

## The Long-Term determinants of the Real Exchange Rate in Egypt over the period 2002-2019

المحددات طويلة الأجل لسعر الصرف الحقيقي في مصر خلال الفترة ٢٠١٩-٢٠٠٢

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### المستخلص:

يتم تحديد سعر الصرف الحقيقي من خلال عدد من العوامل الديناميكية والخاصة بكل بلد. في مصر ، حدثت تحولات في أنظمة أسعار الصرف منذ خمسينيات القرن الماضي نتيجة لتغيير أوقات التحول الاقتصادي. الغرض من هذه الورقة هو وصف ودراسة العوامل التي تحدد المحددات طويلة الأجل لسعر الصرف الأجنبي في الاقتصاد المصري خلال الفترة ٢٠١٩-٢٠٠٢ ، باستخدام اختبار يوهانسن - جوسيلْيوس للتكامل المشترك. وخلصت الدراسة إلى أن سعر الصرف الحقيقي للجنيه المصري يتم تقديره من خلال الاستهلاك الحكومي والاحتياطات الدولية وتحويلات العاملين ، بينما تؤدي معدلات نمو الناتج المحلي الإجمالي إلى انخفاض سعر الصرف الحقيقي للجنيه المصري على المدى الطويل. يضاف إلى ذلك أن الدراسة وجدت أن درجة الانفتاح وشروط التبادل التجاري ليس لها تأثير كبير على سعر الصرف الحقيقي للجنيه المصري على المدى الطويل.

الكلمات المفتاحية: سعر الصرف الحقيقي ، اختبار التكامل المشترك جوهانسن وجوسيلْيوس ، نموذج (VAR) ، الجنيه المصري.

### Abstract:

Real exchange rate is determined by number of factors which are dynamic and country specific. In Egypt, shifts in the exchange rate systems have been taking place since the fifties of the last century as a result of altering economic transition times. The purpose of this paper is to describe and investigate the factors which determine the long-term determinants of the foreign exchange rate in the Egyptian economy over the period 2002–2019, using the Johansen–Juselius co-integration test. The study concludes that the real exchange rate of the Egyptian pound is appreciated by governmental consumption, international reserves and workers' remittances, while GDP growth rates depreciate the real exchange rate of the Egyptian pound in the long run. Added to that, the study has found that the degree of openness and terms of trade do not have a significant effect on the real exchange rate of the Egyptian pound over the long run.

**Keywords:** Real Exchange Rate, Johansen and Juselius Co-integration Test, VAR model, Egyptian Pound.

**JEL Classification:** C32, F31, F41

## 1. Introduction

The escalating importance of foreign trade in promoting economic development and financial markets stability, in addition to countries inter-reliance on global markets to secure domestic demand for goods and services, have augmented the role of exchange rates (ERs) in achieving macroeconomic goals. Used as a tool to ensure macroeconomic stability and growth, ERs are directly and indirectly linked to multiple indicators including inflation rates, the balance of payments, growth

rates, risk assessments, and uncertainty (Gohsh, 1996). This makes the misalignment in the real ERs easily trigger misallocations in resources between tradable and non-tradable sectors (Calo & Comunale, 2019), and it negatively impact labor market dynamics and reduce external competitiveness (Gohsh, 1996). In this regard, governments seek to pursue policies aimed at ensuring the stability of its ER by adopting specific ER systems. In practice, some countries choose a floating ER regime when the price of their currency relative to other currencies depends entirely on supply and demand, while others opt for a managed floating system at different points in time (Bostan & Firtescu, 2018). To better understand ERs movement, many studies have examined its determinants. Purchasing power parity PPP, GDP growth rates, consumption, productivity levels, market openness, expectations, and other factors are all contributing in specifying countries' ERs value (Faruqee, 1995). In Egypt, the ER has witnessed years of stability and others of volatility accompanied by major economic transformations and altering ER regimes. In the light of that, this study is employed to elucidate the main concepts concerning ERs and presents a brief literature review pertaining to real ERs determination. The paper proceeds with a concise overview of data from Egypt for the period between 2002 and 2019 to analyze the determinants of the real ER of the country. This is followed by a section presenting the methodology, model and data used in the analysis. The paper then presents the empirical findings, summary and conclusion.

## **2. An Overview of Economic and Exchange Rate Policies in Egypt**

After the 1952 revolution, the Egyptian economy has witnessed periods of economic transformations associated with different Exchange Rate Regimes (ERR) (Mohieldin, 2003). It started with the nationalization and heavy state intervention of the 1960s, followed by the economic reform after external shocks during the 1980s, the initiation of a comprehensive Economic Reform and Structural Adjustment Program (ERSAP) in the early 1990s, and finally a period of structural reform after the 2011 revolution. In this section, we discuss the different (ERR) that Egypt adopted between 2002 through 2020 (Mahfouz, 2019). The rest of this section sheds the light on how ERR in Egypt had been managed during the same period.

### **2.1 The Fixed yet Adjustable Peg ERR**

Starting from the mid-sixties until 1990, Egypt had put a fixed yet adjustable peg in practice (Diwedat, 1989). The “infatih” (open door) policy adopted during the 1970s created a corresponding ER market and the value of the pound went from \$2.5 to \$.7 in September 1973, then to \$.42 by the end of 1973 (Almasry,1997). Later, The Egyptian authority kept the ER of the pound fixed. The Central Bank of Egypt CBE then adjusted the ER of the pound from LE 1.1 per dollar to LE 2 per dollar in July 1990 (Mabrouk and Hassan, 2012).

### **2.2 The Managed Floating ERR**

With the implementation of the ERSAP (Nassar, 1997), the Egyptian authority adopted a managed floating ERR leading to a devaluation from LE 2 per dollar to LE 3.4 per dollar between February 1991 and December 2000 (Hendi,2007). This period can be divided into two sub-periods. The first started in January 1991

through September 1997 which was characterized by a steady increase of reserves from 3.1 billion dollars in January 1991 until it reached its peak of 19.1 billion dollars in September 1997 (Central Bank of Egypt, 2010) due to the foreign debt relief introduced after the “Gulf War” in 1991(Almasry,1997). The second period took place from October 1997 till December 2000, when the ER was kept at LE 3.388 per dollar. The pound experienced a sustained real effective appreciation during the second half of the 1990s (Ammar, 2003), reflecting the combination of a fixed nominal ER, a depreciation of the Euro, and a positive inflation differential between Egypt and its main trading partners (Brixiova et., 2014). As a result, the current account of the balance of payments deteriorated by the end of the 1990s. In 1998, the IMF revised its classification of the de jure “Managed Floating” ERR in Egypt to a de facto “Conventional Fixed Peg” ERR regime rather than the official classification of a managed floating regime (Massoud &Willett, 2014).

### **2.3 The Crawling Peg ERR**

The period from January 2001 to December 2002 has marked three consecutives ER devaluations. The first one was in January when the CBE adopted the de jure “Crawling Peg ERR” and the ER was set at LE 3.85 per dollar. Then on September following the 9/11 terrorist act, the CBE devalued the pound to LE 4.14 per dollar (Khamies,2012). Finally, by January 2002, due to losses in the tourism sector, the CBE was forced to devalue the pound one more time to LE 4.5 per dollar (Tayell, 2004).

## **2.4 The De Facto Vs. the De Jure Egyptian ER Regime After the Float**

In January 2003, the CBE announced a “Free Floating ERR” which has raised IMF concerns as well as market participants and local economists. During 2003, the pound decreased in value against USD from LE 3.85 to LE 6.86 while being traded at LE 7 in the black market. One year later, the IMF revised its classification of Egypt’s ERR as follows: in 2004, 2005, and 2006, the IMF classified Egypt’s ERR to a de facto “Managed Floating with no predetermined path for ER” combined with a “Monetary Aggregate Target” policy framework (Massoud, 2014). The value of the pound has improved to LE 5.80 per dollar, the inflation rate increased to 15.9% and 16.1 %, measured as WPI and CPI respectively, and the reserves increased from 14.8 billion dollars by the end of June 2004 to 22.4 billion dollars by the end of February 2006 (Khamies, 2012). In 2008, the IMF changed its classification to a de facto “Other Conventional Fixed Peg Arrangement” with the ER as a nominal anchor, and in 2009 the IMF reclassified it to a de facto “Managed Floating with no Predetermined Path for ER”. By the end of 2011, it was reclassified as a de facto “Craw-Like Arrangement” and few months later, in 2012, it was reclassified as a de facto “Stabilized Arrangement”. Then in 2013, it was reclassified again as a de facto “Craw-Like Arrangement” (Massoud, 2014).

## **2.5 The 2016 Floating Regime**

On the 3rd of November 2016, the CBE decided to float the pound. The decision has been made after a period of economic instability, a shortage of foreign currency inflows and political disruptions (Mahfouz, 2019). The floatation was also one of

the IMF conditions to secure a 12-billion-dollar loan. The floatation aimed at boosting external competitiveness, encouraging foreign investors, increasing transparency and fighting against the black market which was trading at a double-the-official price.

### **3. Literature Review**

The behavior of ERs has been frequently discussed in the international finance literature. Although ERs are erratic and unpredictable in the short run, its long-run behavior is believed to be guided by economic fundamentals. Some studies are similar to our approach in examining country specific regimes.

In 1999, a study conducted by Wu analyzed the behavior of the real ER in Taiwan and found that changes in the nominal ER and changes in the domestic and foreign price level result in changes in the real ER. It stated that the purchasing power parity relationship does not hold in the long run in Taiwan. It also concluded that differentiation in productivity growth between traded and non-traded goods leads to an observed change in the real ER and that unit labor cost has a significant influence on the real ER in Taiwan. Another country-specific study was done by Mkenda (2001) who found that terms of trade, government consumption and the level of investment impact the real ER for imports in Zambia, while terms of trade and central bank reserves affect real ER for exports. Osinubi and Ahamefule (2005) analyzed the ER regime choice in Nigeria over the period from 1960 to 2000 and concluded that the degree of openness, inflation, foreign reserves and monetary shocks explain the choice of ER regime. In Canada, Kia (2013) concluded that real

ER in the long run is a function of real money supply, domestic and foreign interest rate, real GDP, governmental expenditure, deficit per GDP, debt per GDP and price levels.

Bashir and Luqman (2014) used the Johansen cointegration test and error correction model to examine the long run determinants of real ER in Pakistan from 1972 to 2013. They used data about terms of trade, trade restrictions, price level, and workers' remittance. They found that the ER is depreciated by the terms of trade and price level while trade restrictions and workers' remittance are exerting negative effects or appreciations of the real ER in the long run. Published in the same year (2014), Chowdhury analyzed the determinants of ERs in Bangladesh economy for the period of 1990 to 2011 using simple single equation linear regression model and concluded that inflation rate, GDP growth rate, interest rate and current account balance has positive impact on ER and the major role played by GDP. In 2016, Benazic and Skabic published a study which used ARDL co-integration approach to analyze the real ER movements in Croatia and found that an increase of FDI flows and price levels lead to ER appreciations, while the ratio between foreign currency deposits and total saving and time deposits, and international reserves are insignificant in determining long run ER in Croatia.

In a recent study, Cato and Comunale (2019) computed the Real Effective Exchange Rate (REER) in Italy. They found that the effect of government consumption on the real effective ER is significantly larger than government investment. They also concluded that a decrease in the terms of trade (imports

value > exports value) increases the real effective ER. Using GDP per capita as a proxy of Balassa–Samuelson effect, the study found an increase in non–tradable prices without a comparable increase in productivity relative to the tradable sectors.

Other studies included more than one country in their analysis. Faruqee (1995) examined the long run determinants of real ER from a stock flow perspective. He used a co–integration method on data from USA and Japan over the period of 1950 to 1990 to understand the trend movements of the real value of the dollar and the yen. The study found that the net foreign assets and productivity differentiations share a long run relationship with the real ER in the US, while for Japan only productivity matters in the long run and that the terms of trade and net foreign assets were less important in determining the real ER in both countries. In another multi–country study, Juhn and Mauro (2002) investigated the long run determinants of real ER regimes for 184 countries over the period of 1990 to 2000. They included trade openness, share of trade with the largest trading partner, economic size, per capita GDP, terms of trade, fuel exporting amount, inflation, and reserves as determinants of ER regimes. The study concluded that neither the variables identified by old theories nor other economic or political variables identified by new theories are robust predictors of ER regimes. The only variable that seems to bear some relationship to ER regime choice was the size of the economy.

In 2003, Egert et al. examined the long run determinants of the real ER for 45 developing countries from Latin America, Africa and Asia. They used data of terms of trade, tariff reduction, net foreign assets, public spending, domestic investment,

and technical progress. They concluded that terms of trade, per capita GDP and capital flows entail a long run appreciation of the real ER, while the increase in domestic investment and the increase of openness entail real ER depreciation. The public spending effect was ambiguous. Candelon et al. (2007) also estimated the long real ER determinants for eight European Union member states over the period 1993 to 2003. They used panel cointegration techniques to examine the relationship between the real ER and governmental consumption, private consumption, openness and productivity. They found a significant positive relationship between productivity and real ER, while they found a stable negative relationship between openness and real ER. Another study done in 2008 by Carrera and Restout examined the long run behavior of real ER in 19 countries of Latin America over the period 1970 to 2006, and concluded that the long run purchasing power parity does not hold in this region. They found that higher governmental spending, an increase in productivity differentials, a positive terms of trade, a surge in foreign capital flows and high net foreign assets positively affect the real ER, while an increase in openness leads to a depreciation of the real ER. The study suggested that the de facto exchange regime has a strong influence on real ER in Latin America. AbuDalu et al. (2014) analyzed the long run variables affecting the real ER of five ASEAN currencies. By using ARDL approach to co-integration for the period from 1991 to 2006, the study concluded that the foreign interest rate and money supply M1 are the significant long run determinants of ER in ASEAN countries.

Published in 2014, Comunale examined the long run determinants and misalignments of the real effective ER in the European Union over the period from 1994 to 2012 by using heterogeneous co-integrated panel framework in static and dynamic terms. He used data about real effective ERs, net foreign assets, trade balance, terms of trade, and productivity. He found that countries which experienced positive net foreign assets positions have an increase in their real effective ERs in the medium-long run. He also found a positive relationship between terms of trade and real ER and a positive relationship between the relative GDP per capita, as a measure of the Balassa-Samuelson effect, and the real ER in the EU countries.

Some studies examined the Middle East and North Africa MENA region. Daly and Sami (2009) analyzed the determinants of real ER practices in 15 MENA countries over the period 1993 to 2007. The study concluded that international reserves play a major role in determining the real ER in these countries. Another study conducted by Brixiova et al. (2013) studied the real ER determinants in the long run in Egypt, Morocco and Tunisia. The study results indicated that the net foreign assets has a negative effect in the three countries which means that a decrease in net foreign assets results in an appreciation of the real ER. The study indicated that, in Egypt, the increase in productivity leads to a real ER depreciation, while in Morocco it leads to a real ER appreciation. In Tunisia, the effect of productivity was ambiguous. In a more recent study, Eslamloueyan and Kia (2015) estimated a model of the real ER for oil-producing countries in the MENA for the

period from 1985 to 2009. They found that over the long run, money supply, gross domestic product (GDP), government expenditure, oil price, and the U.S. externally financed debt to GDP influence the real ER, and that government expenditure, local interest rate has a positive impact on ER, while money supply, local real GDP, oil price, external debt to GDP ratio, and foreign interest rates negatively affect it.

At the national level, Almasry (1997) conducted a study aimed to identify the determinants of the Egyptian ER against both the US dollar and the sterling pound in the nineties and concluded that interest rates, imports, and political stability are the most influential variables. As for the sterling pound, the study concluded that prices and imports are the most influential determinants. In 2007, Hendi conducted another study aimed to identify the most influential factors in determining the value of the Egyptian pound. The study used the Hedrick and Prescott model and the co-integration model on data for the period from 1980 to 2002. The study concluded that there are only three variables with a significant effect on the ER, which are the budget deficit, the trade deficit and the local credit, while government spending, exports, imports, gross domestic product, foreign assets, international reserves have not shown a significant effect. In another attempted to clarify the determinants of the ER in Egypt during the period from 1991 to 2013, Bakr (2014) conducted a study applying the ordinary least squares and concluded that the most influential variables in determining the ER are trade deficit (71%), followed by inflation rates (44%) and local credit (32%). The study has also found that the ER has a significant affect on the trade balance deficit, followed by investment rates

and budget deficits. In 2015, Rofail and Hosni published a study which used co-integration and VECM to assess the real ER in Egypt from 1974 to 2012. They found that productivity differentiations and government consumption caused an appreciation in the real ER, and concluded that the effect of openness of the economy is dominated by the substitution effect as it leads to a depreciation in the real ER equal to the effect of the investment share.

As presented, long term determinants vary across countries and along time periods. In our study we use a combination of variables to study the long term determinants by examining the most recent data available for the period 2002–2019 for Egypt. In the next section we present our methodology.

#### **4. Methodology and Data Analysis**

##### **4.1 Methodology**

In the study of economic time series data, data points are often non-stationary and this implies over time changes in data means, variances and covariances. Nonstationary of time series data may lead to wrong conclusions; two variables might be related when they are not in what is known as spurious regression (Stock and Watson 2006). Granger introduced the cointegration method to test this kind of relationships. There are two types of cointegration tests based on Granger theory, the first is Engle-Granger test which is suitable for bivariate analysis, the other is johansen-juselius JJ cointegration test which is suitable when we use more than two variables (Maddala 2001). In this study we examine the long run relationship between more than two variables using the JJ cointegration test. The

idea behind the cointegration is that if  $Y_t$  and  $X_t$  are integrated of order one then  $Y_t$  and  $X_t$  are said to be cointegrated if and only if  $u_t$  obtained from the long run relationship is integrated from order zero. If the co-integration criteria is met, then  $Y_t$  and  $X_t$  move together in the long run such that they cannot drift arbitrary apart from each other as time goes on (Engle and Granger, 1987). To apply the co-integration analysis, the time series should be stationary. There are many tests that can be used to determine the stationarity of the data, such as ADF test and PP test. (EViews User's Guide I&II Version 6).

To determine the relative importance of each variable innovation, forecast error variance decomposition is used to observe the relative importance of each variable in the VAR model. The variance decomposition results can be used to predict the percentage contribution of each variable due to a change in a certain variable in a VAR model. (Enders et al., 2011).

#### 4.2 Data

To investigate the long run determinants of the real ER in Egypt, the study uses a log – log model and include five independent variables. The real ER model is specified as follows:

$$\ln \text{RER} = \alpha + \beta_0 \ln \text{GC} + \beta_1 \ln \text{GR} + \beta_2 \ln \text{OPEN} + \beta_3 \ln \text{RES} + \beta_4 \ln \text{TOT} + \beta_5 \ln \text{WREM}$$

(1)

Where: **RER** = real ER of USA dollar in Egyptian pounds<sup>(1)</sup>; **GC** = governmental consumption; **GR** = GDP growth rate; **OPEN** = degree of openness<sup>(2)</sup>; **RES** = international reserves; **TOT** = terms of trade<sup>(3)</sup>; and **WREM** = workers' remittances

### 4.3 Data Sources and Range

The study explores the determinants of real ER using quarterly time series data for Egypt from Q1-2002 to Q1-2019. Data of nominal ER for Egypt, CPI for Egypt and USA, GDP growth rates, exports and imports, nominal GDP, and international reserves values are all obtained from the International Financial Statistics of International Monetary Fund ([data.imf.org](http://data.imf.org)). Data of government consumption and workers remittances are obtained from the Central Bank of Egypt published by the Information Decision Support Center website ([www.idsc.gov.eg](http://www.idsc.gov.eg)).

## 5. Empirical results

### 5.1 Unit Root Test

Unit root test aims to determine the stationarity of each time series. We assigned Augmented Dicky Fuller test. Table (1) shows the test result for the data in its level and first difference.

Variable	Level (p-value)	First-Difference (p-value)
RER	0.4162	0.000
GC	0.9404	0.0002
GR	0.0964	0.000
OPEN	0.3564	0.0114

RES	0.4507	0.000
TOT	0.7698	0.0000
WREM	0.8275	0.0000

Table (1): Unit Root Test Results

From table (2), it is clear that the variables are not stationary in their level but they are all stationary in their first difference. From these results we can conclude that all the variables are integrated of order one  $I(1)$ . Being integrated of the same order, we decide to use a Vector Autoregressive Model (VAR).

### 5.2 Lag Length Selection

Using the VAR model results we can determine the optimum lag length.

Table (2) presents the lag length criteria derived from the VAR model.

Table (2): Optimum Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	23.16851	NA	1.41e-09	-0.513286	-0.275160	-0.419630
<b>1</b>	<b>384.5661</b>	<b>631.0117</b>	<b>7.03e-14</b>	<b>-10.43067</b>	<b>8.525661*</b>	<b>9.681421*</b>
2	421.2964	55.97003	1.10e-13	-10.04116	-6.469265	-8.636314
3	464.8464	56.68414	1.51e-13	-9.868141	-4.629367	-7.807706
4	538.4705	79.46726	9.44e-14	-10.64986	-3.744201	-7.933829
5	633.0343	81.05465*	3.93e-14	-12.09633	-3.523787	-8.724705

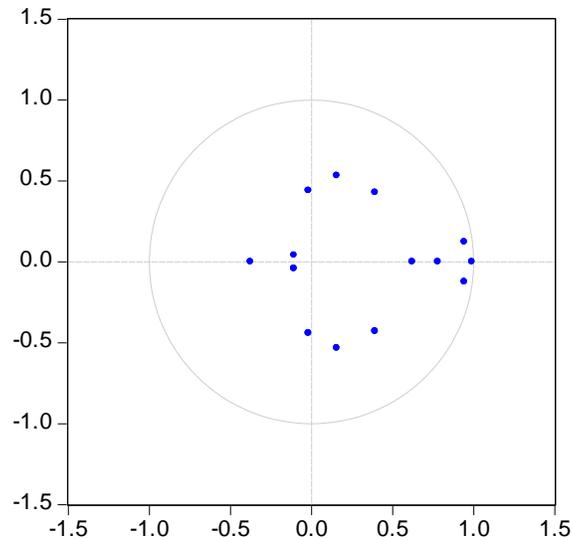
6	730.1172	61.63994	2.38e-14*	13.62277*	-3.383346	-9.595553
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Using Schwarz Information criterion (SC) and Hannan–Quinn information criterion (HQ), we find that the optimum lag length is one period.

### 5.3 Model stability

The VAR model should be stable for the results to be trusted. The VAR model stability can be checked by the inverse root circle, if there are no roots lying outside the unit circle in the model, the model is stable (Mirdala 2009). Figure (1) shows the inverse root circle of the VAR model which indicates a stable model.

Figure (1): Inverse Roots of AR Characteristic Polynomial



### 5.4 Results of the Johansen–Juselius Cointegration Test

The final step for the Johansen–Juselius cointegration test is to determine the number of cointegration vectors. Table (3) shows the Johansen–Juselius cointegration test results.

Table (3): Cointegration Test Results

Sample (adjusted): 2002Q4 2019Q1				
Included observations: 66 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LRER LGC LGR LOPEN LRES LTOT LWREM				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.577110	149.0801	125.6154	0.0008
At most 1	0.451148	92.27753	95.75366	0.0847
At most 2	0.255204	52.68236	69.81889	0.5192
At most 3	0.208554	33.23578	47.85613	0.5438
At most 4	0.153790	17.79877	29.79707	0.5810
At most 5	0.094167	6.777601	15.49471	0.6036
At most 6	0.003783	0.250149	3.841466	0.6170
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.577110	56.80253	46.23142	0.0027
At most 1	0.451148	39.59516	40.07757	0.0566
At most 2	0.255204	19.44658	33.87687	0.7938
At most 3	0.208554	15.43701	27.58434	0.7129
At most 4	0.153790	11.02117	21.13162	0.6452
At most 5	0.094167	6.527453	14.26460	0.5465
At most 6	0.003783	0.250149	3.841466	0.6170

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

As shown in table (3), the Trace test and the Max-eigenvalue indicates that there is one cointegration vector, at 0.05 level. According to these results we can conclude that there is a long run relationship between real ER and the variables included in the model. Given that there is at least one cointegration vector among the variables, the analysis normalizes the cointegration vector on real ER. The following equation represents the finding of the model (the numbers between parenthesis are T test results):

$$\text{LRER} = 0.722\text{LGR} - 4.102\text{LGC} + 0.2636\text{LOPEN} - 0.916\text{LRES} + 0.78\text{LTOT} - 0.39\text{LWREM} \quad (2)$$

$$(7.12) \quad (6.4) \quad (0.326) \quad (4.7) \quad (1.587) \quad (2.73)$$

The normalized cointegration vector in equation (2) suggests that growth rate, governmental consumption, international reserves and workers' remittances have a long run effect on real ER, while the degree of openness and terms of trade do not have a significant effect on real ER in the long run.

The equation also shows that governmental consumption, international reserves, workers remittances are all in a negative relationship with the real exchange rate which suggests that an increase in any of them will appreciate the Egyptian pound, while GDP growth rate has a positive relationship with real exchange rates, which means an increase in GDP growth rate depreciates the Egyptian pound.

### 5.5 Forecast Error Variance Decompositions

In this study we use the FEVD to assess the relative importance of each structural shock to the variables in the system. As shown in table (4), changes in period one results entirely from shocks in real ER itself (100 %), while from period 2 to period 4 governmental consumption shocks are the most important of all other variables. Then in the other periods the degree of openness becomes more important.

Table (4): FEVD results of the VAR

Perio	S.E.	LRER	LGC	LGR	LOPEN	LRES	LTOT	LWREM
d								

	0.05676	100.000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
1	9	0	0	0	0	0	0	0
	0.08748	90.6216	6.69451	0.55063	1.11962	0.97750	0.00235	0.03373
2	4	4	5	4	4	2	3	2
	0.10645	83.4034	9.40624	1.17577	3.40082	1.73770	0.51359	0.36237
3	1	9	4	8	0	1	9	2
	0.11992	78.2298	9.81578	0.99733	6.51798	1.97822	1.52027	0.94052
4	7	8	3	1	0	3	4	7
	0.13035	73.3926	9.81307	0.94675	9.70440	2.05888	2.38946	1.69474
5	2	8	0	6	5	2	6	0
	0.13888	68.6469	9.72021	1.07799	12.7599	2.06370	3.20051	2.53061
6	1	8	6	6	8	2	6	1
	0.14610	64.2872	9.47455	1.11501	15.7344	1.98790	3.99234	3.40850
7	5	6	6	0	1	9	8	8
	0.15240	60.4219	9.07124	1.05290	18.6891	1.85594	4.64136	4.26743
8	9	4	5	4	7	6	5	3
	0.15800	57.0095	8.59149	0.97998	21.5888	1.72724	5.03583	5.06708
9	3	2	9	1	3	9	9	4
	0.16301	53.9775	8.11615	0.94560	24.3208	1.66368	5.18094	5.79523
10	3	3	6	2	4	2	5	9

## 6. Discussion and Conclusion

Recurrent exchange rate shocks and ER volatility are common features of developing countries' economies especially the import-dependent ones like Egypt where the Egyptian pound has responded upwardly and downwardly to changes in a range of economic fundamentals and shocks. The empirical results of the co-integration analysis of our study shows that there is a long run relationship among variables of this study. Analyzing the direction and magnitude of the explanatory variable coefficients, we observed that government expenditure, growth rate of GDP, international reserves, and workers' remittances are significant determinants of real exchange rate volatility during the period 2002-2019 in Egypt, while the degree of openness and the terms of trade have no significant influence on real exchange rate volatility during the same period. These findings are partly consistent with studies in the previous literature (Eslamloueyan & Kia, (2015); Chowdhury (2014); Mkenda (2001); Osinubi & Ahamfule (2005); Benazic & Skabic (2016); Juhn & Mauro (2002); Daly & Sami (2009); Bashir & Luqman (2014); Faruqee (1995)). We conclude that the real exchange rate of the Egyptian pound is highly affected by exogenous shocks. In Egypt, more than one exchange rate regime has been adopted since 1952 to contain various economic shocks. Even after the 2016 currency floatation, the extent to which the Central Bank intervene to maintain a stable ER is still unclear. Surely, letting local currencies to depreciate, in a free fall, is not in the interest of economies similar to Egypt. As a consequence, deciding between a floating or a fixed exchange rate system should be guided by the determinants of the ER itself. Despite the fact that currency appreciation

help imports become cheaper at the expense of global market price competitiveness, however, Egypt is not an export-led economy. Currency depreciation puts more pressure on domestic prices and increases foreign currency liabilities, which in turn creates an overall negative impact on the economy. Egypt and Import-led economies are advised to keep relatively appreciated and stable ER rates by adopting a fixed ER regime or a managed floating regime. In future studies, we recommend examining the role of expectations in determining the real ERs volatility in Egypt. Side by side, we recommend future research to be conducted to examine the practical reasons behind the insignificance of trade openness and terms of trade in determining the ER of the Egyptian pound.

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هوامش الدراسة :

- (1) The real exchange rate is calculated by using the consumer price index (CPI) in both Egypt and United States of America as follows: Nominal exchange rate in Egypt \* CPI in USA/ CPI in Egypt
- (2) The ratio of exports plus imports to GDP
- (3) It is the relative price index of exportable commodities to price index of

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