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Measuring the Impact of Exchange Rate Balance of Payment in Algeria Using a Distributed Time-Lag Autoregressive Model during the Period 1980-2023

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Abstract

This paper aims to measure the impact of the exchange rate on the Algerian balance of payments, as one of the main variables affecting the balance of payments. In order to achieve the objective of the study and try to answer the main question, several applied literatures were addressed that tried to address the relationship between the two variables, as well as try to analyze various previous studies on this topic. The standard approach was adopted using the autoregressive model for the periods of slowdown distributed during the period from 1980 to 2023. The study concluded that there is a positive long-term equilibrium relationship for the exchange rate on the Algerian balance of payments.

Keywords: *Balance of Payments, Exchange Rate, Balance of Payments Imbalance, ARDL.*

I. INTRODUCTION

The exchange rate is a decisive economic indicator and one of the effective mechanisms on which the economic system relies in its attempt to protect the state from economic shocks, and is considered a link for contemporary international exchange, which has known wide openness due to its impact on economic globalization, which has become the subject of interest to all countries. The development of these relations between countries faces several challenges, the most important of which is the problem of the relationship between the local currency and foreign currencies, known as the exchange rate. Due to the special nature of the Algerian economy, which is heavily dependent on fuel sector exports and pricing in US dollars, while imports are estimated in euros, this problem causes fluctuations in currency exchange rates. This leads us to understand the consequences of these fluctuations on the balance of payments. This puts him in the problem of fluctuations in currency exchange rates, which prompts us to know the consequences of these fluctuations on the balance of payments.

The problem of the research is to know the impact of exchange rate fluctuations on the balance of payments, and more precisely: **to what extent do exchange rate fluctuations affect the Algerian trade balance during the study period?**

In light of the previous problem, the research proceeds from a number of hypotheses, which we explain as follows:

- There is a causal relationship between the variables, as the balance of payments balance is sensitive to the change in the exchange rates of the Algerian state.
- The exchange rate positively affects the rebalancing of the balance of payments.

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- There is a positive relationship between the exchange rate and the balance of payments during the study period.

The importance of the study stems from the importance of the exchange rate and its essential role in addressing the imbalance in the balance of payments and achieving external balance in Algeria, which remains subject to oil price fluctuations in international markets on the one hand, and trying to find out the relationship between exchange rate fluctuations and the Algerian balance of payments during the study period on the other hand.

Our study aims to study and analyse the impact of exchange rate behaviour on the balance of payments from an econometric perspective, while trying to highlight the exchange rate variable as one of the elements affecting the balance of payments, which represents one of the indicators of external balance on the one hand, and the most prominent elements contributing to international economic integration on the other hand.

In this research, both the descriptive and historical approach were relied upon as appropriate to accommodate the theoretical aspect, with regard to the exchange rate and the balance of payments, in addition to the use of the quantitative standard approach represented in statistical and standard methods using the EVIEWS12 program to measure the impact of the exchange rate on the Algerian balance of payments during the study period.

There are many studies that have dealt with the subject in one way or another, and we will address in this part of the research to present the most important studies that we relied on in trying to address this sensitive topic:

Study of Muhammad Al-Sayd, Ahmed Hamid and Abdul Rahman Ali Saleh Mahfouz in an article published in Al-Ustad magazine entitled: The impact of the exchange rate change on the balance of payments: An applied study on the Libyan economy during the period from 1990 to 2018. The main research problem was to know the role of monetary policy using the exchange rate of all kinds in addressing the imbalance in the balance of payments to reach the state of equilibrium, and to know the picture that the state of economic balance reflects on the prevailing economic situation in Libya. The researchers tried to build a standard model that allows to measure the relationship between the variables of the study the dependent variable (balance of payments) was expressed in both the index of exports and imports and the exchange rates an independent variable. The simple linear regression model was used and at the end of their research they found a positive relationship between the exchange rate and exports, as increasing the exchange rate by one unit leads to an increase in exports by 1.76 monetary units. Since the level of significance was less than 5%, the study proved a relationship between both the dependent and independent variable, the researchers also found a positive relationship between the exchange rate and imports, as the increase in the exchange rate by one monetary unit leads to an increase in imports by 1.84%. The researchers recommended the need to support non-oil exports, encourage local industries, pay attention to small industries and work to achieve national economic integration.

Study of Farraj Tayeb and Yousfi Rashid in an article published in the magazine Notebooks Budex entitled The impact of the change in the exchange rate on the Algerian balance of payments, an econometric study for the period from 1990 to 2017: This study dealt with the problem of the impact of fluctuations in the exchange rate on the balance of payments by showing and understanding the relationship between exchange capacity and the balance of payments, in addition to trying to find out the effects of fluctuations in exchange rates on the economy as In general and the balance of payments in particular. In addition to

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knowing the developments of the Algerian balance of payments in light of the fluctuations in the exchange rate of the US dollar. This study relied on the exchange rate variable to interpret the total balance of payments balance. At the end of their study, the researchers concluded that the impact of the exchange rate on the balance of payments was weak and negative, which is not in line with economic theory, given the restriction of the pricing of Algerian exports to dollars (hydrocarbons). Imports have also not been affected by the exchange rate due to their inflexibility and therefore there is no point in using the exchange rate as a mechanism to adjust the balance of payments in Algeria.

Study of Ali Adel Abbas, Hayman Tawfiq Aziz and Hayman Ali Wali in a study entitled The Impact of Exchange Rate Changes on the Iraqi Balance of Payments: An Analytical Study for the Period 2004 to 2019: Through this study, researchers measured the impact of the exchange rate on the Iraqi balance of payments for the period from 2004 to 2019 using the ARDL model. The independent variable was expressed in the exchange rate index while the dependent variable represented in the balance of payments was expressed in both the export and import indicators, and the results of the study in its theoretical and practical aspects revealed the existence of relative stability in the exchange rates of the Iraqi dinar against the US dollar during the study period. The analytical study showed a large dependence of the Iraqi economy on oil exports by 99%. While the results of the standard study revealed a long-term and inverse equilibrium relationship between the study variables, in addition to a common integration relationship between the independent variable and the dependent variables. The results also showed a strong correlation in both the short and long term between the exchange rate and both exports and imports in Iraq.

Study of Assoul Mohamed El Amin and Zahaf Habiba through a study entitled: The impact of the exchange rate on the Algerian balance of payments, an analytical study for the period from 2000 to 2004. This study aimed to shed light on the mechanism by which the exchange rate affects the Algerian balance of payments, in addition to clarifying the importance of the state's adoption of an appropriate exchange rate policy within the framework of its foreign policy to protect the national economy from external shocks. The results of this study concluded that the exchange rate does not affect the volume of foreign trade and therefore it does not affect the balance of payments of the state, and the study also found that the exchange rate and the balance of payments are variables that have no relationship in the economy Algerian. The researchers also pointed to the failure of Algeria's settlement policy due to the characteristics of the inflexible foreign trade structure of both exports that focus heavily on hydrocarbons and dependent imports. The researchers explained the surplus in the balance of payments during the study period due to the improvement in fuel prices and not due to the successive devaluation of the Algerian dinar.

Study of Another study by Mohammadi Siham and tawal sihem in an article published in the Journal of the Forum for Studies and Research under the title The role of the exchange rate in achieving balance of payments balance for Algeria, an analytical study for the period 2010-2018, this study aimed to try to highlight the impact of the exchange rate on the balance of payments, a research that analyzed the evolution of the exchange rate and the balance of payments throughout the study period and tried to know its role in achieving balance of payments and improving its balance. The results showed after the analysis is the rise in oil prices and that a large proportion of incomes are lost as a result of the difference in currencies dealt with between exports and imports, and from it the researchers concluded that imports outside the euro area limit exchange losses resulting from the conversion of the dollar

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against the euro, and the results of the study concluded to the great role played by the exchange rate in improving the balance of payments, and the researchers recommended through this study the need to diversify exports outside the hydrocarbon sector to avoid Oil crises causing low oil prices

Study (ukangwa, onyenze, & uke-ejibe, 2022): which aims to analyze the impact of the exchange rate on the balance of payments in Nigeria, using secondary data derived from the statistical bulletin of the Central Bank of Nigeria during the period 1981-2021. This study was conducted using the ARDL model in order to estimate the immediate and long-term effects of the exchange rate on the balance of payments, the results of the study showed a long-term equilibrium relationship between the exchange rate and the balance of payments. The results also showed that the exchange rate has a negative and significant impact on the balance of payments in the short term only.

Study (nawanekezie & Onyiro, 2018): which aims to study the impact of exchange rate fluctuations on the Nigerian balance of payments during the period 1981-2016. This was done using annual data covering each study period and analyzing them through ECM. The study tests showed an integration relationship between the variables, and the study also revealed a long-term relationship between exchange rate fluctuations and the balance of payments.

Study (Kanar & Bzhar, 2022): which aims to verify the impact of the exchange rate on the Iraq balance of payments on the one hand and the impact of the exchange rate on economic growth on the other hand between 2004 and 2019, in addition to examining the direction of the exchange rate of the Iraqi dinar for the mentioned period and how this affected the trade budget and economic growth, using the ARDL model The results of this study showed that each increase in the exchange rate has a positive and noticeable impact on the economic growth and trade balance in Iraq.

A study (Aidi , Suleiman , & Saidu , 2018), which aims to study the relationship between the exchange rate, inflation and the Iraqi balance of payments using time series data for the period 1986-2015, and using the OLS method, the study revealed that the exchange rate and inflation have statistically significant negative effects on the balance of payments during the study period.

A study (Oladippo & Onotanyohuwo, 2011), which analysed the impact of the exchange rate on the balance of payments in Nigeria during the period between 1970-2008 using the least squares method OLS, the researchers concluded that there is a significant impact of the exchange rate on the balance of payments, as the decline in the exchange rate can lead to improving the balance of payments position.

A study (Imoisi, 2012), through which he studied the relationship between exchange rate variations and the position of the balance of payments during the period 1960-2013. The researchers relied on the OLS and ECM method to analyze the data, and the results showed that the exchange rate has a significant impact on the balance of payments position during the study period.

A study by (nwachukwu, 2021), which aims to study the impact of the exchange rate on the Nigerian balance of payments. Data were collected from the Statistical Bulletin of the Central Bank of Nigeria for the period 1981-2019, and using VECM to analyze the data, the results of the study revealed a positive relationship between the balance of payments and the exchange rate in Nigeria, and that the exchange rate has a significant impact on the balance of

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payments in Nigeria, in addition to a causal relationship between exchange rate fluctuations and the balance of payments. Nigerian.

A study (Chi & Hong, 2022), which focuses on the impact of the exchange rate on the Vietnamese balance of payments, data was collected from the Central Bank of Vietnam for the period from 2000 to 2020 using the ARDL model. The results of the study showed that the foreign exchange rate has a positive and noticeable impact on the balance of payments, which means that when the foreign exchange rate is stable, it is reflected in a developed and effective economic environment.

After reviewing the literature, we noticed that studies that looked at the relationship between the exchange rate and the balance of payments are rather rare at the level of Algeria, despite the sensitivity of the economy to variables.

Through our review of studies and research that dealt with the subject of the impact of the exchange rate on the balance of payments, we found that most of them focus on the analytical and descriptive aspect of each of the two variables, and neglect the standard aspect by addressing these forms in Algeria, and there is no consensus among the literature on the relationship between the relevant variables. Therefore, this study seeks to fill the gaps identified in the mentioned literature, and our research differs from previous studies in a number of points:

- Different period of study
- Addressing the problem of research through a standard model

1. The theoretical framework exchange rate and balance of payment

The exchange rate and the balance of payments are fundamental concepts in the field of economics. They reflect the economic situation of the country and its impact on international trade, investments and economic growth. Understanding the important relationship between the exchange rate and the balance of payments helps us understand their impact on the economy and make appropriate economic decisions.

1.1. Exchange rate

The most important thing that distinguishes internal trade from foreign trade is that the latter uses in its transactions a common international monetary unit that is dealt with at the international level, as is the case in internal trade, which is subject to a single monetary system, the national currency. Thus, the process of pegging the rates of national currencies to international currencies is carried out through the foreign exchange rate.

In fact, economists differed in defining a unified definition of the exchange rate, with **Abdul Muttalib Abdul Hamid** arguing that the exchange rate is the number of currencies of one currency that must be paid to obtain one unit of another currency (Abdul Muttalib, 2016, p. 19). This definition focuses on the mechanisms of supply and demand as one of the two currencies as a commodity and the second as its price. While **Samir Fakhry** defined it through his **book (The reciprocal relationship between the exchange rate and the interest rate and its reflection on the balance of payments)** The number of units of domestic currency exchanged for one unit of foreign exchange (Samir Fakhry, 2011, p. 15). It is also defined as the main instrument with a direct impact on the relationship between domestic and external prices and is often the most effective tool when it is necessary to encourage exports and provide imports (Hamidat, 1996, p. 105).

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It should be noted that there are two ways to price currencies (Al-Taher, 2003, p. 96):

- **Direct pricing:**

It is the number of units of foreign currency that require payment to obtain one unit of the national currency. Currently, few countries use the direct pricing method. Among the countries that adopt this method mainly is the United Kingdom and, specifically, the financial center of London. For example, the pound sterling relative to the French franc is measured as follows: 1 British Pound = 3.476 French Franc.

- **Indirect pricing:**

The exchange rate is the number of units of national currency that have to be paid to obtain one unit of foreign currency. It is worth noting that most countries in the world use this method of currency pricing, including Algeria. In Algeria, the US dollar is measured in the number of units of Algerian dinars, specifically as follows: 1 dollar = 59.67 Algerian dinars.

The exchange rate is an essential tool in economic policy, as it affects the variables of the national economy and foreign trade. Price reveals the relationship between exports and imports, whether this relationship is balanced or unbalanced. In addition, the exchange rate reflects the status of the state and its relationship with the outside world when left free without restrictions. The exchange rate plays a crucial role in linking the national economy with other global economies, and enhances the economy's competitiveness. It directly affects inflation, economic growth and balance of payments, reflecting the importance of its role in promoting economic stability and sustainable development (Abdulmutallab, 2016, pp. 29-30).

Exchange rate policy seeks to achieve a set of objectives, most notably (Qadi, 2003, pp. 136-137):

- **Resistance to inflation:**

The improvement in the exchange rate leads to a decrease in the level of imported inflation and an improvement in the level of competitiveness of institutions, in the short term, the decrease in import costs has a positive impact on the decrease in the level of imported inflation and an improvement in the level of competitiveness of institutions and the profits of institutions are doubled to enable them to rationalize the production tool in the medium term, and thus institutions achieve productive returns and be able to produce high-quality goods, which means improving their competitiveness.

- **Resource allocation:**

The real exchange rate, which makes the economy more competitive, shifts resources to the international goods sector (export-oriented), and this expands the international goods base so that a large number of goods become exportable, and thus the number of goods that are imported decreases.

- **Income distribution:**

The exchange rate plays an important role in the distribution of income between groups or between local sectors, when the competitiveness of the traditional export sector rises... (raw materials, agricultural) as a result of the decline in the real exchange rate, this makes it more profitable and the profit from this situation returns to the owners of capital at a time when the purchasing power of workers decreases, and when the competitiveness resulting from the

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decline in the nominal exchange rate decreases, this leads to a rise in the purchasing power of wages.

- **Local industrial development:**

The Central Bank can adopt a policy to reduce exchange rates in order to encourage national industry, the German Federal Bank in 1948 made an important devaluation of the currency, which encouraged exports and in a second stage it adopted a strong currency policy, and the monetary authorities adopted a policy of reduction to protect the domestic market from external competition and encourage exports. (Kaddi, 2003, pp. 136-137)

1.2. Balance of payment

Countries are linked to each other by mutual relations that must be settled by making external payments between the various parties, as each country records all its economic dealings with other countries during the year by monitoring all exports and imports of goods and services, and capital movements to and from the outside world in the balance of payments, which is one of the most important indicators used in economic policy-making, and what has increased its importance is the high volume of international foreign exchanges as a result of countries' adoption of a policy of liberalization Foreign trade.

The specific definitions of the concept of balance of payments differed, as the **International Monetary Fund** defined it as a record based on a double entry that deals with the statistics of a certain period of time, with respect to changes in the value of the assets of a country's economies due to its dealings with the rest of the world, or because of the migration of individuals or because of the change in the value or components of the monetary gold it holds, special drawing rights from the Fund, and its rights and obligations towards the rest of the world. (Said, 2013, p. 77). While **Reda Abdel Salam** defined it in his book **(International Economic Relations in Light of the Global Economic Crisis)** as an accounting record that regulates all economic, international and financial transactions that take place between residents and non-residents of a particular country with the rest of the world during a certain period of time, often a year. (Reda Abdeslam, 2011, pp. 183-184).

Balance of payments data have their own connotations that reflect the economic conditions of the country regardless of the time period covered by the study of these data, so the recording of these international economic transactions in itself is vital for any national economy for the following reasons (Al-Marzouk, 2016, p. 9):

- The structure of these economic transactions reflects the strength of the national economy, its viability and the degree of its adaptation to the changes taking place in the international economy because it reflects the size and structure of both exports and products, including the factors affecting it such as the volume of investments, the degree of employment, the level of prices and costs.... Etc.
- The balance of payments shows the specific strength of the exchange rate through the conditions of demand and the supply of foreign currencies, and shows the impact of economic policies on the structure of foreign trade in terms of the volume of exchanges and the type of exchange goods, which leads to follow-up and knowledge of the extent of development of the economic structure of the state and the results of its economic policies.
- The balance of payments is an important tool that helps public authorities to plan and direct the foreign economic relations of the country because of its inclusive structure, such as planning foreign trade from the commodity and geographical side or when setting financial

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and monetary policies, and therefore the information recorded in it is necessary for banks, institutions and persons within the fields of finance and foreign trade.

- The economic transactions that link a country with the outside world are the result of its integration into the international economy, and thus they measure the international economic position of the country.

Causes of balance of payments imbalance

The imbalance is in certain sections of the balance, and the deficit is usually in the current account as one of the largest accounts, whose deficit leads to damage to the national economy, which will negatively affect the value of the local currency in the foreign exchange market as a result of the supply of local currency more than the demand of foreigners for it, so the authorities in this case use monetary and financial policies to address the imbalance, and there are many reasons that lead to this imbalance, perhaps the most important of which are (Rozzia, 2023):

- **Incorrect valuation of the exchange rate of the local currency**:

There is a close relationship between the balance of payments and the exchange rate of the country's currency. If the exchange rate of a country's currency is greater than its real value, this will lead to a rise in the prices of goods of the same country from the point of view of foreigners, leading to a decrease in external demand for them and thus an imbalance in the balance of payments. Either if the exchange rate of the currency is set at less than it should be, this will lead to the expansion of exports against a contraction Imports, which also leads to an imbalance in the balance, so these imbalances often result in inflationary pressures which contribute to the continuation of the imbalance in the balance.

- **Structural reasons:**

They are the reasons related to the structural indicators of the national economy, especially the structure of foreign trade (whether exports or imports), in addition to its production capacity and advanced technical methods, and this is fully applicable to the case of developing countries whose export structure is characterized by commodity concentration, that is, their dependence on one or two basic commodities (agricultural, mineral or petroleum), where these exports are usually affected by external factors, embodied In the elasticity of external demand in global markets, such as changing consumer tastes and their departure from these goods, or when technical progress occurs abroad that leads to reducing the prices of goods similar to the exports of these countries abroad.

- **Periodic reasons:**

They are reasons related to the economic fluctuations that affect the capitalist economic system, in periods of contraction, production, incomes and prices decrease, unemployment rates increase, imports contract, which may lead to a surplus, and in periods of inflation production increases and prices, wages and incomes rise, so the country's ability to export decreases and its imports increase, which may lead to a deficit in the balance of payments. It is noted that fluctuations do not begin at the same time in all countries, and their intensity varies from one country to another, and these fluctuations are transmitted Periodicity of countries with weight in the global economy to other countries (trading partners) through the multiplier of foreign trade, and thus the balance of payments of these countries is affected by what affects price levels and incomes.

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- **Emergency conditions:**

There may be unpredictable accidental causes, and may lead to an imbalance in the balance of payments, as in the case of natural disasters and the outbreak of wars, and a sudden change in the tastes of consumers locally and internationally, these cases will affect the exports of the country concerned, which results in a decrease in the proceeds of these exports estimated in foreign exchange, especially and may be accompanied by capital transfers outside the country, which leads to a deficit in the balance of payments.

- **Other reasons:**

Other reasons that may result in an imbalance in the balance of payments are such as low productivity in developing countries as a result of the lack of production tools, so these countries submit economic and social development programs in which their import of machinery, technical equipment, production requirements and other development goods increases for a long time. These countries aim to raise the level of investment, which often exceeds their capacity of voluntary saving, and this disparity between the level of investment and the level of saving results in a trend Towards inflation, which is a temporary trend, as it is year after year as a result of this inflation and due to the increase in imports of these developed countries, they suffer from a permanent or chronic deficit in their balance of payments, and these imports are financed by long-term loans held in advance.

Therefore, solutions must be resorted to be taken and drawn up by the monetary authorities. These policies have several approaches that have tried to analyze the possible economic effects of changes in the exchange rate to correct the imbalance in the balance of payments, and for this we will try to address the most important of these approaches in the following points (Mohammadi and Tawal, 2021, pp. 351-352):

- **Flexibility approach:**

This approach is based on the balance of the trade balance, considering that the balance of payments balance is the result of the difference between exports and imports, and therefore any changes in the exchange rate will exert an impact on the relative prices of both exports and imports, leading to improving the trade balance.

- **Economic Assimilation Methodology:**

This methodology was introduced by (J. Mead, 1951), which is based on Keynesian analysis, where this approach examines by considering the impact of reduction on spending behaviour in the local economy, and the impact of domestic spending on the trade balance.

- **The Monetary Approach to Correcting the Deficit in the Balance of Payments:**

The Evolution of the Monetary Approach to Correcting the Balance of Payments Deficit and Harmonized with the Ideas of Cash Critics from the Chicago School Supporters This approach addresses the problem of deficit and surplus in the balance of payments by highlighting the important and effective role of money supply and demand, as it begins by defining the balance of payments as a monetary phenomenon not real, and that the balance of payments imbalance is a balance imbalance and not an imbalance of flow (Gharib and Khider, 2017, p. 16)

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1.3. Relationship between balance of payment and exchange rate

Exchange rates are one of the main variables that affect the balance of payments besides (inflation, GDP growth rate, difference in interest rates). The most important balances of the balance of payments, whether it is related to the balance of foreign trade, the balance of current transactions or the balance of the base balance, are factors explaining the change in the exchange rate in the medium term, as a deficit in the trade balance necessarily leads to a decrease in the exchange rate.

The opposite effect we notice in the case of a decrease in the current account balance deficit, the importance of these balances increases as they have a relationship with inflation and interest rates, noting that a country characterized by a high inflation rate finds great difficulties in exporting its products to the impact of the trade balance, and vice versa in the case of a low inflation rate.

Exchange rates show effects on the balance of payments, so the rise in the external value of the national currency leads to a decrease in the competitiveness of locally produced goods and services, and import prices become more attractive to residents, and on the contrary, the decline in the exchange rate of the national currency leads to an increase in the competitiveness of domestic exports, and thus import prices become less attractive for residents (Al-Hajjar, 2001, p. 64) To address the imbalance in the balance of payments, the monetary authorities resort to the exchange rate policy, it is known that the foreign exchange supply derives It originates from the various transactions that appear on the creditor side, which represents the demand of non-residents for local currency.

While the demand for foreign currency is only the supply of citizens to the national currency, which derives its source from the various transactions that appear on the debtor's side. Therefore, the balance in the free exchange market is related to the balance of payments, according to what is known as market equilibrium, where changes in the exchange rate automatically correct imbalances in the balance of payments (Zaghloul, 2010, p. 144)

One of the most important conditions that must be met in order for the exchange rate be able to affect the balance of payments is to be free and unrestricted by the monetary authorities, in the event of a country's balance of payments deficit, it usually needs foreign currencies, so it will risk displaying its currency in foreign markets, and increasing the supply of currency will lead to a decrease in its prices in the mentioned markets, which leads to a decrease in the prices of local goods and services compared to foreign.

Thus, the demand for local products rises, which leads to an increase in their exports and a decrease in their imports, and the process continues until the balance of payments returns, while in cases of surplus, the state reduces the supply of its currency and thus its value will rise against foreign currencies, and the demand for local products decreases and exports decrease, which leads to an increase in imports. (Mohamed Sayed, 2001, p. 320)

2. The Experimental Framework for the Study

This part of the research is devoted to studying the relationship between the exchange rate and the balance of payments in Algeria during the period 2000-2023 in order to determine the type of relationship between the two variables.

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2.1 Study methodology and variables

In this study, we will use the ARDL methodology developed by Pesaran 1997, Shinand and Sun 1998 and Pesaran et al. 2001 as this test does not require the time series to be integrated of the same degree. Pesaran believes that the boundary test under ARDL can be applied regardless of the characteristics of the time series, whether they are stable at the plane, first-order integral, or a combination of the two.

The only condition for applying this test is that the time series should not be integrated in the second order (2) and the Pesaran method has better characteristics in the case of short time series compared to other methods typical of cointegration testing such asGranger – Engel 1987 Two-stage and cointegration test in terms of Durben Watson, or Johansson Cointegration Test within the framework of the VAR model

The long-term relationship is estimated according to the following equation (Imoisi, 2012):

$$\Delta Y_t = c + B_1 Y_{t-1} + B_2 X_{1t-1} + B_3 X_{2t-1} + \ldots\ldots + B_{k+1} X_{kt-1} + \mu_t$$

As for the short-term parameters

$$\Delta Y_t = \sum_{i=1}^{p-1} \lambda_{1i}\, \Delta Y_{t-i} + \sum_{i=0}^{q_1-1} \lambda_{2i}\, \Delta X_{1t-i} + \sum_{i=0}^{q_2-1} \lambda_{3i}\, \Delta X_{2t-i} + \ldots\ldots + \sum_{i=0}^{q_k-1} \lambda_{(k+1)i}\, \Delta X_{kt-i}$$

As for the variables of the study, we used from the data of the exchange rate **TCH** and the balance of payments **BP**, which we obtained from the reports of (Central Bank of Algeria, 2024), and the model equation for the study variables was formulated according to the following relationship (aidi , suleiman, & saidu , 2018):

$$bp_t = \beta_0 + \sum_{i=1}^{P} \delta_i\, \Delta bp_{T-i} + \quad + \quad \sum_{i=1}^{P} \alpha_i\, \Delta tch_{t-i} \quad + \varphi_1 bp_{T-1} + \varphi_2 tch_t + U_t$$

where δ،α ،are the parameters of independent variables in the short term φ_1 ،φ_2 are the parameters of independent variables in the long term and U_t is the remainders (nwachukwu, 2021).

$$\begin{cases} H_0 : \varphi_1 = \varphi_2 \\ H_1 : \varphi_1 \neq \varphi_2 \end{cases}$$

2.2 Stationarity test and time series

There are several methods to test the root of the unit, the most important of which are the augmented dickey fuller and Phillips-Perron tests, which can be used to examine the bounds.

We say that the time series is stable if the fluctuation around the arithmetic mean is a constant independent of time, but if the data is in a state of rise or fall and depends on a time trend, the time series is unstable, and this leads to a false correlation between the variables, and we rely on the Phelps Peron test to find out if the series are stable or not, which depends on the first difference in the series using nonparametric correction, and allows the existence of a mean that is not equal to zero and a linear direction of time as follows (oladipupo & onotanyohuwo, 2011):

$$\Delta Y_t = a + B Y_{t-1} + u_t \quad \ldots\ldots\ldots\ldots\ldots (2)$$

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The Phelps Perron test is based on the t-test of the parameter B The following hypotheses are tested:

$H_{0:}$ B= 0 null hypothesis and denotes the non-stationary of time series;

H_1: B≠ 0 Alternative hypothesis and denoting the stationary of time series

If it is negative and significant, we accept the alternative hypothesis and vice versa if it is not significant, but the most common test in the time series stationary test is the simple and extended Dickie Fuller test, which takes the following formula (if equation 1 suffers from the linear correlation problem) (chi & hong, 2022):

$$\Delta Y_t = a_0 + a_1 t + B_1 Y_{t-1} + (B_2 Y_{t-1})^2 + \sum_{i=1}^{p} \lambda_i \, \Delta Y_{t-i} + u_t \qquad \ldots\ldots(3)$$

Whereas:

Δ: First difference. **a_0,a_1,B:** parameters to estimate. **Y:** The variable to test.

P: number of periods of slowdown. **u_t:** random error element. **t:** time in the form of a general trend.

Table (1): Unit root test for model variables series using pp

UNIT ROOT TEST RESULTS TABLE (PP)			
Null Hypothesis: the variable has a unit root			
	At Level		
		bp	**Tch**
With Constant	t-Statistic	-2.0938	-2.8401
	Prob.	***0.2487***	***0.0683***
With Constant & Trend	t-Statistic	-2.7052	-2.4807
	Prob.	***0.2443***	***0.3333***
		N0	N0
Without Constant & Trend	t-Statistic	-0.2801	0.2583
	Prob.	***0.5728***	***0.7522***
	At First Difference		
		D(bp)	d(tch)
With Constant	t-Statistic	-7.3555	-4.1192
	Prob.	***0.0000***	***0.0046***
With Constant & Trend	t-Statistic	-9.6940	-4.3015
	Prob.	***0.0000***	***0.0133***
Without Constant & Trend	t-Statistic	-6.6184	-4.1587
	Prob.	***0.0000***	***0.0002***

Source: Prepared by researchers based on the outputs of the Eviews 12 program

It is clear from the above table that the series (bp) is integrated of the first degree Pb (1), where the degree of significance reached at the level (Sig>0.05) as well as the series (Tch). Integrated of the first order TCH (1), as the bound test requires the absence of an integrated chain of the second degree I (2) and therefore the ARDL model can be applied

2.3 Selection of the optimal slowdown period for changes in ARDL estimation

We use the bounds test to detect the existence of co-complementarities between variables in the long and short term, so that we can estimate these relationships simultaneously using the ARDL model. But before that, the degree of delays must be determined based on several criteria (AIC, BIC, SC, HQ) and this is in order to self-link the error limit where we will choose

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the lowest value and the following figure shows the degree of delay of the optimal tricks of the AIC standard:

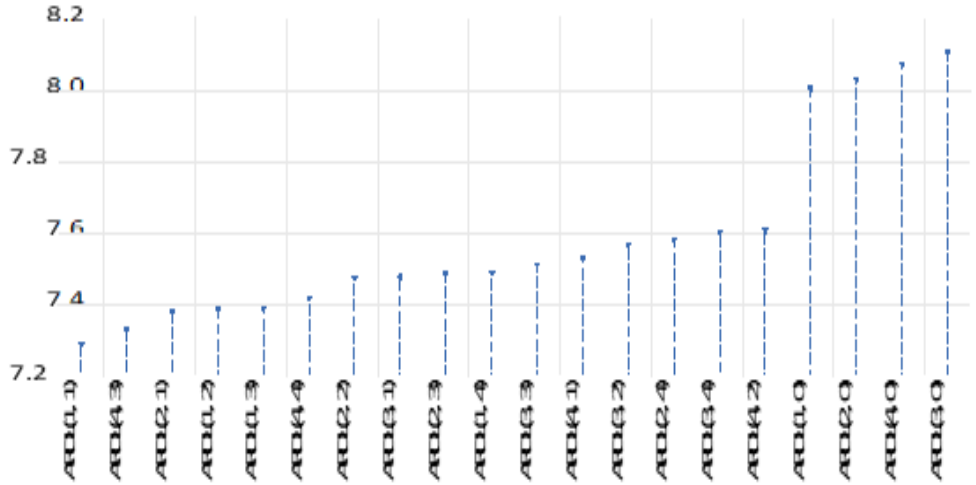

Figure (1): Testing of optimal delay degrees according to the AIC standard

Source: Prepared by researchers based on the outputs of the Eviews 12 program

From Figure 03 we can choose the degree of deceleration that corresponds to the lowest value of the AIC standard and that enables us to write the optimal model in the formula (ARDL 1.1).

2.4 Cointegration testing through ARDL Bounds Tests

The cointegration test within the ARDL model is based on the boundary test based on the Fisher (F) statistic and the results are as follows:

Table (2): ARDL Bounds Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	4.807143	10%	3.02	3.51
K	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58

Source: Prepared by researchers based on the outputs of the Eviews 12 program

The data in the above table indicate that Fisher's statistic (F = 4.80) is greater than the critical values of the maximum (4.16) at the confidence level (95%), and therefore it is possible to assert the existence of a common integration relationship.

2.5 Estimation of the model according to the autoregressive approach to slowed distributed time gaps

After confirming the existence of a cointegration relationship within the bound test between (BP) and (TCH), we measured the long-term relationship within the framework of the ARDL model using the Eviews 12 program and Estimation of the model according to the criterion (Akiaki info criterion AIC) with the following sluggish

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values (ARDL (1.1) and the parameters of the model are shown in the long term as shown in the following table:

Table (3): Estimation of ARDL Variables (Long Term)

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
TCH	0.096243	0.579410	0.166106	0.0498
C	7.786146	44.78554	0.173854	0.0438
EC = BP - (0.0962*TCH + 7.7861)				
R^2=0.8292	proF = 0.000	F = 30.16	DW = 199	

Source: Prepared by researchers based on the outputs of the Eviews 12 program

We can see from the table that (**R^2 = 0.82),** which indicates the good explanatory ability to predict, mean that (**TCH)** interprets (**BP)** by (**82.92%)** while interpreting random factors (BP) by (11.08%) and the parameter (TCH) recorded a significant significance at the confidence level (95%), where **$sig_{\alpha 1}$=0.0498** and the model as a whole defines the validity of the totality where the value of Fisher is recorded as 0.05>(**sig_F=0.000**).

While it can be confirmed that there is a positive relationship between ((**TCH)** and (**BP),** as the increase in the exchange rate leads to an increase in the balance of payments by $ 96,000.

2.6 Estimation of error correction formula (ECM) for slowed distributed time gap autoregressive model (ARDL))

The error correction vector model (CointEq (-1), which measures the speed of adaptation of short-term imbalances to long-term equilibrium, was applied to estimate the economic relationships between the variables under study, and the following table shows the results:

Table (4): ECM (short-term) error correction model estimates

ARDL Error Correction Regression				
Dependent Variable: D(BP)				
Selected Model: ARDL(1, 1)				
Case 2: Restricted Constant and No Trend				
Date: 02/11/24 Time: 23:43				
Sample: 2000 2023				
Included observations: 23				
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(TCH)	-1.599609	0.303690	-5.267247	0.0000
CointEq(-1)*	-0.302539	0.075778	-3.992427	0.0008
R-squared	0.605028	Mean dependent var		0.523514
Adjusted R-squared	0.586220	S.D. dependent var		11.51632
S.E. of regression	7.407963	Akaike info criterion		6.925929
Sum squared resid	1152.436	Schwarz criterion		7.024668
Log likelihood	-77.64819	Hannan-Quinn criter.		6.950762
Durbin-Watson stat	1.992254			
* p-value incompatible with t-Bounds distribution.				

Source: Prepared by researchers based on the outputs of the Eviews 12 program

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The results shown in the previous table indicate the existence of explanatory power in the short term, where R2 = 0.60 and the model defines a partial validity, where the exchange rate parameter recorded a significant significance estimated at Sigα1 = 0.0000, in addition to the existence of an inverse relationship between slowing (TCH) and slowing (BP) in the short term, as the increase of (TCH) by one unit leads to a decline (BP) by one million and 60 thousand dollars, while the error correction coefficient recorded a significant significance (sigECM=0.0000). <0.05 when ECM = -0.30, meaning that equilibrium returns after 1 year and 4 months, which means that 0.3 short-term errors are corrected in the long term.

2.7 Diagnostic tests of model quality

The quality of the model can be tested through a number of tests given as follows.

- **Correlation test (BG LM):** The results are as follows:

Table (5): Correlation test (BG LM)

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	1.374858	Prob. F(2,17)	0.2796
Obs*R-squared	3.202248	Prob. Chi-Square(2)	0.2017

Source: Prepared by researchers based on the outputs of the Eviews 12 program

It is clear from the data of the above table that the value of Fisher has reached 1.37 with a probability value (proF = 0.27) >0.05, and therefore we are sure that there is no problem of serial correlation between the residues

- **ARCH variance instability test:** The results are as follows:

Table (6): ARCH Variance Instability Test

Heteroskedasticity Test: ARCH			
F-statistic	0.084510	Prob. F(1,20)	0.7743
Obs*R-squared	0.092569	Prob. Chi-Square(1)	0.7609

Source: Prepared by researchers based on the outputs of the Eviews 12 program

We can see from the table that the value of Fisher recorded a significant significance where proF = 0.77>0.05 and therefore it can be said that the variance of the random error limit is constant.

- **RAMSEY rest Test**: The results are as follows:

Table (7): RAMSEY restt Test

Ramsey RESET Test			
Equation: UNTITLED			
Omitted Variables: Squares of fitted values			
Specification: BP BP(-1) TCH TCH(-1) C			
	Value	**Df**	**Probability**
t-statistic	0.755975	18	0.4594
F-statistic	0.571499	(1, 18)	0.4594
Likelihood ratio	0.718895	1	0.3965

Source: Prepared by researchers based on the outputs of the Eviews 12 program

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From the table, we can see that the value of Fisher (F=0.45) with a probability value (ProF=0.57)>0.05, which indicates the angels of the linear figure adopted in estimating the model Normal Distribution Moderation

- **Test JB:** The results are as follows:

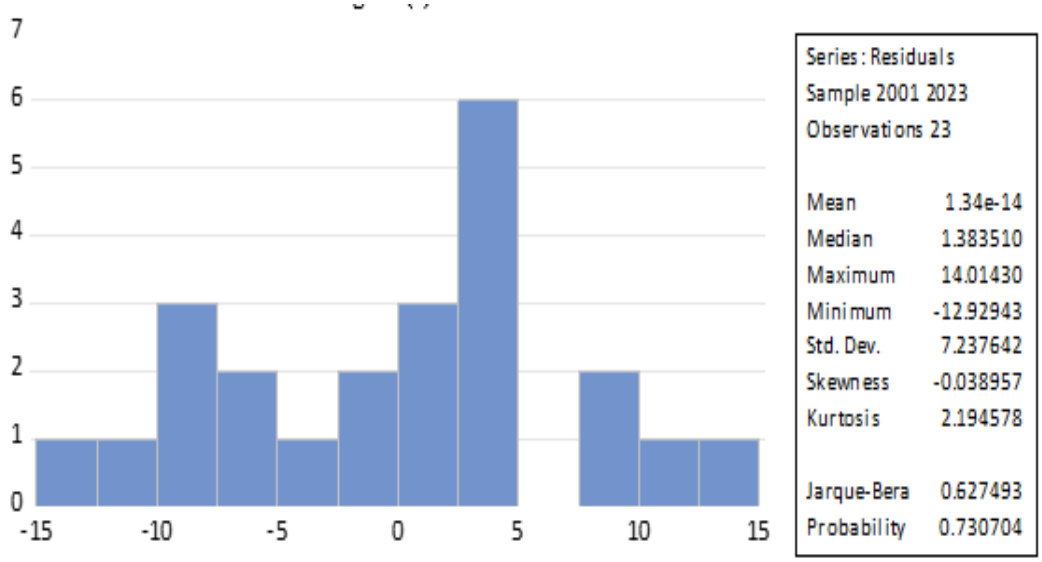

Figure (2): Normal distribution test JB

Source: Prepared by researchers based on the outputs of the Eviews 12 program

It is clear from the previous figure that the null hypothesis can be accepted, which indicates that random errors follow the normal distribution, where it reached (ProJB=0.73)>0.05

- **Structural stability test of the model:** The results are as follows:

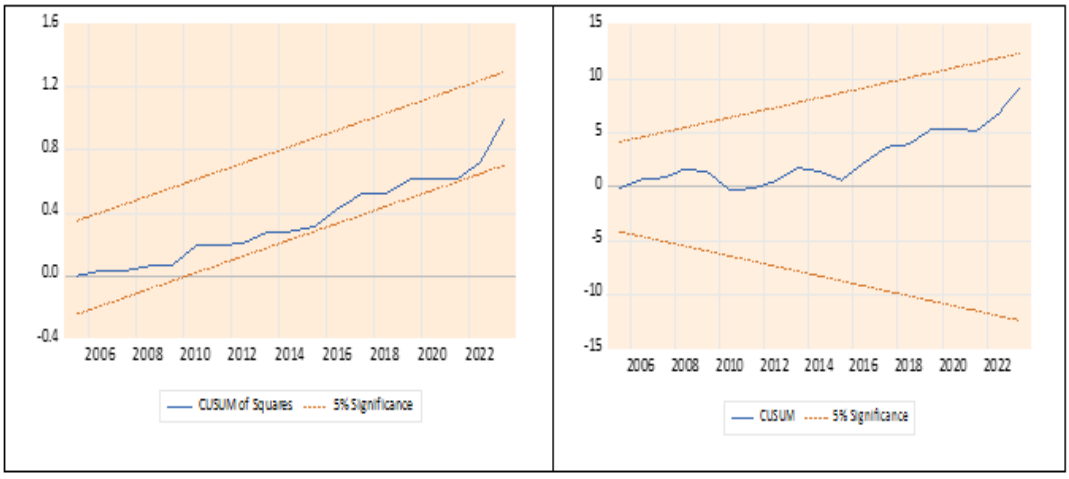

Figure (3): Structural stability test for model CUSUM, CUSUM2

Source: Prepared by researchers based on the outputs of the Eviews 12 program

It is clear from the figure that the cumulative sum test is within the critical limits, which indicates that the parameters of the UECM used are structurally stable within the critical limits of the study, as well as the cumulative sum test for the squares of the residual CUSUM2 is

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within the critical limits, which confirms that the estimated parameters are structurally stable in the long and short term.

Theil predictive performance test: The Theil test refers to the validity of the model estimated to predict where the results can be observed from the following figure:

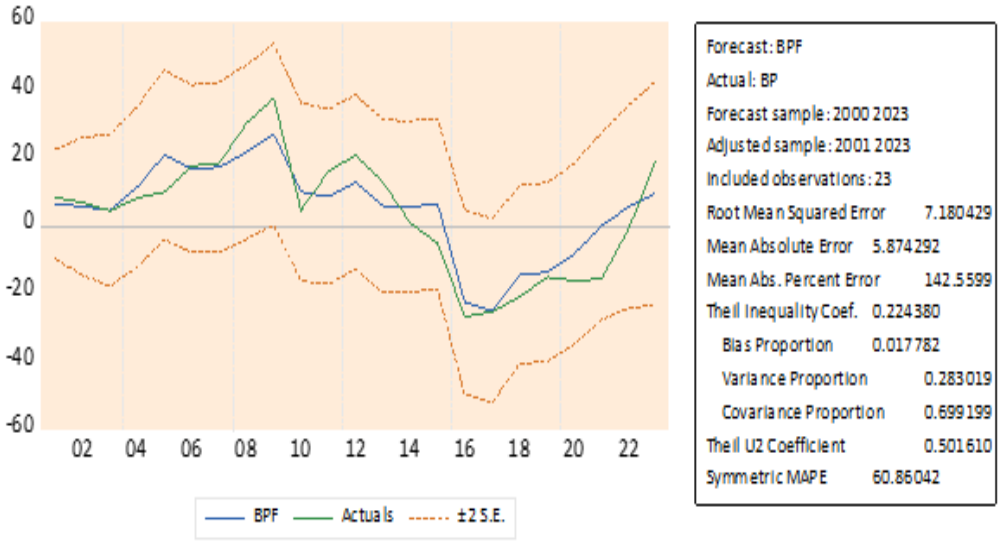

Figure (4): Predictive performance test (THEIL)

Source: Prepared by researchers based on the outputs of the Eviews 12 program

Through the table and data, it is clear to us that the value of Thiel (T=0.224) <1, which is a value close to zero (Theil=0), and the value of Bias proportion = 0.01 <1 is close to zero, as well as the variance proportion = 0.28<1, which is a value close to zero, while the percentage of covariance was closer to one covariance proportion = 0.69, which indicates the predictive ability of the model

2 8.Results of the standard study and its discussion:

The results of the standard study in various stations resulted in a number of results, which we summarize in the following points:

- The data indicate that Fisher's statistic, which reached (F = 4.80) is greater than the critical values of the maximum (4.16) at the confidence level (95%), and therefore it can be confirmed that there is a common integration relationship between the variables of the study
- The existence of a positive relationship between (TCH) and (BP) in the long term, as the increase in the exchange rate leads to an increase in the balance of payments b $ 96 thousand
- R2 value = 0.82 in the long term, which indicates a good explanatory ability to predict, that is, (TCH) interprets (BP) by (82.92%) while the interpretation of random factors (BP) by (11.08%)
- The presence of explanatory power in the short term, where it reached R2 = 0.60 and the model defines partial validity, where the exchange rate parameter recorded a significant significance estimated at Sigα2 = 0.0000, in addition to the existence of an inverse relationship between (TCH) and (BP) in the short term, as the increase of (TCH) in one leads to a decline (BP) of 60 million dollars, and it reached ECM = -0.30, meaning that the

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balance returns after 1 year and 4 months, which means that 0.3 short-term errors are corrected in the long term.

At the conclusion of this standard study, it can be concluded that the exchange rate has an important and influential impact on the balance of payments in Algeria. The results found a strong relationship between factors related to the exchange rate and the performance of the balance of payments in the country, which is consistent with the literary theories that support the existence of the impact of the exchange rate on the balance of payments.

CONCLUSION

Concluding this work, we can conclude that the impact of the exchange rate on the balance of payments in Algeria requires extensive attention and study. Understanding this complex relationship is crucial to achieving economic stability and promoting sustainable growth in the country.

This study reached important results and valuable recommendations that can be applied in practice to improve the balance of payments in Algeria. Decision-makers and economic officials should take into account the impact of the exchange rate when developing economic policies and actions, and ensure that these policies are balanced and sustainable.

Based on the evidence from the study, there are several recommendations that could contribute to improving economic performance and enhancing the stability of the balance of payments in Algeria. Here are some basic recommendations:

- Promote economic reforms: The Algerian government must continue to promote economic reforms to improve the business environment and attract foreign direct investment. This will contribute to enhancing the competitiveness of the Algerian economy and increasing exports, leading to an improvement in the balance of payments.
- Diversification of the economic base: Algeria should diversify its economic base by developing sectors other than oil and gas. Manufacturing, agriculture, tourism and services can be promoted to boost exports and strengthen the balance of payments.
- Enhancing fiscal sustainability: The government should focus on enhancing fiscal sustainability by increasing non-oil revenues and improving public debt management. Sustainable fiscal policies can contribute to boosting confidence in the economy and improving balance of payments performance.
- Promoting regional economic integration: Economic cooperation with neighboring countries and promoting regional integration can be an opportunity to expand the export base and enhance trade. Developing trade and investment links with other countries can contribute to improving the balance of payments.

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