"External Debt and Exchange Rate in Egypt (1977-2022)"

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- ## Abstract

The study aims to analyze the impact of external debt in Egypt on the exchange rate. The independent variables considered are external debt, Gross savings, Gross capital formation, interest rate, broad money growth, and final consumption expenditure. The study used the Dickey-Fuller test statistic to ensure the stationarity of the time series of variables. It indicated that most of the variables were stationary at the first difference. Therefore, the ECM model was chosen to estimate the relationship between the independent variables and the exchange rate. The Johansson Cointegration Test was conducted, indicating the presence of at most one long-term relationship between the study variables. The Granger Causality Test results indicated a two-directional relationship for all variables except for the relationships between the exchange rate and the growth of broad money, and between the interest rate and the growth of broad money, which were one-way. The relationship between gross saving and gross capital formation was also one-way. The relationship between external debt and gross capital formation was one-way, starting from external debt. When estimating the ECM model, a negative

relationship was found between the exchange rate and gross saving, while a positive relationship was found between the exchange rate and the other independent variables: external debt, gross capital formation, broad money growth, interest rate, and final consumption expenditure.

- **Keywords**: Exchange Rates, Broad money growth, External debt (growth rate), Gross capital formation, deposit interest rate, consumption expenditure, Gross savings, External debt (growth rate), Egypt.

ملخص :

تهدف الدراسة إلى تحليل تأثير الدين الخارجي في مصر على سعر الصرف. والمتغيرات المستقلة التي تم أخذها في الاعتبار هي الدين الخارجي، وإجمالي المدخرات، وإجمالي تكوين رأس المال، وسعر الفائدة، ونمو النقود بمعناها الواسع، ونفقات الاستهلاك النهائي. واستخدمت الدراسة إحصائية ديكي فولر للتأكد من ثبات السلاسل الزمنية للمتغيرات وأشارت إلى أن معظم المتغيرات كانت ثابتة عند الفرق الأول. ولذلك تم اختيار نموذج ECM. لتقدير العلاقة بين المتغيرات المستقلة وسعر الصرف. تم إجراء اختبار يوهانسون للتكامل المشترك، والذي يشير إلى وجود علاقة طويلة الأمد بين متغيرات الدراسة. أشارت نتائج اختبار السببية جرانجر إلى وجود علاقة ذات اتجاهين لجميع المتغيرات باستثناء العلاقات بين سعر الصرف ونمو النقود بمعناها الواسع، وبين سعر الفائدة ونمو النقود بمعناها الواسع، والتي كانت في اتجاه واحد. وكانت العلاقة بين إجمالي الادخار وإجمالي تكوين رأس المال في اتجاه واحد أيضًا. وكانت العلاقة بين الدين الخارجي وإجمالي تكوين رأس المال ذات اتجاه واحد، بدءاً من الدين الخارجي. عند تقدير نموذج ECM وجدت علاقة سلبية بين سعر الصرف وإجمالي الادخار، في حين وجدت علاقة إيجابية بين سعر الصرف

الكلمات المفتاحية : الدين الخارجي، إجمالي تكوين رأس المال، نمو النقد بمعناه الواسع، سعر الفائدة، ونفقات الاستهلاك النهائي.

- **Introduction**

In order to achieve their growth objectives, developing countries often require substantial external financing. This is due to a number of factors, including limited domestic resources, inadequate infrastructure, and a lack of access to international markets. Without sufficient funding from external sources, these countries may struggle to invest in critical areas such as education, healthcare, and technology. As a result, external financing is often seen as a critical component of any development strategy aimed at improving the economic prospects of developing nations. Sustainable investment in infrastructure is essential for achieving sustainable development and growth. External debt can boost investment activities by providing the necessary funds for investment to improve the economy, particularly infrastructure and large productive economic projects. This, in turn, helps in the process of economic growth and achieving economic stability. However, if foreign debts are taken on without being used in productive projects, it can lead to an increase in the cost of these debts, particularly with interest rates. This can put pressure on the local currency due to increased demand for foreign currencies to repay the loans and interest, which can result in an increase in the exchange rate. Therefore, it is essential to use foreign debts in productive projects to reap the benefits of economic growth and stability. Egypt's external debt poses a significant risk to the

country's financial stability. Failure to repay debts could lead to severe economic consequences, including the possibility of default. Additionally, high levels of external debt increase the risk premium on borrowing and servicing, making it more expensive for Egypt to borrow money from external sources. This can lead to a reduction in funds available to the government for social and financial needs. Therefore, it's essential for Egypt to manage its external debt carefully and responsibly to avoid potential disastrous consequences while still benefiting from the positive effects of external borrowing and maintaining the stability of the exchange rate., Developing countries often have ambitious growth targets, but achieving sustainable growth and development requires significant funding, particularly for investment in sustainable infrastructure. One of the most common ways for countries to obtain the necessary funding for infrastructure development is through external debt financing, which involves borrowing from foreign entities or governments to fund development projects. The external debt can be utilized to finance a wide range of projects, including transportation, energy, water, and telecommunications infrastructure, among others. External debt financing can boost macroeconomic stability and increase domestic savings by investing in productive infrastructure projects, which, in turn, can encourage further investment. Additionally, external borrowing can have a positive impact on the economy by increasing capital inflows

and accelerating economic growth rates. Capital inflows can be used to finance trade deficits or investment in projects that have a positive impact on the economy. Furthermore, external borrowing can provide access to technical expertise, management knowledge, technology, and international financial markets, which are essential resources for making productive investments. However, excessive external debt can expose countries to serious difficulties and create high levels of debt servicing costs. If countries become heavily indebted or their economies are exposed to external shocks, debt repayment may become challenging, leading to devastating financial and economic changes. Large foreign loans can become a disaster for the economy. If lenders realize that a borrower's ability to repay their debts is restricted, it will be difficult or expensive to make further loans. Therefore, it is crucial for countries to manage their external borrowing carefully and avoid excessive debt accumulation. Moreover, high levels of external debt pose solvency risks and increase the risk premium on external debt, making borrowing and servicing more expensive for debtor countries. This elevated risk premium increases interest payments and the interest rate on government loans, leaving little room for the government to meet its social and financial needs responsibly. This may put pressure on the government to increase its borrowing, especially from the domestic market, to cover increased spending on debt repayment and infrastructure.

This can displace the private sector and increase inflation, leading to a higher level of external debt. To investigate the impact of external debt, broad money, gross capital formation, deposit interest rate, and final consumption expenditure on the exchange rate, an in-depth study was conducted. The study aimed to understand the relationship between these factors and the exchange rate and provide valuable insights into economic trends that can be used to guide future economic analysis. The data collected for this study spans from 1977 to 2022, providing a comprehensive understanding of how these factors impact the exchange rate. The study focused on data series gathered from Egypt, which allowed us to obtain a clear understanding of the relationship between these factors and the exchange rate in the country. The findings of this study are of utmost importance as they provide valuable insights into economic trends that can be used to guide future economic analysis. The regression analysis applied to the data reveals that external debt has a significant negative impact on the exchange rate. This means that as the level of external debt increases, the exchange rate of the country decreases. The analysis also shows that broad money and gross capital formation have a significant positive impact on the exchange rate. On the other hand, the deposit interest rate and final consumption expenditure have a negative impact on the exchange rate. These results can be used to inform economic policies and guide future research, helping countries manage

their external borrowing carefully and avoid excessive debt accumulation. By being mindful of the risks and benefits of external borrowing, countries can make informed decisions about their financing strategies and promote sustainable economic growth.

- **Literature Review**

Over the past few years, several research studies have been conducted to analyze the complex relationship between interest rates, exchange rates, and stock prices. One such study conducted by Hamrita and Trif in 2011 used wavelet transform to investigate this relationship and found that the series of interest rates and exchange rates are largely independent of each other. This suggests that investors may need to consider other factors that have an impact on stock prices, beyond just interest and exchange rates. Similarly, Rapetti, Skott, and Ramzi (2011) carried out a study to determine the relationship between exchange rates and economic growth, particularly in developing countries. They found that currency undervaluation declines as GDP per capita increases, and this effect is more prominent in developing nations. This indicates that the relationship between exchange rates and economic growth is complex and varies based on the country's level of development. Another study by Chatterjee and Mursagulov (2012) focused on the impact of public infrastructure spending on real exchange rate dynamics.

They discovered that government spending creates a non-monotonic U-shaped path exchange rate, which has significant intertemporal trade-offs. The study suggests that the effect of government spending on the real exchange rate is determined by a composition of public spending, financing policy, private capital in production, and public infrastructure productivity. This highlights the importance of considering a range of factors when analyzing the impact of government spending on exchange rates. In 2013, Alam et al analyzed the relationship between external public debt, budget deficit, current account deficit, and exchange rate depreciation in Asian Pacific Developing Countries. They studied two groups of countries: six "Debt Trap Countries (DTC)" and eight "Non-Debt" Trap Countries. The study found that public infrastructure spending affects real exchange rate dynamics in a non-monotonic U-shaped adjustment path, with intertemporal tradeoffs. This indicates that the impact of public infrastructure spending on exchange rates can vary based on the country's level of debt and other economic factors. Bunescu (2014) also examined the impact of public infrastructure spending on real exchange rate dynamics and found similar results. The study suggests that the factors that determine the effect of such spending are a composition of public spending, financing policy, private capital in production, and public infrastructure productivity. This highlights the importance of considering a range of factors when analyzing the impact of

government spending on exchange rates. In 2015, Quilent investigated the crucial role of external public debt in shaping the volatility of real effective exchange rate in Kenya under a complete float regime. The study found that the external debt to GDP ratio has a significant and negative effect on the REER (Real Effective Exchange Rate) volatility in Kenya. The studies also indicate that an increase in debt works as a tax, which negatively affects the incentive to save and invest. Moreover, when paying off debt, it limits the amount of income that can be used for future growth, which can harm overall economic development. In 2018, Kouladoum aimed to examine how external debt impacts the real exchange rate in Chad between 1975 and 2014. The study found that debt service has a negative and significant effect on the real exchange rate in Chad. This highlights the importance of carefully managing external debt to avoid negative impacts on exchange rates. Finally, in 2020, Adeyemo et al investigated the relationship between external debt and exchange rate fluctuations in Nigeria from 1981 to 2018. The study found that external debt has been discouraged as a means of financing the budget deficit in the short term due to its negative impact on the foreign exchange market. Servicing and repayment of external debt puts pressure on the foreign exchange market, leading to short-term exchange rate fluctuations and depreciation of Naira in Nigeria. This highlights

the importance of carefully managing external debt to avoid negative impacts on exchange rates and the broader economy.

- **<u>Exchange rate and external debt in Egypt since 1970:</u>**

in 1970s, Egypt experienced a trade imbalance with a significant increase in imports, particularly a 300% rise, and a smaller increase in exports. This period was also characterized by a decline in agricultural production, largely due to decreased investments Furthermore, the fall in global cotton prices and the rise in wheat prices exacerbated the situation. As a result, Egypt's foreign debt increased from $ 2 billion in the late 1960s to $6.5 billion in 1975. The country's external debt and debt service obligations continued to rise due to frequent short-term borrowing with high interest rates, leading to a significant devaluation of the Egyptian pound. In the latter half of the 1970s, Egypt's foreign debts increased to unprecedented levels, causing the country to struggle to meet its debt obligations. The trade deficit grew due to a surge in imports, leading to a significant imbalance in the balance of payments and a rise in debt. The value of merchandise imports surged from 3 billion pounds to 6.5 billion pounds between 1977 and 1981, while exports could not keep up with this increase. By December 1980, the exchange rate of the Egyptian pound had declined significantly against the US dollar, reaching approximately 70 piasters to the dollar, or $1.43 per pound. This decline, coupled

with a decrease in foreign exchange inflows, led to an economic recession. . In response to these economic difficulties, Egypt implemented a new economic policy. Measures included better control of imports, limiting borrowing for higher return projects, removing barriers to agricultural production, and reducing the need for imports. However, the reliance on external borrowing continued, leading to a growing balance of payments deficit and a significant external debt of about $47 billion in 1986. In 1986, the Egyptian pound faced a significant drop against the dollar, reaching 93 piasters to the dollar. The economic crisis persisted into the late 1980s and early 1990s, with the exchange rate of the US dollar against the pound increasing from about 0.40 pounds in 1989 to approximately 0.83 pounds in 1990, and further to about 1.50 pounds in 1991. The exchange rate for the Egyptian pound has fluctuated significantly over the years. In 1992, it doubled to about 3 pounds, and by 1993, it rose to about 3.33 pounds, an increase of approximately 11%. From 1993 to the early 2000s, the exchange rate remained relatively stable, increasing to about 3.40 pounds by 2000 and 3.75 pounds by 2001. However, in 2002, the exchange rate rose to about 4 pounds, then to 4.60 pounds in 2003, and to 5 pounds in 2004. By the end of 2005, the exchange rate had reached about 5.75 pounds, rising by approximately 15%. From 2005 to the January 2011 revolution, the exchange rate continued to climb, reaching about 6.5 pounds in 2011, representing a 13% increase. By

November 2016(The central bank's decision to liberalize the exchange rate), the exchange rate had reached 14.6 pounds, due to economic measures required by the International Monetary Fund, leading to a decline in the value of the Egyptian pound by over 60%. The pound continued to decline, reaching a peak decrease of over 61% in 2024 due to new loan agreements and the necessity of liberalizing the exchange rate. This decline was also influenced by global events such as the Corona pandemic and the Russian-Ukrainian war, negatively impacting the Egyptian economy and the value of the pound against foreign currencies after The central bank's decision to liberalize the exchange rate.

- **Model Specification and Methodology:**

The study at hand delves deep into the investigation of how external debt, broad money, gross capital formation, deposit interest rate, and final consumption expenditure impact the exchange rate. The study aims to discover and comprehend the economic trends that are associated with these factors. To measure the impact of these factors, we utilized a long data series that spans from 1977 to 2022 and analyzed it through a regression equation. The analysis of the data revealed some valuable insights into the relationship between these factors and the exchange rate. These insights can be used to understand the economic trends associated with these factors and can lay a solid

foundation for future economic analysis. It is important to note that the data used in this study is from Egypt, which adds more significance to the findings as they can be used to understand the economic trends and patterns in the country:

$$EX = a + b1BR + b2CF + b3IR + b4ED + b5CE + b6GS + U1$$

EX = Exchange Rates, (US dollar) per domestic currency

BR = Broad money growth (% (annual))

CF = Gross capital formation (% of (GDP))

IR = Deposit interest rate ((%))

ED = External debt (growth rate)

CE = Households, NPISHs final consumption expenditure (% of (GDP))

GS = Gross savings (% of (GDP))

a = the intercept term.

b, b1, b2, b3, b4, b5, b6 = The parameters

UI = Random variables

Table1: Variable of study (197٧-2022)

Variable	definition	Data	Variable
EX	Exchange Rates, (US dollar) per domestic currency	World bank	Independent
BR	Broad money growth % (annual)	World bank	Depended
CF	Gross capital formation (% of (GDP))	World bank	Depended
IR	Deposit interest rate ((%))	World bank	Depended
ED	External debt (growth rate) *	World bank	Depended
CE	Households, NPISHs final consumption expenditure (% of (GDP))	World bank	Depended
GS	Gross savings (% of (GDP))	World bank	Depended

account by the researcher from the Data World Bank *

Figure1: Variables of study Egypt 1977-2022
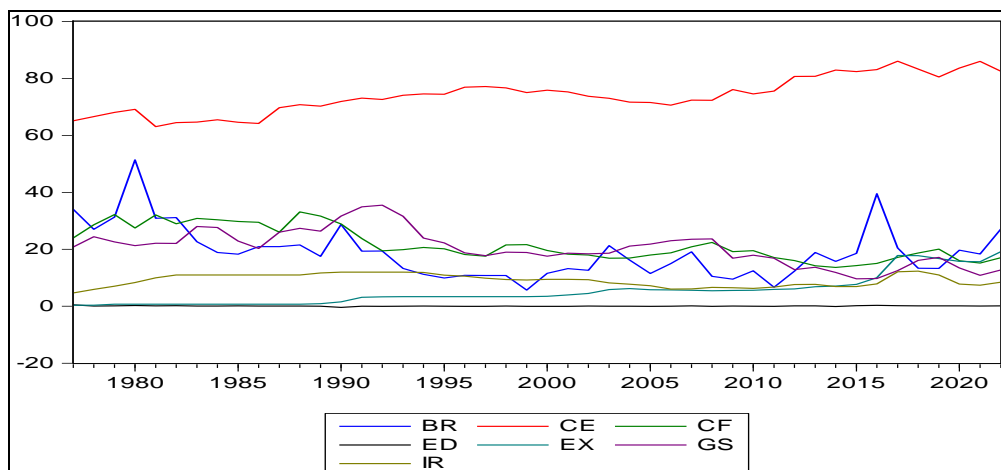
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Table2: Descriptive stats common sample for Variables of study Egypt 1977-2022

	BR	CE	CF	ED	EX	GS	IR
Mean	18.76984	74.07635	21.71412	0.060008	5.318015	20.53406	9.126386
Median	18.31915	73.93205	19.69922	0.059101	3.433650	20.53285	9.347917
Maximum	51.41943	86.08004	33.11688	0.458191	19.16044	35.47563	12.31667
Minimum	5.663642	63.09865	13.64319	-0.383466	0.391304	9.593465	4.666667
Std. Dev.	8.999605	6.276385	5.777487	0.122453	5.209607	6.243588	2.158970
Skewness	1.383222	0.129141	0.618316	-0.217247	1.421376	0.383552	-0.134612
Kurtosis	5.417368	2.216713	2.041183	7.056044	4.081497	2.892954	1.724367
Jarque-Bera	25.86902	1.303811	4.693130	31.89386	17.73084	1.149823	3.257798
Probability	0.000002	0.521052	0.095697	0.000000	0.000141	0.562755	0.196145
Sum	863.4129	3407.512	998.8496	2.760367	244.6287	944.5668	419.8138
Sum Sq. Dev.	3644.680	1772.685	1502.071	0.674764	1221.300	1754.208	209.7519
Observations	46	46	46	46	46	46	46

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Upon analyzing the time series graph and descriptive statistics of the common sample for various variables, it can be observed that the variable of Broad money growth % (annual) is the most volatile when compared to the other variables in the study. Its maximum height was recorded in 1980 at a rate of 51.4%. This was after Egypt signed a peace treaty and implemented a policy of economic openness, following a series of wars fought between 1956 and 1973. In 1999, the variable of Broad money growth % (annual) witnessed the smallest decline due to the economic reform policies that Egypt pursued in collaboration with the International Monetary Fund. This was a common phenomenon in most developing countries after the Cold War ended in 1990, and international institutions gained control over the global economy. During this period, the rate of growth of broad money was recorded at 5.6%. The highest percentage of foreign debt in Egypt was recorded in 1977 at a rate of 0.46%, owing to the policy of economic openness. On the other hand, the lowest growth rate of external debt was recorded in 1990, reaching -0.38%, due to the end of the Kuwait War and the decision to drop most of Egypt's external debts from coalition countries (European countries and the United States of America).It is also important to note that the exchange rate increased during the study period, starting at a rate of 0.39 in 1977 and reaching 19.21 at the end of the period in 2022. This

indicates a significant change in the value of Egyptian currency compared to other currencies during the study period. Furthermore, the variable of Gross savings(% of (GDP)) increased from 9.59% in 1977 to 35.47% at the end of the period in 2022. This indicates an increase in the saving behavior of the Egyptian population over time. Finally, the Deposit Interest Rate is the least volatile during the study period, starting at a rate of 4.6% in 1977 and reaching a high rate of 13.30% in 2018 due to the policy of monetary action taken to face inflation during this period. The variable of Average Households and NPISHs final consumption expenditure% of (GDP) increased from 62% at the beginning of the period to an average of 82% at the end of the period. This indicates a substantial increase in consumer spending in Egypt over the study period

Unit roots test

The unit roots test conducted on the Egypt study variables reveals that all variables, except for the ED variable, are valid and stable in the first-order differences. However, the ED variable is stable at the level. This provides a high level of confidence in conducting further tests and analysis, as it lays the foundation for explaining the relationships between the study variables in Egypt. You can refer to the table provided for more information

Table3: Egypt variables (Dickey-Fuller test statistic)

indicator	Egypt					
	level		1st		2nd	
	t-statistics	prob	t-statistics	prob	t-statistics	prob
EX	1.069873	0.9967	-4.713550	0.0004		
BR	-3.382680	0.0169	-8.925866	0.0000		
CF	-1.409943	0.5691	-7.400923	0.0000		
IR	-1.609587	0.4689	-5.142634	0.0001		
ED	-5.420591	0.0000				
CE	-1.191874	0.6700	-7.217188	0.0000		
GS	-1.327226	0.6088	-5.457480	0.0000		

From table 2 to 14 in appendix

- **Cointegration test**

The Johansson test for co-integration of variables in Egypt has produced some interesting results. Firstly, the initial hypothesis of no co-integration among the variables under study has been rejected. This is because the calculated statistic value (189.2469) is greater than the critical value (125.6154). Additionally, the probability value (0.0000) is less than the significance level of 0.05, further supporting the rejection of the initial hypothesis. Furthermore, the second hypothesis of a single integration vector has also been rejected. This is due to the statistic value (112.7344) being greater than the critical value and the probability value (0.0021) being less than the significance level. However, the third hypothesis of a second integration vector at most has been accepted. This is because the calculated statistic

value (60.48965) is smaller than the critical value (69.81889) and the probability value (0.2206) is greater than the significance level. Overall, these results suggest that there is co-integration among the variables in Egypt, but there is not a single integration vector. Instead, there may be a second integration vector at most. For further details, please refer to the table provided.

Table4: Egypt variables (Johansson Cointegration Test)

Hypothesized	Eigenvalue	Statistic	Critical Value	Prob.	Result
None *	0.824290	189.2469	125.6154	0.0000	long-run relationship
At most 1 *	0.694981	112.7344	95.75366	0.0021	long-run relationship
At most 2	0.409161	60.48965	69.81889	0.2206	
At most 3	0.355228	37.33632	47.85613	0.3318	
At most 4	0.245671	18.02657	29.79707	0.5641	
At most 5	0.118365	5.621783	15.49471	0.7397	

* Rejection of the hypothesis (0.05 level)

- **Granger Causality Test**

The Granger causality test is a statistical tool used to examine the presence of a linear relationship between the dependent and independent variables in a given study. By analyzing the cause-and-effect relationship between the two variables, this test helps researchers to identify whether the relationship is bidirectional, one-way, or if there is no relationship at all. After conducting the Granger causality test, the results indicated that there is indeed a

linear relationship between the study variables. Most of the relationships found were two-way, suggesting that both variables have a mutual effect on each other. The test also allowed us to determine the level of continuity or consistency in the measurement of the variables. It is important to note that the Granger causality test examines the existence of a linear relationship between the dependent and independent variables and the direction of the relationship. This is useful in determining the extent of the influence of one variable on the other, which can provide valuable insights for researchers and decision-makers. Overall, the Granger causality test proved to be an effective tool in identifying the presence of a linear relationship between the study variables, and the results obtained can be used to inform future research and decision-making processes.

Table5: Egypt variables (Granger Causality Test) two-way relationship

Null Hypothesis:	result	Null Hypothesis:	result
CE doesn't Granger Cause BR BR doesn't Granger Cause CE	two-way relationship	IR doesn't Granger Cause CF CF doesn't Granger Cause IR	two-way relationship
CF doesn't Granger Cause BR BR doesn't Granger Cause CF	two-way relationship	EX doesn't Granger Cause ED ED doesn't Granger Cause EX	two-way relationship
GS doesn't Granger Cause BR BR doesn't Granger Cause GS	two-way relationship	GS doesn't Granger Cause ED ED doesn't Granger Cause GS	two-way relationship
ED doesn't Granger Cause CE CE doesn't Granger Cause ED	two-way relationship	IR doesn't Granger Cause ED ED doesn't Granger Cause IR	two-way relationship
EX doesn't Granger Cause CE CE doesn't Granger Cause EX	two-way relationship	GS doesn't Granger Cause EX EX doesn't Granger Cause GS	two-way relationship
GS doesn't Granger Cause CE CE doesn't Granger Cause GS	two-way relationship	IR doesn't Granger Cause EX EX doesn't Granger Cause IR	two-way relationship
IR doesn't Granger Cause CE CE doesn't Granger Cause IR	two-way relationship	IR doesn't Granger Cause GS GS doesn't Granger Cause IR	two-way relationship
EX doesn't Granger Cause CF CF doesn't Granger Cause EX	two-way relationship		

Based on the available data, it is difficult to establish a clear correlation or lack thereof between the variables under study. This is due to the fact that some of these variables are unidirectional, meaning that they do not necessarily influence one another. As a result, we will need to conduct further analysis to determine the extent of causality between the study variables. To gain more insight, we suggest taking a look at the next table.

Table6: Egypt variables (Granger Causality Test) one -way relationship

Null Hypothesis:	result	Null Hypothesis:	result
EX doesn't Granger Cause BR BR doesn't Granger Cause EX	one-way relationship	ED doesn't Granger Cause CF CF doesn't Granger Cause ED	one-way relationship
IR doesn't Granger Cause BR BR doesn't Granger Cause IR	one-way relationship		
GS doesn't Granger Cause CF CF doesn't Granger Cause GS	one-way relationship		

- Estimating model

Based on the estimation results, it can be concluded that the selected independent variables are highly significant in explaining the variance in the dependent variable. This is evident from the Adjusted R-squared value of 0.67, which indicates that the model variables explain 67% of the variation in the dependent variable. This percentage is considered to be

conclusive evidence that the selection of the model variables is highly sound and the model estimates can be relied upon to a high degree. Moreover, the model's strength is further confirmed by the Prob(F-statistic) value of 0.0000, which indicates that the overall model is highly significant. Additionally, the Durbin-Watson statistic of 0.60 also indicates that the model has strong moral significance. Therefore, it can be inferred that the model is highly reliable and can be used to make accurate predictions about the dependent variable. For more detailed information, please refer to the table provided below:

Table 7: Regression (Error Correction Model ECM)

table External Debt and Exchange Rate in Egypt (1977-2022)

Equation:	EX = C(1) + C(2)*GS + C(3)*IR + C(4)*ED + C(5)*CF + C(6)*CE + C(7)*BR + C(8)*ECT(-1)
Adjusted R-squared	0.831483
Durbin-Watson stat	1.916689
Prob(F-statistic)	0.000000
Substituted Coefficients:	EX = -44. - 0.16GS + 0.42*IR + 2.5*ED + 0.017*CF + 0.64*CE + 0.056*BR + 0.85*ECT (-1)

The data analysis reveals that there is a positive correlation between the exchange rates (USD per domestic currency) and broad money growth (annual%). This means that when there's an increase in broad money supply in its broad sense, it leads to a increase in the exchange rate. Although Several studies have shown that increasing the money supply in the broad sense can hurt the speed of money circulation in the long term, as it leads

to a decrease in the speed of money circulation. This, in turn, causes the exchange rate to fall, This effect did not occur in the case of Egypt due to high inflation rates . Moreover, there is a positive correlation between exchange rates and Households and NPISHs final consumption expenditure% of (GDP). This means that when there's an increase in Households and NPISHs final consumption expenditure% of (GDP), it leads to an increase in exchange rates, which is consistent with economic theory. When consumption increases, the demand for goods and services increases, including imported goods, which, in turn, increases the demand for foreign currency and leads to an increase in the exchange rate. There is also a positive correlation between gross capital formation and exchange rates. An increase in gross capital formation leads to an increase in exchange rates. In Egypt, capital formation depends on loans to some extent. Therefore, when capital formation increases, the loan repayment tax and its interest also increase, which leads to an increase in the demand for foreign currency to repay these debts. This increase in demand for foreign currency leads to an increase in the exchange rate. Furthermore, there's a positive correlation between the External debt (growth rate) and the exchange rate. An increase in the External debt (growth rate) leads to an increase in the exchange rate. When external debt increases, future payments for these debts and their interest also increase, which leads to an increase in the demand for foreign currency.

As a result, the foreign currency rises against the local currency, which, in turn, leads to an increase in the exchange rate. On the other hand, there's a negative correlation between gross savings and the exchange rate. An increase in gross savings leads to a decrease in the exchange rate. In line with economic theory, increasing savings leads to a decrease in demand for goods and services, including imported goods. Increasing savings also leads to increased investment and, thus, increased domestic production. This reduces the import bill, and consequently, the exchange rate. Lastly, there's a positive correlation between deposit interest rate and exchange rate. An increase in deposit interest rate leads to an increase in exchange rate, which is consistent with economic theory. High interest rates increase the cost of investment, which affects the establishment of investment projects that increase the production process. This, in turn, leads to a decrease in local production, a reduction in the demand for the local currency, and an increase in the demand for foreign currency to import goods and services that the state doesn't produce due to a lack of investment

Table 8: the relationship between dependent variable (exchange rate) and independent variables in Egypt
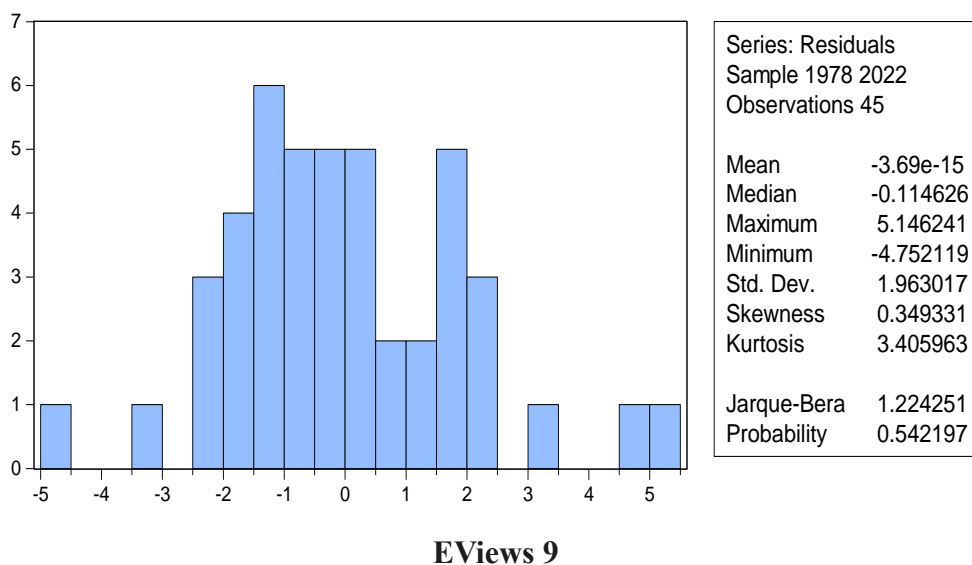
independent variables	relationship between dependent variable (exchange rate) and independent
Broad money growth % (annual)	positive
Gross capital formation ((% of (GDP))	positive
Deposit interest rate ((%))	positive
External debt (growth rate) *	positive
Households, NPISHs final consumption expenditure% of (GDP)	positive
Gross savings (% of (GDP))	negative

- ## model quality

When performing a regular least squares method, it is crucial to ensure that the estimated model is valid and of high quality. To achieve this, several tests are conducted to verify the model's integrity, including the normal distribution condition test for the residuals of the estimated model and the absence of linear duplication condition test. The normal distribution condition test is performed using the Jarque-Bera test, which is a statistical test used to determine if the data distribution is normal. In this case, the Jarque-Bera test value obtained was found to be 1.02 with a probability of reaching 0.542. This result indicates the acceptance of the null hypothesis, which assumes that random errors (i.e., residuals of the estimated model) follow the normal distribution. Furthermore, the test value is less than the tabular value of 5.99 at a degree of freedom of 5%, which further confirms the validity of the estimated model. This means that there is no evidence of non-normality in the residuals of the estimated model, ensuring

that the model is reliable and can be used for further analysis. It is important to note that the Jarque-Bera test is just one of the many statistical tests used to verify the validity of a model. Therefore, it is recommended to analyze the next graph for a more comprehensive understanding of the test results. In conclusion, conducting tests like the normal distribution condition test is essential to ensure accuracy, reliability of a model. By verifying the validity of the estimated model, we can be confident in our analysis and make informed decisions based on the results.

Figure2: Jarque-Bera test

Series: Residuals	
Sample 1978 2022	
Observations 45	
Mean	-3.69e-15
Median	-0.114626
Maximum	5.146241
Minimum	-4.752119
Std. Dev.	1.963017
Skewness	0.349331
Kurtosis	3.405963
Jarque-Bera	1.224251
Probability	0.542197

EViews 9

In order to ensure that the study variables do not suffer from the issue of linear duplication, the variance inflation factors (VIF)

were used. After thorough analysis, it was found that all the values of the inflation factors for the study variables lie within the range of 1.19and 4.68. This indicates that there is no significant problem of linear duplication in this model. It is important to note that the values of the inflation factor are typically observed when its value exceeds 5 in the presence of a linear pairing problem in the variables of the estimated model. Based on the previous results of statistical tests on the study model, we can confirm that the estimated model is of high quality and is safe from any standard defect. Therefore, its results can be relied upon in proportion to the economic reality. This means that the study model is accurate and can be used to make informed decisions about the economic situation.

Table 9 : variance inflation factors test

variables	ECT(-1)	BR	CF	IR	ED	CE	GS
Value	1.19	1.63	4.43	1.83	1.85	4.68	3.66

- **Conclusion:**

Over the years, researchers have conducted several studies to explore the relationship between exchange rates and broad money growth. The findings of these studies have revealed an inverse correlation between the two variables. Broad money growth is typically used to indicate the percentage increase in the money supply on an annual basis. On the other hand, exchange rates refer to the value of the US dollar compared to the local currency of a particular country. According to the research,

increasing the money supply in the broad don't impede the speed of money circulation in the long run because a big inflation in Egypt. Consequently, expanding the balance of the money supply in the broad sense leads to a increase in the speed of money circulation, which ultimately results in a increase in the exchange rate. Interestingly, there is a positive correlation between the exchange rate and the percentage of GDP accounted for by final consumption expenditure of households and non-profit institutions serving households (NPISHs). When consumption increases, the demand for goods and services also rises, including imported goods. This, in turn, increases the demand for foreign currency, leading to a rise in the exchange rate. Additionally, capital formation and exchange rates are positively correlated. Capital formation in Egypt is partly dependent on loans. Therefore, an increase in the gross capital formation leads to an increase in exchange rates. This is because the tax and interest payments on loans also increase, which drives the demand for foreign currency to repay these debts. This subsequently increases the exchange rate. Furthermore, there is a positive correlation between the External debt (growth rate) and the exchange rate. An increase in external debt leads to higher future payments for the debts and their interest, which boosts the demand for foreign currency. This causes the foreign currency to rise against the local currency, leading to an increase in the exchange rate. However, it is essential to note that external debt

exposes Egypt to serious difficulties, making it challenging to repay debts and leading to devastating financial and economic consequences. High levels of external debt increase the risk premium on external debt, making borrowing and services more expensive for Egypt. This leaves little room for the government to meet its social and financial needs responsibly. Lastly, gross savings and the exchange rate have a negative correlation. Egypt must manage its external debt carefully and responsibly to avoid potentially disastrous consequences while benefiting from the positive effects of external borrowing and maintaining the stability of the exchange rate. Therefore, it is crucial to take measures to manage external debt, such as implementing fiscal policies, reducing external borrowing, and increasing foreign exchange reserves, to ensure that the country does not fall into a debt trap.

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