

Indexes of Effective Exchange Rates of the Algerian Dinar: Nominal and Real a Study (2010-2017)

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Abstract: The indexes of nominal effective exchange rate (NEER) and real effective exchange rate (REER) are used as indicators of international competitiveness. The NEER is the weighted average of bilateral nominal exchange rates of the home currency in terms of foreign currencies important to home trade. It measures the movement of the home currency against the relevant currencies with indications on import prices and export demand. Conceptually, the REER, defined as a weighted average of nominal exchange rates adjusted for relative price differential between the domestic and foreign countries, relates to consumer price index and reflects not only nominal exchange rates but also inflation differentials with trading partners, and is a measure of external competitiveness. The aim of this study is to present the calculation of nominal and real effective exchange rate indexes values on the basis of consumer price index methodology for Algerian dinar for the period 2010-2017. In general, there are two problems associated with the conversion of the NEER to the real effective exchange rate (REER). First, there is an issue of what type of price index to use. There are several indexes including the consumer price index (CPI), the wholesale price index (WPI), the unit labour costs (ULC) and the deflator gross domestic product (GDP). Second, data availability and data quality. Each type of effective exchange rate can be constructed in different ways depending on the calculation of trade weight and the method of averaging. The results are shown for the period 2010-2017 there have been significant changes in Algerian dinar's nominal and real effective exchange rate (ANEER and AREER). Between 2010-2017, although the effective exchange rates of Algerian dinar against 19 currencies was relatively unstable, Algeria's NEER and REER depreciated unsteadily by 19.66 % per cent and 8.59 % per cent ,respectively due to relatively higher inflation and lower productivity in Algeria compared to that in trading partners this resulted in the deterioration in international competitiveness of Algerian products.

Keywords: Effective exchange rates, Algerian dinar indexes of effective exchange rates, Nominal effective exchange rate and Real effective exchange rate.

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I. Introduction

The effective exchange rate (EER) for a particular currency represents its exchange value against a weighted group of other currencies .The group is usually weighted for trade with the country issuing the currency. For an open economy, the exchange rate of its currency is a key price. If the exchange rate is relatively high, the international competitiveness of local companies is adversely affected even if they have low production costs and high productivity. On the other hand, a low exchange rate can benefit exporting companies or local companies that compete with imports. The effective exchange rate is an indicator that captures the international competitiveness of a currency, which cannot be measured by only examining bilateral exchange rates. A common way of measuring is to use an index that includes a number of currencies. Information from bilateral exchange rates is extracted to construct an index of the effective exchange rate. Such an index is usually constructed to measure the impact of exchange rate movements on trade in goods and services an index of competitiveness. According to (Edwards S. ,1989,p.24) four alternative price indices are suggested as possible candidates for estimation the real effective exchange rate. The following price indices were suggested: Consumer price indices, domestic and foreign-CPI, Wholesale price indices, domestic and foreign-WPI, GDP deflators and wage rate indexes-WR. In addition to those indices there are several more that can be used for the constructing the real effective exchange rate. The EER nominal and real is expressed as an index number which shows the average increase, appreciation (above 100) or average decrease, depreciation (below 100) compared to base year (base year=100).

Generally, there are two indexes that can measure the competitive position of an economy, namely the nominal effective exchange rate index (NEER) and the real effective exchange rate index (REER). These two indexes are indicators to grasp an economy's international competitiveness in terms of its foreign exchange rate. However, there is no consensus on the choice of foreign currencies in the calculation and the appropriate weights of the currencies to be used. Nevertheless, in compiling the indexes, most countries basically follow the

methodology set forth by the International Monetary Fund (IMF), with the NEER calculated as a geometric weighted average of changes in bilateral nominal exchange rates of the domestic currency against currencies of trading partners as compared to period of time. In addition, international competitiveness is not only affected by the exchange rate but also by a number of variables, such as interest rate, inflation rate, money growth rate, expectations on these variables, etc. Taking this into account, the nominal effective exchange rate is adjusted to incorporate these differences, and the indicator so calculated is called the real effective exchange rate. In this respect, REER values above 100 signify a downward trend in the country's competitiveness relative to the base period, whereas an REER below 100 means rising competitiveness of the country relative to the base period. The REER summarises movements in relative prices with the partner economies, and other things being equal, the domestic economy becomes (less/more) competitive when the real exchange rate appreciates or depreciates, regardless of the movements of the nominal effective exchange rate. Real effective exchange rate (REER) is a useful summary indicator of essential economic information. It has occupied a major place in theoretical discussion between economists. The REER is commonly used as a measure of international competitiveness of the traded goods sector and a measure of the standards of living in one country relative to another (trading partners), also determines and influences the performance of export sector (Caballero and Corbo, 1989), (Turner, P. and Van't Dack, J, 1993), (Maciejewski, E.M, 1983), (Rhomberg, R.R., 1976), (Artus, J.R. and Rhomber, R.R., 1973) and (Hirsch and Higgins, 1970). Added to that, changes in the real exchange rate are seen as an important part of the adjustment process to real shocks. Movements in the real effective exchange rate may significantly affect inflation and output in transition economies. They can also signal currency crises.

. It has occupied a major place in theoretical discussion between economists. The concept of an effective exchange rate was developed when the collapse of the Bretton Woods system robbed the simple bilateral dollar rate, which up to then had dominated post-war discussions, of much of its meaning. According to a Bank for International Settlements (BIS) economic paper on measuring international cost and price competitiveness (Turner and Van't Dack, 1993) three elements are important for ensuring proper construction and interpretation of nominal effective exchange rates:

- (1) The choice of currencies to be included;
- (2) The weighting structure to be assigned to the set of currencies;
- (3) And the base period.

This study focuses on the methodology and the data used in compiling the effective exchange rate nominal and real indexes of the Algerian dinar. Taking into account the change in Algeria's trade structure and the international monetary environment in recent years, we also revise the effective exchange rate indexes for the Algerian dinar (for example Tunisia, Morocco, Turkey and China). The study is organised as follows. Following this introduction, a brief review of different methodologies for compiling effective exchange rate indexes. Discusses the current of Algeria's NEER and REER. Considers the computation of consumer price index (CPI)-based real effective exchange rate indicator of Algeria AREER. Concludes the study, while laying down the foundation for further studies of alternative measures of effective exchange rate nominal and real for the Algerian dinar.

II. Literature Review

When one tries to compute indexes of effective exchange rate between a developing country on the one hand and between major trading countries then the adequacy of such indexes may come into question. The index of effective exchange rate, as suggested by (Hirsch and Higgins, 1970), (Rhomberg, 1976) and others IMF (Wickham, P., 1987, Bayoumi, T., Jaewoo, L. and Jayanthi, S., 2004, Bayoumi, T., Lee, J. and Jayanthi, S., 2005, Bayoumi, Tamim, Jaewoo Lee, and Sarma Jayantha, 2006 and Zanello, Allesandro, and Dominique Desruelle, 1997), OCDE (Durand M, J Simon and C Webb, 1992 and Durand M. 1986), BIS (Koch, E., 1984 and Klau, M. and Fung, S.S., 2006), Bank of England (Birone Lynch and Simon Whitaker, 2004 and Roy Cromb, 1998), FED (Leahy, Michael, 1998, Acree, Bryan, 1999, Jack I. Hervey and William A. Strauss, 1987 and Loretan, M., 2005) and ECB (Buldorini, L, S Makrydakis and C Thimann, 2002, Schmitz, M., De Clercq, M., Fidora, M., Lauro, B. and Pinheiro, C., 2012 and European Central Bank, 2004) and JPMORGAN (Morgan Guaranty Trust, 1983 and 1986), does not seem to consider some major methodological and conceptual issues involved in the construction and interpretation of the various indexes. More specifically, the informational content of different indexes and their interpretation in relation to different market conditions needs to be analyzed. Moreover, the indexes already summarized do not seem to differentiate between the nominal and real effective exchange rate. (Maciejewski, 1983) states that a meaningful interpretation of the various nominal and real exchange rates depends on the combination of four issues, namely the proper choice of a base period; the proper choice of weighting and the policy question being addressed; the plausibility of the relative price or cost indicator, and the mathematical formulation. After recognizing that the effective exchange rate should be an index and be expressed in relative terms, Hirsch and Higgins defined an effective exchange

rate of any given currency as the percentage direct change in the numeraire rate (Rhomberg ,1976) elaborates more on the construction of indexes of exchange rate and discusses issues that have to be taken into consideration when constructing effective exchange rates. Like Hirsch and Higgins he confines his analysis to developed western economies. In other words, the unique conditions and characteristics of developing countries are not taken into consideration. When considering the choice of a base period in the construction of an index, Rhomberg states that the base date should be chosen in such a way that the period is as close to the equilibrium rates as possible. According to Rhomberg, weighting is an important issue in constructing an effective exchange rate index. The choice of weights is said to depend on the objective of the study or on the economic analysis. One may have as many weights (indexes) as the number of policy issues that one wishes to analyze. In Rhomberg's words, the proper choice of weights depends, therefore, on the particular policy objective selected as focal point of the index. For different objectives, indexes employing different weighting schemes would be appropriate (Rhomberg, 1976, p.89). Rhomberg discusses seven indexes that are commonly used by various financial institutions. The author states that it is generally difficult to compare the various indexes because they may differ on the choice of the sample countries included, the base period and the data inputs. Even though Rhomberg considers seven different indexes, there are essentially four, while the other remaining three are simply extensions. One major issue that Maciejewski addresses in appraising various indexes is the need to link economic theory as related to exchange rate movements and the process of index construction. Again this link can only be realized by considering one issue at a time.

This study looks at the adequacy and consistency of exchange rate indexes for the Algerian dinar. Such indexes have been estimated for many developed countries since the early 1970s (Hirsch and Higgins ,1970) were among the first to develop this concept of effective exchange rate and (Bahmani-Oskooee ,1995), (Bahmani-Oskooee and Mirzai ,2000), (Bahmani-Oskooee, Mohsen, 2001), (Bahmani-Oskooee and Gelan ,2007), (Bahmani-Oskooee and Kandil ,2007), and (Bahmani-Oskooee and Harvey ,2007) make attempts to calculate the effective exchange rates for developing countries. The indexes are adequate for comparing exchange rate movements between industrialized countries and with comparable economic performances. However, in a world where currency floating is the order of the day, a fixed exchange rate is inappropriate. This raises the question as to the exchange rate of an Algerian dinar against the major trading partners of the country under consideration. In order to calculate the effective exchange rate of an Algerian dinar at a given time, one needs to identify that country's major trading partners. Once the major trading partners have been identified the next step is to devise an index form that expresses an average change in the exchange rate of an Algerian dinar against the currencies of its major trading partners (19 currencies). The simplest way of doing this would be to calculate the simple arithmetical mean of individual bilateral exchange rates; moreover, this approach is valid only if each trading partner has the same share of trade with the particular country under study. This is obviously not the case. The most reasonable approach would be to have a weighted average of bilateral exchange rates. The latter method is what is known as an effective exchange rate. They recognised that, for analytical purposes, the exchange rate of a particular currency should reflect the evolving relationship between that currency and all other currencies. They also identified that the effective exchange rate should be an index and should not be expressed in absolute terms, and that only the currencies of major trading partners (not all the currencies) should be included.

The effective exchange rates (EERs) are adjusted for such changes. In contrast, nominal EERs are calculated as geometric weighted averages of bilateral exchange rates of a currency against those of a country's major trading partners. A rising index normally signifies appreciation of the Algerian dinar and a falling index depreciation. However, nominal EERs are not adjusted for price movements. The more prices in Algeria increase, the more price competitiveness of Algerian products are reduced. Therefore, even if the nominal exchange rate does not change, it will have the same impact as an appreciation of the Algerian dinar. On the contrary, if the prices in Algeria's trading partners rise, it will have the same effect as a depreciation of the Algerian dinar. From this consideration, the real EERs would be calculated by adjusting the nominal EER for the bilateral price inflation differentials between Algeria and its trading partners. Finally, real effective exchange rate indexes are calculated as a rule to obtain information about a country's international competitiveness. Bilateral exchange rates are therefore weighted together so that they mirror the importance of other countries as trading partners. It turns out that discrepancies can arise mainly in connection with the number of countries that are included in such an index. This seems to be due, above all, to differences in rates of inflation. The differences between real indexes are therefore usually considerably smaller, regardless of how many countries are included (Bank of Japan, 2009; Brodsky, D.1982; Boshkov, S.,2004; Cooper, S., 1988 and Ellis, L. ,2001) . It can be of interest to work with a variety of indexes, particularly in the event of large exchange rate movements for countries that are not currently included in the existing EER index.

III. Methodology And Data

The effective exchange rate (EER) is a summary measure of the rate at which a country's currency exchanges for a basket of other currencies, in either nominal or real terms. Effective exchange rates become relevant when a country conducts trade and investment transactions with a number of other countries. These rates can vary along several dimensions, including country coverage, weighting, and whether or not the effect of inflation is taken into account (i.e., the distinction between nominal and real). The real effective exchange rate (REER) is subject to greater methodological debate than is the nominal effective exchange rate (NEER), since the NEER requires only data on trade volumes, and the REER requires price indexing. In theory, the REER contains information useful to estimating the future growth in exports and imports for a country since it expresses the overall premium that consumers in that country pay relative to consumers in the country's trading partners. If the REER is high, then the currency is cheaply valued relative to its domestic purchasing power; exports will be expensive, while imports will be cheap (Ha, J. and Fan, K.,2003 and Chinn, Menzie. ,2006) . Movements in REER and NEER indexes would indicate whether REER and NEER has been stable, appreciating or depreciating.

3.1 Methodological Features

The main objective of the effective exchange rate (EER) is to summarize the effects of currencies appreciation and depreciation against foreign currencies on the international competitiveness of local country products relative to goods produced by important trading partners of the local country. Several key issues are considered for actual calculation for example, export competitiveness. The nominal effective exchange rate of a country or, equivalently, the trade weighted currency index of the country aims to track changes in the value of the country's currency against the currencies of its main trading partners. The real effective exchange rate or, equivalently, the relative price and cost indicators aims to assess a country's external competitiveness in terms of prices and costs against its main competitors in international goods and services markets. The methodologies used for the computation of the effective exchange rates differ between the International Monetary Fund (Black, Stanley W.,1976) , European Central Bank (Martin Schmitz, Maarten De Clercq, Michael Fidora, Bernadette Lauro and Cristina Pinheiro, 2012 and Solomou, S. and Catão, L. ,2000) and OECD (Durand Martine , 1986) . In our research specifically, the NEER is calculated as a weighted geometric average of the bilateral exchange rates against the currencies of trading partners countries (19 currencies) and reported as an index; a rise in the index indicates a strengthening of the currency. The REER corresponds to the NEER deflated by CPI; a rise in the index signifies a loss of external competitiveness. The REER is a key macroeconomic relative price, which plays an important role in the broad allocation of resources in production and spending behaviour in the economy.

3.1.1 Choice of Index Formula

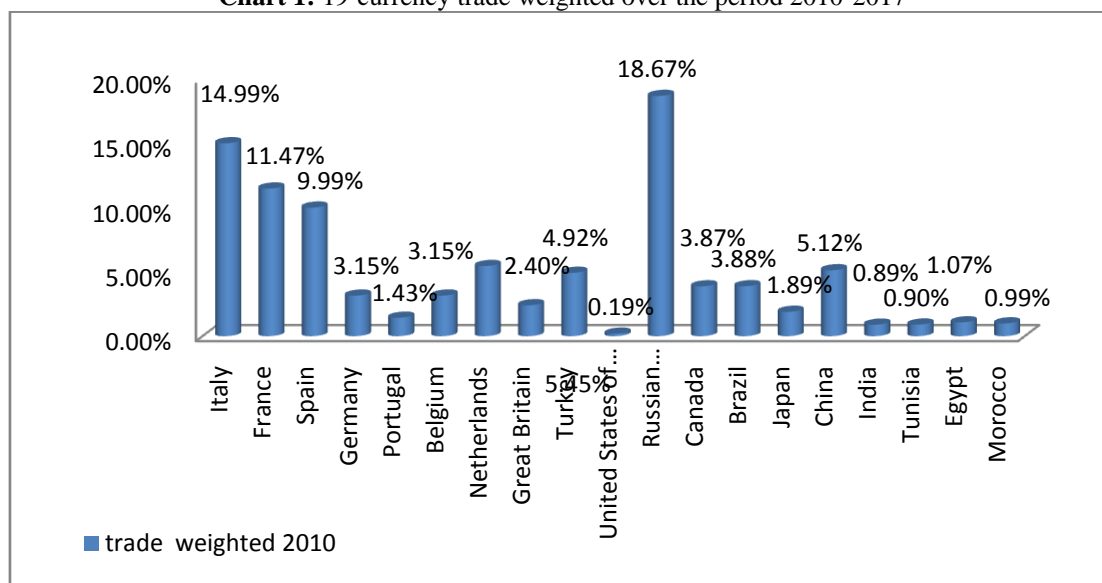
The practice followed by the staff of bank of Algeria and by that of several other central banks such as (FED , ECB , BOJ (Shimazaki, M. and Solomou S. ,2001) , BANK of ENGLAND , Bank of Canada (Ong, J. , 2006) and Bank of New Zealand (Steenkamp, D.,2014 and Kite, H. ,2008), international organizations (IMF, WB , JPMORGAN and BIS), and private-sector financial institutions are to use exchange rate indexes that are geometrically weighted averages of bilateral exchange rates (Erlandsson. M. and A. Markowski ,2006).

3.1.2 Design of Currency Weights

To create an operational exchange rate index, one must not only choose a formula for aggregating bilateral exchange rates into a single number but also devise methods for calculating the weights of those currencies and for selecting the currencies to be included in the index. Because the bank of Algeria's exchange rate indexes are intended primarily to measure the competitiveness of Algeria goods in international trade, the exchange rates in the indexes are those of economies that figure importantly in international trade with the Algeria. These economies can be important either because the Algeria imports substantial amounts of goods from them or because the Algeria exports products that compete with goods produced in those economies. Exchange rates influence international competitiveness because they affect the relative prices of goods as perceived by sellers and buyers. The weights associated with each of the currencies are designed to reflect the importance of the respective economies for trade competition. Competition in traded goods occurs in both domestic and foreign markets. In Algeria markets, goods that are produced abroad and are imported to the Algeria compete with domestically produced goods. The weights that represent the structure of currencies used in trade transactions. The weights that correspond to shares of foreign trade partners in the amount of total trade in Algeria. There are two methods available for the determination of weights. In one method, the weights represent the structure of currencies used in trade transactions (currency weights); in another, the weights represent the structure of foreign trade (trade weights). According to these approaches of defining weights, we develop several measures of weights. The main weights in the index are presented in the chart 1. In the chart 1

below depicts Algeria’s trade-weighted index, taking into account 19 currencies of different countries depending on their trade (imports plus exports) with it. Following countries sorted by significance have fulfilled this condition Italy ,France Spain ,Germany, Netherlands, Portugal , Turkey, Great Britain ,Russian Federation ,USA ,Canada ,Brazil ,Argentina, Japan ,China, Egypt ,Tunisia and Morocco. Tunisia , Morocco , Egypt ,were added to the selection due to the strong growth of its foreign trade with Algeria over the period 2010-2017 and included in the revised series of ANEER/AREER .The major trading partners of Algeria are Italy ,France ,Germany, Spain ,Portugal, Belgium, Netherlands, Turkey ,Great Britain , USA , Canada , Brazil , Japan, China , India , Egypt , Tunisia and Morocco. These countries and regions cover 86 % of Algeria's total trade (imports and exports). After the selection the shares of above mentioned trading partners were normalized in order to sum up to 1. Weights of the 19 selected countries W_i , that are necessary for the effective exchange rate computation, were obtained in the process. The selection of countries is based on their importance as trading partners of the Algeria and on data availability, particularly in respect of the high quality data on price and cost indicators required for calculating the AREER. The trade weights used cover 19 countries, and reflect the aggregated trade flows in merchandise trade for the year 2010 and 2017. The period for setting the ANEER to 100 is 2010.The coverage has also been revised for the 19-country AREER/NEER indexes. With an objective to broad base the AREER/ANEER and also to highlight Algeria’s changing trade pattern, countries have been chosen in the new series based on three broad criteria: The share in Algeria’s trade; Regional representation ;And the regular availability of data on exchange rates and prices on an annually basis.

Chart 1: 19-currency trade weighted over the period 2010-2017



Source: Author's own calculation based on different sources of data such as: central bank of Algeria International financial statistics, national office of statistics, World Bank and Algerian customs, Various years from Microsoft Excel.

3.1.3 Deflators

The Algerian dinar real effective exchange rates indicators measure the external competitiveness of the Algeria in terms of prices or costs relative to their trading partners. These indicators are defined as the relative prices between the Algeria and its partner countries expressed in a common currency and are constructed by deflating the NEER index using appropriate price or cost indexes. The real effective exchange rates belong among principal indicators of price competitiveness. There exist two main approaches to their calculation: one based on the comparison of foreign and domestic price levels, the other based on the comparison of development of domestic prices of tradable and non-tradables. While CPI is more representative of the cost/inflationary conditions in the markets to which most of Algeria’s exports are directed, WPI reflects the producer costs (Gabriel Di Bella, Mark Lewis, and Aurélie Martin, 2007).

3.1.4 Base Period and Frequencies

In order to calculate a nominal and real effective exchange rate series, the appropriate base year where the macroeconomic internal as well as external balance is fulfilled should be chosen. Internal balance is a situation in which real output is close to its potential level and the inflation rate is low, while external balance is considered as a current account position sustained by capital inflows or export revenue, and the level of

international reserves is adequate and stable . However, it is impossible to find an appropriate year for all countries surveyed. Therefore, we choose the year where Algeria’s macroeconomic internal as well as external balance is relatively fulfilled. The base period for Algerian dinar indicator is 2010 (2010=100). It does not relate to any notion of an equilibrium value of the Algerian dinar. The choice of the base year 2010 is attributable to the significant changes in the macroeconomic environment due to structural reforms introduced in the wake of balance of payments crisis in 2008-2009. Algeria adopted a market determined exchange rate regime since 2000. This is also supported by generally stable macroeconomic and external sector performance during that year.

3.1.5 Data Sources

The basic source for data on exchange rates, trade (imports and exports) and consumer price index (CPI) for 19 countries are the international financial statistics (IFS) of the international monetary fund and world development Indicators (WDI) of world bank. Data on Algeria’s trade with these 19-countries/regions has been taken from central bank of Algeria (CBA), Algerian customs and national office of statistics.

3.2 Nominal Effective Exchange Rate

The nominal effective exchange rate (NEER) index shows the appreciation (above 100) or depreciation (below 100) of the Algerian dinar against a basket of selected currencies for a certain period relative to a base period (base period =2010) . According to the interpretation of the international monetary fund the NEER may be calculated using various methods. Owing to its symmetry, the most widespread method appears to be the weighted geometric average of nominal exchange rates, taking into consideration the shares of the Algeria republic’s largest trading partners in total exports and imports (total trade). The process begins by first calculating Algerian dinar’s nominal effective exchange rate (ANEER) index which reflects the value of the Algerian dinar relative to the value of the currencies of its major trading partners, with reference to a specific base period (Des Vignes and Smith,2005). Using the geometric mean, the formula for computing the nominal effective exchange rate can be calculated as follows:

$$ANEER = \prod_j^n (E_j)^{W_{jt}}$$

Where :

ANEER = Algerian nominal effective exchange rate index in a given period (t)

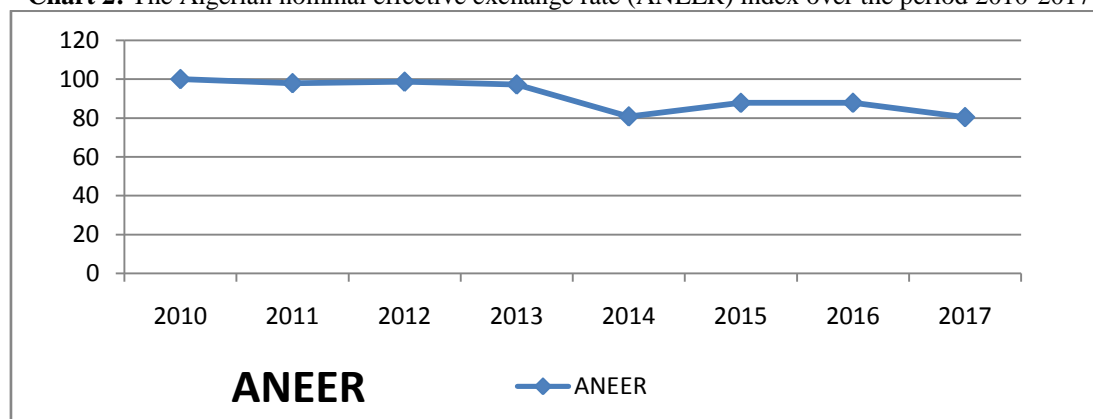
E_j = Price of foreign country (j) currency in terms of the home country (i) currency in period (t) expressed as an index form (base =2010).

W_{jt} = the appropriate trade weight for each trading partner (j) in period t (weight for country j) note that $\sum_{j=1}^N W_{jt}=1$

∏ = is the product of the N currencies in the basket

n = the number of countries in the basket 19 currencies.

Chart 2: The Algerian nominal effective exchange rate (ANEER) index over the period 2010-2017



Source: Author's own calculation based on different sources of data such as: central bank of Algeria, International financial statistics, national office of statistics, World Bank and Algerian customs from Microsoft Excel.

As shown in the chart 02, the ANEER provides useful information about the movement of the Algerian dinar over the time 2010-2017. It is a measure of the value of the Algerian dinar against a trade-weighted basket of other currencies, relative to a base date 2010. The weights used are designed to measure the relative

importance of each of the other countries as a trading partner. During the period 2010-2017, the ANEER of the Algerian dinar depreciated and continuing till the end of 2017 because the slipping policy of the Algerian dinar. This is mainly driven by the movements of the Algerian dinar against Euro, USD and GBP. As shown in the chart 03, movements in the nominal effective exchange rate (ANEER) are reflected in the evolution of the real effective exchange rate (AREER), but not with the same magnitude. This shows a general tendency for the value of Algerian dinar to fall relative to other currencies during this period. This calculation has the advantage that it enables us to assess immediately the extent to which the exchange rate has appreciated, fixed or depreciated. In this case we see that the value of the Algerian dinar relative to the 19-country mentioned above depreciated between 2010 and 2017.

3.3 Real Effective Exchange Rate

The nominal effective exchange rate (NEER) is not adjusted or deflated for a corresponding change in relative prices. If the NEER is applied to study the effect of exchange rate policy, then the "real" exchange rate effect may not be isolated. This is because the NEER may also include the effect of inflation differentials between a country under consideration and its partners. Thus, in order to isolate the pure exchange rate effect on export performance, the NEER may have to be deflated so as to arrive at the REER. Unlike the NEER, the real effective exchange rate (REER) may not be used to measure the effect of undervaluation or overvaluation of a currency. In this particular case, the REER may be interpreted as a gain or loss in international price competitiveness between the current and the base period. To obtain the AREER for the Algerian dinar, the ANEER is deflated by the respective consumer price index of partner countries. The AREER released by the central bank of Algeria (CBA), is computed as the weighted geometric average of the prices in Algeria relative to the prices of its principal trade partners in international markets (Hinkle, 2000, p.49). The real effective exchange rate can be formulated as follows:

$$AREER = \prod_j^n (E_j \cdot P_i/P_j)^{W_{jt}}$$

Where :

AREER = Algerian Real effective exchange rate index in a given period (t)

E_j = Price of foreign country (j) currency in terms of the home country (i) currency in period (t) expressed as an index form (base=2010).

P_i = Index of the cost (or price) indicator of home country i (Algeria).

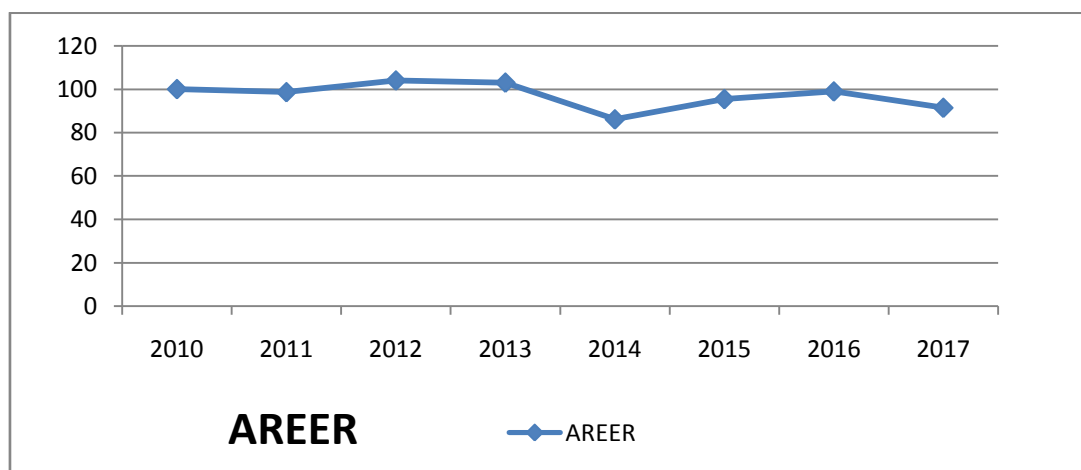
P_j = Index of the cost (or price) indicator of partner country j (19-country).

W_{jt} = the appropriate trade weight for each trading partner (j) in period t (weight for country j) note that $\sum_{j=1}^N W_{jt}=1$

∏ = denotes the product of the variables.

n = the number of countries in the basket 19 currencies.

Chart 3: The Algerian real effective exchange rate (AREER) over the period 2010-2017



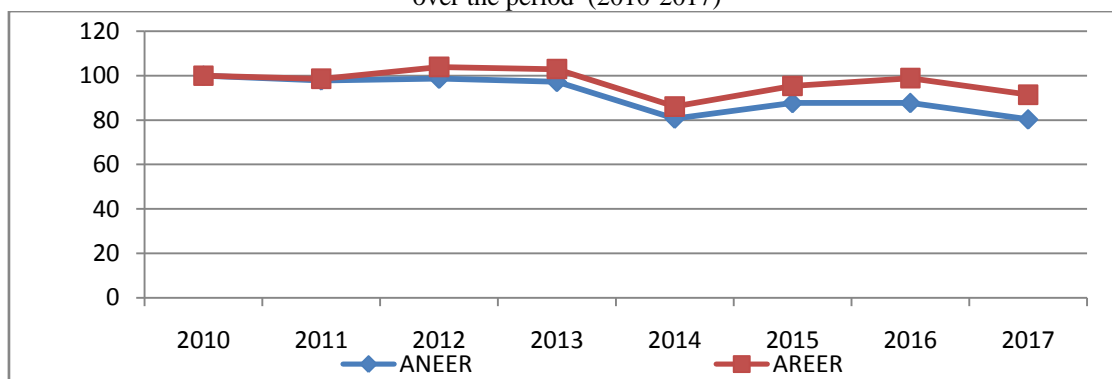
Source: Author's own calculation based on different sources of data such as: central bank of Algeria, international financial statistics, National office of statistics, World Bank and Algerian customs from Microsoft Excel.

As shown in the chart 3, there were three distinct periods of movements in the AREER stable, appreciated and depreciated.. Over the entire period, the AREER depreciated as the rate of inflation in Algeria was higher than those of its major trading partners and competitors, except for Brazil, Russian federation, Turkey, India and Egypt. Thus, the impact of the inflation differential on the AREER outweighed the effect exerted by the depreciation of the nominal effective exchange rate (ANEER). From the chart 3 we see that between 2010 and 2017 Algerian dinar depreciated in real terms relative to all the other currencies in our sample. This is because the fall in the nominal exchange rate shown in the chart 2 mainly acted to offset the fact that Algerian inflation was rather higher than that of competitor economies during the 2010 and 2017. For example, from 2010 through to 2017 (100, 91.41), the real effective exchange rate depreciated by 8.59% per cent significantly leading to a substantial profit of competitiveness for Algerian industry but not the case because the large entries in capital in foreign currency and a significant drop in oil prices. According to the Dutch Disease theory, capital inflows affect real exchange rate through the tradable and non-tradable sectors of the Algerian economy and through that extends to affect the level of international competitiveness of Algeria. In fact, this has not happened because of the poor productivity of the Algerian industrial economy.

IV. Empirical Results And Discussion

As shown in the chart 4, movements in the Algerian nominal effective exchange rate (ANEER) are reflected in the evolution of the Algerian real effective exchange rate (AREER), but not with the same magnitude. The AREER appears to be more stable than the NEER. The central bank of Algeria's dinar indexes have been successful in summarizing major long-term fluctuations in the Algerian dinar's exchange value. The results suggest that the Algerian dinar was severely overvalued from 2010 to 2017 when the fixed exchange rate regime was abandoned. As the Algerian dinar was put on a floating basis, it depreciated sharply and became somewhat undervalued relative to the equilibrium value implied by the fundamental variables, the Algerian dinar depreciated unsteadily from the 2010 to 2017. This weakening of the Algerian dinar may largely be explained by changes in the fundamental variables and a subsequent depreciation of the real effective equilibrium exchange rate due to higher inflation and lower productivity of industrial sector compared to trading partners. The prime force behind this development has been deteriorating terms-of-trade. One method of analyzing movements in the AREER is through a simple accounting decomposition of its constituent elements (the ANEER, domestic inflation and the foreign level of inflation) while noting that movements are influenced not only by the domestic exchange rate, oil prices and monetary policies but also by foreign inflation and exchange rates which are influenced by the policy decisions of other countries.

Chart 4 : Evolution of the Algerian effective exchange rates (ANEER and AREER) indexes over the period (2010-2017)



Source: Author's own calculation based on central bank of Algeria, international financial statistics, National office of statistics, World Bank and Algerian customs from Microsoft Excel.

4.1 First Episode (2010-2017)

The first episode of depreciation in ANEER is observed from (2010 to 2017) the main reasons were high inflation, low productivity in sectors benefiting from low real exchange rate, decrease of oil prices and the weakening of Algerian dinar against others major currencies while the latter was depreciated due to rise in current government expenditures, deterioration in the terms of trade, trade liberalization and increase of cost of security.

4.2 Second Episode (2012-2013) The AREER despite the appreciation of Algerian dinar, during (2012-2013) interestingly due to significant increase in exchange reserves due to high oil prices, but the Algerian products continued to lose the international competitiveness of Algeria's manufacturing exports due to:

- ✓ The fact that basket of currencies appreciated against Algerian dinar more than the Dollar ,Euro and British Pound .
- ✓ Absorbed the negative impact due to the relatively higher inflation and lower productivity compared to trading partners.
- ✓ Slipping policy of the Algerian dinar.

4.2 Third Episode (2014-2017)

From 2014 to the boom decrease oil prices and slipping policy of the Algerian dinar, both the AREER and the ANEER were largely unstable and continued to depreciated until the end of 2017. And also between 2010 and 2017, the AREER of the Algerian dinar was largely depreciated, although there were wide fluctuations in the ANEER and the REER became volatile following the volatility in the ANEER, with a huge fall (depreciation) between 2014 and 2017. This period was characterized by political disturbances, decrease oil prices, slipping policy of Algerian dinar , and falling rising international commodity prices. The reserve bank of Algeria appeared to be more active in stabilizing the AREER, partly out of concern for the international competitiveness of Algeria's manufacturing exports. So the appreciation of the dollar, Euro and British pound mean depreciation of the Algerian dinar and vice versa. The ascending of the dollar Euro and British pound from 2014 to 2017 mean depreciation of the Algerian dinar. That is the one exporters and importers have been worried about.

V. Conclusion And Recommendations

5.1 Limitations of the Study and Areas of Further Research

Some of the issues which form bases for such index are (1) the number of countries to be included (usually the major trading partners are included) (2) the weight of each chosen currency in the basket (import, export and trade weighted) (3) the base period when the index is (100) (4) the choice of the measure of inflation (wholesale price index, retail price index, GDP deflator) and (5) the mathematical formulation (arithmetic or geometric weights). But there is no single definitive methodology to compute the nominal and real effective exchange rate as many approaches utilize different price indexes, weighting schemes and baskets of countries. The choice of indicator is usually a compromise between an ideal measure and what is practical, given data availability. Recognizing that a competitiveness index seeks to capture a country's ability to sell its products on international markets, it was felt that the focus for Algerian dinar should be on domestic costs. The weighting scheme, another important aspect of the index, took into consideration the type of international traded goods competition to be measured between Algerian exporters and foreign domestic producers, Algerian exporters and third country exporters of the same products, and Algerian import substitution producers and foreign exporters to the country. A composite weighting system was designed that took into account all three types of competition. And finally, data limitations lead to several problems in their calculations and get accurate calculations.

5.2 Policy Implications and Recommendations

Note that there is no simple formula for exchange rate management to achieve two important goals of exchange rate management, such as competitiveness and price stability, simultaneously (Ohno,1999). In the absence of a solid consensus on the proper target of exchange rate management, we propose in particular, the following recommendation is made based on the results obtained in this study construct different types of AREER such as $AREER_{Euro\ area}$, $AREER_{America\ area}$, $AREER_{Asia\ area}$, $AREER_{Arab\ area}$ and $AREER_{Africa\ area}$ (Jair Santoya Candice Soutar , 2011; Buldorini, L, S Makrydakis and C Thimann , 2002 and Simon Potter ,2018) . Given the vulnerable financial system, this study suggests that it is better for Algeria to continue a managed floating regime with frequent and small interventions. Simultaneously, central bank of Algeria needs to work on developing mechanisms for inflation targeting policies, ensuring efficiency in the financial system, strict measures and policies must be taken (towards the service sector (non-tradables sector)) to face with the Dutch disease in order to benefit some productive sectors from the real decline of the Algerian dinar during the coming periods and building necessary institutions in order to manage exchange rates efficiently. Maintaining short-term stability and medium-to-long term flexibility should be the general objective of exchange rate management policy of Algeria. Social and administrative factors influence prices and competitiveness. A transparent tax and customs system would foster a more equitable business environment and spur domestic competition. An effective policy against crime and security, a major operating cost to any business (in terms of security), is imperative to promote competitiveness. While the depreciation of the AREER has been beneficial to certain industries, these industries still require essential structural reforms to improve productivity and, where the opportunity arises, to broaden their export base through value added products.

5.3 Concluding Remarks

The concept of nominal and real effective exchange rates is extremely useful for examining the overall competitiveness of a country against her major trading partners. In the context of aggregate export, import or trade balance modeling especially in the 80s these concepts received considerable importance to policymakers and researchers. Following this path, International Monetary Fund started preparing its data base of effective exchange rates for developed countries and data is available in its database named International Financial Statistics. However, there is a growing demand for constructing the effective exchange rates for developing countries. To fill this gap, economists made attempts to construct effective exchange rates for several developing countries (Rhomberg, 1976; Koranchelian, 2005; Zaldueño, 2006; Oomes and Kalcheva; Turner and Van't dack, 1993; Maciejewski, 1983; Artus and McGuirk, 1981; Bahmani-Oskooee, Mohsen, 1995c), and Hirsch and Higgins, 1970). From the study it is observed that there is a declining trend in the effective exchange rates of Algeria which indicates that Algerian dinar depreciated both in nominal and real terms over the period from 2010 to 2017. However, the appreciation of Algerian dinar, during (2012–2013) interestingly, real exchange rate continued to lose the competitiveness. A major problem is sharp depreciation of the Algerian dinar against US dollar, Euro, GBP as most commodities are priced in the US dollar and sharp depreciation pushes up the prices impacting our trade and current account deficit, as witnessed in the beginning of 2016. Moreover, the increase in oil prices leads to an increase in the flow of capital in foreign currency, leading to a trend towards the service sector (non-tradables sector) more than the productive sector and this is known as the Dutch disease, which led to the acceleration of multiple devaluations of the Algerian dinar during the period 2010-2017 exert pressure on company balance-sheets.

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Appendixes: Data and Methodology Description

Table 1: Data sources

Variables	Data source
Consumer Price index of Algeria, France, Germany, Italy, Spain, Belgium, Netherlands, Belgium, Portugal, Turkey, Russian Federation, United States of America, Canada, Brazil ,China, Japan, India , Egypt ,Morocco and Tunisia.	World development Indicator (World Bank) and International Financial Statistics (IMF)
Official exchange rate USD/DZD	International financial statistics, World Bank, Central bank of Algeria. Various years.
Official exchange rate EUR/USD	European Central Bank and Eurostat.
The 19 main importers of the Algerian economy	National Office of Statistics Algeria.
The 19 main exporters of the Algerian economy	National Office of Statistics Algeria.

Table 02: Evolution of the effective exchange rates (ANEER and AREER) indexes over the period (2010-2017)

	2010	2011	2012	2013	2014	2015	2016	2017

The ANEER	100	97.89	98.63	97.20	80.70	87.71	87.74	80.34
The AREER	100	98.95	103.95	102.97	86.10	95.39	98.92	91.41

Source: Author's own calculation based on different data such as: international financial statistics, World Bank Central bank of Algeria, national office of statistics and Algerian customs from Microsoft Excel.

Methodological Construction of ANEER and AREER over the period 2010-2017 notes

How is the NEER calculated? So there are three questions to answer Which currencies? Which weighting system? Which formula? Finally, to obtain ANEER. And Why AREER?, Why is such an adjustment sensible for competitiveness assessment? , How is the AREER calculated? and Which indices? Finally, to obtain AREER.

(1) Calculation of Algerian nominal effective exchange rate (ANEER)

Step one: using geometric formula as follows: we use geometrically weighted averages, because this is the most frequently used method in the literature.

$$ANEER = \prod_j^n (E_j)^{W_{jt}}$$

Where :

E_j = Price of foreign country (j) currency in terms of the home country (i) currency in period (t).

W_{jt} = the appropriate trade weight for each trading partner (j) in period (t) note that $\sum_{j=1}^N W_{jt}=1$.

∏ = denotes the product of the variables.

n = the number of countries in the basket 19 currencies.

Step two : shares of Algeria’s trading partners (base year = 2010 , 19-currency trade Weighted

Weights : first, let us calculate the weights of each of the 19 currencies. We do this by getting the trade volume (imports plus exports) data for the 19 basket countries.

Step three: compute the exchange rate indexes E_j (2010=100)

Exchange rates : Now let us look at the exchange rates of the 19 basket currencies with respect to the Algerian dinar.

Step four : compute the Algerian nominal effective exchange rate ANEER weighted

The process begins by first calculating Algerian’s Nominal Effective Exchange Rate (ANEER) index which reflects the value of the Belize dollar relative to the value of the currencies of its major trading partners, with reference to a specific base period (Des Vignes and Smith, 2005). Using the geometric mean, the nominal effective exchange rate can be calculated as follows:

$$ANEER = (E_1)^{w_1} * (E_2)^{w_2} * (E_3)^{w_3} ... * (E_n)^{w_n} = \prod_j^n (E_j)^{W_{jt}}$$

Where E_j= Price of foreign country (j) currency in terms of the home country (i) currency expressed as an index form , W_j= Weight for country j (19 trading partners ,weight for country j note that $\sum_{j=1}^N W_{jt}=1$, n = the number of countries in the basket 19 currencies. and ∏ = denotes the product of the variables

(2) Calculation of Algerian real effective exchange rate (AREER)

Step one: Using geometric formula as follows: we use geometrically weighted averages, because this is the most frequently used method in the literature.

$$AREER = (ANEER) * \prod_j^n (P_i / P_j)^{W_{jt}}$$

Where : P_i = domestic price level (CPI) and P_j = foreign price level (CPI) , W_{jt} = Weight for country j (19 trading partners ,weight for country j note that $\sum_{j=1}^N W_{jt}=1$, ANEER = Algerian nominal effective exchange rate index, n = the number of countries in the basket 19 currencies and ∏ = denotes the product of the variables

Step two : Shares of Algeria’s trading partners (base year = 2010 , 19-currency trade weighted

Step three : consumer price indices for main competitors (P_j)

Inflation : Let us now look at the inflation data of the 19 basket currencies and Algeria.

Step four : real Bilateral exchange rates [(P_i/P_j) x E_j x100]

Step five : weighted real effective exchange rate (AREER)

The REER is obtained by deflating the NEER index using an index of relative prices and is expressed as:

$$AREER = \prod_j^n (E_j \cdot P_i/P_j)^{W_{jt}}$$

Where : AREER = Algerian Real effective exchange rate index of home country i in a given period

P_i = Index of the cost (or price) indicator of home country i (Algeria)

P_j = Index of the cost (or price) indicator of partner country j

W_{jt} = Weight for country j (19 trading partners ,weight for country j note that $\sum_{j=1}^N W_{jt}=1$).

Now let us calculate the Algerian real effective exchange rate (AREER) component for trading partners 19-currencies, using four steps as follows:

- ✓ The exchange rate component = (e/e) trading partner one
- ✓ The inflation component = (P/P₁) trading partner one
- ✓ The product of exchange rate component and inflation component = (e/e₁ * P/P₁) trading partner one
- ✓ The final REER component = [(e/e₁) * (P/P₁)]^{W₁} trading partner one

Similarly for the rest of trading partners 18-country, once we perform this calculation for the rest of the Basket countries. Taking the product of all the Algerian real effective exchange rate (AREER) Components we get the total AREER for Algeria with respect to the basket of 19-country.

Table 03: Data and series construction

Variables	Data construction	Data source
Trade weighted	Author's own calculation	International financial statistics, World Bank, Central bank of Algeria. Various years.
Exchange Rate Indexes E _j	Author's own calculation	International financial statistics, World Bank, Central bank of Algeria. Various years.
Real Bilateral Exchange Rates	Author's own calculation	International financial statistics, World Bank, Central bank of Algeria. Various years.
Weighted ANEER	Author's own calculation	International financial statistics, World Bank, Central bank of Algeria. Various years.
Weighted AREER	Author's own calculation	International financial statistics, World Bank, Central bank of Algeria. Various years.

Table 4 : Abbreviations

Abbreviations	Meaning
NEER	Nominal effective exchange rate.
REER	Real effective exchange rate are.
CPI	Consumer price index.
WPI	Wholesale price index.
ULS	Unit labour costs.
GDP	Gross domestic product.
ANEER	Algerian nominal effective exchange rate.
AREER.	Algerian real effective exchange rate.
EER	Effective exchange rate.
WR	Wage rate.
IMF	International monetary financial.
ECB	European central bank.
BIS	Bank for international settlements.
FED	Federal reserve Bank.
OECD	Organisation for economic co-operation and development.
EERs	Effective exchange rates (nominal and real).
CBA	Central bank of Algeria.
AREER _{Euro}	Algerian real effective exchange rate for Euro area.
AREER _{America}	Algerian real effective exchange rate for America area.
AREER _{Asia}	Algerian real effective exchange rate for Asia area.
AREER _{Arab}	Algerian real effective exchange rate for Arab area.
AREER _{Africa}	Algerian real effective exchange rate for Africa area.

Table 05 : Shares of Algeria's trading partners (base year = 2010 , 19-currency trade weighted) Gives the normalized weights for the 19-currencies for over the period 2010-2017, which is based on trade weighted (imports plus exports = total trade).

19-country	trade weighted 2010	trade weighted 2017
Italy	14,99%	13,49%
France	11,47%	12,54%
Spain	9,99%	10,40%
Germany	3,15%	4,64%
Portugal	1,43%	1,96%
Belgium	3,15%	2,23%
Netherlands	5,45%	3,75%

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Great Britain	2,40%	3,15%
Turkey	4,92%	5,52%
Russian Federation	0,19%	1,76%
United States of America	18,67%	7,60%
Canada	3,87%	1,83%
Brazil	3,88%	5,03%
Japan	1,89%	0,99%
China	5,12%	12,91%
India	0,89%	1,41%
Egypt	0,90%	1,26%
Tunisia	1,07%	1,56%
Morocco	0,99%	1,02%
Total	100	100

Source : Author's own calculation based on different data such as : central bank of Algeria, international Financial statistics, national office of statistics, World Bank and Algerian customs from Microsoft Excel.

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