Original Research Article

On The Impact of Exchange Rate Depreciation on bilateral Trade of Egypt and China: An ARDL Approach

ABSTRACT

The main purpose of this study is to examine the relationship of exchange rate depreciation with Egypt and China bilateral trade. The Autoregressive Distributed Lag (ARDL) approach to co-integration is employed to investigate the long run and short run relationship between the variables in sample economies over the period of 1994 to 2019. The model results further provided additional evidence that the impact of real exchange rate changes on bilateral trade in Egypt and China case is asymmetric in the long run, as real depreciation played a significant role in influencing bilateral trade between the two countries. Empirical results from the analysis revealed that real depreciation would lead to improvements in Egypt's trade balance in the long-run. It also indicated that growth in foreign income tend to worsen the trade balance, while growth in domestic income improved the Egypt's trade balance. In the short-run, however, the findings revealed that the J-curve phenomenon does not hold.

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Keywords: Exchange Rate, bilateral Trade, Egypt , China, Depreciation, ARDL

1. INTRODUCTION

1.1. Background

A considerable devotion has been seen to the analysis of trade balance for different economies as it is considered as an imperative indicator of macroeconomic stability and the competitiveness of a country which can be used to judge its relationships with other countries of the world. The countries engage in international trade often face the problem of negative trade balance which is not associated with developing countries only rather some of the technologically advanced countries have also faced large trade deficits over time because these countries consume more than they produce. A great challenge for an economy facing the negative trade balance over the time is to formulate the appropriate degree of foreign exchange rate flexibility. One view criticized that the exchange rate should be freely determined by market forces, independently of any intervention or targeting by Central Bank's monetary policy, other view confirming the Central Bank intervention and control. Therefore, Floating exchange rate has been regarded as an automatic stabilizer, which is able in some cases to rebalance the unbalanced economy. However, many countries are unwilling to let their currencies fluctuate because of the possibility for severe exchange rate fluctuations. Thus, an overvalued currency could pose distortive implications on the trade flows encouraging imports and reducing export competitiveness.

For Egypt, The Egyptian market has been gradually opening up, where trade represents 48% of GDP. Structurally, the Egyptian economy has many trade partners.In 2019, The Central bank of Egypt (CBE) reported that the statistics data has evidenced China as the main trade partner with Egypt (constituting 6.8 percent of total foreign trade), followed by the USA (6.6 percent), Saudi Arabia (6.3 percent), the UAE (6.1 percent), Russia (5.0 percent), Italy (4.7 percent), both Germany and the UK (4.5 percent each), Turkey (3.8 percent), and Switzerland (3.5 percent). These countries combined constituted 51.8 percent of total foreign trade (Fig. 1).

Hence, China is Egypt's largest trading. China also Egypts's largest importer with 20.4% shares of the total imports in 2019. The two countries have been enjoying solid economic ties which date back to more than half a century. The current volume of the exchange between them reflect a long-aged economic relation. Particularly, the majority of trade deficit between the two countries over time is accounted for China's exports to Egypt resulting in a large trade surplus in favor of China.

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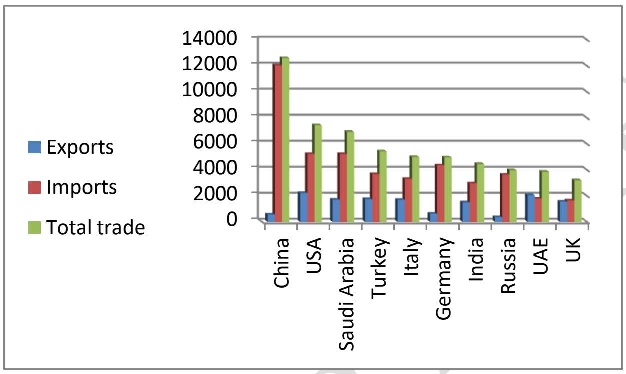

Fig. 1. Egypt trade partners during 2018-2019.
Source: Central Bank of Egypt, Annual report 2018/2019.

During the last few decades, Chinese exports into Egypt have shown relative stability. Fig. 2 shows that Chinese exports to Egypt increased from US$194.4 million in 1994 to roughly US$ 642.5 million in 2000, or 230.4 percent greater than their value in 1994. After achieving slight declines during 2001-2003, Chinese exports to Egypt have been continuously increasing, as they increased from US$ 675.3 in 2004 to more than US$4.4 billion in 2008. After 2009 Chinese exports to Egypt have been continuously growing, as they increased from US$ 3.91 billion in 2009 to more than US$12.04 billion in 2019.

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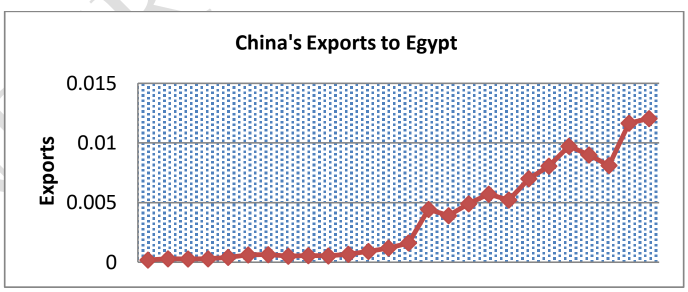

Fig. 2. China's Exports to Egypt trends
Source: Author's calculation using United Nations Comtrade Database (UN Comtrade)

Given its importance to the economy, Egyptian exports into China have grown from US$10.6 million in 1994 to US$342.5 million in 2008. However, Over 2007-2008, exports from Egypt to China increased from US$129.1 million to US$342.5 million. The Egyptian exports of goods and services increased from 975.1 million US dollar in 2009 to 1.040 billion in 2018, but Egyptian exports into China have decreased to 557 million in 2019, As presented in fig. 3.

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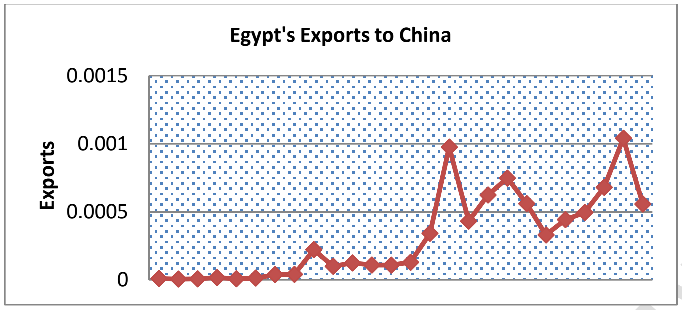

Fig. 3. Egypt 's Exports to China trends
Source: Author's calculation using United Nations Comtrade Database (UN Comtrade)

Several macroeconomic factors have been affected the bilateral trade between Egypt and China. Floating The exchange rate policy in Egypt was one of the instruments that utilized to achieve economic stabilization and sustainable external balance. Particularly in the last few years, The exchange rate policy in Egypt has been characterizing by sharp fluctuations. Starting from January 2001, the Central Bank of Egypt (the CBE) announced the adoption of a *de jure* crawling peg exchange rate regime that was followed by several devaluations of the Egyptian pound. In January 2003 the CBE adopted a new *de jure* floating exchange rate regime. However, the IMF has reclassified the *de facto* exchange rate regime of Egypt several times in the last few years. In fact, until 2012 the IMF has classified the Egyptian regime as crawl-like arrangement, from 2012 to 2016 as stabilized arrangement, from 2016 to 2017 as other managed arrangement. Since 2017 the IMF reclassified Egypt to floating arrangement (IMF, 2016 and 2017). Table 1 reveals IMF classifications of Egypt exchange rate regimes

Table 1. IMF classifications of Egypt exchange rate regimes

Year	**classification of Egypt exchange rate regimes**
2017-2019	Flexible exchange rate
2016	Floating Other managed
2015	Stabilized arrangement
2014	Maintaining a de facto exchange rate anchor to US dollar.

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2013	Crawl-Like arrangement
2012	Stabilized arrangement
2011	Crawl-like arrangement
2010	Other Managed Arrangement
2009	Other Managed Arrangement
2008	Managed floating with no predetermined path for the exchange rate
2007	Managed floating
2006	Other conventional fixed peg arrangements
2005	Managed floating
2004	Managed floating with no pre-determined path for the exchange rates
2003	Managed floating with no pre-determined path for the exchange rates
1999-2002	“pre-announced horizontal band that is narrower than or equal to +/- 2%”
1994-1998	Conventional Fixed Peg

The various epochs of devaluation in Egypt since 2016 has been a subject of debate on the short run and long run effects of devaluation on the trade balance. In this context it worth mention that starting from 2016 Egypt began a period of economic instability This has negatively affected Egypt's foreign position. The expected result is the deterioration of the value of the Egyptian pound significantly. Since then, The central bank has targeted in November 2016 providing further liberalization of the foreign exchange market to help address the foreign currency crisis in the medium term**.**

In the near past, Different economic policies, strategies and reforms have been adopted to improve the Chinese international trade and hence its trade balance. In August 2015 China's Yuan moved as a managed floating exchange rate regime resulted in rising effective RMB equilibrium rate in the context of large external surpluses and productivity increases (Sonali Das 2019).Fig. 4 shows the Egyptian exchange rate and Chineese yuan value from 1994 to 2019.

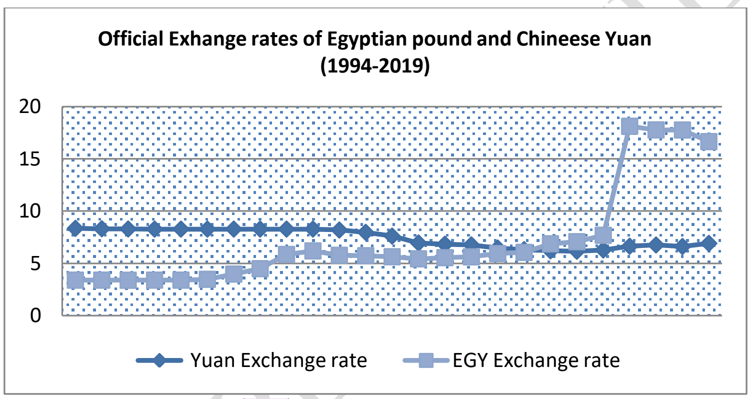

Fig. 4. Exchange rates of the Egyptian pond and Chinse Yuan

Source: Author’s calculations based on IFS data.

The Egyptian government, in the process of devaluation, assumed a long-term positive relationship between devaluation and trade balance . This is important in providing insights into how economic agents react to currency depreciations (or currency devaluations). As noted the floating of the Egyptian pound lead to loss of the pound value about 18% of its value against yuan since November 2016, followed by increasing in the bilateral exchange rate from 0.65 in 2016 to 2.28 by the year 2019.

1.2. Economic Relationships within the Exchange Rate and Bilateral Trade: Recapitulation of the Literature

Given the importance of the real exchange rate as a key economic indicator in any economy, There is a strong argument that depreciation causes a decrease in trade balance deficit (Bahmani-Oskooee, 1985; Backus et al., 1994). The economic theory suggests that when markets are free of distortions, Real exchange rate depreciation leads, in the short term, to a deterioration in the trade balance, while in the long term it leads to balance (Arize et al., 2000; Win Lin &Chi-Chur, 2000).

1.2.1 The elasticity approach

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The international trade literature estimating the effects of depreciation on the trade balance has evolved using a plethora of approaches that has generated mixed results (Arize et al., 2017). According to the elasticity approach, the effect of exchange rate variation on trade balance depends on the demand elasticity of export and import. This approach focuses on the volume and value responses of exports and imports to change in the exchange rate. According to the elasticity approach, currency devaluation improves the trade balance of a devaluating country if and only if the demand for both domestic products for foreigners and the demand for foreign goods by domestic consumers are elastic (Boyd,Caporale, & Smith, 2001; Gopalan, Malik, Shieh, 2009).

There are numerous studies has focused on the impact of the exchange rate devaluation on trade nexus. In general, some of these studies checked the effects of devaluation on TB can vary over time as elasticities changes. In the short-term, demand for exports and imports are less-elastic. The reason for this is the length of time needed to change consumers' behavior and negotiate a change in trade deals as argued in the studies of Bahmani-Oskooee, M. & Hosny, A., (2013) ; (Chaulagai, M. K. (2015); (Begović and Kreso, 2017).

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1.2.2 The Marshall Lerner Condition

The Marshall Lerner Condition is also an extension of the elasticity approach, and it states that currency depreciation improves the trade balance of a country if the sum of the elasticities of export and import is greater than one. For this condition to hold, the trade balance should be zero (Bhattarai & Armah, 2005;Sugema, 2005).

The assumptions of the Marshall-Lerner condition (MLC) encompass the perfect competition, one export commodity, and one import commodity, in addition to full employment.

The required condition for real devaluation to improve the balance of the current account is as follows:

$e_x + e_m > 1$

Where e_x is a country's elasticity of foreign demand for exports, while e_m represents the country's elasticity of import demand. The validity of this condition relies on the response of exports and imports to the real exchange rate.

1.2.3 The J-curve Effect

Another extension of the elasticity approach is the J-curve phenomenon which assumes that the short-run and long-run effects of currency depreciation (devaluation) on trade balance may differ due to the volume and the value effects of devaluation. In short term, the value of import in domestic currency increases while the value of export in foreign currency decreases. This increases the volume of exports and decreases the volume of imports in the long term, and leads to the J-curve Phenomenon (Lal, A. K. and T. C. Lowinger (2002) ; Hussain M. and U. Bashir (2012).

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Despite embracing currency devaluations, some countries experience short-term unfavorable TB outcomes before the correction is eventually realized in the long-term. This phenomenon, dubbed "the J-Curve" effect, was attributed to several factors. Initially, Magee (1973) explained that the post-devaluation time path of TB is subject to pre-existing binding contracts with rigid volumes. Ultimately, devaluation and depreciation would reduce export values and increase import payments with little impact on volumes as consumers and producers respond with a lag to changes in relative prices as revealed by Junz and Rhomberg (1973), Magee (1973) and Meade (1988); the matter that justify the TB short run declining path post currency devaluation and depreciation. However, over time, matured contracts are renewed based on the newly depreciated currency; the matter that incentivizes decision makers to adjust their contracted volumes in favor of the TB adjustment. Likewise, Junz and Rhomberg (1973) revealed that post-depreciation TB adjustment is subject to at least 5 lags; namely, recognition, decision, delivery-time, inventory replacement and production lags that last for at least 5 years before the exchange rate variations reflect on the respective economies share in global trade. Eventually, investigating the existence of the "J-curve effect" in the response of a country's TB to exchange rate movements equip policy makers with insights regarding the time path and dynamics of the adjustment process allowing them to make better decisions regarding the most relevant policy tools, implementation timing and anticipated drawbacks.

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Hence, the J-curve phenomenon can be explained by the previous theories with conditions .The elasticities of export and import demands are inelastic in the short term due to sluggish changes in consumer's behavior and lag of negotiated deals. Hence, the trade balance deteriorates in the short term due to sluggish changes in price and quantity demanded. But, in the long term, domestic consumers shift their consumption from foreign products into domestic products and the volume of export of the country also increases. These two effects improve the trade balance of the devaluating country. (Dash, A. K. (2013), Bahmani-Oskooee et al. (2016).

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A large part of the literature has focused on the J-curve effect. In particular, all these studies can be classified in two bunches. Whereas the first bunch consists of the studies which check the effects of The J-curve analyze the EXR devaluation and trade nexus taking one country's trade with its partners. As Arora, Bahmani-Oskooee and Goswami (2003), Liew, K Hussain, H. (2003) and Khan and Hossain (2012), Bahmani-Oskooee, B. Niloy (2018) these studies investigate the issue using data from developing countries. For example, Arora and Bahmani-Oskooee examine bilateral trade data of India with her 7 largest trading partners while Khan and Hossain (2012) have conducted panel data study for determining the trade balance of Bangladesh by using variables like real exchange rate, relative GNI, import weighted index and real GDP. The short-run findings showed that all variables have significant impact except import weighted index. however Bahmani-Oskooee, B. Niloy (2018) have modelled the trade balance model in a nonlinear ARDL framework for China and it's partners in order to examine whether appreciations and depreciations of the exchange rate have asymmetric effects on the trade balance.

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The second bunch consists of the studies which investigate the EXR devaluation and trade nexus taking bilateral trade case study. The most of these studies have compared the outcomes of an ARDL analysis and have reported more evidence of J-curve effects . The most recent studies led by Bahmani-Oskooee and Fariditavana (2015), Bahmani-Oskooee and Baek (2016), Phong et al. (2018), suggested that, while Bahmani-Oskooee, Amr Hosni, and Hegerty (2015) examined the link between exchange-rate and trade flows of industry trade between the US and Egypt.

2. METHODOLOGY AND MODEL

Following Rose and Yellen (1989), the trade balance behaviour of a country can be modelled as a function of the real exchange rate and the real domestic and foreign incomes.

The model starts with the standard specifications of the exports and imports demand functions. Exports are a positive function of foreign income and real exchange rate while imports are a negative function of the real exchange rate and a positive function of domestic income. The trade balance model employed in the study of Rose and Yellen (1989) takes the following long-run (cointegrating) form:

$$\ln TB = a + a \ln RER + a \ln YW + a \ln YT + \varepsilon_t \quad (1)$$

where the measure of the trade balance, TB is the ratio of imports to exports; RER is the real exchange rate; YW is the Gross Domestic Income of bilateral trade partner. Ln is the natural logarithm transformation and ε_t is the random error term. According to the J-curve phenomenon, it is expected that since an increase in real exchange rate initially reduces the demand for the home country's export but increases its demand for imports. As a result, the balance of trade worsens initially but it will improve after a while as export and import volumes adjust to price changes.

Among the different co-integration techniques used in the empirical literature, this paper adopts the application of the ARDL model (or bound test co-integration approach proposed by Pesaran and Shin (1999) and Pesaran et al. (2001) as it has multiple advantages.

In regression analysis involving time series data, if the regression model includes not only the current but also the lagged values of the explanatory variables, it is called a distributed-lag model. On the other hand, if the model includes one or more lagged values of the dependent variable among its explanatory variables, it is called an autoregressive model. So the autoregressive distributed-lag model (ARDL) is the amalgamation of this two at once. An autoregressive distributed lag (ARDL) model is an ordinary least square (OLS) based model which is applicable for both non-stationary time series as well as for times series with mixed order of integration. **An ARDL representation of equation (1) is formulated as follows:**

$$\Delta \mathrm{LnTBE_t} = \mathrm{B_0} + \mathrm{B_1 LnTBE_{t-1}} + \mathrm{B_2 Ln\ YE_{t-1}} + \mathrm{B_3 Ln\ YC_{t-1}} + \mathrm{B_4 Ln\ RX_{t-1}} + \sum_{i=1}^{p} \mathrm{B_{5i} \Delta LogTBE_{t-i}} + \sum_{i=1}^{k} \mathrm{B_{6i} \Delta LogYE_{t-i}} + \sum_{i=1}^{m} \mathrm{B_{7i} \Delta LogYC_{t-i}} + \sum_{i=1}^{n} \mathrm{B_{8i} \Delta Log\ RX_{t-i}} + \varepsilon_t \quad (2)$$

Where Δ is a first difference operator, t is time; B_0 is an intercept term, to be the short run coefficients and to be the long run parameters of the model. The null hypothesis in the equation is that $B_1 = B_2 = B_3 = B_4 = 0$, which means non-existence of long run relationship. For this conduct an ARDL bound test to examine the existence of long-run relationship. Pesaran *et al.* (2001), initiate the bounds tests in the unrestricted model or namely an ARDL model. They provide two critical values for the co-integration test. The lower critical bound assumes that all the variables are I (0) while the upper critical bound assumes that all variables are I (1). If there was existed any co-integration among variables then ARDL long run model can be estimated Following the non-structural, partial reduced form model of Rose and Yellen (1989) as follows:

$$\mathrm{LnTBE_t} = \mathrm{B_0} + \mathrm{B_1 LnTBE_{t-1}} + \mathrm{B_2 Ln\ YE_{t-1}} + \mathrm{B_3 Ln\ YC_{t-1}} + \mathrm{B_4 Ln\ RX_{t-1}} + \sum_{i=1}^{p} \mathrm{B_{5i} \Delta LogTBE_{t-i}} + \sum_{i=1}^{k} \mathrm{B_{6i} \Delta LogYE_{t-i}} + \sum_{i=1}^{m} \mathrm{B_{7i} \Delta LogYC_{t-i}} + \sum_{i=1}^{n} \mathrm{B_{8i} \Delta Log\ RX_{t-i}} + \varepsilon_t \quad (3)$$

The international trade theory illustrates that the increase in the country's GDP/income can have a direct (or inverse) effect on the TB depending on which effect dominates the other, income or (substitution) effects. Therefore; β_2 can be positive or negative. Similarly, the increase in the country's GDP/income can also be negative (or positive) depending on which effect dominates the other, income (or substitution) effects. Therefore; β_3 can be positive or negative. The reduction in the value of REX means depreciation in the real value of the currency which increases the relative competitiveness of domestic production. Hence; β_4 is expected to be positive if the devaluation of the currency improves TB which is consistent with J-curve phenomenon in the long run.

To ensure the convergence of the dynamics to the long-term equilibrium Bounds test is performed while:

The null hypothesis: $\beta\beta 0=\beta\beta 1=\beta\beta 2= \beta\beta 3=\beta\beta 4$

The alternative hypothesis: $\beta\beta 0\neq\beta\beta 1\neq\beta\beta 2\neq \beta\beta 3\neq\beta\beta 4$

The formula below is employed to compute the real exchange rate (RER) between Egyptian pound (EGY) and Renminbi currency (RMB):

$$RER = \frac{EGY}{RMB} x \frac{CCP}{ECP}$$

where RER is the real exchange rate, EGY is the currency of Egypt, RMB is the currency of China, CCPI is the consumer price index of China and ECPI is the consumer price index of Egypt.

In case of the existence of a long-run relationship and after the estimation of the long-run coefficients of the model, the analysis moves forward to the estimation of short-run coefficients of the model (Equation 4).

$$\Delta \mathrm{LnTBE_t} = \mathrm{B_0} + \mathrm{B_1 LnTBE_{t-1}} + \mathrm{B_2 Ln\ YE_{t-1}} + \mathrm{B_3 Ln\ YC_{t-1}} + \mathrm{B_4 Ln\ RX_{t-1}} + \sum_{i=1}^{p} \mathrm{B_{5i} \Delta LogTBE_{t-i}} + \sum_{i=1}^{k} \mathrm{B_{6i} \Delta LogYE_{t-i}} + \sum_{i=1}^{m} \mathrm{B_{7i} \Delta LogYC_{t-i}} + \sum_{i=1}^{n} \mathrm{B_{8i} \Delta Log\ RX_{t-i}} + \alpha\ \mathrm{ECT_{t-1}} + \varepsilon_t \quad (4)$$

where ECT is the error correction term reflecting the speed of adjustment with the parameter α that should be negative and statistically significant.

3. DATA, TESTING, AND INTERPRETATIONS

Comment [FCR29]: Data Testing and Interpretations

The purpose of this section is to test, both of short and long run effects of changes in the real exchange rate of the Egyptian pound on the bilateral trade with China. For this purpose, The bounds testing approach to

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cointegration model within a symmetric and asymmetric autoregressive distributed lag (ARDL) framework is used for the estimation.

3.1 DATA AND TIME SERIES CHARACTERISTICS

Current study investigates the J-curve hypothesis of Egypt's bilateral trade China. This hypothesis is incurred by using Egypt's trade balance with China and exchange rate of Chinese yuan in terms of Egyptian pound, China's Gross Domestic Income and Gross Domestic Income of Egypt are also used as control variables. Time series data spanning from the period of 1995 to 2019 has been used. Data for Trade balance is collected from (UN Comtrade), and the other variables data source is the Word Development Indicator (WDI, 2021) of the World Bank.

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3.2 DESCRIPTIVE RESULTS

This research explores the relationship of Egyptian Bilateral Trade with China from 2000 to 2018. Several empirical types of research have been used (ARDL) model through (cross-section data) to analyze the foreign trade relationship over specific a period of time, **Descriptive statistics of Egypt – China bilateral trade model reported in Table 2:**

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Table 2. Descriptive statistics of TBE

Variable	TBE	YC	YE	RX
Mean	0.100584	2926073	102625.4	0.610610
Median	0.092809	2455409	97688.54	0.595245
Maximum	0.234841	6148251	149133.0	0.779828
Minimum	0.013166	958039.5	61117.07	0.502475
Std. Dev.	0.058958	1677922	28516.62	0.076636
Skewness	0.494232	0.531866	0.134999	0.697788
Kurtosis	2.567635	1.930654	1.609849	2.862861
Probability	0.586548	0.352494	0.398858	0.406048

Sum	2.212852	64373608	2257758	13.43343
Sum Sq. Dev.	0.072996	64373608	1.71E+10	0.123333

Source: Author

3.3 TESTING ESTIMATIONORS STATIONARITY RESULTS

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It is not necessary that a variable become stationary at level when we run an autoregressive distributed lag model. A mixture of stationary and non-stationary variable can be used in this model.

Thereafter, we want to check stationary for all variables. For this purposes the standard Elliott-Rothenberg-test (Stock DF-GLS) is employed to check the order of integration of the variables under investigation. Based on the results of (Stock DF-GLS) test, the variables included for both domestic income and foreign income were stationary without taking the first difference while both trade balance (TBE) and real exchange rate (RX) is a stationary at first difference (I(1)) in level form with an intercept and trend and this confirms the ability to use ARDL model. **The (Stock DF-GLS) test results are reported in Table 3:**

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Table 3. The (Stock DF-GLS) test results

Variable	DF-GLS Test in Level	DF-GLS Test in First Difference
Ln TBE	- 2.806300	-7.012806
LnYE	- 3.403435	-2.307461
LnYC	- 3.516193	-1.553834
Ln RX	- 2.418419	-2.968398

***Note*.** The test is carried out using both intercept and trend at 5% level of significance.

Source: Author

3.4 BOUND TESTING ESTIMATIONS RESULTS

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After examining the order of integration of the time-series, the two-step bound test of co-integration was employed. The optimal lag order of the ARDL model was firstly chosen based on the Schwarz Criterion (SC), and the order of the model was selected to be ARDL (1,3,3,1). Following Pesaran et al. (2001), for *p* = 1, 2, …, 6, the conditional error correction model is estimated by OLS methodology both with and without trend components in the regression. **The results are given in the next Table which summarizes Optimal Lag Length Selection with Unrestricted (UECM).**

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Table 4. Optimal Lag Length Selection with Unrestricted Error Correction Model (UECM)

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	512.565	NA	5.2e-13	-14.099	-14.0361	-13.9409
1	792.353	559.57	4.4e-16	-21.1765	-20.7988	-20.2279
2	861.275	137.84	1.3e-16	1.3e-16	-22.3965	-21.7042
3	898.913	75.277	9.4e-17	-22.7476	-21.7405	-20.218

Source: Author

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It is then appropriate to move forward to the second step in which the long-run relationship among the incorporated variables is investigated based on the F-statistic of the chosen model. **Table 5 summarizes Error Correction model Bound Test**

Table 5: Error Correction model Bound Test

Calculated F	Critical values	
	Lower value	Upper value
12.89	2.79	3.67

Source: Author

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The calculated F-statistic is 12.89, which is above the upper bound critical value at 5% level of significance. This resulted in there was a long-term relation between variables. This means that the variables used in ARDL model move together in the long term Symmetry.

3.5 ARDL LONG-RUN DYNAMICS AND SHORT-RUN DYNAMICS

Based on the results of the Bound Test for the time series described previously, which showed that the series are stable when taking the first difference, the next step is to test the existence of a long-term equilibrium relationship between the trade balance, **The results of the long-term coefficient estimates of the TBE model for Egypt's bilateral trade with China are shown in Table 6**

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Table 6. Coefficient estimates of long-term TBE model (ARDL (1,3,3,1)

Variable	Coefficient*	Standard error	E - Statistic	Prob
C	-161.7435	1.9294	5.4013	0.0267
LnYC	-16.75792	0.10695	0.94773	0.0260
LnYE	35.54680	0.300311	-8.2177	0.0124
LnRX	2.624486	0.13340	-5.7705	0.0245

Note. ARDL (1,3,3,1) is selected on the basis of SBC. The ARDL model was chosen such that the trend specification is neither constant nor trend case. and * indicate 5% level of significance. RX indicate real bilateral exchange rate.

Source: Author

Comment [FCR49]: apply previous comments

Considering the long-run coefficients in Table 6, the variables appear to be statistically significant with signs consistent with economic theory. Result shows that in the long run China income (YC) has negative impact on the trade balance of Egypt. On the other hand, the coefficients of income (YE) in Egypt is statistically significant and positivity related to TB in case of Egypt-China bilateral trade. Based on the equation of trade balance, the growth of domestic income leads to an improvement of the trade balance. The estimated elasticity of income in Egypt is 35.54%. These results suggest that a 1% increase in domestic income would account for a 35.54% increase in trade balance. The growth of domestic income occurred as a result of the growth in domestic production and exports, i.e. the growth of foreign demand. As for The estimated elasticity of income in China the results suggest that a 1% increase in domestic income in China would account for a 16.7% decrease in trade balance of Egypt.

Comment [FCR50]: lower case

Based on the resulting cointegration equation, ARDL model shows the positive impact of real depreciation and income on the trade balance. Long-term real depreciation leads to an improvement of the trade balance. Result shows that Exchange rate change has positive impact on Egypt's bilateral trade with China. The estimated or calculated elasticity is 2.6%, which indicates that the real depreciation of 1% causes an improvement of 2.6% in the trade balance. In addition, This result sticks to the J-curve hypothesis that the exchange rate has positive impact on trade balance in the long run.

To verify the existence of the effect of the (J) curve empirically in the case of the Egyptian economy, There is a necessary and sufficient condition that must be fulfilled, which is that the sign of the coefficient of the exchange rate variable be positive and statistically significant, and that it be the value of the coefficient that measures the elasticity of the total exports and imports are greater than the correct one and to make sure there is an effect (J) curve, it is distinguished that the value of the exchange rate coefficient is firstly negative and statistically significant in In the short term, the value of the coefficient becomes positive and greater than the integer one and is statistically significant in In the long term .

Comment [FCR51]: there

Comment [FCR52]: check

Comment [FCR53]: check

Empirical results from the short run ARDL model as presented in table 7, shows that the coefficient of the exchange rate is positive but statistically insignificant in the short run. Other variables, partner country income has negative sign as Egypt's export decrease with the increase in partner's income

Comment [FCR54]: Table

which means that holding constant for other variables, a one percentage point increase in the income of the importer will decrease to approximately 3.40e-5 percentage point in the total Egyptian trade.

Table7. Short run Coefficient estimates of TBE lags in TBE model

Dependent variable: TBE		
Variable	**Coefficient**	**Probability**
ARDL →	**ARDL (1,3,3,1)**	
Dlog (YC)	-8.680300	-7.012806
Dlog (YC (-1))	- 3.403435	-2.307461
Dlog (YC (-2))	- 3.516193	-1.553834
Dlog (YE)	-0.5590	-2.968398
Dlog (YE(-1))	- 2.418419	0.0982
Dlog (YE(-2))	-17.71124	0.0041
Dlog (RX)	0.890648	0.2254
Coint Eq. (-1)	-1.121958	
R^2	0.930756	
Adj. R^2	0.8556	
DW-Sta.	1.9343	

Note. All variables are used in their logarithmic form. An intercept was added in each equation of the tests employed.

Source: Author

Comment [FCR55]: Previous comments

Through Table 7 , The results do not support the evidence of the short-run worsening of trade balance suggested by the J-curve effect, while large depreciations are passed to the trade balance in a larger extent than large appreciations the findings also suggest that in monitoring the exchange rate movements, attention should not only be focused on large changes but also on relatively small changes.

3.6 DIAGNOSTIC TESTS OF THE ARDL MODEL

The result confirms the long run relationship among the variables that they cause one another for each time series. Apart from this, diagnostic checking are performed to make sure there are no biases and economic problems in the model.

Comment [FCR56]: reword

Several tests were conducted to check the reliability of the ARDL model estimated for the bilateral real exchange rate.(Table 8 reveals the results of the diagnostic tests). These tests include normality, serial correlation LM and heteroscedasticity tests along with two stability tests, which produce recursive estimates and are known as cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ whose results confirmed that the regression equation was stable.

Comment [FCR57]: align well

TABLE 8. DIAGNOSTIC TESTS OF THE ARDL MODEL

CALCULATED F	***CHI SQUARE****
BREUSCH-GODFREY	0.1577
HETEROSKEDASTICITY BREUSCH-PAGAN-GODFREY	0.1862
RAMSEY RESET	0.7854

Note.* Diagnostic tests show that all classic assumptions are significant at 5%.

Source: Author

As outlined in Table exchange rate is evaluated to be reliable in terms of serial correlation, normality and heteroscedasticity, The ARDL model estimated using the bilateral real exchange rate is evaluated to be reliable in terms of serial correlation and normality checks.

Comment [FCR58]: no Table number

After the Error Correction model is tested according to the ARDL, there are several criteria to test the quality of the model.Using The negative sign on the coefficient of the first lag of the error correction term (Coint Eq. (-1), -1.121958) shows a high rate of convergence to the long run equilibrium. This implies that residuals are normally distributed , Normality tests are carried out on the fitted model to establish the normality of the residuals using the Jarque-Bera test against the null hypothesis stating that residuals are normally distributed. The null fails to be rejected. Hence, the residuals are normally distributed with a Jarque-Bera (2,2171) and Prob (0,140).

Comment [FCR59]: lower case

Table 9. Jarque-Bera test

Statistics	Estimated Value	Probability
Functional Form	2,0966	1,1147
Normality	2,2171	0,140
Cusum		Stable
Cusuma		Stable

Source: Author

Through Table No. 9, the results reavels that the cumulative sum of the squares of the residuals lies within the limits, this means that the model has no problems related to the serial correlation or the difference in variance and fulfills the condition of the normal distribution, as it is to determine what If the regression equations were stable throughout the study period, Cusum and Cusuma tests were used, whose results confirmed that the regression equation was stable.**The following figure shows the structural stability test of the ARDL model estimated for the long-term and short-term relationship**

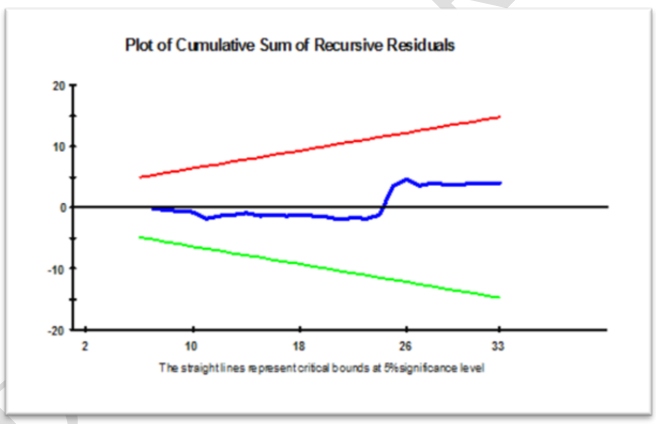
Comment [FCR60]: reveals

Comment [FCR61]: what-if

Comment [FCR62]: reconfirm your position

Comment [FCR63]: check for correction

Fig 5. Plot of Cumulative Sum of Recursive Residuals for TBE ARDL Model (5% significance).



Source: Author

4. CONCLUSION

This paper assesses the behaviour of real exchange rate depreciation on Egypt and China bilateral trade (the J-curve phenomenon) using aggregate trade data for the period 1994 to 2019. The paper uses the bounds test approach to cointegration developed) to analyze the long-run relationship among the variables. The empirical results indicate that there is cointegration between the bilateral trade and the real exchange rate, and domestic and foreign income. The long-run results indicate that the real exchange rate carries a negative sign and statistically significant .Although the short-run result shows evidence for positive values as the lag length increases, the coefficient is insignificant. Therefore the results do not find support for the J-curve phenomenon in the short-run.

Comment [FCR64]: is J-Curve synonymous with the relationship being tested?

Comment [FCR65]: Remove bracket

Comment [FCR66]: And is …..

Comment [FCR67]: Not-significant or non significant

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