

AN EMPIRICAL STUDY ON REAL EXCHANGE RATE LEVELS AND THE ROLE OF MACRO-ECONOMIC INDICATORS: EVIDENCE FROM ALGERIA

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Abstract

The purpose of this study is reviewing the real exchange rate RER evolutions and measuring their macroeconomic impacts on the economic performance indicators during the period from 1970 to 2012, also determining the trend of those impacts and their influence nature on the Algerian economy applying modern econometric methods as Error Correction Model, Johansen Cointegration Approaches and Ordinary Least Squares OLS to estimate the last formulation of the relation between used variables. The extracted econometric results, affirm the existence of a cointegration relationship between the RER and the macro variables of economy in general and with the Algerian economy in particular. More specifically and according to these results the association between the RER and the gross domestic product GDP, the investment INV, the index of openness OPEN and the financial sector development FD is significantly positive but significantly negative with both inflation INF and the index of political stability POLSTAB, while its relation to government GOV is insignificant.

Keywords: Real Exchange Rate (RER), economic performance indicators, Cointegration test, Error Correction Modelling, Ordinary Least Squares.

المخلص :

تهدف هذه الدراسة الى قياس الآثار الاقتصادية لتغيرات سعر الصرف الحقيقي على مؤشرات الأداء الاقتصادي الكلي أي الناتج المحلي الإجمالي GDP، التضخم INF، نسبة الاستهلاك الحكومي GOV، الاستثمار INV، مؤشر الانفتاح التجاري OPEN، مقياس تطور القطاع المالي FD الممثل بالقروض الموجهة للقطاع الخاص ومؤشر الاستقرار السياسي POLSTAB من 1970 الى 2012 وتحديد اتجاه تلك الآثار وطبيعة تأثيرها على الاقتصاد الجزائري باستخدام الأساليب القياسية الحديثة وتقديرها كاختبارات الاستقرار والتكامل المشترك، ثم الاعتماد على طريقة المربعات الصغرى لتقدير الصيغة النهائية للعلاقة بين تلك المتغيرات. النتائج المحصل عليها تؤكد وجود علاقة تكامل متزامن بين سعر الصرف الحقيقي وهذه المتغيرات بصفة عامة وفي الاقتصاد الجزائري بصفة خاصة حيث وجدت علاقة طردية بين سعر الصرف الحقيقي وبين كل من نمو نصيب الفرد من إجمالي الناتج المحلي، إجمالي التكوين الرأسمالي الثابت، مؤشر الانفتاح للتجارة العالمية ومدى تطور القطاع المالي في حين وكانت العلاقة عكسية بينه وبين مؤشر الاستقرار السياسي والتضخم بينما النفقات الحكومية لم تؤثر اطلاقاً على سعر الصرف الحقيقي.

الكلمات المفتاحية: سعر الصرف الحقيقي، مؤشرات الأداء الاقتصادي الكلي، التكامل المتزامن، طريقة المربعات الصغرى.

Introduction :

In today's world, the economies differ from country to other in their development degree through continual intensive evolutions due to the expansion of the international exchanges volume, in particular after the emergence of the open economy which directly or indirectly requires the coordination between different policies and programs, in order to maintain the internal and external economic balances, the tool the most important to achieve that and protect the economy is the exchange rate policy due to its efficacy on influencing all internal and external sectors, it reflects the performance and the economic significance of countries; therefore the exchange rate is considered, due to their multitude utilizations, as a goal for depreciating the inflation ratios appropriately to the monetary policy objectives, however it can be used as a competitiveness indicator because it represents the balance of payments, also it can be used as a tool and this is on what we will focus in this study which has its importance from measuring the impact occurred by the exchange rate volatilities on the Algerian economic performance.

The relation between RER and macro-economic indicators occupies an important standing in economics and it chafes a big controversy through the exchange rate influence on the economic performance, it can be interpreted by answering the following statement: to what range the economic performance could be influenced by the exchange rate volatilities?

This study bases on the descriptive analytical method to variables' performance over the period studied as it applies new quantitative methods to measure such association.

I. The Exchange Rate:

1. A Brief Review of the Theoretical Literature:

1.1. Exchange rate: there are many types of exchange rate, namely:

1.1.1. The Nominal Exchange Rate (NER): which represents the current exchange rate without taking in consideration its purchase power; the trends of NER volatilities are defined by its index number which reflects the average of the volatilities in the other currencies in relation to a specific currency and it changes according to the followed exchange rate regime, fixed or flexible. It is divided into official exchange rate used in the official current changes and the parallel exchange rate used in the parallel markets;

1.1.2. The Real exchange rate (RER): The most commonly used definitions of the RER include measures based on the consumer price indices, the prices of tradable goods or output prices, the price of the economy's exports compared to the price of its imports, relative unit labour costs and the ratio of tradable to non-tradable prices. Since these different price indices do not move together in the short run or even necessarily in the long run, there is no unique measure of the RER on which it is appropriate to focus on. Having a RER which approaches from the equilibrium exchange rate is the purpose of all countries following commercial policies in addition to and the liberalization policy, due to its significant impact on reducing their RER, reducing goods' prices and the possibility to access international markets. A country knows in general, an appreciation of its RER when it industrialises. (Owen Barder, 2006).

1.1.3. The Real Effective Exchange Rate (REER): The REER is derived by (Rhomberg, 1976) similarly to *Lapser indicator derivation*; it is a nominal price because it is the average of many bilateral exchange rates but it should be modified by removing relative prices changes effects to state the country's competitiveness toward abroad.

1.1.4. The Equilibrium Exchange Rate : Is the symmetrical rate with the macroeconomic balance; it represents a lasting equilibrium to the balance of payments while the economy is normally growing, wherein it is the exchange rate ruling in a dysfunctional economic environment. According to (Edwards, 1989), it is the proportion of the tradable to the non-tradable goods. In case if an equilibrium and optimal values of some variables exist in the long run term, such as world prices, taxes, commercial policy, capital flows or technology, an internal and an external equilibriums will happen at the same time, while the first one necessitates the equilibrium of both goods and employment markets in the short and the long run terms, in a parallel direction with the unemployment rate realisation that does not accelerate the inflation ratios; In return the second one necessitates the compatibility of the current and the future discount value with expected capital flows in the long run term and ability to keep on.

Among the factors influencing the exchange rate, we mention the current operations account's fund in addition to the capital operations account's fund in the balance payment, central banks activity, the political stability extent, inflation ratio and the change in the local and foreign interest rates. It is noteworthy that the nominal shocks (temporal monetary) affect the RER and isolate it from its equilibrium level, which is in return affected by the real shocks; for that it is requisite to determine the equilibrium level of the exchange rate by one of the known methods, as the purchase power parity which indicates that the exchange rate harmonizes with the internal and the external relative price, or as the concept given above by *Edward*.

1.2. The Macro-Economic Performance Indicators: represent a set of statistics and economic reports used in measuring the performance of different economic sectors to assess the economic performance and know the extent of economy's strength or weakness in addition to the ability of forecast the future economic situation; they reflect the efficiency of the economic policies on promoting the development, fighting against the poverty and the unemployment, reducing the inflation and fixing the prices. These indicators include many factors, namely: the economic development, the INV ratio (% of GDP), the exchange rate stability, the currency's devaluation ratio and the INF ratio, (The Arab competitiveness report, 2003, p:02); generally they can be classified into many types, are:

1.2.1. The prices and wages indicators: Which measure the prices evolution and the consumption volume, and reflect the economy's inflation levels, wherein the monetarists, in particular *Freedman*, think that the excessive raise in the money amount is responsible for them, therefore the foreign exchange rate will be associated directly proportional to the general level of prices. In fact, the exchange rate affects the inflation whether directly where the RER affect the relative price of domestic goods to the foreign ones influencing subsequently the domestic demand, or indirectly where it affects the prices of imported goods included in the indicator of consumption prices, and subsequently the domestic goods. The direct exchange rate channel plays an important role in transferring the monetary fluctuations rapidly, for which it permits to the monetary policy to affect the inflation ratio, and because the exchange rate is

interacting with other macro-economic variables, the *pass through** influences the optimal utilisation of the other transfer channels, in particular the interest rate, then subsequently it affect the economic dynamism and the emergence of the macro-economic variables which are determinative and decisive for the inflation forecast procedures.

1.2.2. Production indicators: Which measure the general level of production and represent generally the economic development during a specific period, as GDP but although it is a trusty indicator, it is not ideal, because its measurement does not comprise all related sides for increasing the economy's welfare; so it is considered as a well-being indicator but this interpretation is not final objective for a society, for that if the goal is to assess the life level, it will be necessary to complete the other measures based on the production with a large tray of indicators. (The German economic analyse council's Report of experts on economy, 2010, p:51).

1.2.3. Shocks: As shows evidence related to exchange rate, this later influence the economic development, whether directly through the exchange rate sensibility to shocks or indirectly through its influence on investment, trade and financial sector development, as well as the economic theory indicates, the countries efficiency on dealing with the commercial shocks depends firstly on the exchange rate system adopted which is in return reflected on the economic development; Generally, shocks can be divided to:

a. Nominal Shocks: that emerge mainly from the instable demand for money, through the evolutions of economic approach on acquiring the domestic currency in light of the new innovations of the financial papers or the fluctuation of the trust level; the external shocks could be treated by adopting flexible exchange rate, for example the exchange rate decrease helps to lower the real wages and guarantee the spending transfer from the foreign goods the most expensive to the relatively cheap domestic goods, then maintains the product and the employment appointment. Most of policymakers and economists believe that RERs can be temporarily pushed away from their long-run equilibrium values by nominal shocks, such as changes in monetary policy, for that matter, pegging of nominal exchange rates at levels that imply disequilibrium RERs at current price levels. Perhaps the most famous example in theory is the (Dorunbusch, 1976) model, in which a monetary expansion leads temporarily to a large nominal depreciation that both exceeds and precedes the subsequent price increase;

b. Real Shocks: it's agreed that real events can change equilibrium RERs, which are after all relative prices like any others. The sources of dispute are how large and how frequent such shocks are. One possible source of shifts in equilibrium RERs is the potential presence of secular trends due to differences in rates of technological change, differences in product mix, and so on. Aside from such long-run trends, the major source of real shocks to equilibrium exchange rates seems likely to be commodity-price shocks.

1.2.4. The foreign direct investment (FDI): The channels by which the exchange rate influences the FDI are that the currency devaluation leads to reduce the cost of local employment, therefore the decrease of employment which in return leads to increase the capital profit, as well as the currency devaluation leads to appreciate the foreign investment by rising the fortune of investors, also there are some opinions that affirm the positive relation between the

*The *Pass-Through* is the proportion of general prices level's evolutions to the exchange rate evolutions ratio, it is calculated as follow: $\frac{(P_t - P_{t-1}) / P_{t-1}}{(E_t - E_{t-1}) / E_{t-1}}$ where P is the general prices level, E is the exchange rate and t is time.

exchange rate evaluation and the foreign investment that refers to the increase of importation which might push the state to impose some restrictions or following a close policy or imposing taxes what pushes the foreign investors to rise the investment forecasting that such procedures might be limited;

- 1.2.5. **The financial markets development (FD):**the flexible exchange rate is usually joined by high fluctuations which will have a negative effect on the economy if the financial system is not able to absorb shocks and supply agents with appropriate caution tools, for that the financial system should be developed to benefit of the flexible exchange rate;
 - 1.2.6. **The balance of payments:**which is used to pursuit the sale and purchase operations of goods and services in addition to the investment operations done by state with other states, where its importance indwells on the illustration of supply and demand evolutions for the country's products;
 - 1.2.7. **Financial policy reports and interest rates:**That reflect the central bank movements in order to deal with the economic situations, where such reports represent one of the strongestmarket engines;
 - 1.2.8. **Employment indicators:**Due to the importance of employment and unemployment ratios in relation to the decision makers in any country, the indicators that reflect the employment market situation are very important and should be taken into consideration;
 - 1.2.9. **Housing indicators:**The housing sector is an important economic sector as it is considered a pioneer sector for the economy where its improvement leads to a general improvement in the economic status from which its importance is emerged;
 - 1.2.10. **Trust indicators:**which reflect the trust and the optimism or pessimism extensity of different categories that construct the economy as producers, investors and consumers.
2. **Empirical Studies:**Today, there is an important empirical literature that relates many macroeconomic variables to RER levels; it is relatively rich, finding different correlations between them. Among studies dealing with this issue, the one of [Ofair, R. & S. M. Collins \(1997\)](#) which explains the RER fluctuations by absorption, production shocks and money supply variations, extractingthat RER increases significantly with capital flows and terms of trade in the long run term anddecreases with the trade balance, but has a slightly significant association with the monetary policy in the developing countries, contrary to the industrialist countries apropos of the trade balance and the capital flows but also,that the absorption and the monetary shocks appreciate significantly the RER in the industrialist countries while the production shocks depreciate it in the developing ones.

According to [Dufrenot J. G. & E. B. Yehoue \(2005\)](#), the trade openness decreases the RER and its equilibrium level, also a rise of the governmental consumption leads to increase the RER but not always significantly in countries with a low revenue; the impact of those fundamentals is relatively more significant in countries with median revenue than the low one while the flows of net foreign assets increase the RER in countries with low revenue where the monetary policy and the exchange reserves are not significant as it is the case in countries with medium revenue except of the monetary policy.

While [Peter, B. & al., \(2004\)](#), argued that there is no significant causal association between exchange rate fluctuations and trade, therefore it's not important for trade development but this doesn't cancel the possibility of hard volatilities of exchange rate which could affect other

channels of the same economy. Ricci L.A. & al. (2008), has demonstrated that RER increases significantly at the equilibrium level, whereas the governmental consumption rises while the trade terms improve or again while the country accumulates net foreign assets; then a country which decides to liberalize its external trade, registers a decrease of its equilibrium ERER and in countries where the prices are controlled its reduction rise significantly the ERER.

Gala, P. (2008), brought more theoretical elements to the connections between RER levels and economic development and by providing new econometric evidence for the negative effects of overvaluations on growth, the results point out to the relevance of RER levels and policy to GDP per capita growth rates therefore the RER levels may have an important impact on real per capita income growth rates. A study by Imed, D. & R. Christophe (2010), searches for the nominal exchange rate's devaluation impact on the economic performance through analysing their evolutions, indeed the extracted results have shown a causal association between the NER and the production and their elements, also have revealed an inflationary negative impact of the currency's nominal value devaluation on the economic activity, but this devaluation could be useful to manage the crises of the balance of payments.

According to Goldfajn & Valdés, (1999), the ERER appreciates further to an amelioration of terms of trade and further to a lasting rise of the government consumption or of the world interest rates while it depreciates due to high and validated trade openness. In a work with the Euro zone, since 2000 which analyse the principal external shocks, namely: monetary, financial and real shocks, Jean-Baptiste, G. & G. Cyriac, (2010), revealed different feedbacks in the Euro zone, so if the oil and monetary shocks have the same impact on the most of countries, the financial shocks of the international imbalances have extremely different impacts, as well as the external shocks contribute in explaining 1/5 of the divergence of growth differential and the current balance, also approximately a 1/3 of the effective RER volatility in Europe, additionally to that, the oil shock's impact is significant but it devaluates € and the international imbalances explain an important part of the exchange rate volatility but they appreciate €, from the other side the response functions to the monetary and financial shocks are alike except for the current balance. In fact the financial shock requires an exit of capitals more than the monetary shock. A recent research suggests that leaning against an appreciated exchange rate can prevent an inefficient loss of tradable output but at the cost of generating a misallocation of resources in other sectors of the economy. Lama, R. & J. P. Medina, (2012).

The previous studies discussed the impact of exchange rates volatility on some macro-economic indicators as INF, GDP...etc., most of them agree about the association's nature which will be studied in this research dealing with the Algerian economic performance and to what range it is influenced by the exchange rate volatility using cointegration model and OLS method to answer the put forward statement.

II. Algeria's economy:

The Algerian economy is a small open economy due to the littleness of its GDP volume, but despite of the uncertain international economic environment; it has been doing relatively well. In 2010 Real non-hydrocarbon GDP growth reached 6% and total GDP growth was 3%, overall

inflation fell to 3.9% due to a fall in fresh food prices, while non-food inflation remained low and Unemployment continued to decline slightly to 10%; In 2011, growth was estimated to have remained solid and higher oil prices are strengthening Algeria's external balance and boosting fiscal revenues as the openness degree of the Algerian market attained 60.5%. The generally prudent macroeconomic management has enabled large external reserves to be accumulated (US\$16 billion since end-2010, reaching US\$178 billion at the end of 2011 and sizable budgetary savings to be built up in the oil stabilization fund, while substantially reducing debt levels. The outlook remains favourable in the short term, but fiscal sustainability and financial stability over the medium term have become more dependent on volatile oil prices. Due to pronounced state intervention and one-sided dependency on hydrocarbon exports, the Algerian economy remains highly vulnerable to price shocks – both for its exports, as observed during the sharp decline in global oil prices (2008–2009), and for its imports, as seen in the dramatic rise of food prices in 2008 and again in late 2010. Under these circumstances, the Algerian government was less effective than before in implementing its formerly prudent fiscal management.

Between 1980 and 2010, Algeria's HDI rose by 1.4% annually from 0.44 to 0.68. Compared to 2009, the country rose 20 ranks in the overall HDR ranking to the 84th position out of 169 countries. Thus, Algeria has been classified as one of the four “highly developed” African countries below Libya (53rd), Mauritius (72nd) and Tunisia (81st). Algeria is placed well above the regional average (HDI increase from 0.39 in 1980 to 0.59 in 2010) and ranks 9th among the MENA countries. Not surprisingly, according to HDR, Algeria ranks behind oil-rich Gulf countries and Libya. However, given the country's wealth in hydrocarbon resources and an overall successful macroeconomic record in recent years, it may come as a surprise to find Algeria ranking behind Tunisia and also Jordan. According to the Economic Freedom Index (Heritage Foundation) in 2011, Algeria ranks 132nd out of 179 countries, classifying the country at the lower end of “mostly closed” economies (in regional comparison: Morocco: 93, Egypt: 96, Tunisia: 100, Libya: 173, Mauritania: 134). Algeria's downgrade compared to 2010 (its score of 52.4 is 4.5 points lower than last year) reflects the worsened investment climate and the distorting impact of government spending and corruption. Also, the ranking shows that the regulatory framework is often undermined by complex bureaucracy and an inconsistent application of commercial laws. With the implementation of the macroeconomic stabilization program in the mid- 1990s, inflation was brought down from near 30% averages to low single-digit rates following 2000. Recently, it has increased from an average of 2.7% over the period from 2001 to 2005 to an (overall constant) average of 4.1% from 2006 to 2009. With which, domestic price pressures remained relatively high but constant in 2010. Inflation projections for 2011 stand at 4%. Inflation in Algeria has been driven in recent years by a number of factors, primarily by the dramatic rise in (hydrocarbon) export earnings with the crude oil price per barrel standing at all-time records around \$140 before plummeting in mid- 2008. Crude oil prices have been slowly rising again since mid-2009. Structurally, it has also been boosted by the devaluation of the U.S. dollar, as Algeria's hydrocarbon earnings are still denominated in dollars, while more than half of its imports are purchased in euros. Other factors contributing to the medium inflation level were Algeria's

ambitious infrastructure development projects and the increase in global commodity prices, given the share of the food price segment in the consumer sector, and monopolistic price rigidity in a number of product markets. On the other hand, subsidies and direct price controls on some essential commodities, including water, energy, and agricultural products, had an overall moderating influence on prices. While inflation did not erode Algeria's overall macroeconomic performance in the evaluation period, as evidenced for instance in the country's sound external financial position, low external debt and stable exchange rates, the decreasing purchasing power of the Algerian population was undoubtedly a factor in the riots of 2010 and early 2011. Faced with this situation, the government's tendency to cap prices for essential commodities by means of subsidies has become even more pronounced.

The Algerian dinar is not freely convertible to foreign currencies. The rate of the national currency is pegged against a basket of 14 foreign currencies and fixed by the Algeria's bank. The REER of the Algerian dinar in recent years hovered closely around the index value of 100 (2009: 103.2, 2008: 104.3, 2007: 99.0, 2006: 100.1, 2005: 100.0). The official exchange rate of the dinar against € has ranged between 90-100 dinars to one € between 2009 and 2011.

On the black market, however, one € was worth as much as 130 dinar in early 2011. The dinar has been partially convertible since 1995 for currency transaction transfers for foreign investors; residents as well as non-residents may hold foreign currencies (subject to some restrictions), and foreigners may hold foreign currency accounts. Abundant hydrocarbon exports since 2000 have buttressed the Algerian state's highly active stance in developing the country. Government spending rose to 35.4% of GDP in 2010. General government expenditure increased from 11.2% of GDP in 2006 to 13.9% in 2009.

Thus the conservative of the Algerian central bank 'Lakssassi' has affirmed that the net external financial status of Algeria stills strong at which the external debt were attained 3.4 milliard\$ in the last of 2013 facing 3.6 milliard\$ in the last of 2012, but its balance of payments was in deficit although the oil prices were increased with approximately 109\$ in the average during the first semester of 2013, also the exchange reserves decreased where the current account attained a deficit of 1.2 milliard\$ in the same period facing to 10 milliard\$ in the first semester of 2012, as he declared admonishing that the Algerian economy is in facing to an external shock like the one in 2009 where it aggravates by the continuous decline of the balance of payments fund due to the decline of oil revenues. The real effective exchange rate (REER) depreciated by 1.5 % during the first eight months of 2011; this reflects a depreciation of 2.2% in the nominal effective exchange rate in 2011, it remained broadly in line with its medium-term equilibrium level, which is linked to fundamental factors including oil prices and government expenditure.

Although, Algeria has had a solid economic growth during the past decade owing to increasing oil revenues and generally prudent macroeconomic policies nonetheless, Algeria continues to face important challenges, especially the need to diversify the economy, reduce youth and female unemployment, and meet other social demands. Algeria's growth remains relatively strong, but potential inflationary pressures are emerging.

III. Practical approach: (Empirical Analysis):

The economic approaches cannot be accurate and accepted if they could not be quantitatively approved so the econometrics has been found to facilitate their assay and examination, also the model should significantly explain the relationship between the studied economic variables, due to that, an econometric study will be applied on a set of economic variables and the nature of their influence on the Algerian RER using Cointegration test which requires doing the stationarity test then *Johansen* cointegration to know if there is a long-run relationship between variables.

1. Data and the Definition of Variables: This econometric study uses the cointegration approach estimated by ordinary least squares method OLS, employing annual data from Algeria over the period from 1970 to 2012, collected from different sources as the *World Bank* (www.worldbank.org/), World Development Indicators WDI Database, center of statistic economic social researches for Islamic countries SESRIC, united state statistics UNSD and the site of freedom in world. For further details, definition, explanation and expected effects of variables are as follow:

- 1.1. RER:** it represents the dependent variable of this model to estimate the optimal Algerian dinar's exchange rate; It is one of the important variables for the macroeconomic policies which represents the country's competitiveness worldwide (UNSD), and also captures the macroeconomic instability impact;
- 1.2. GDP (-):** is the real per capita income which represents the economic development, it can be obtained by division of real gross domestic product on the total of population evaluated by current prices. (World Bank); the expected sign of this variable is to be negative. An appreciation of the RER is predicted when developing countries economically converge towards developed countries in the Balassa-Samuelson effect. In this process, the productivity rises in the tradable sector more than in the non-tradable sector since the former is more exposed to international competition than the latter. The decreases in the prices of the tradable sector are relatively bigger than in the non-tradable sector, so it causes appreciation of RER.
- 1.3. INV (+):** represents the investment; It is calculated by the division of the gross fixed capital forming (GFCF) on government consumption as a ratio of GDP (SESRIC).
- 1.4. GOV (?):** represents the government spending as percent of GDP (SESRIC); its impact on the RER is ambiguous depending on the GOV composition of non-tradable that tends to appreciate the RER, while that of tradable leads to real depreciation, especially that Algeria is an oil country where higher oil prices lead to higher GOV, which in turn would appreciate the RER. However, the appreciation significance relies on a number of factors including the share of tradables and non-tradables in government consumption.
- 1.5. INF (-):** represents the annual inflation rates, it is a proxy for macroeconomic stability in the economy calculated via the evolutions of the prices index number (World Bank). A high ratio of inflation indicates a lower macroeconomic stability and real incomes, caused mainly by capital flows which appreciate money supply. (Rodriguez, C. M., 2006);

- 1.6. **OPEN (?)**: it represents the openness indicator of a country to the international trade, defined as sum of exports and imports expressed as a ratio of GDP ((export+ imports)/GDP). (World Bank); the expected theoretical impact of trade openness on the RER is mixed; (Egert, 2003) suggests that if OPEN represents the trade liberalization and reduces (increases) the demand for non-tradables, it should depreciate (appreciate) the RER. Nevertheless the production can improve with the openness so that can ameliorate the trade balance what will appreciate the exchange rate;
- 1.7. **FD (+)**: represents the criterion of the financial sector development, it is calculated by the bank loan in the private sector in relation to GDP (World Bank);
- 1.8. **POLSTAB (-)**: is the political stability indicator, (Political stability and lack of violence). (Freedom in world); the expected sign of this variable is to be negative.

2. **Model Specification**: Based on the previous theoretical and empirical studies dealing with the relation between the RER and the economic performance, the following model will be formulated to response the up forward study's statement:

$$RER = f(GDP, INV, GOV, INF, OPEN, FD, POLSTAB) \dots \dots \dots (1)$$

This model could be written as follow:

$$RER = \alpha_0 + \alpha_1 gdp + \alpha_2 inv + \alpha_3 gov + \alpha_4 inf + \alpha_5 open + \alpha_6 fd + \alpha_7 polstab + \epsilon_t \dots \dots \dots (2)$$

Where: ϵ_t is the error term; the coefficients $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7$ are the parameters to be estimated. The subscript t denotes time.

- 3. **Empirical Results**: As we previously mention this study follows a three stage procedure to explain the long run relationship between RER and other control variables:
 - 3.1. **Time Series Stationarity Test**: The first stage is to examine if the time series is stationary or not then the ADF test (*Augmented Dickey Fuller, 1979*) will be applied; if the time series is stationary at the level, it will be integral at level 0 "I(0)" but if it requires taking into consideration the 1st difference to make it stationary, it will be integral at level 1 "I(1)" and if it requires taking into consideration the 2nd difference to make it stationary, it will be integral at level 1 "I(2)". After, in the next step the PP test (*Phillips & Peron, 1988*) will be applied; this test will give significant estimations in the case of time series that have a serial correlation and an unstable variance Heteroscedasticity. The next table shows the results of ADF and PP tests upon "I(0)" and "I(1)" of all studies variables:

Table n° 01: The results of ADF and PP tests for the time series stationarity

Variables	ADF test		PP test	
	Level	1 st Differences	Level	2 nd Differences
RER	-1.512109 (0.5178)	-5.968474*** (0.0000)	-1.735377 (0.4066)	-5.984336*** (0.0000)
GDP	0.546517 (0.9864)	-6.216729*** (0.0000)	0.300196 (0.9756)	-6.294019*** (0.0000)
INV	-1.885411 (0.3358)	-6.526700*** (0.0000)	-1.910838 (0.3243)	-6.538820*** (0.0000)
GOV	-2.568238 (0.2960)	-5.096559*** (0.0009)	-1.795909 (0.3774)	-4.862115*** (0.0003)
INF	-2.060466 (0.2611)	-5.847276*** (0.0000)	-2.172460 (0.2186)	-5.851542*** (0.0000)
OPEN	-2.741643 (0.2263)	-4.880998*** (0.0016)	2.153587 (0.5020)	-4.819443*** (0.0019)
FD	-1.163507 (0.6810)	-4.799442*** (0.0003)	-1.138993 (0.6974)	-4.806624*** (0.0003)
POLSTAB	-0.202297 (0.9695)	-4.300583*** (0.0015)	0.755164 (0.9920)	-4.355628*** (0.0013)

*, **, ***: variables stationarity at 10%, 5% and 1% levels consecutively.

From the results of ADF and PP tests shown on table 01, we observe that all variables are not stationary at their first level, where the calculated values are inferior than the tabulated ones at 1%, 5%, 10%, therefore the time series are not stationary at their first level which led us to accept the null hypothesis with the unit root, but by applying the same test on the 1st differences, the results have shown that all variables are stationary at the 5% confidence level which means the calculated values are superior than the tabulated values, so we refuse the null hypothesis and accept the alternative hypothesis, therefore the time series stationarity at their first difference.

3.2. The cointegration test and the estimation of Vector Error Correction Model (VECM):

3.2.1. Determination of the optimum lags: For estimating the Vector Error Correction Model (VECM), we firstly calculate the number of the optimum lags which give the lower value to both AIC (Akaike Information Criteria) and SC (Schwarz Criteria).

Table n°02: The Number of Optimum Lags

Number of optimum lags	SC(Schwarz Criteria)	AIC (Akaike Information Criteria)
1	46.677	43.698
2	49.953	44.269
3	48.635	40.191

After testing the number of optimum lags, the results of *Akaike* criteria and *Schwarz* criteria have shown that the number of the optimum lags is one lag.

3.2.2. Johansen Cointegration Test: The cointegration test will be applied to know the number of integral relations between variables after making sure that the time series are stationary and integral upon the same level, so according to this, we conclude that there is long run cointegration relationship between the independent variables and the dependent one (RER) of the model. In order to affirm this conclusion, we will use the *Johansen* cointegration test as a different method, more general and more complete through the result of “ λ trace” test; this is what the results of the next table will show:

Table n° 03: The Results of Johansen Cointegration Test

Hypothesized NO. Of CE (s)	Eigen value	Trace statistic	0.05 Critical value	Prob**
R=0	0.739507	188.2648	159.5297	0.0005
R≤1	0.674061	133.1123	125.6154	0.0161
R≤2	0.470536	87.14946	95.75366	0.1687
R≤3	0.444246	61.07799	69.81889	0.2038
R≤4	0.356649	36.99341	47.85613	0.3478
R≤5	0.232001	18.90973	29.79707	0.4995
R≤6	0.163229	8.087077	15.49471	0.4562
R≤7	0.018861	0.780685	3.841466	0.3769

- *Trace test* indicates 2 cointegrating eqn(s) at the 0.05 level

Based on the previous table's results, *Johansen* cointegration test points out two significant positive values 188.2648 and 133.1123, which are superior to the critical values 159.5297 and 125.6154 successively at the 5% confidence level with a probability of 0.0005 and 0.0161 successively. Also we observe from this table that the two values of *trace* test are superior than the critical value at 5% level, therefore we reject the null hypothesis that banishes the existence of a cointegration vector because of the matrix rank π equal to 2, [**H0: (r=2)**] facing to the alternative hypothesis [**H1: (r>2)**]. According to the previous results, there is a cointegration relation between the independent variables and the dependent one in the long run term.

3.2.3. The estimation of Vector Error Correction Model (VECM): After affirming the existence of a relationship between variables, we move to estimate the Vector Error Correction Model for studying from a side the model's dynamic behaviour from a side and adjusting any unsteady case in the long run term from the other side.

$$\begin{aligned} (\text{RER}) = & -0.412048819315 * (\text{TCR}(-1)) + 8.18037895065 * \text{INV}(-1) - 2.54627324076 * \text{GOV}(-1) \\ & - 2.807028591 * \text{INF}(-1) - 5.13797490858 * \text{OPEN}(-1) - 2.0213925802 * \text{FD}(-1) - \\ & 17.359145036 * \text{POLSTAB}(1) + 91.6345869792 + 0.00612866081715 * (\text{GDP}(-1)) \\ & + 699.177004912 * \text{INV}(-1) - 453.507949511 * \text{GOV}(-1) - 213.724017768 * \text{INF}(-1) - \\ & 392.025632105 * \text{OPEN}(-1) - 135.197224195 * \text{FD}(-1) - 2043.86234811 * \text{POLSTAB}(1) \\ & + 8245.54528219 + 0.102137326066 * \text{D}(\text{TCR}(-1)) - 0.00211887395874 * \text{D}(\text{GDP}(-1)) - \\ & 0.128369269202 * \text{D}(\text{INV}(-1)) + 0.278100088464 * \text{D}(\text{GOV}(-1)) - 0.000852706642622 \\ & * \text{D}(\text{INF}(-1)) + 0.349314128509 * \text{D}(\text{OPEN}(-1)) + 0.0319361590857 * \text{D}(\text{FD}(-1)) + \\ & 9.37519485555 * \text{D}(\text{POLSTAB}(-1)) + 0.514337833206. \end{aligned}$$

It's known that the VECM estimate the economic relations taking into consideration the error term, the lags and the cointegration degree of variables. This results show that the value of adjustment coefficient (the estimated parameter of the Error term Correction in the RER equation) is significant negative attaining -0.412049 what means that the term of correction error helps in explaining the RER evolution.

3.3. Model's Estimation Using Ordinary Least Squares Method:

Estimating the equation 02 with the OLS method, has given the following results:

$$\text{RER} = -51.71665 + 0.014473 \text{ GDP} + 0.570694 \text{ INV} - 0.601097 \text{ GOV} - 0.263978 \text{ INF} \\ + 0.261140 \text{ OPEN} + 0.161351 \text{ FD} - 21.03463 \text{ POLSTAB};$$

$$t = (-4.122897) (9.942689) (3.796381) (-1.314616) (-2.260387) (2.439054) (2.919167) (-5.510966);$$

$$\text{SE} = (0.0002) (0.0000) (0.0006) (0.1972) (0.0301) (0.0199) (0.0061) (0.0000);$$

$$\text{R}^2 = 0.929; \quad \text{R}^- = 0.915; \quad \text{DW} = 1.172; \quad \text{F(Prob)} = 0.000.$$

4. Findings and Discussion:

The statistical analysis depends on the econometric tools for testing the model's quality through comparing the statistic results with the economic theory and proving if they conform with each other or not. Based on the shown results, the relation between the independent variables and the dependent one is too significant through the correlation coefficient **R2: R-squared** which approaches to 1 and this means that the obtained results are good and they affirm the existence of a relationship between the RER and the variables of the macro economy in general and the Algerian economy in particular. The annex n°02 shows:

- At the level 5%, the parameter (α_0) influence significantly and negatively the RER;
- At the level 5%, GDP is significantly positive, therefore there is a positive relation between GDP and RER because this later increases (the domestic exchange rate decrease means that the domestic prices are more attractive than the relatively high foreign prices what leads to increase the overall income level), so the RER has a positive impact on the GDP through the production and exportation channels;
- At the level 5%, INV is significant positive which means that RER's increase and the local currency decrease stimulate the domestic investment, therefore the trend toward domestic products which are more competitive than the foreign products which are less demanded, what encourages the local production and raises the exporting capacity;
- GOV is insignificant what explain why this variable does not influence the RER, and the negative sign (negative relation between the two variables) indicates the followed policy by the government where the excessive governmental expenditure leads to increase RER;
- About INF, it has a negative relation with RER but at the level of 5%, because INF is the continuous increase in the general prices level during a period where this increase affects the domestic demand of products and services leading to increase their local prices which in return affects the exports prices leading to decrease their external competitive capacity, and at the same time the demand of imports raises which negatively affects the current account movement then the balance of payments therefore affecting the exchange rate stability;
- OPEN is significant positive at the level 5%, which means its relation with RER is extrusive, but this does not conform with the economic theory, whereas the Algerian economy knows widely the challenges of openness aspects through its high rely on petroleum revenues and the weakness of its productif sector contributing less in exportations value at which the Algerian dinar's RER has registered a palpable decrease despite of the increased imports value and the decreased exports value out of hydrocarbon;
- FD is significant positive at the level of 5%, therefore a extrusive association between RER and the ratio of local loan for the private sector relative to GDP that measures to what range the banking system is developed about the endowment of loans and facilitations to the private sector as well as its role in gathering informations, varying risks and filling savings;
- Finally, POLSTAB is significantly negative at the level of 5% which proves that it has a reverse relation with RER, it represents the state's shocks whether they are successful or unsuccessful including wars, but it is considered as barrier in front of the economic development, therefore it affects the economic and financial activities.

IV. Conclusion:

The transfer to the market economy was the direct objective of the economic reforms that Algeria has started since the oil crisis in 1986 in order to limit the balance of payment disorder and also the external shocks consequent of the foreign exchange reserves weakness in that period, as it has known a stability since 2000, where the adequate world environment about oil prices and their good control contributed in realizing the net external financial status till 2006.

The RER is an indicator of worldwide country's competitiveness; this is why we examined its econometric relation with other macro-economic indicators in Algeria (GDP, INV, GOV, INF, FD, OPEN, and POLSTAB) in light of the available economic and statistical data. The aim of this study was to measure the economic impacts of RER on the economic performance indicators during the period 1970-2012, applying both of cointegration model and OLS method; afterwards, the experimental results have shown that the RER plays an important role in associating the domestic economy to the world economy, wherein it is the linkage tool between goods services values, assets and prices in the local market, for that the declined foreign exchange rate makes the price of foreign goods more competitive in relation to the local ones from a side, and reduces the ability of this later to compete in the external markets from the other side, and vice versa, therefore the most important recommendations that could be suggested are the attempt toward realizing more flexible exchange rate through the quantitative models depending on the economic indicators which have a direct impact on it and the fairness from the administrative decisions for determining the exchange rate in addition to the rise the productive power of the local economy in all sectors in order to rise the national production and diversify it without depending only on hydrocarbons which represents more than 95% of the Algerian exports that are mostly oriented toward USA and Europe in order to boost the forming of foreign exchange reserves and their uses in the monetary policy management, and also to maintain the stability of the exchange rate according to the economic data.

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