ESLSCA Business School

The Impact of Inflation, Exchange Rate, Interest Rate, and External Debt-to-GDP Ratio on Economic Growth in Egypt: A Quarterly Analysis (2012–2022) Using least absolute shrinkage and selection operator Regression (LASSO)

تأثير التضخم، وسعر الصرف، وسعر الفائدة، ونسبة الدين الخارجي إلى الناتج المحلي الإجمالي على النمو الاقتصادي في مصر: تحليل ربع سنوي (٢٠١٢-٢٠٢٢) باستخدام الانحدار بالمشغل الأقل انكماشًا واختيارًا (LASSO)

Researcher
Mohamed Fathy Morsy
ESLSCA University

Supervised by
Prof. Doaa Salman
Head of Economics, MSA university
Adjunct Prof. ESLSCA University

الملخص

يبحث هذا البحث المقترح في تأثير المتغيرات الاقتصادية الكلية - وخاصة معدل التضخم، وسعر الفائدة الحقيقي، وسعر الصرف، ونسبة الدين الخارجي إلى الناتج المحلي الإجمالي - على معدل النمو الاقتصادي في مصر عن الفترة من الربع الأول من عام ٢٠١٢ إلى الربع الرابع من عام ٢٠٢٢. وتستخدم الدراسة الأنحدار بالمشغل الأقل انكماشًا واختيارًا (LASSO) ، وهي تقنية إحصائية متقدمة ، لمعالجة قضايا التعدد الخطي التي غالبًا ما يتم تجاهلها في الأبحاث السابقة ، و من خلال تحليل البيانات الربع سنوية من البنك المركزي المصري، يكشف البحث عن تأثيرات إيجابية كبيرة

للتضخم وأسعار الفائدة الحقيقية على النمو الاقتصادي، على عكس التأثيرات السلبية لسعر الصرف ونسبة الدين الخارجي إلى الناتج المحلي الإجمالي ، وتساهم هذه الدراسة برؤى أصلية للدراسات الموجودة حول ديناميكيات الاقتصاد المصري، وتوفر إرشادات قيمة لصناع السياسات لصياغة استراتيجيات تعزز النمو الاقتصادي المستدام .

الكلمات الافتتاحية: النمو الاقتصادي؛ الدين الخارجي؛ معدل التضخم؛ سعر الصرف؛ الأنحدار بالمشغل الأقل انكماشًا واختيارًا (LASSO)

Abstract

This dissertation proposal investigates the impact of macroeconomic variables—specifically inflation rate, real interest rate, exchange rate, and external debt to GDP ratio—on Egypt's economic growth rate from Q1 2012 to Q4 2022. The study employs Lasso regression, an advanced statistical technique, to address multicollinearity issues often overlooked in previous research. By analyzing quarterly data from the Central Bank of Egypt, the research reveals significant positive effects of inflation and real interest rates on economic growth, contrary to the negative impacts of the exchange rate and external debt to GDP ratio.

This study contributes original insights to the existing literature on Egypt's economic dynamics, providing valuable guidance for policymakers to formulate strategies that foster sustainable economic growth.

Keywords : Economic Growth; External Debt ; Inflation Rate; Exchange Rate ; Lasso Regression

1.0 | Introduction

By listing variables that will be analyzed in this study and starting with the inflation rate as the first independent variable. The relationship between the inflation rate and economic growth rate has been of interest to many studies and policymakers. Through concentrating on studies conducted in Egypt, the negative relationship was highlighted through the study of Benli (2020) also by Thouraya (2021) but with a threshold of more than 5.69%, and a positive relation if the rate was below the threshold of 5.69%, in addition to Opeyemi (2020) study on five African countries including Egypt which also resulted in a positive relationship between inflation rate and economic growth.

The second independent variable in the list will be the exchange rate. The importance of the relationship between exchange rate and economic growth was also included in many studies, including those that were applied to Egypt. Yahia (2021) found a positive relationship while analyzing five MENA countries, including Egypt. Ashour (2018) found the same positive relationship between exchange rate and economic growth while analyzing sixteen developing countries, including Egypt.

Then, exploring the third independent variable, the external debt to GDP ratio, and its relationship with the economic growth rate, many studies also got in touch with it through the studies of Benli (2020), Mesbah (2021), and Shawkat (2022) on Egypt. They all resulted in a negative relationship between external debt and economic growth, but Mesbah (2021) was the only study that indicated external debt to GDP ratio.

Then, the fourth independent variable will be the interest rate, which has been studied extensively by many researchers and policymakers because of its necessity. Through studies performed in Egypt, El Banna (2018) found a significant negative

relationship, but Tawfiq (2019) found no significant impact of interest rate on economic growth.

On the other hand, it had been noted from above previous studies conducted in Egypt that they were all missing the multicollinearity test, and this study will be the first one to apply Lasso regression "Least Absolute Shrinkage and Selection Operator" by Tibshirani (1996) to face the multicollinearity that could be presented in the data.

2.0 | Problem statement.

This study will attempt to figure out the following questions: As from the point of view of the Egyptian economy, what will be the relationship between the economic growth rate and the exchange rate? Will the evaluation or devaluation of the Egyptian pound positively or negatively affect economic growth? Additionally, what will be the relationship between economic growth and INF? Did the CBI procedures that the CBE could implement improve the INF in Egypt? What was the effect of the last actions taken by the CBE (assigning regulations to import processes through letters of credit payments) on the INF?

Moreover, did CBE realize an improvement in economic growth through its interest rate-setting policies? Will continuing to borrow more money from foreign parties or increasing external debt improve economic growth or worsen the situation?

3.0 | An overview of Egypt's Macroeconomic variables, and external debt to GDP ratio:

Starting with ***exchange rate***, here there is a question should be asked "did the Egyptian pound had been liberalized or governed by the Egyptian authorities?". By applying the expected EXR equation on the current EXR of USD, which was at the end of Q2 of 2022 (Q4 of FY2021/2022) equals 18.8269 L.E., and comparing it with the result of the equation (19.644 L.E.), that

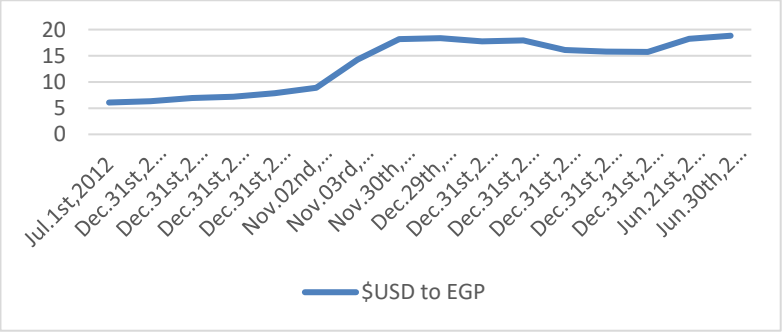
means the Egyptian pound was overvalued by about 4.34% at the end of (Q4 of FY2021/2022), and according to (IMF Press Release No. 16/501, Nov.2016), Egypt applies regime type *"Independently Floating, or Floating Exchange"* mentioned my IMF according the definition highlighted by (Rajesh Kumar, sciencedirect.com, 2014). Through historical data of the Egyptian pound, the exchange rate of $USD to EGP from the first quarter of the financial year 2012/2013 to the last quarter of the financial year 2021/2022 has been presented in the following table:

Table 1: Exchange rate history for the period from Q1:2012/2013 to Q4:2021/2022, listing highest spot exchange rate during the study period:

Spot date	EXR, $USD to EGP	Spot date	EXR, $USD to EGP
Jul.1st,2012	6.0717	Dec.29th,2016	18.3817
Dec.31st,2012	6.3134	Dec.31st,2017	17.7808
Dec.31st,2013	6.9523	Dec.31st,2018	17.9559
Dec.31st,2014	7.149	Dec.31st,2019	16.0931
Dec.31st,2015	7.8291	Dec.31st,2020	15.7842
Nov.02nd,2016	8.8758	Dec.31st,2021	15.7583
Nov.03rd,2016	14.2757	Jun.21st,2022	18.2683
Nov.30th,2016	18.1653	Jun.30th,2022	18.8269

Source(s): Central Bank of Egypt "economic research section, statistics & time serious data reports ", and exchangerates.org.uk for exchange rate of Egypt during 2012 till 2022.

Figure 1: Egypt exchange rate during 2012 till 2022.



Source(s): Author established based on data mentioned in Table 2.

Through Table 1 and Figure 1, when we consider the exchange rate of the $USD to the Egyptian pound on (Jul.1st,2012), the spot exchange rate on that date was (1$=6.0717 EGP), by the end of 2012, exchange rate increased about 4% reached (1$=6.3134), then by the end of 2013 EXR of the EGP to $USD increase was about 10%, by the end of 2014 EXR reached (1$=7.149 EGP) as 3% increase in the EXR, then about 10% increase in the EXR by the end of 2015, another 13.3% approximately increase appeared in the EXR on (Nov.02nd,2016), then a devaluation by the CBE had been applied on (Nov.03rd,2016) to be (1$=14.2757 EGP) reaching (1$=18.1653 EGP) by the end of (Nov.2016) as a 104% increase in the EGP.

After the devaluation in (November 2016), EXR went back to (1$=17.7808 EGP), a 3% decrease in the EXR from the highest EXR in (Nov.2016), and another decrease appeared at the end of 2019 about 10.3% approximately. Through COVID-19 time, EXR presented very low movements in 2020 and 2021. In addition, another devaluation on (Mar.21st,2022) had been conducted by the CBE, reaching (1$=18.8269 EGP) at the end of (Jun.2022), which was about 19.5% approximately increase in the EXR.

The analysis focuses on the interest rate framework in Egypt, particularly during the study period. The Central Bank of Egypt (CBE) implemented various interest rate adjustments to influence economic conditions, particularly to manage inflation and attract foreign investment. Table 2 presents the discount rate, nominal interest rate for loans, and real interest rate in Egypt from Q1:2012/2013 to Q4:2021/2022.The discount rate is a crucial tool used by the CBE to control monetary policy. Throughout the study period, adjustments to the discount rate were made to respond to inflationary pressures and stabilize the economy. The

nominal interest rate for loans reflects the cost of borrowing, which is influenced by both the discount rate and market conditions.

The real interest rate, which accounts for inflation, provides insights into the actual cost of borrowing for consumers and businesses. Analyzing these rates allows for a better understanding of their interrelationships and their collective impact on economic growth in Egypt.

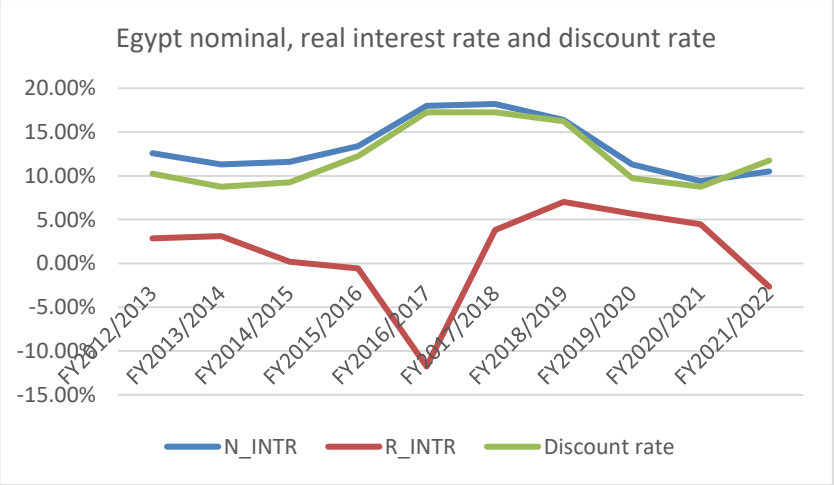
Overall, the data in Table 2 is essential for examining the dynamics of Egypt's interest rate policies and their implications for the economy during the specified period.

Table 2: Egypt nominal interest rate (N_INTR), real interest rate (R_INTR) and discount rate (DR) during the period from Q1FY2012/2013 to Q4FY2021/2022 "values at the end of each quarter":

FY	N_INTR	R_INTR	Discount rate
FY2012/2013	12.60%	2.8470%	10.25%
FY2013/2014	11.30%	3.1000%	8.75%
FY2014/2015	11.60%	0.2120%	9.25%
FY2015/2016	13.40%	-0.5690%	12.25%
FY2016/2017	18.00%	-11.7630%	17.25%
FY2017/2018	18.20%	3.8160%	17.25%
FY2018/2019	16.40%	7.0230%	16.25%
FY2019/2020	11.30%	5.6690%	9.75%
FY2020/2021	9.40%	4.4700%	8.75%
FY2021/2022	10.50%	-2.6550%	11.75%

Source(s): Central Bank of Egypt "economic research section, statistics & time serious data reports" during the period from 2012 to 2022.

Figure 2: Author Establishment for Egypt N_INTR, R_INTR and DR during the period from 2012 to 2022.



Source(s): Established by based on data mentioned in Table 2.

From the above Table 2 and Figure 2, the highest deflation in Egypt during the study period was at the end of FY2016/2017 (-11.7630%). R_INTR then returned to being positive, and another deflation occurred at the end of FY2021/2022 (-2.6550%).

Concerning Egypt's External Debt and ***External debt to GDP ratio*** and according to a conducted study by the World Bank Caner (2010), when the D/GDP ratio exceeds 77%, it might have a negative effect on economic growth, and it had been mentioned that each additional percentage point of debt above that level reduced annual real growth by 1.7%. The debt-to-GDP ratio is commonly misunderstood, as many think it is a ratio when it exceeds 100%, indicating that this country is going through bankruptcy or insolvency. As mentioned, Japan has had a ratio of over 200% over a decade with no signs of defaulting. Therefore, the ratio does not offer strong insights into a country's likelihood

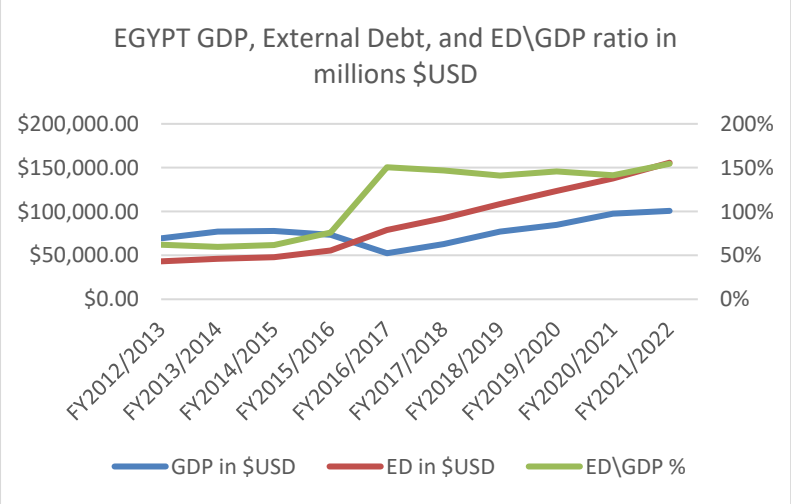
of default, and below going through an image of Egypt's external debt in the table below:

Table 3: Egypt's external debt, GDP, and ED\GDP ratio in $USD for the period from 2012 to 2022.

FY	GDP in $USD	ED in $USD	ED/GDP Ratio
FY2012/2013	68,755.39	43,233	62.88%
FY2013/2014	76,254.71	46,067	60.41%
FY2014/2015	77,469.59	48,063	62.04%
FY2015/2016	73,576.63	55,764	75.79%
FY2016/2017	**52,382.07**	**79,033**	**150.88%**
FY2017/2018	62,745.32	92,644	147.65%
FY2018/2019	78,518.71	108,699	138.44%
FY2019/2020	83,257.05	123,490	148.32%
FY2020/2021	97,333.94	137,859	141.64%
FY2021/2022	99,419.02	155,708	156.62%

Source(s): Data collected from CBE, and domestic debt values calculated in $USD through EXR values in each period from the historical data gathered from CBE, in millions $USD at the end of each quarter.

Figure 3: Graph of Egypt's external debt, GDP, and ED\GDP ratio in $USD for the period from 2012 to 2022.



Source(s): Author established based on data mentioned in Table 3 for the period from Q1:2012/2013 to Q4:2021/2022.

From the above Table 3 and Figure 3, it is clear enough to see the annual double increase in the ED\GDP ratio of Egypt, in parallel with the devaluation of the Egyptian pound in November 2016, which was affected in 2017, followed by (-3.23%) decrease in the next financial year, then a (-9.21%) decrease presented in the ED\GDP ratio by the end of FY2018\2019, then (9.88%) increase by the end of FY2019/2020 and a reduction of (-6.68%) appeared at the end of FY2020/2021, ending up with a high percentage increase in ED\GDP ratio equaling (14.98%) by the end of FY2021/2022. The point here is that even with the annual increase in external debt, the ED\GDP ratio has been managed by GDP itself; in other words, getting more foreign money from outside with taking care of the GDP increase in the same way as that will control the ED\GDP ratio. Also, it is essential to check devaluation and its role in finding a proper way to affect the ED/GDP ratio and force it towards a positive impact.

To follow up with what had been mentioned in the study of Mesbah (2021) as an overview of Egypt's external debt from 1988 to 2019, the study mentioned that Egypt's external debt historically was $1.8 billion in 1970. In the middle of the 1970s, ED reached $6.4 billion, and in 1982, ED hit $22 billion. This was followed by $46.1 billion in 1988, in which the ED to GDP ratio was %131.9, which was the highest percentage of the ED to GDP ratio from 1980 to 2019. The increase in external debt within the 1980s was one of the most critical factors in increasing the current account deficit. Then, in the 1990s, there was an improvement in the ED and ED/GDP ratio, which had a spot of $29.2 billion as ED and 29.3% as ED/GDP ratio, then in 2010, ED reached $36.8 billion then another increase in 2011 up to $46.5 billion during the Arab Spring. A decrease followed this in 2014 when external

debt reached $41.3 billion, and ED/GDP reached a lower rate of 13.7%. The external debt continued to increase to a larger border, reaching $125.3 billion in 2020. Figure (4) below will indicate the quarterly ED/GDP ratio for the period from 2019 to 2022.

Regarding ***inflation rate*** and by figuring out Central Bank Independence (CBI) as one of the main tools for controlling inflation that governments can use, as a higher CBI can give the ability to realize lower inflation rates and better economic performance (Emam & Fayed, 2021). In 2003, CBI was legally highlighted through a price stability declaration as one of the main objectives of CBE as it added more autonomy to the governor of CBE and board members in front of the government. Additionally, that provided stronger accountability and gave the CBE the power to regulate and govern the foreign exchange market.

An example would be the last procedure undergone by the CBE in (Feb.2022) when they forced all non-food importers in Egypt to use letters of credit in their importing processes and closed all direct swift payments to mitigate the problem of USD shortage in banks. Through considering data of non-petroleum exports, non-petroleum imports, and inflation rate for the period from FY2021/2022:Q3 to FY2023/2024:Q4 in Egypt, just to see the directions of these titles, there was a continuous increase in the inflation rate from FY2021/2022: Q4 till FY2023/2024:Q3 (13.155% to 33.340%), then a drop-down in inflation rate happened by the end of Q4 of FY2023/2024. Also, there was a decrease in imports till the end of Q4 of FY2022/2023; then another increase appeared by the end of Q4 of FY2023/2024, but of course, not the exact amount spotted by the end of Q3 of FY2021/2022.

However, export numbers' fluctuations weren't too high compared to imports and the inflation rate. So, what we can benefit from the above data mentioned is that Feb.2022 CBE's decision was in favor of Egypt's inflation rate, which means that CBI here had positive impacts on inflation rate controlling.

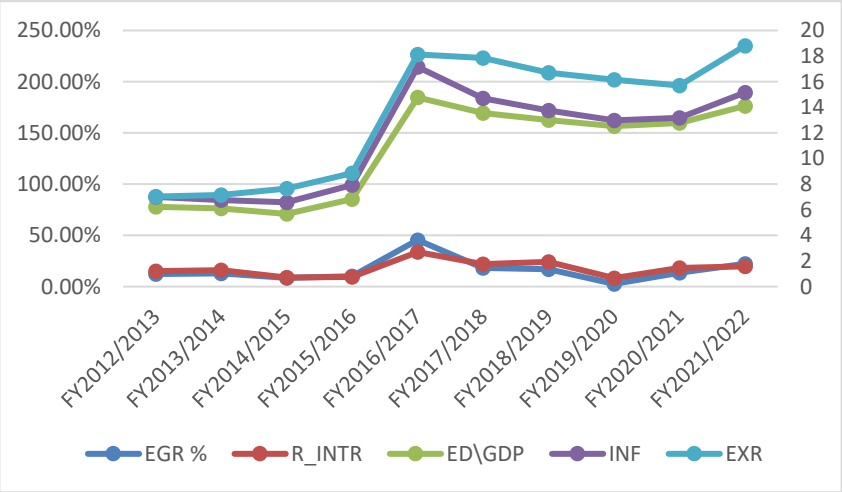
Through presenting the historical ***economic growth rate*** (EGR), ***real interest rate*** (R_INTR), ***external debt to GDP ratio*** (ED/GDP), ***inflation rate*** (INF), and ***exchange rate*** (EXR) of ***Egypt*** by annual intervals for the study period from Q1FY2012/2013 to Q4FY2021/2022, we will consider the following table:

Table 4: Egypt economic growth rate (EGR), real interest rate (R_INTR), external debt to GDP ratio (ED\GDP), inflation rate (INF), exchange rate (EXR) for the period from Q1FY2012/2013 to Q4FY2021/2022:

FY	EGR %	R_INTR	ED\GDP	INF	EXR
FY2012/2013	12.231%	2.8470%	62.88%	9.753%	7.0303
FY2013/2014	12.811%	3.1000%	60.41%	8.200%	7.1529
FY2014/2015	8.667%	0.2120%	62.04%	11.388%	7.6519
FY2015/2016	10.046%	-0.5690%	75.79%	13.969%	8.8622
FY2016/2017	45.483%	-11.7630%	150.88%	29.763%	18.125
FY2017/2018	18.073%	3.8160%	147.65%	14.384%	17.8622
FY2018/2019	16.991%	7.0230%	138.44%	9.377%	16.7028
FY2019/2020	2.609%	5.6690%	148.32%	5.631%	16.1487
FY2020/2021	13.604%	4.4700%	141.64%	4.930%	15.6955
FY2021/2022	22.302%	-2.6550%	156.62%	13.155%	18.8039

Source(s): Data collected from Central Back of Egypt, for the period from Q1FY2012/2013 to Q4FY2021/2022.

Figure 4: Graph of Egypt economic growth rate (EGR), real interest rate (R_INTR), external debt to GDP ratio (ED\GDP), inflation rate (INF), exchange rate (EXR) for the period from Q1FY2012/2013 to Q4FY2021/2022 annual intervals:



Source(s): Author established based on data mentioned in Table 8.

The insights derived from Table 7 and Figure 7 reveal crucial trends in the Economic Growth Rate (EGR) in Egypt over the study period. The EGR peaked at the end of FY2016/2017, achieving an impressive 45.483%. This remarkable growth was accompanied by significant independent variable figures: inflation (INF) at 29.763%, exchange rate (EXR) at 18.125%, debt-to-GDP ratio (ED/GDP) at 150.88%, and a notable interest rate (R_INTR) of -11.763%. In contrast, the EGR saw a stark decline to 2.609% by the end of FY2019/2020, amidst values for INF at 5.631%, EXR at 16.1487%, ED/GDP at 148.32%, and R_INTR at 5.6690%.

At the study's outset, the EGR was at a respectable 12.231%, with the accompanying figures showing INF at 9.753%, EXR at

7.0303%, ED/GDP at 62.88%, and R_INTR at 2.8470%. By the study's conclusion, EGR rebounded to 22.302%, with inflation at 13.155%, EXR reaching 18.8039%, ED/GDP climbing to 156.62%, and R_INTR at -2.6550%.

These findings, as illustrated in the table and graph, provide compelling evidence of the dynamic interplay between EGR and these variables. Notably, the sustained increase in inflation, the debt-to-GDP ratio, and the exchange rate contributed positively to EGR through the end of FY2016/2017. However, the subsequent drop in EGR aligns closely with decreases in both the inflation rate and the debt-to-GDP ratio, despite an uptick in the exchange rate at the end of FY2019/2020. This thorough analysis is essential to grasping how these independent variables distinctly impact EGR, ultimately emphasizing the importance of strategic economic policies moving forward.

4.0 | Theoretical and Empirical Framework

Through the study's theoretical framework, and starting by *Debt Overhang Theory*, which updated by Krugman (1988), in addition to *Standard Neoclassical Growth Theory*, mentioned the negative impact of public debt on economic growth. On the other hand, in *Debt Laffer Curve Theory*, Sachs (1989), *Keynesian Theory*, and *Dual Gab Theory,* Ajayi & Khan (2000) present the positive impact of ***external debt*** on economic growth. *Conventional development theory* exposed the negative effects of ***exchange rate*** fluctuations on economic growth, and *the Theory of rational expectations* & Mirzaie (2002) approved that positive shocks of exchange rates decrease economic growth through the supply-side impact, in addition to the proposal of an intermediate exchange rate regime by *the Impossible Trinity Theory* and Williamson (2000). Also, the positive effects of ***the inflation rate*** on economic growth is highlighted by *Lucas (1973) and Ball et*

al. (1988), in addition to *the Endogenous Growth Theory by Frankel (1962)* and *the theory of money by Friedman (1977).* Moreover, *the Neo-classical theory of* Mundell (1963) and Tobin (1965) also stated a positive relationship between inflation rate and economic growth. However, the negative effect was also noted by *the classical growth theory*. According to *the Finance-Led-Growth Theory* and *the Neo-Classical Golden Rule*, the low ***interest rate*** will positively affect economic growth. ***LASSO***, *"Least Absolute Shrinkage and Selection Operator," primarily conducted by Tibshirani (1996)*, as an upgraded image of an will be the best method for defending multicollinearity problem.

By studying the empirical framework and going through studies that found a negative impact of ***external debt*** on economic growth. There was a study by *Farooq (2024)* on the long and short run using FMOLS and DOLS models, *Ayana (2023)* in the short and long run using a two-step system generalized method of moment (SGMM) estimation technique, *Necib's (2023)* study using the ARDL mentioning that negative impacts were because of the poor management of public finances, *Zhetibayev (2022)* study used panel cointegration method, and found that with 1% increase in the external debt, a decrease in the economic growth will be shown by 0.11%, and *Benli (2020)* using cross-sectional augmented autoregressive distributed lag (CS-ARDL) and cross-sectional augmented distributed lag (CS-DL) estimators. The study here exposed negative relationships between ***external debt and inflation against economic growth***. In addition to other studies of *Amal (2023)* using the VAR "value at risk" technique, *Duru's (2024)* study using the Pooled Mean Group Heterogeneous Dynamic Panel Data Approach & the Toda Yamamoto, *Shawkat (2022)* using panel quantile regression, *Mesbah (2021)* using the (ARDL) & augmented Dickey-Fuller

(ADF) test, *Ghafour (2020)* using ADF's unit root Test, Bound Test, ARDL Model & Error Correction Model, and *Tareque (2019)* using ARDL model, and they are all approved the negative impact of external debt on economic growth.

On the other hand, some studies mentioned the positive impact of ***external debt*** on economic growth, *such as Alemu's (2023)* study on the long-run at the moderate level of external debt using (ARDL) model through a pooled mean group (PMG) estimator. Still, here, the study also mentioned that with more external debt, the growth rate starts to go down; Bilewicz's *(2022)* study using ordinary least squares (OLS) regression and backward stepwise regression model, *Lakshmanasamy (2022)* using the error correction mechanism estimation method, *Yeboah (2023)* using multiple regression (ordinary least squares), and *Tuncer (2019)* using (ARDL) technique.

Concerning studies conducted to approve the negative impact of ***exchange rate*** on economic growth, Andrew's (2022) study using Panel Autoregressive Distributed Lag, *Eugene's (2023)* study using generalized autoregressive conditional heteroskedasticity (GARCH) & vector error correction (VEC) models through stationary collected data, *Samira's (2021)* study using NARDL "nonlinear autoregressive distributed lag," part of *Kwaku's (2022)* study using an Autoregressive Distributed Lag, and part of *Hassan's (2021)* study using Exponential, generalized, autoregressive, conditional heteroscedasticity (EGARCH) models. Also, the positive impact of ***exchange rate*** on economic growth mentioned by studies of; *Agosu's (2024)* study using the Ordinary Least Square (OLS) method, *Fayyaz's (2022)* study using the Fully Modified Ordinary Least Squares (FMOLS) model, *Yahia (2021)* study using ordinary least squares (OLS),

Adam's (2023) study using the nonlinear auto-regressive distributed lag model, *Ashour's (2018)* study using feasible generalized least squares methods (FGLS), and *Ivan's (2021)* study using vector Auto-regression (VAR).

Regarding studies arranged for clarifying the positive impact of ***inflation rate*** on economic growth, *Uddin's (2019)* study using (DF, ADF, PP, and KPSS test) and vector error correction model (VECM), *Issie's (2023)* study using the OLS model, *Jannika's (2022)* study using the Unit Root Test, Johansen's Cointegration Test & Ordinary Least Square (OLS), *Suzana's (2022)* study using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, part of El-khodary's (2024) study using Vector Auto-regression (VAR) model and cointegration, *Ayfer's (2022)* research using Dumitrescu and Hurlin's causality approach, also part of *Opeyemi's (2020)* study using the ordinary least square method (OLS), and part of *Malik's (2015)* using a multiple linear regression model.

On the other hand, the negative impact of ***the inflation rate*** on economic growth has been highlighted through the following studies; *Azam (2020*) study using fixed effects and feasible generalized least squares (FGLS), part of *Hassan's (2021)* study using Exponential, generalized, autoregressive, conditional heteroscedasticity (EGARCH) models, part of *El-khodary's (2024)* study using Vector Auto-regression (VAR) model and cointegration, Hung's (2024) using a time-varying coefficient Bayesian vector auto-regression (TVC-BSVAR) model, part of *Low's (2017)* study using the Unit Root Test, Cointegration Test, Vector Error-Correction Modeling (VECM), Impulse Response Function (IRF), and Variance Decomposition, and part of *Malik's (2015)* study using a multiple linear regression model. In addition, some studies presented both negative and positive impacts of ***the***

inflation rate on economic growth, as mentioned by *Hamdi's (2023)* research on Tunisia's economic growth using a non-linear logistic smooth transition regression model. The research presented a positive impact of inflation on economic growth with an inflation threshold equal to 3.63%, but a negative impact will be shown when the inflation rate exceeds 3.63%. The study of *Thouraya (2021)* using Dynamic Panel Threshold Regression, mentioned that an inflation rate of 5.69% had a positive impact on economic growth, while any increase of more than 5.69% in the inflation rate will have a negative effect on economic growth.

Studies mentioned the negative impact of ***interest rate*** on economic growth; the other part of the study by *El-khodary (2024)* used the Vector Auto-regression (VAR) model and cointegration, and the other part of *Low's (2017)* study used the Unit Root Test, Cointegration Test, Vector Error-Correction Modeling (VECM), Impulse Response Function (IRF), and Variance Decomposition, and the remaining part of *Malik's (2015)* study using a multiple linear regression model. From above previous studies conducted on Egypt and most other countries; they are all missed the multicollinearity test, which might result in errors because of the multicollinearity problem if it exists in such analysis. So, the current study will apply the Multicollinearity test through the variance inflation factor (VIF) test, and the study will use the ***LASSO*** regression model, "Least Absolute Shrinkage and Selection Operator," to arrange a regression model to face the multicollinearity problem that could be presented in the data.

5.0 | Objectives

(1) Finding out the relationship between the exchange rate and economic growth and whether devaluation of the EGP will improve economic growth or worsen it over the study period. (2)

Detecting whether there is a relationship between the INF and economic growth and whether an increase in the INF of Egypt will be in favor of the economic growth or have negative impacts.
(3) Identifying whether the ED/GDP ratio impacts economic growth and whether an increase in external debt will positively affect it or have negative effects.
(4) Exploring types of exchange rate regimes applied in Egypt through the study period according to the IMF classifications. (5) Finding out the impact of CBE's applied interest rate setting policies on the economic growth rate.

6.0 | Variables, Descriptive Analysis, and Assumption tests:

Below **Table 8** will include details about the dependent variable and independent variables which will be used in the study, using quarterly data collected from the central bank of Egypt, CAPMAS, Word Bank Data, Ministry of Finance, exchangerates.org.uk, poundsterlinglive.com, and ceicdata.com, and variables as follows:

Table 5: details about variables used in the study:

Economic Growth Rate (EGR)	Egypt Economic Growth Rate in EGP, for the time period from 2012/2013:Q1 to 2021/2022:Q4 "quarter intervals", through GDP historical records, GDP at factor cost by economic activity - current prices (mn/EGP), GDP_t as quarter end spot GDP value and GDP_{t-1} as one year back GDP value for the same quarter. (Dependent Variable)
External Debt to Gross Domestic Product Ratio (ED_GDP)	(independent Variable) Egypt – External debt to Gross domestic product ratio, GDP at factor cost by economic activity - current prices (mn/$USD), for the time period from 2012/2013:Q1 to 2021/2022:Q4 "quarter intervals", and values calculated in EGP through exchange rate spot values in each period from the historical data gathered from "CBE, and exchangerates.org.uk" in millions EGP. (independent Variable)
Inflation Rate (INF)	Egypt inflation rate, as an annual core CPI indices, for the time period from 2012/2013:Q1 to 2021/2022:Q4 "quarter intervals", from the historical data gathered from "CBE, and exchangerates.org.uk". (independent Variable)
Real Interest Rate (R_INTR)	Egypt Real Interest from 2012/2013:Q1 to 2021/2022:Q4 "quarter intervals". (independent Variable)
Exchange Rate (EXR)	$USD to Egyptian pound exchange rate, for the time period from 2012/2013:Q1 to 2021/2022:Q4 "quarter intervals". (independent Variable)

All above data had been collected from CBE

6.1 | Descriptive Analysis:

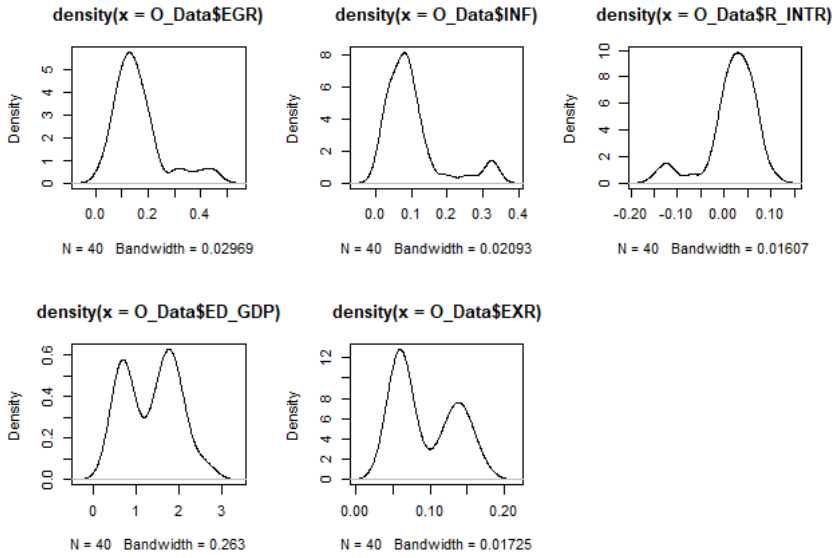
Table 6: Descriptive Analysis

---	vars	n	mean	sd	median	trimmed	mad
EGR	1	40	0.16	0.10	0.14	0.15	0.07
ED_GDP	2	40	1.36	0.61	1.54	1.34	0.73
EXR	3	40	0.09	0.04	0.06	0.09	0.01
INF	4	40	0.10	0.08	0.08	0.08	0.05
R_INTR	5	40	0.02	0.05	0.03	0.03	0.04

---	min	max	range	skew	kutosis	se	
EGR	0.03	0.45	0.43	1.14	1.65	0.02	
ED_GDP	0.47	2.60	2.13	0.09	-1.31	0.10	---
EXR	0.05	0.16	0.11	0.42	-1.65	0.01	
INF	0.01	0.33	0.32	1.68	2.16	0.01	
R_INTR	-0.14	0.10	0.25	-1.39	1.84	0.01	

Source: Arranged by author using R, and data collected from (Central Back of Egypt, Word Bank Data, Ministry of Finance, exchangerates.org.uk, poundsterlinglive.com, and ceicdata.com).

Figure 5: Histogram and plotting of analyzed data during the study period.



Source(s): Arranged by author using R, plotting of analyzed data through the study period

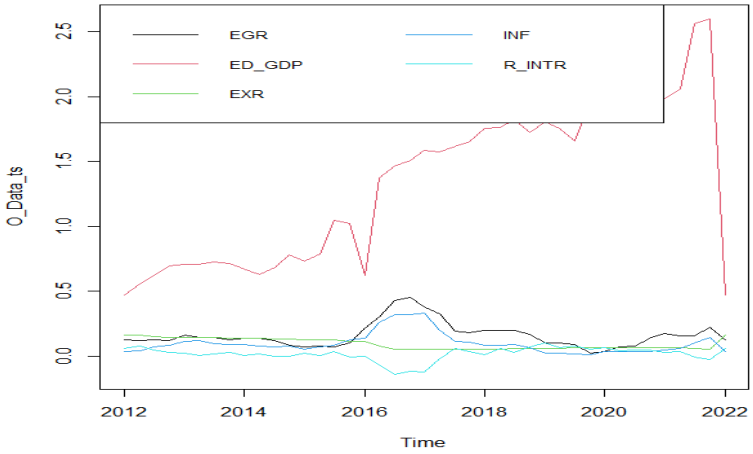
6.2 | Time Serious, Stationary Test, Normality Test, and Heteroskedasticity Test:

Table 7: Stationary Test, and Normality Test p-value numbers

Test type	Statistical method	P-value	results
Stationary test	Augmented Dickey-Fuller Test	0.01	P-value < 0.05, so data is stationary.
Normality test	Kolmogorov-Smirnov Test	0.9037	P-value > 0.05, so data is normally distributed.
Heteroskedasticity Test	studentized Breusch-Pagan test	0.9652	P-value > 0.05, so no Heteroskedasticity problem presented

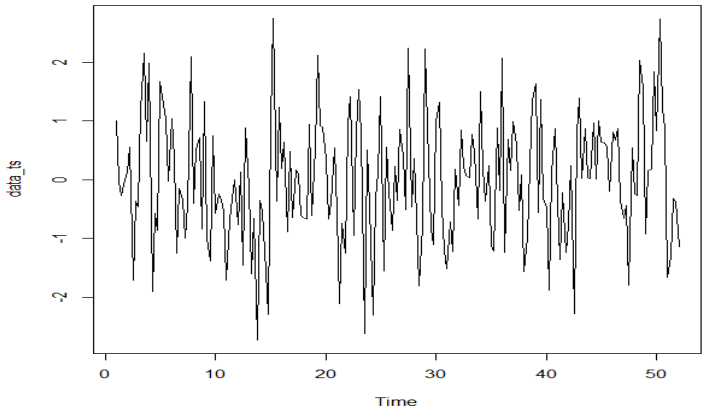
Source(s): Values calculated by author using R studio

Figure 6: A graph about time serious plotting of including all variables of the analyzed data through the study period.



Source(s): Arranged by author using R.

Figure 7: A plotting graph of data analyzed through the study period showing stationary data.



Source(s): Arranged by author using R.

6.3 | Multicollinearity Test:

Also, a multicollinearity test will be applied to the data using R studio, through variance inflation factor (VIF), and results were as follows:

Table 8: variance inflation factor (VIF) results

INF	R_INTR	ED_GDP	EXR
10.196624	8.625146	9.049539	9.786621

Source(s): Arranged by author using R.

** Here, the Variance inflation factor (VIF) was more than 5 in all variables, presenting a high correlation between the dependent and independent variables in the model. Therefore, it will be better to use Lasso regression, "Least Absolute Shrinkage and Selection Operator."

6.4 | LASSO regression model:[1]

Using a Lasso regression "Least Absolute Shrinkage and Selection Operator" to arrange a regression model when there is a multicollinearity presented in the data, as LASSO regression search for minimizing the following:

$$RSS + \lambda \Sigma |\beta j|$$

Where *j* scopes from 1 to *p* predictor variables and $\lambda \geq 0$, and this second part in the equation will be the shrinkage penalty. By using LASSO regression, selecting a value for λ that results the smallest possible test MSE (mean squared error).

[1] (Zach Bobbitt, Nov.2020, statology.org) illustrate that least squares regression attempts to detect coefficient estimates by minimizing RSS "sum of squared residuals" as RSS = $\Sigma(y_i - \hat{y}_i)^2$ where y_i is the actual response value for the i^{th} observation and $\hat{y}_i$ is the predicted response value based on the multiple linear regression model. So, where multicollinearity problem presented in the model because of high correlation between predictors, that will cause a high unreliable and high variance coefficient estimates in the model.

By recognizing previous studies that applied the LASSO regression model to macroeconomic variables, Ozgur's (2021) study used the LASSO regression model to get effective forecasting for Turkish inflation, in which the performance of shrinkage methods was much better for variable selection. In addition, Jokubaitis (2020) mentioned that LASSO regression improved forecasting of the real expenditure components of the US and EU GDP. Moreover, Thach's (2022) study used the LASSO regression model to find out factors affecting non-interest income Vietnamese commercial banks, mentioning the LASSO regression model applied by Tibshirani (1996), which was an upgraded regression model from OLS "ordinary Least Square" regression that performs both variables election and regularization through a shrinkage factor for giving effective prediction and accurate results. Fokin (2020) used the LASSO regression model to inspect the implementation of the VAR-LASSO model to Russia's key macroeconomic indicators, incusing GDP, exports, imports, and real exchange rate. Gizem (2022) highlighted that LASSO regression will clarify the model effectively because it prevents variables that have no significant impacts on the response variable.

6.5 | Correlation Matrix

By using R studio, data will give the following results about correlation matrix:

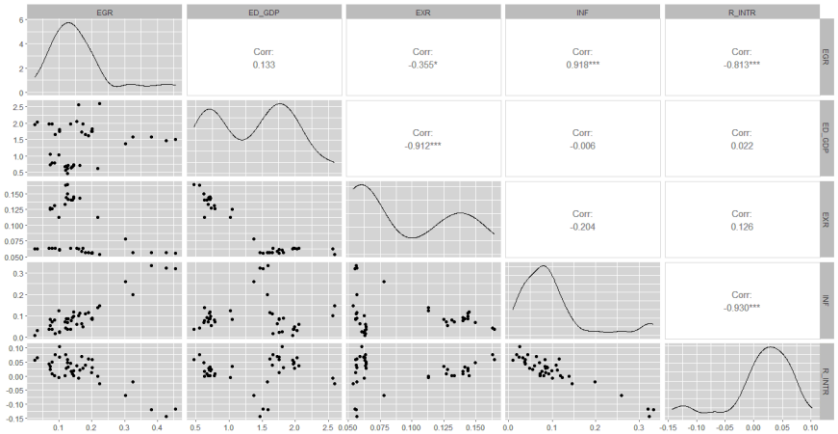
Table 9: correlation matrix:

---	EGR	ED_GDP	EXR	INF	R_INTR
EGR	1.00	0.13	-0.36	0.92	-0.81
ED_GDP	0.13	1.00	-0.91	-0.01	0.02
EXR	-0.36	-0.91	1.00	-0.20	0.13
INF	0.92	-0.01	-0.20	1.00	-0.93
R_INTR	-0.81	0.02	0.13	-0.93	1.00

Source(s): Arranged by author using R

From the above **Table 10**, the highest positive relationship is (0.92) between INF "inflation rate" and EGR "economic growth rate", and the lowest negative relationship (-0.93) between INF "inflation rate" and R_INTR "real interest rate". Also, it had been presented that the highest positive relationship between EGR "economic gross rate" as the dependent variable and INF "inflation rate" as one of the independent variables is (0.92), and the highest negative relationship between EGR "economic gross rate" as the dependent variable and R_INTR "real interest rate" as one of the independent variables is (-0.81), and below exported graphs from R studio about above correlation matrix:

Figure 8: Graph of correlation matrix:



Source(s): Arranged by author using R, as correlation chart of analyzed data through the study period.

From Figure 12.0 above, the variable's names were presented on the outer edge of the matrix chart, and the variables' density plots were presented through boxes along the diagonals. A scatterplot between each variable was exposed in the lower left-corner boxes, and in the higher-right corner boxes, the *Pearson Correlation Coefficient* between each variable was presented.

The highest negative correlation was between INF and R_INTR (-0.930), a very close number to (-1), which pointed out a strong negative linear relationship between the above variables, and another strong negative linear relationship between EXR and ED_GDP (-0.912), moreover another strong negative linear relationship between EGR and R_INTR (-0.813). Also, there is a weak negative linear relationship between EGR & EXR (-0.355) and between INF & EXR (-0.204). In addition, the highest positive correlation was between EGR and inflation rate (0.918), which pointed out a strong positive linear relationship between EGR and INF. Also, two weak positive linear relationships are presented in the relationship between EGR & ED_GDP (0.133) and R_INTR & EXR (0.126). Moreover, no clear relationships were presented in the following relationships: INF & ED_GDP and R_INTR & ED_GDP.

6.6 | Granger causality test:

Through R studio, a Granger Causality test had been arranged between dependent variable and other independent variables, and below results from tests that had been arranged:

Table 10: Granger causality test using R studio for analyzed data through the study period.

	EGR ~ INF	EGR ~ EXR	EGR ~ R_INTR	EGR ~ ED_GDP
P-value	0.0004895	0.01861	0.009603	0.01807
Significance	"***"	"*"	"**"	"*"
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

Source(s): Arranged by author using R

Here, there is two hypothesis to be considered, which are as follows:

H0: INF, R_INTR, ED_GDP, & EXR doesn't granger cause EGR.

H1: INF, R_INTR, ED_GDP, & EXR granger cause EGR

And here there will be a reject for the null hypothesis as the p-value for all tests was below 0.05, and so H1 will be accepted.

7.0 | Model, Regression, and Econometric Results:

7.1 | Model[2]

$$EGR = y_i + \beta_1 INF + \beta_2 EXR + \beta_3 R\_INTR + \beta_4 ED\_GDP + \varepsilon_{it}$$

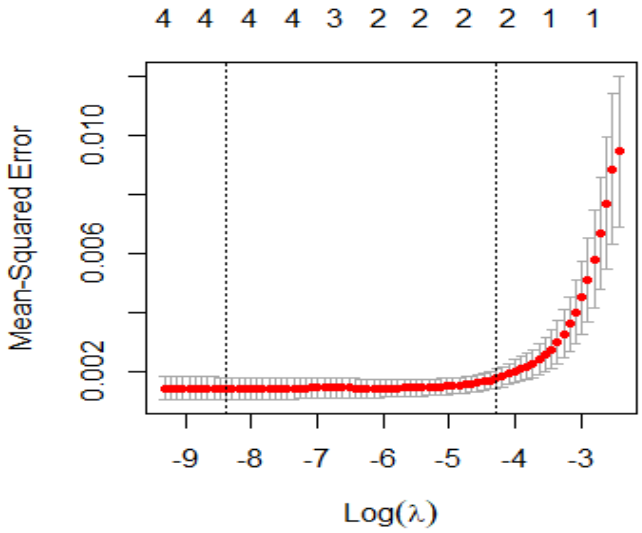
Where, ***EGR*** = Economic growth rate, as the response variable, $y_i =$ Intercept where all independent variables equal to zero, $\beta_{1,2,3,4}$ = Coefficients of independent variables, how much the dependent changes for each change in independent, in other words, it is the average effect on EGR of a one unit increase in Xj, holding all other *predictors* fixed., ***INF*** = Inflation rate, predictor #1, ***EXR*** = Exchange rate, predictor #2,
R_INTR = Real interest rate, predictor #3, ***ED_GDP*** = External debt to GDP ratio, predictor #4, ε_{it} = Error in predicting the value of the dependent, given the value of independent.

7.2 | Lasso regression analysis:

Through defining the response variable "dependent variable" EGR, and matrix of the independent variables using R studio, then by fitting the Lasso regression model through performing k-fold cross-validation to find optimal lambda value, the analysis found the **optimal lambda** value that minimizes test MSE will be **(0.0002290516)**, and below is the exported graph from R studio as a plot of testing MSE by the optimal lambda value mentioned in below Figure 12. Then, by analyzing final model and finding out coefficients of best model, here below will be the resulted matrix from R studio:

[2] Using LASSO regression model mentioned in the study of Gizem (2022), about "analysis of the factors affecting the profitability of banks in turkey by LASSO regression", published in AYBU Business Journal, 2(1), 46-57, as part of the study was finding out relationship between INF & GDP on ROE and ROA.

Figure 9: A plotting graph presenting the fitted LASSO regression model, and showing MSE test to get best lambda value of analyzed data through the study period.



Source(s): Arranged by author using R.

Table 11: Matrix of coefficients of best model using Lasso regression by R studio:

Matrix of class "dgCMatrix"	
Variables	**Coefficients of EGR**
(Intercept)	0.10108779
INF	1.23479302
EXR	-0.56154221
R_INTR	0.30320094
ED_GDP	-0.01147355

Source(s): Arranged by author using R

So, after that the next step will be though using the fitted best model to make predictions and finding out SST "Total sum of squares" and SSE "Sum of squares error" to get R-Squared of the

model, and by using R studio, **R-Squared will be (0.8797545~ 88%)**.

7.3 | Hypotheses:

H0: No relationship between EGR as the dependent variable and all independent variables EXR, R_INTR, ED\GDP, and INF.
H1: ED/GDP ratio has a relationship with EGR in Egypt for the study period.
H2: INF has a relationship with EGR in Egypt for the study period.
H3: EXR has a relationship with EGR in Egypt for the study period.
H4: INTR has a relationship with EGR in Egypt for the study period.

7.4 | Econometric Results:

For EGR as the dependent variable according to the LASSO regression analysis, and through using independent variables for clarifying the model, it had been perceived that the independent variables in the model illustrate the EGR model by 88%, while the optimal lambda values for the model is 0.00022 for EGR. Using the LASSO regression technique, the analysis found that no coefficients of variables could clarify the model as no variables were reduced to 0. It had been cleared from the above matrix in Table 13.0 that all independent variables were still working in the model, statistically significant, and no variable had been deleted. By recognizing the model, there are negative relationships among economic growth rate (EGR) as the dependent variable and two independent variables, which are as follows: exchange rate (EXR) and external debt to GDP ratio (ED_GDP ratio), and also there is a positive relationship among two independent variables; economic growth rate (EGR) as the dependent variable against inflation rate (INF) and real interest rate (R_INTR) as independent variables.

Through the lasso regression model, within the first result, there was a positive relationship between INF "inflation rate" as one of the independent variables and EGR "economic growth rate" as

the dependent variable, which means that an increase in the inflation rate of course in the moderate level, a positive effect on the economic growth rate appeared. Through the study period from Q1:2012/2013 to Q4:2021/2022, inflation rate had a spot (29.763%), which means that with such high percentage of inflation, and through LASSO regression there was a significant positive relationship between inflation rate and economic growth rate, but further studies should be conducted for future intervals to check whether the same threshold will give identical results or the opposite will be presented.

Secondly, there was a negative significant relationship between exchange rate (EXR) as another independent variable and economic growth rate (EGR) as the dependent variable, which means that any increase in the exchange rate ($USD to EGP) that will cause a negative impact on the economic growth rate. In other words, more devaluation for the EGP will cause a decrease in the economic growth rate.
So, the most proper way to avoid negative effects on economic growth is to go through the *Other Conventional Fixed Peg Arrangements* exchange rate regime type.

Thirdly, there was a significant positive relationship between R_INTR, "real interest rate," as the third independent variable in the model and EGR, "economic growth rate," the dependent variable, which means that any increase in the real interest rate, a positive effect on the economic growth rate will be presented. So, interest rate as a tool for controlling a country's inflation rate could also be a tool to positively affect the economic growth rate.
The fourth result was a negative relationship between external debt to GDP ratio (ED\GDP ratio) as the fourth independent variable in the model and economic growth rate (EGR) as the

dependent variable, which means that any increase in the external debt to GDP ratio that will cause a negative effect on the economic growth rate. So, borrowing more money from abroad could be a tool for economic growth rate improvement, but policymakers should also take care of the GDP to be increased at the same level or more than it to keep the ED/GDP ratio going to the declining way to give positive impacts on the economic growth rate. So, null hypothesis H0 will be rejected, and H1, H2, H3, and H4 will be accepted.

8.0 | Conclusion:

To sum up, this study was conducted to find out if there is a relationship between economic growth rate as the dependent variable and exchange rate, inflation rate, interest rate, and external debt to GDP ratio as the independent variables of Egypt for the period from Q1:2012/2013 to Q4:2021/2022 through quarterly intervals, using Lasso regression (Least Absolute Shrinkage and Selection Operator) to arrange a regression model for facing any multicollinearity could be presented in the model between the dependent variable and independent variables, which will be the first study to conduct such regression model on these macroeconomic variables for Egypt to assure having accurate results.

The statistical analysis findings revealed relationships between the dependent variable economic growth rate and all independent variables, including exchange rate, inflation rate, interest rate, and external debt to GDP ratio through Table 11 in which it had included Matrix of coefficients of best model using Lasso regression. On one hand, a significant positive relationship was found between the economic growth rate and two independent variables; the first one is the inflation rate as statistical analysis had resulted a positive coefficient equal (1.2348), which will

support the study of Opeymi (2020) and conflict with other studies conducted on Egypt that resulted in a negative relationship between inflation rate and economic growth. Also, this study will conflict with the study of Thouraya (2021) about the negative impact of an inflation rate above the 5.69% threshold on economic growth.

The second positive relationship will be between Egypt's interest rate as an independent variable and economic growth as the dependent variable during the study period because the statistical analysis had resulted a positive coefficient equal (0.30320). This will conflict with previous studies conducted on Egypt by E Banna (2018) and Tawfiq (2019), which resulted in a negative relationship between interest rate and economic growth.

On the other hand, there were significant negative relationships among economic growth as the dependent variable against two of the independent variables. The first one is the negative relationship between exchange rate and economic growth as statistical analysis had resulted a negative coefficient equal (-0.561542), which will conflict with previous studies of Ashour (2018) and Yahia (2021).

The second negative relationship was between external debt to GDP ratio and economic growth as statistical analysis had resulted a negative coefficient equal (-0.011473), supports previous studies by Benli (2020), Mesbah (2021), and Shawkat (2022) conducted on Egypt by figuring out the same negative relationship between external debt and economic growth. Mesbah (2021) concentrated on the ED\GDP ratio, and the current study will be the first one to check the direct impact of the ED\GDP ratio on EGR.

Recommendations

1. **Policy Formulation**: Policymakers in Egypt should consider the study's findings to create monetary policies that stabilize the inflation rate while promoting real interest rates conducive to economic growth.
2. **Debt Management Strategies**: It is essential to develop a comprehensive strategy for managing external debt, ensuring that borrowing is aligned with GDP growth objectives to maintain a healthy external debt to GDP ratio.
3. **Continuous Monitoring**: Establish a robust framework for the continuous monitoring of macroeconomic indicators to adapt policies dynamically in response to economic fluctuations.
4. **Further Research**: Encourage further empirical studies that explore the long-term effects of external debt on economic growth and the interplay between various macroeconomic variables in different contexts.
5. **Public Awareness**: Increase awareness among stakeholders about the implications of macroeconomic variables on economic growth, fostering a collaborative approach to economic planning and development.

By addressing these recommendations, Egypt can harness its macroeconomic variables effectively to stimulate sustained economic growth and resilience against external shocks.

References

Abed, M. (2020). The impact of foreign capital inflows on economic growth and employment in Egypt. *Journal of Economic and Administrative Sciences, Vol. 36 No. 3, pp. 258-276.*

Adam, P. (2023). Effect of Exchange Rates and Information and Communication Technology on Indonesia's Economic Growth. *Journal of Telecommunications and the Digital Economy, ISSN 2203-1693, Volume 11 Number 4* , 21.

Ahmad, F. (2022). Revisiting the nexus between exchange rate, exports and economic growth: further evidence from Asia. *ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA, VOL. 35, NO. 1, 7128–7146*, 20.

Ajayi, S. l., & Khan, M. S. (2000). EXTERNAL DEBT AND CAPITAL FLIGHT IN SUB-SAHARAN AFRICA . *International Monetary Fund* , 330.

Alemu, T. (2023). External Debt, Institutional Quality and Economic Growth in East African Countries. *JOURNAL OF EAST-WEST BUSINESS, 2023 Taylor & Francis Group, LLC*, 28.

AL-Tamimi, K. A. (2019). Impact of External Debt on Economic Growth in Jordan for the Period (2010-2017) . *International Journal of Economics and Finance; Vol. 11, No.4*, 5.

Amal, G. (2023). PUBLIC EXTERNAL DEBT AND ECONOMIC GROWTH IN TUNISIA. *College of Business and Economics, Qatar University, SBE, Vol.26, No.1, 2023, ISSN 1818-1228*, 21.

Ashour, M. (2018). Theimpactofexchangerateregimesoneconomic growth: Empirical study of a set of developing countries. *THEJOURNALOFINTERNATIONALTRADE&ECONOMICDEVELOPMENT, VOL. 27, NO. 1, 74–90*, 18.

Awan, A. G. (2020). IMPACT OF EXTERNAL DEBT ON ECOOMIC GROWTH OF PAKISTAN . *Global Journal of Management, Social Sciences and Humanities; Vol 6 (1) Jan-March, pp.30-61*., 33.

Ayadi, F. S. (2008). THE IMPACT OF EXTERNAL DEBT ON ECONOMIC GROWTH: A COMPARATIVE STUDY OF NIGERIA AND SOUTH AFRICA. *Journal of Sustainable Development in Africa (Volume 10, No.3, 2008)* , 31.

Ayana, I. D. (2023). Effect of external debt on economic growth in sub-Saharan Africa: System GMM estimation. *Informa UK Limited, trading as Taylor & Francis Group*, 21.

Azam, M. (2020). Threshold effects in the relationship between inflation and economic growth: Further empirical evidence from the developed and developing world. *Int J Fin Econ. ;27:4224–4243, 2020 John Wiley & Sons, Ltd.*, 21.

B., K. J. (2022). The Impact of Inflation, Unemployment, and Population Growth on Philippine Economic Growth. *Journal of Economics, Finance and Accounting Studies, ISSN: 2709-0809, DOI: 10.32996/jefas* , 11.

Banna, I. M. (2018). DIRECTION OF CAUSALITY BETWEEN FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH EVIDENCE FROM EGYPT. *Egyptian Journals*, 31.

Becha, H. (2023). Smooth transition regression model relating inflation to economic growth in Tunisia. *Becha et al. Journal of Economic Structures 12:14*, 27.

BENLI, M. (2020). The effect of external debt on long run economic growth in developing economies: Evidence from heterogeneous panel data models with cross sectional dependency. *Theoretical and Applied Economics Volume XXVII (2020), No. 3(624), Autumn, pp. 127-138*, 13.

BILEWICZ, E. (2022). THE IMPACT OF EXTERNAL DEBT ON POLAND'S ECONOMIC GROWTH. *SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY*, 12.

BOUCHETA, Y. (2021). The Current Exchange Rate Regimes Effect's on the Economic Growth: Case Studies of MENA Countries. *Management Dynamics in Knowledge Economy, 9(4), 419-431*, 14.

BOUJELBENE, T. (2021). NONLINEARITY RELATIONSHIP OF INFLATION AND ECONOMIC GROWTH: ROLE OF INSTITUTIONS QUALITY . *Romanian Journal of Economic Forecasting – XXIV (1)*, 14.

Buthelezi, E. M. (2023). Exploring the relationship between exchange rate misalignment uncertainty and economic growth in South Africa. *uthelezi, Cogent Economics & Finance, 11: 2267920*, 31.

COCHRANE1, J. H. (2001). LONG-TERM DEBT AND OPTIMAL POLICY IN THE FISCAL THEORY OF THE PRICE LEVEL. 48.

Duru, I. U. (2024). External debt and economic growth in selected African economies: A heterogeneous dynamic panel data analysis. *Asian Themes in Social Sciences Research, ISSN: 2578-5516, Vol. 8, No. 1, pp. 1-23*, 24.

EL-KHODARY, M. (2024). The Impact of Money Supply, Interest Rate and Inflation Rate on Economic Growth: A Case of Morocco . *Journal of Economics, Finance and Accounting Studies, ISSN: 2709-0809, DOI: 10.32996/jefas* , 12.

Elnabawy, N. (2020). Using the ARDL bound testing approach to study the inflation rate in Egypt. *Economic consultant, 31 (3), 24-41. doi: 10.46224/ecoc.2020.3.2*, 18.

Farooq, U. (2024). External debt and economic growth: moderating role of governance in South Asia Region. *Eurasia Business and Economics Society*, 23.

Frankel, M. ((Dec., 1962)). The Production Function in Allocation and Growth: A Synthesis. *American Economic Association, Vol. 52, No. 5 (Dec., 1962), pp. 996-1022*, 28.

FRIEDMAN, M. (1976). INFLATION AND UNEMPLOYMENT. *Nobel Memorial Lecture*, 20.

GÖVDELİ, T. (2019). External Debt and Economic Growth in Turkey: An Empirical Analysis. *Sosyoekonomi, Vol. 27(40), 119-130*, 13.

HARMON, E. Y. (2011). THE IMPACT OF PUBLIC DEBT ON INFLATION, GDP GROWTH AND INTEREST RATES IN KENYA. *(Doctoral dissertation, University of Nairobi,).*, 68.

Heidari, H. (2021). An Investigation into Dynamic Relationship Between Economic Growth and Fluctuations in Macroeconomic Variables in Iran (MRS-GARCH) . *Journal Of Business and Development Studies, 14 (1), 59- 8*, 31.

Hung, L. D. (2024). Economic Growth and Inflation Tradeoffs within Global Stagflation: Evidence from the Vietnam Economy. *Journal of International Commerce, Economics and Policy, Vol. 15, No. 2 - 2450005*, 22.

Issie, F. M. (2023). DOES INFLATION CONTRIBUTE TO ECONOMIC GROWTH: THE CASE OF CEMAC (CENTRAL AFRICAN ECONOMIC AND MONETARY COMMUNITY). *JIET (Jurnal Ilmu Ekonomi Terapan) Vol. 8 : 81-93*, 14.

Kandil, M. (2002). Exchange rate fluctuations and disaggregated economic activity in the US: theory and evidence. *Journal of International Money and Finance, 21 , 1–31*, 31.

Krugman, P. (1988). FINANCING VS. FORGIVING A DEBT OVERHANG. *NATIONAL BUREAU OF ECONOMIC RESEARCH*, 34.

Kwaku, J. (2023). Foreign direct investment, remittances, real exchange rate, imports, and economic growth in Ghana: An ARDL approach. *Mawutor et al., Cogent Economics & Finance, 11: 2185343*, 28.

Lakshmanasamy, T. (2022). External Debt and Economic Growth in India: Error Correction Model Estimation of the Causal Relationship. *International Journal of Financial Management*, 8.

Low, Y. W. (2017). Foreign Exchange Rate, Interest Rate, Inflation Rate and Economic Growth in Malaysia . *Global Business and Management Research: An International Journal Vol. 9, No. 4s* , 19.

Malik, M. W. (2015). Impact of Major Economic Variables on Economic Growth of Pakistan . *ACTA UNIVERSITATIS DANUBIUS, Vol 11, No.2, pp. 94-106*, 14.

Maredza, A. (2022). Exchange Rate Volatility, Inflation and Economic Growth in Developing Countries: Panel Data Approach for SADC. *MDPI*, 19.

Mundell, R. A. (1961). A Theory of Optimum Currency Areas. *The American Economic Review , Sep., Vol. 51, No. 4 (Sep., 1961), pp. 657-665*, 10.

Necib, A. (2023). The Linear and Non-Linear Effects of External Debt on Economic Growth in MENA Countries: An Empirical Investigation. *International Journal of Finance, Insurance and Risk Management*, 28.

Opeyemi, A. F. (2020). Impact of foreign direct investment and inflation on economic growth of five randomly selected Countries in Africa . *Journal of Economics and International Finance, Vol. 12(2), pp. 65-73*, 9.

ÖZYILMAZ, A. (2022). Relationship Between Inflation and Economic Growth in EU Countries. *İktisat Politikası Araştırmaları Dergisi Journal of Economic Policy Researches, Cilt/Volume: 9*, 15.

Rihan1, M. a. (2018). AN ECONOMETRIC STUDY OF THE PRESENT AND FUTURE EFFECT OF INFLATION ON ECONOMIC GROWTH IN EGYPT. *Arab Univ., J. Agric. Sci., Ain Shams Univ., Cairo, Special Issue, 26(2A), 891-907* , 15.

Robert E. Locas, J. (1973). Some international evidence on output-inflation tradeoffs. *The american economic review, Vol.62, No.3*, 11.

Romer, P. M. (1989). ENDOCENOUS TECHNOLOGICAL CHANGE. *NATIONAL BUREAU OF ECONOMIC RESEARCH, Working Paper No. 3210*, 45.

Sachs, J. D. (1989). Developing Country Debt and Economic Performance. *A National Bureau of Economic Research* , 13.

Sahnoun, M. (2019). Causality Between Inflation, Economic Growth and Unemployment in North African Countries. *Economic Alternatives, Issue 1, pp. 77-92*, 16.

Silva, J. (2020). Impact of public and private sector external debt on economic growth: the case of Portugal. *Eurasian Economic Review (2020) 10:607–634*, 29.

Stevanovic, S. (2022). EFFECTS OF THE IMPLEMENTATION OF THE INFLATION TARGETING REGIME ON ECONOMIC GROWTH . *Economic Horizons Volume 24, Number 3, 285 - 298*, 16.

Stockman, A. C. (1981). EFFECTS OF INFLATION ON THE PATTERN OF INTERNATIONAL TRADE. *NATIONAL BUREAU OF ECONOMIC RESEARCH, Working Paper No. 713*, 27.

Taiwo-Agosu, B. (2024). IMPACT OF EXCHANGE RATE VOLATILITY ON ECONOMIC GROWTH: 1981-2019 (ARDL MODEL) . *Applied Research in Administrative Sciences, vol. 5, 41-52*, 13.

Tareque, M. (2020). External debt and growth: role of stable macroeconomic policies. *Journal of Economics, Finance and administrative Science, published by Emerald Publishing Limited, Vol. 25 No. 50*, 20.

Tawfiq, T. T. (2019). The Impact of the Exchange, Interest, and Inflation Rates on Economic Growth- The Case of Arab Republic of Egypt. *Journal of Economics and Sustainable Development, ISSN 2222-1700 (Paper), Vol.10, No.12*, 9.

The Asymmetric Effects of External Debt on Economic Growth in Selected MENA Countries: Some Insights from a Panel Quantile Regression. (2022). *Topics in Middle Eastern and African Economies, Proceedings of Middle East Economic Association, Vol. 24, Issue No. 2, September 2022*, 6.

Thiel, M. (2001). Finance and economic growth. *©European Communities, 2001*, 61.

Tibshirani, R. (1996). Regression Shrinkage and Selection via the Lasso. *Wiley for the Royal Statistical Society*, 23.

Tobin, J. (1965). Money and economic growth. *Econometrica*, 15.

TODOROV, I. K. (2021). IMPACT OF EXCHANGE RATE REGIMES AND EURO AREA MEMBERSHIP ON THE ECONOMIC GROWTH OF THE NEW MEMBER STATES FROM CENTRAL AND EASTERN EUROPE . *International Journal of Contemporary Economics and Administrative Sciences ISSN: 1925 – 4423, Volume: XI, Issue: 1, pp. 216-246* , 32.

Uddin, M. N. (2019). Dynamic Inflation and Economic Growth Nexus in Bangladesh . *Journal of Accounting, Business and Management vol. 26 no. 2 35-45* , 12.

Williamson, O. E. (September 2000). The New Institutional Economics: Taking Stock, Looking Ahead. *Journal of Economic Literature, vol. 38, no. 3, (pp. 595–613)*, 18.

Yeboah, E. (2023). DO EXTERNAL DEBT AND FOREIGN DIRECT INVESTMENT (FDI) INFLOW SUPPORT ECONOMIC GROWTH? EVIDENCE FROM GHANA. *Journal of Finance and Financial Law marzec/March 2023 ● vol. 1(37): 139–154,* 17.

ZAREI, S. (2021). HOW DO REAL EXCHANGE RATE MOVEMENTS AFFECT THE ECONOMIC GROWTH IN IRAN? . *International Journal of Contemporary Economics and Administrative Sciences ISSN: 1925 – 4423 , Volume: XI, Issue: 1, pp. 297-313* , 18.

Zhetibayev, Z. (2022). RELATIONSHIP BETWEEN EXTERNAL DEBT AND ECONOMIC GROWTH:PANEL DATA ANALYSIS FOR BRIC COUNTRIES. *The Journal of Economic Research & Business Administration*, 10.