents the constant Gross Domestic Product for Algeria and the foreign constant Gross Domestic Product denominated in U.S. dollars during 1992-2007. For the constant Gross Domestic Product of Algeria, data of time series were obtained from the World Bank database.

For the foreign constant Gross Domestic Product, we have estimated the weighted GDP^* based on the following method:

- Five important partners of Algeria in foreign trade have been chosen, and this is due to the availability of the necessary data for each country. If there is a partner for Algeria in foreign trade, its data should be available for both exports and imports for the study period. This is an important requirement to determine the weighting coefficient α_i . Among the countries that meet this condition since the sixties, there are: Italy, France, USA, Spain, and Brazil:

$$\text{Thus } \alpha_i = \frac{GDP \text{ of } country_i}{\sum_{i=1}^5 GDP \text{ from 5 countries}}, \quad i = ITY, FR, USA, SPN, BRZ$$

- Time series data of constant Gross Domestic Product for each country from 1992 until 2007 have been obtained from the World Bank database. After having identified α_i for each country, we identified the weighted GDP^* for the five countries which is given by the following formula:

$$GDP^* = \sum \alpha_i GDP_i, \quad i = \overline{1..5}$$

Figure (2) presents the uncertain real effective exchange rate denominated in U.S. dollars. Its time series data have been obtained from the World Bank database for the period 1992-2007.

Figure (3) shows the prices of the Algerian exports and imports. For export prices, they are formed basically from petroleum prices because Algerian exports are formed about 98% of hydrocarbons. Their data were obtained from *OPEC* organization^[11] for the period 1992-2007. As for the prices of imports, they were obtained from the national office of statistics (ONS) from 1992 to 2007. They are denominated in U.S. dollars too.

Figure (4) denotes the value of the Algerian exports and imports denominated in U.S. dollars. Their time series data were obtained also from the national office of statistics (ONS) from 1992 to 2007.

Figures (5), (6), and (7) present the quarterly data for the previous variables respectively. Figure (8) presents the quarterly trade balance of Algeria in which its data were obtained from calculating the difference between the values of Algerian exports and imports. They are also denominated in U.S. dollars.

3.2. Model specification

In order to test the relationship between exchange rate and net exports in Algeria, we consider the last version of *MF* model with specific adjustment of the standard basic model. For the imports equation and the exports equation previously identified within the *MF* model, it is obvious that the exchange rate affects both imports and exports. This evidence allows us to introduce two additional variables since the *MF* model imposes prices stability. These two variables are the exports' effective prices in the exports equation and the effective prices in the imports equation.

$$X = X(GDP^*, REER, P_X)$$

$$X = x_1GDP^* + x_2REER + x_3P_X + C$$

The same thing for the exports equation, we add another independent variable that explains imports. It is the effective price of the imports:

$$M = M(GDP, REER, P_M)$$

$$M = m_1GDP + m_2REER + m_3P_M$$

Finally, we can deduce the following trade balance equation:

$$X - M = x_1GDP^* + x_2REER + x_3P_X + C - m_1GDP - m_2REER - m_3P_M$$

$$BT = (x_2 - m_2)REER + x_1GDP^* - m_1GDP + x_3P_X - m_3P_M + C$$

4. Results and discussion

4.1 Exports function

$$X = x_1GDP^* + x_2REER + x_3P_X + C$$

Table (1) highlights the preliminary results obtained from estimating the exports model. We note that the probability values for each variable C , GDP^* , P_X are less than $\alpha=05\%$ which means that they are significant variables; however, $REER$ is not a significant variable. Thus, we estimate the second selected model (exports model) by excluding the nominal effective exchange rate variable.

Results obtained from estimating the final exports model are shown in Table (2). For F statistics, its value is less than the critical value $\alpha=05\%$ [$Prob(F - statistic) = 0.0000$]. Hence, we accept the model containing the independent variables C , GDP^* , P_X and the dependent variable X .

$$\text{Log}X = -36.29779 + 1.238915\text{Log}GDP^* + 0.906108\text{Log}P_X$$

4.2. Imports function

$$M = m_1GDP + m_2REER + m_3P_M$$

Table (3) highlights the preliminary results obtained from estimating the imports model where one can note that the probability values for each variable GDP , $REER$, P_M are significant independent variables since its probability values are less than $\alpha=05\%$.

$$\text{Log}M = 0.352186\text{Log}GDP - 1.402017\text{Log}REER + 0.530429P_M$$

Nevertheless, the significance of model parameters resulting from the difference $BT = M - X$ is still in question, especially the relationship between the exchange rate and the trade balance. Also, the commitment to the elasticity condition is still in question. All that will be tested through the estimation of the net exports equation and its impact on the exchange rate.

4.3. The net exports equation: checking out the Marshall-Lerner condition

$$BT = (x_2 - m_2)REER + x_1GDP^* - m_1GDP + x_3P_X + m_3P_M + C$$

with

$$\begin{aligned} (x_2 - m_2) &= \alpha \\ x_1 &= \beta \\ -m_1 &= \delta \\ x_3 &= \phi \\ -m_3 &= \omega \end{aligned}$$

$$X_{net} = C + \alpha REER + \beta GDP^* + \delta GDP + \phi P_X + \omega P_M$$

Due to the limited number of observations, we referred to the quarterly data for the previous mentioned variables.

A. Testing time series stationary

The purpose of this test is to examine the characteristics of time series for the following variables: BT , $REER$, GDP^* , GDP , P_X , P_M , and to identify the rank of the integration of each variable separately. In fact, testing the time series stationary for the model variables requires the unit root test. In spite of the multiplicity of unit root tests, we preferred to choose only the *Augmented Dickey-Fuller test (ADF)*.^{[12] [13]}

- **Null hypothesis: H_0 :** There is a unit root. That means the time series are not stationary, and thus they cannot be used for the estimation.
- **Alternative hypothesis: H_1 :** the time series are stationary.

Table (4) displays the results of ADF test. It shows that the absolute values for $t\hat{\theta}_j$ are higher than its critical values; therefore, we reject the null hypothesis and accept the alternative one. Consequently, the stationary condition is met for all previous cases at $\alpha = 05\%$. Therefore, one can conclude that the time series for the variables: GDP^* , GDP , $REER$, P_X , P_M , BT are neither stationary at level nor at first difference; however, they are stationary at second difference in the second model. Each variable is seen as integral of the second degree:

$$(GDP^*, GDP, REER, P_X, P_M, BT) \rightarrow IN(2)$$

trend and (When we tested time series using ADF test, we referred to the second model intercept) in order to check whether there is a spurious regression or not. The main aim of this process is to know if the equal co-integration equations "EC" contain intercept and trend or not.

Table (5) summarizes the results of this test, and its aim is to see if time series for the variables have intercept, stochastic trend or linear trend.

B- Co-integration Test

In our model, we have applied co-integration test of Johansen given to its importance in the co-integration theory vis-à-vis the linear hybrid that determines the equal integration equation. To define the number of co-integration vectors, *Johansen and Juselius 1990* ^[14] suggest testing two distinct statistics, namely:

- **Trace test** tests the null hypothesis. In this case, the number of unique co-integration vectors r is less than or equal to the number of variables n versus the alternative hypothesis which is: $m = r$.
- **Maximal Eigenvalue** tests the null hypothesis. In this case, there is r vector for co-integration versus the alternative hypothesis which is equal to $r + 1$.

One can distinguish three distinct cases of linear hybrid matrix:

- a) If the rank of the matrix $r = 0$, so in this case we reject the existence of co-integration.
- b) If the rank of the matrix $r = m$, so in this case the rank of matrix is perfect which means that the original variables are stationary.
- c) If $0 < r < m$, so we conclude that there is at least one integration equation which indicates that there is equilibrate relationship in the long run.

In the first two cases $r = m$ and $r = 0$, we can neither use the unrestricted VAR model nor the error-correction model ECM.

Table (6) shows the results of determining the lagged period, because we have already gave a lagged period $t = 2$ for the variable BT when we tested time series earlier. However, this is taken into account ^[15] because it could affect the co-integration test. The four criteria LR FPE, AIC, and HQ have chosen five lagged periods whereas the SC criterion has chosen two lagged periods. Therefore, we will test co-integration in VAR model in two lagged periods (2 and 5).

Table (7) highlights the results of co-integration test where the results on the effect test suggest that the probability value of the effect is higher than the significant table value for the five cases of the study. Hence, we reject the null hypothesis H_0 and we accept the alternative hypothesis H_1 . This result is confirmed when we refer to the likelihood maximum value test. Thus, there is at least one co-integration equation which means also that a static linear hybrid exists among the economic variables. This finding confirm the existence of equilibrate relationship in the long run among these variables, i.e. they do not get away from each other so much, and they show a common similar behavior.

C- Estimating the error correction model (ECM)

We found earlier that time series are stationary at second difference, and they are totally co-integrated. This finding drives to the final step which consists in designing a VAR model in order to estimate the net exports equation. It is found also five vectors of co-integration

which allows the application of ECM model. We have applied the Unrestricted VAR model^[16] that made possible the estimation of the parameters of the net exports equation in both the short and the long run in one equation at second difference:

$$(GDP^*, GDP, REER, P_X, P_M, BT) \rightarrow IN(2)$$

With adding a lagged time gap, the model takes the following form:

$$\begin{aligned} \Delta^2 Xnet_t = & C + \sum_{j=1}^{\rho} \psi_j \Delta^2 Xnet_{t-\rho} + \sum_{j=0}^{\rho} \alpha_j \Delta^2 REER_{t-\rho} + \sum_{j=0}^{\rho} \beta_j \Delta^2 GDP_{t-\rho}^* + \sum_{j=0}^{\rho} \delta_j \Delta^2 GDP_{t-\rho} + \\ & \sum_{j=0}^{\rho} \phi_j \Delta^2 P_{Xt-\rho} + \sum_{j=0}^{\rho} \omega_j \Delta^2 P_{Mt-\rho} + \lambda_1 \Delta^2 Xnet_{t-1} + \lambda_2 \Delta^2 REER_{t-1} + \lambda_3 \Delta^2 GDP_{t-1}^* + \lambda_4 \Delta^2 GDP_{t-1} \\ & + \lambda_5 \Delta^2 P_{Xt-1} + \lambda_6 \Delta^2 P_{Mt-1} + \varepsilon_t \end{aligned}$$

Using EVIEWS.5, we have chosen AIC and SC criteria in order to define the length of distributed lagged periods while estimating the model. In this case, the parameter of the dependant variable lagged for one period on the right of equation; λ_1 is the adjustment parameter or error correction limit, whereas the following parameters of second difference α_j , β_j , δ_j , ϕ_j , ω_j , ψ_j represent the elasticity in the short run.

$$Xnet_t = \frac{C}{\lambda_1} + \frac{\lambda_2}{\lambda_1} REER + \frac{\lambda_3}{\lambda_1} GDP^* + \frac{\lambda_4}{\lambda_1} GDP + \frac{\lambda_5}{\lambda_1} P_X + \frac{\lambda_6}{\lambda_1} P_M \dots (*)$$

Table (8) highlights the results of model estimations. We can check whether the *Marshall-Lerner* condition is met or not based on the net exports equation, especially the sign of the coefficient of the real effective exchange rate; if the sign is plus, the condition is met and vice versa.

According the estimated equation, the judgment will be done at two stages given the lagged time gap:

- If the time gap is one lagged period, the sign of the coefficient on the real effective exchange rate is positive, and thus *Marshall-Lerner condition* is met.
- If the time gap is two lagged periods, the sign of the coefficient on the real effective exchange rate is positive which confirm strongly the existence of the first time gap. In this case, the change in the real effective exchange rate responds to net exports change. This finding is in line with the economic theory that suggests if the sum of imports and exports elasticity is more than one, the devaluation will inevitably lead to an increase in net exports.

Conclusion

This study attempted to estimate exports equation for the case of Algeria. Based on the results, the real effective exchange rate variable (REER) has been excluded while all the other variables were retained. This could be explained as follows:

The Algerian fuel exports represent about 98% of total exports, and the small percentage has a very limited impact on exports behavior. On the other hand, fuel exports do not react to any changes in exchange rates (Algeria is a member country in OPEC organization, and each member has its fixed share of fuel exports). Furthermore, among the main findings of this study is that the exports' prices variable has not been excluded because it is seen as a significant variable. Therefore, one can conclude that the Algerian exports, which are almost fuels, depend ultimately on fuel prices.

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Appendix (1)

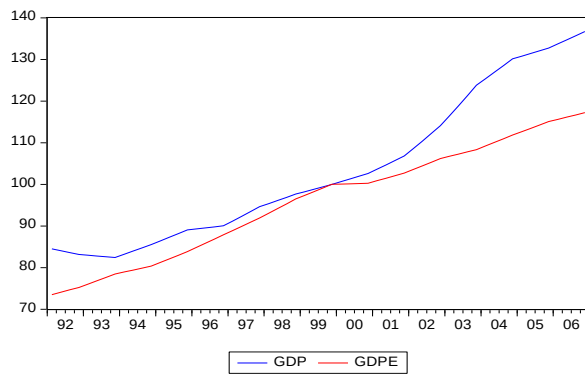
Figure (1)

Gross Domestic Product for Algeria and Foreign

Figure (2)

Real Effective Exchange Rate for Algeria

Gross Domestic Product



REER

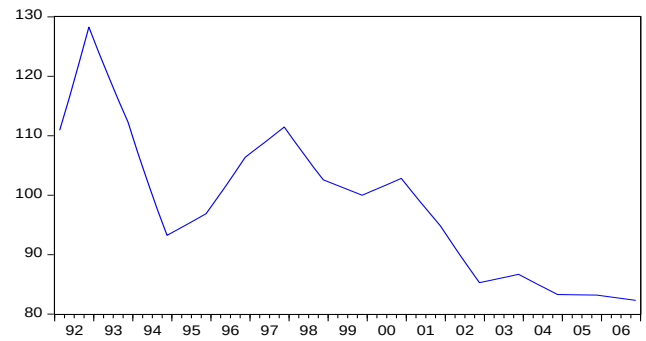


Figure (3)

Prices of Algerian Exports and Imports

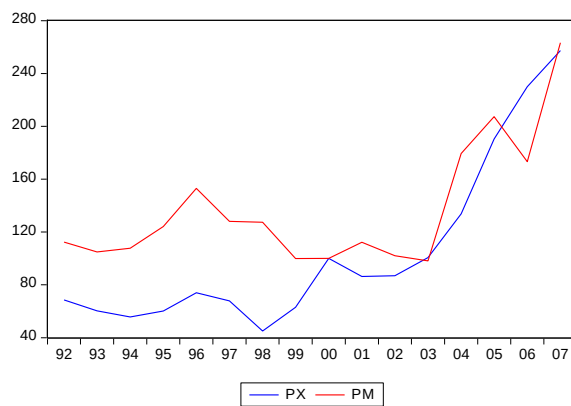


Figure (4)

Algerian Exports and Imports

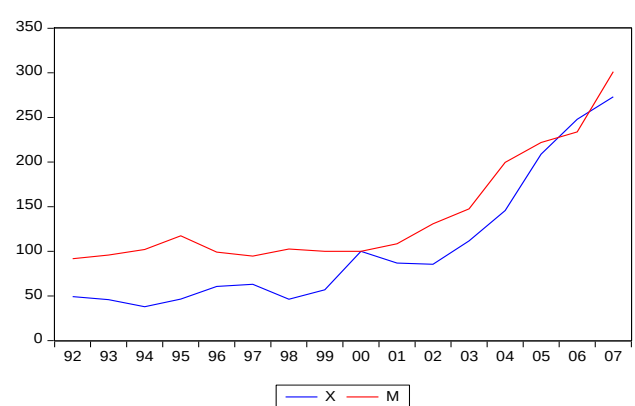


Figure (5)

Quarterly Gross Domestic Product for Algeria and
Quarterly Foreign Gross Domestic Product

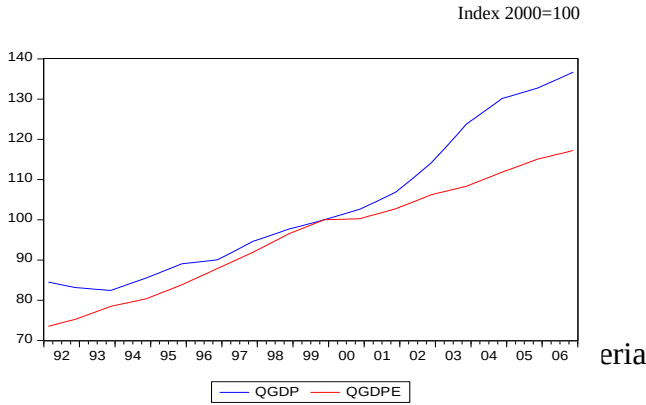
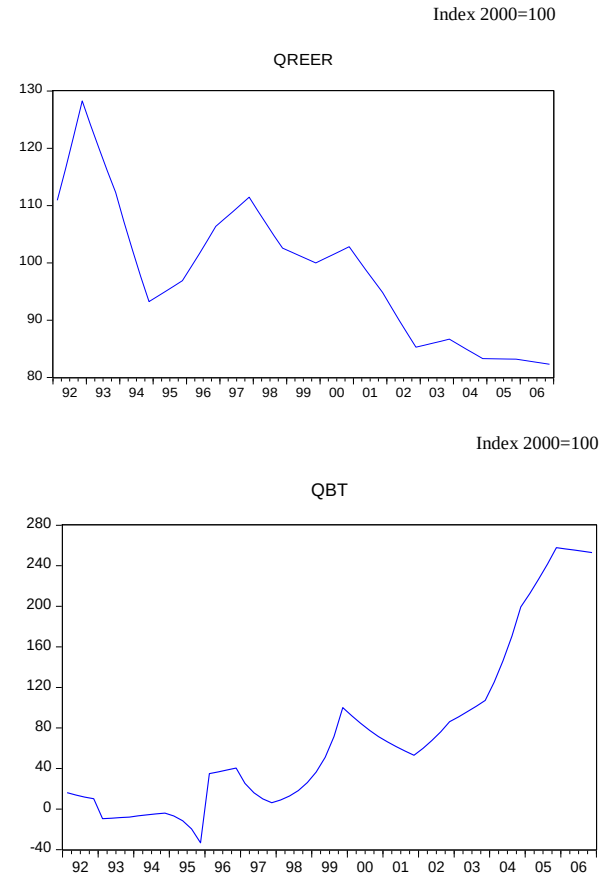


Figure (6)

Quarterly Real Effective Exchange Rates



Appendix (2)

Table (1): Preliminary Results Obtained from Exports Model

Dependent Variable :LOGX Method : Last Squares Included Observations : 16			
Variable	Coefficient	T-Statistic	Prob
C	-37.09585	-6.380644	0.0000
LOGGDP*	1.255956	6.84973	0.0000
LOGREER	0,056908	0.248909	0,8076
LOGP _X	0.913479	15.60101	0.0000

Adjusted R-Squared	0.991074
Durbrbin Watson Stat	2.104732

Table (2): The Results Obtained from the Exports Model

Dependent Variable :LOGX Method : Last Squares Included Observations : 16			
Variable	Coefficient	T-Statistic	Prob
C	-36.29779	-7.169979	0.0000
LOGGDP*	1.238915	7.56142	0.0000
LOGP _X	0.906108	18.62334	0.0000
Adjusted R-Squared	0.992822		
Durbrbin Watson Stat	2.126947		
Prob	0.000000		

Table (3): The results obtained from imports Model

Dependent Variable :LOGM Method : Last Squares Included Observations : 16			
Variable	Coefficient	T-Statistic	Prob
LOGGDP	0.352186	4.416910	0.0007
LOGREER	-1.402017	-4.492059	0,0004
LOGP _M	0.530429	3.151773	0.0076
Adjusted R-Squared	0.858327		
Durbrbin Watson Stat	213262.1		

Table (4): Stationary Test Results

			Non	Trend and Intercept			Intercept	
Variables	MAX LAG	Difference Degree	Critical values : 5%	$t\hat{\theta}_1$ <i>ADF</i>	Critical values : 5%	$t\hat{\theta}_1$ <i>ADF</i>	Critical values : 5%	$t\hat{\theta}_1$ <i>ADF</i>
GDP*	10	I(0)	9-1.94654	1.872795	-3.489228	-2.414616	-2.912631	-0.998886
		I(1)	9-1.94654	537820.8-	-3.489228	463496-2.	-2.912631	828225-2.
		I(2)	654-1.946	730849-7.	90662-3.4	386239-7.	3549-2.91	014243-7.
GDP	10	I(0)	-1.946549	2.130656-	-3.489228	-2.151972	-2.912631	0.042305
		I(1)	-	-	-3.448228	-2.151430	-2.912631	-2.271247
		I(2)	-	-	-3.490662	-7.523068	-2.913549	-7.466247

<i>REER</i>	10	I(0) I(1) I(2)	-1.947520 -1.947520 -	-1.141956 -2.099531 -	-3.502373 -3.502373 -3.490662	-2.484258 -2.512253 -7.643643	-2.921175 -2.921175 -2.913549	-0.068455 -2.375834 -7.600855
<i>P_X</i>	10	I(0) I(1) I(2)	46549-1.9 46549-1.9 46654-1.9	6802361. 919357-1. 786495-7.	-3.489228 -3.489228 -3.490662	936153-1. 781659-2. 170537-7.	-2.912631 -2.912631 -2.913549	3060320. 063208-2. 596044-7.
<i>P_M</i>	10	I(0) I(1) I(2)	-1.947520 -1.947520 -1.947520	-0.931316 -0.294460 -6.206681	-3.502373 -3.502373 -3.502373	-0.335593 -1.453246 -6.171895	-2.921175 -2.921175 -2.921175	-0.033391 -0.684770 -6.194897
<i>X_{net}</i>	number of lags= 2	I(0) I(1) I(2)	-1.946654 -1.946654 -	0.968768 -2.914899 -	-3.490662 -3.492149 -3.493692	-2.047074 -2.460607 636560-5.	-2.913549 -2.914517 -	0.159526 -3.234526 -

Table (5): Deterministic Trend Assumption Test

Second Series of differences	stationary test	Intercept	Trend	The test results
<i>GDP*</i>	stationary	Non significant	Non significant	No deterministic trend
<i>GDP</i>	stationary	Non significant	Non significant	No deterministic trend
<i>REER</i>	stationary	Non significant	Non significant	No deterministic trend
<i>P_X</i>	stationary	Non significant	Non significant	No deterministic trend
<i>P_M</i>	stationary	Non significant	Non significant	No deterministic trend
<i>X_{net}</i>	stationary	Non significant	Non significant	No deterministic trend

Table (6): The Results of Determining the Lagged Periods

VAR Lag Order Selection Criteria
Endogenous variables: BT GDPE GDP REER PX PM
Exogenous variables: C
Date: 04/25/10 Time: 19:51
Sample: 1992Q1 2006Q4
Included observations: 55

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1226.365	NA	1.17e+12	44.81327	45.03225	44.89795
1	-586.3970	1117.035	340.9941	22.85080	24.38367	23.44357
2	-472.3165	174.2321	20.88247	20.01151	22.85827*	21.11237
3	-452.4904	25.95412	42.53004	20.59965	24.76030	22.20861
4	-416.8112	38.92280	55.39463	20.61132	26.08586	22.72837
5	-281.8234	117.8075*	2.407583*	17.01176*	23.80020	19.63690*

* 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 (7): Co-integration Johansen Test Results

Trace Test			
H ₀	H ₁	NoTrend	
		Critical Trace	Critical Value 5%
r = 0	r = 1 **	282.1108	83.93712
r = 1	r = 2 **	169.3324	60.06141

$r = 2$	$r = 3^{**}$	81.70660	40.17493
$r = 3$	$r = 4^{**}$	45.49052	24.27596
$r = 4$	$r = 5^{**}$	20.3304	12.32090
$r = 5$	$r = 6$	0.392904	4.129906
Maximal Eigenvalue Test			
$r = 0$	$r \geq 1^{**}$	112.8085	36.63079
$r \leq 1$	$r \geq 2^{**}$	87.62577	30.43961
$r \leq 2$	$r \geq 3^{**}$	36.21608	24.1591
$r \leq 3$	$r \geq 4^{**}$	25.15748	17.79730
$r \leq 4$	$r \geq 5^{**}$	19.94013	11.22480
$r \leq 5$	$r \geq 6$	0.392904	4.129906

Table (8): The Results of Estimating the Unrestricted Error Correction Model (UECM) for Algerian Net Exports

	X_{net}	$REER$	GDP^*	GDP	P_X	P_M
$X_{net}(-1)$	0.544136	0.013647	-0.004738	0.002841	-0.022506	0.080663
$\Delta X_{net}(-1)$	-0.175187	0.023662	0.000544	0.002532	0.008886	0.046670
$REER(-1)$	0.772634	1.510974	0.004130	-0.048877	-0.415998	-0.551128
$REER(-2)$	-0.409657	-0.719115	-0.004777	0.018096	0.243548	0.159762
$\Delta GDP^*(-1)$	-5.833858	1.625996	1.630519	0.373574	0.728128	9.757702
$\Delta GDP^*(-2)$	7.266780	-1.712938	-0.631867	-0.406955	-1.087730	-10.47437
$GDP(-1)$	-0.655235	-1.422062	-0.068396	1.473242	-4.356965	-2.119745
$GDP(-2)$	0.593970	1.441213	0.089591	-0.426529	5.219763	2.469787
$P_X(-1)$	1.744231	-0.072968	-0.010388	-0.041891	1.424812	-0.365577
$P_X(-2)$	-1.103098	0.007604	0.009154	0.029190	-0.577116	0.313848
$P_M(-1)$	-0.453201	0.056813	-0.000339	0.009652	0.157931	1.892770
$P_M(-2)$	0.531948	-0.057732	0.003985	-0.016225	-0.150904	-1.082972
C	-190.5090	30.71166	-1.663974	3.478979	-17.25809	88.57773