Can Exchange Rates and Interest Rates Affect Macroeconomic Indicators (inflation, unemployment & economic growth)? The evidence from Egypt

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Can Exchange Rates and Interest Rates Affect Macroeconomic Indicators (inflation, unemployment & economic growth)? The evidence from Egypt

Dr. Raghda Saied Ahmed Mohammed

Abstract

The study analyzed the effects of both the exchange rates and the interest rates simultaneously on the selected indicators of the macroeconomic performance in Egypt over the period from 1991 to 2020. And in order to do that, the Engle-Granger two-step Co-integration model is applied to estimate the short and long-term relationships between variables. And it was found that the exchange rate & the interest rate, each one of them in the presence of the other, had no effect on the unemployment rate and economic growth rate. Although the interest rate and exchange rate, each one of them in the presence of the other, had an effect on the inflation rate in the long run. And only the interest rate, in the presence of exchange rate, had an effect on the inflation rate, while the exchange rate, in the presence of interest rate, had no effect on inflation in the short run. Since increasing both the exchange rate and interest rate by one unit increased inflation rates by 0.510 and 0.892, respectively, in the long run. And in the short run, increasing interest rates by 1 unit increased inflation by 2.161.

Keywords: economic growth, unemployment, inflation targeting,exchange rate, interest rate.

Introduction[1]:

Due to the development of international trade and the expansion of international trade services, foreign currencies are used by commercial or financial companies operating inside the country as well as companies operating outside. Thus, they are forced to deal with the exchange market to buy the currency of the exporting country to complete the deal, and the matter is not limited to companies but extends to individuals who want to go to another country for the purpose of work, tourism, or other things.

The importance of implementing an appropriate exchange rate (ER) policy for a country reflects the impact of exchange rate policies on the volume of foreign trade and thus on the status of the country's trade balance. Many developing countries have followed the policy of devaluing the local currency, which is one of the most important policies that seek to achieve balance. And many developing countries desire to encourage their exports by shifting from the fixed exchange rate regime and switching to the flexible exchange rate system.

Where the exchange rate policy is one of the most effective monetary policy tools to protect the national economy from external shock, it also helps the economy solve its internal issues. Since the exchange rates not only have an impact on the balance of trade or payments, but they also have an impact on many economic indicators such as the economic growth rate, inflation rate, unemployment rate, etc. In addition to the interest rate (I), which is also one of the monetary policy tools that stimulates the economy to go through specific channels to achieve certain targets. Since,the strength and stability of the economy of any country are closely linked to the value of its national currency against other currencies, and the interest rates as helping factors to achieve stability and development. But, if there is a lack of integration in decision-making of exchange rate policies & interest rates, which isrepresented by uneducated changes in both interest ratesand exchange rates,

[1]Alhussin M.A, and Mobarak.K.(2018). The Effect of The Liberalization of The Exchange Rate on The Domestic Investment In Egypt.Democratic Arabic Center For Strategic, Political, & Economic Studies. Available online on https://democraticac.de/?p=51446 Access on 5th of December 2021 (In Arabic).

unwanted targets will be achieved. So, in this work, the spot light will be on this integration through focusing on the changes in both exchange rates and interest rates & their impacts on the macroeconomic variables (economic growth, unemployment, and inflation).

Research problem:

The challenges faced by the Egyptian economy, such as structural imbalances that led to a continuous deficit over years in the general budget, a rise in inflation rates, a slowdown in economic growth, and the deficit in the balance of trade, etc. made the government in Egypt resort to international financial institutions such as the World Bank and International Monetary Fund (IMF). Those institutions, as they are known, put monetary and financial reform programs and policies into practice.

Therefore, the changing exchange rate regime, fluctuations in exchange rates, and variations in monetary policies due to the reform programs were applied, which affect the macroeconomic performance. So it is necessary to study the role of both the interest rate & the exchange rates – as the monetary policy channels that effect macroeconomic indicators (economic growth, unemployment, and inflation). Therefore, the research problem focuses on the following questions:

1. Is there an influence of the exchange rates, in the presence on the interest rate, on the economic performance through the indicators of economic growth rate, unemployment rate, & inflation rate?
2. Is there an impact of the interest rate, in the presence on the exchange rates, on the economic performance through the indicators of economic growth rate, unemployment rate, & inflation rate?
3. Is there a relationship between exchange rates & interest rates?

Hypothesis development:

1. The exchange rates & the interest rates affect unemployment rate in Egypt.
2. The exchange rates & the interest rates affecteconomic growth rate in Egypt.
3. The exchange rates & the interest rates affect inflation rate in Egypt.

Purpose: The purpose of this work is to address the role of both the interest rate & exchange rates in affecting the performance of the Egyptian economy through estimating their impact on the macroeconomic indicators.

The scope of the study: this work is based on Egypt, and the study covers the period from 1991 to 2020. Since it covers the years from 1991 to 2002, which is enough to measure the effect of both the exchange rates and the interest rate on the selected macroeconomic indicators before implementing the first floating in 2003, then it covers the years from 2003 to 2016to estimate the effect on the same indicators between the first floating & the second floating in 2016, and it covers the remaining years after implementing the second floating until 2020.

It has to be mentioned that, this study uses the time span from 1991 to 2020 similar to many previous studies, since there are lots of studies that focus on the changes of the exchange rate and their impact on economic growth in Egypt covering the same time span such as the study of Eliwa.T.A. (2014), which is about the impact of exchange rate changes on economic growth in Egypt. The study covered the time span from 1991 to 2013. Although this time period includes many events and circumstances, it witnessed changes in exchange rates, which led to changes in economic performance indicators.

In addition to the study of Mahfouz E.(2019), which is about the effect of the deviation of the real exchange rate from its equilibrium level on economic growth in Egypt, and this study focuses on the time period before 2019 depending mainly on the period of nineties to 2019, which had lots of changes in exchange rates.

Study plan:

1- The theoretical framework
2- The methodology/ approach
3- Results & findings
4- Recommendations

References

Appendix

Originality/value – There are many studies about exchange rates and interest rates, although a few attempted to find out and estimate the link between the status of the Egyptian economy (through its indicators such as economic growth, unemployment, and inflation), and changes in both the exchange rates and the interest rate.

1- The theoretical frame work

The relationship between the interest rate & unemployment: At the macroeconomic level, the interest rate can be inefficient, which is noticeable clearly through unemployment. And in this vein, it should be mentioned that natural unemployment does not exist. Unemployment is a result for many reasons. At the top of these reasons is the interest cost that prohibits an investor from paying for the loans expense, especially in the case where his profit is less than the cost of borrowing money. That is for sure going to lead to a decrease in total investments and a rise in unemployment rate. This inefficiency in the economy means that unemployment will continue if capital is available at a cost. Thus, to reduce unemployment rate, interest rates should be decreased to zero percent, or in the other word, interest-free. In this economy, depositors are obliged to put their savings in the stock market to make up for the returns they used to have from deposits[1].

And there are many studies that totally agree with the above point of view. Since there is a positive direct impact of the interest rate on the unemployment. One of these studies is the work of Herman J. Bierens, and Lourens Broersma, which is about the relationship between unemployment and interest rate in the presence of the industrial production growth rate in Canada, the UK, the USA, Japan, Germany, and France. They pointed out that interest rate plays an important role in employment decisions rather than wage rate[2].

The relationship between the exchange rates & unemployment: There are many studies that investigated the relationship between the ER and unemployment. Some of them pointed out that there was a positive relationship between the ER and unemployment, and some of them illustrated

[1]Abdullah, A. K. (2013). How interest causes unemployment. ICR Journal, 4(2), 304-307.
[2]Bierens, H. J., & Broersma, L. (1993). The relation between unemployment and interest rate: some international evidence. Econometric reviews, 12(2), 217-256:p217- 251

the opposite. For instance, if there is a depreciation for the ER in a country and the industrial sector is based on some raw materials or intermediate products from abroad, that indicates that ER depreciation will increase the prices of inputs, which will lead to a decrease in the amount of production and the number of employed laborers, or in other words, it will lead to an increase in the unemployed rate.

On the other hand, if there is an appreciation in the ER in a country, that will increase the foreign direct investment and it will decrease the value of imports, plus it will lead to more reliance on domestic products, and it will increase the value of exports (if the exported products have a high price elasticity of demand) which will increase the supply of these products & the number of labor as a final result.

So, it depends mainly on the status of the country: if the country depends on imported raw materials, or it depends on its own inputs, if the country has a high price elasticity of demand for its exports, or it has a low price elasticity of demand for its exports and so forth. So, there are different studies about that matter; some of them agree with the ER appreciation, while some others do not. According to the work of Jaime Ros and Roberto Frenkel, which is about the link between the ER and unemployment, it illustrates the ways the ER affects unemployment rate (the growth rate of output, and the aggregate demand, the intensity of labor in the production process) in Argentina, Brazil, Chile, and Mexico. And they showed that the ER had an impact on unemployment through the growth of output and the intensity of labor. And there is a 2-year space between changes in both the rate of unemployment and the ER as the intensity of labor needs time to adjust to the new relative prices[1].

So, it depends mainly on the status of the country. And according to the work of Eyad Mohammed Atya, which is about the relationship between theER and unemployment in Egypt, the real exchange positively affects unemployment.

[1]Frenkel, R., &Ros, J. (2006). Unemployment and the real exchange rate in Latin America. World development, 34(4), 631-646:p631-644

This indicates that decreasing the ER will reduce unemployment rate through offering new vacancies[1].

But according to the work of Atif Ali Jaffri, Haleema Amreen, Moniba Sana, and Rooma Asjed, which is about the influence of the ER on unemployment in Pakistan, they found that trade openness and the ER appreciation decreased unemployment rates in the long term, although the growth of gross domestic product had no significant influence on unemployment[2].

This result is similar to the results of Mehrzad Ebrahimi and Zahra Bakhshi in their work, which is about the impact of the ER on unemployment in Iran using 30 year data up to 2012 in an econometric model. They illustrated that there was an inverse relationship between the exchange rate and unemployment in Iran[3].

The relationship between interest rate & the exchange rate:

The theory claims that a rise in interest rate on domestic currency appreciates this currency against foreign currency. Although the literature review does not always suggest that[4].

Since then, some studies have shown that there is no effect of I on the ER at all, such as the study by Shahid Ahmed Khan, which examines the role interest rate has on the ER in both Pakistan and the USA through a Simple Regression Model. The results showed that there was a non-significant influence of I on the ER[5]. Besides, the work of Amanda Dwi Suciany, and S. Suhadak, which

[1]Atya, E. M. (2017). The effect of real exchange rate on unemployment evidence from Egypt. Arab Journal of Administration, 37(3), 213-230:p251-260

[2]Jaffri, A. A., Amreen, H., Asjed, R., & Sana, M. Impact of Real Effective Exchange Rate on Unemployment in Pakistan: An Empirical Investigation:127 Available online on: https://www.qurtuba.edu.pk/jms/default_files/JMS/special_edition/1%20EIEF/08%20127-136%20Dr.%20Atif%20Ali%20Jaffri.pdf access time on 23/12/2021

[3]Bakhshi, Z., &Ebrahimi, M. (2016). The effect of real exchange rate on unemployment. Marketing and Branding Research, 3, 4-13:p4.

[4]Tafa, J. (2015). Relationship between exchange rates and interest rates: Case of Albania. Mediterranean Journal of Social Sciences, 6(4), 163-163:p163.

[5]Khan, S. A. (2010). Empirical study on impact of interest rate on exchange rate: 1 Available at SSRN 1625492.Access time on 17/2/2022.

is about the impact of the ER on I in Indonesia through the period from 2015 to 2018, found that the ER does not affect I[1].

Additionally, there are lots of studies that pointed out the positive effect of I on the ER, such as the work of Jonada Tafa, which is about the link between the ER and I on deposits in Albania through the period from 2002 to 2014, and she claimed that a rise in interest rates on ALL increases the ER of ALL/USD, so USD will be more expensive.[2] Additionally, the work of Ansgar Belke, Daniel Gros, and Kai Geisslreither in 2004, which examined the link between the volatility of both interest rate and the exchange rates in the Mercosur countries, and it is found that there was a statistical co-movement of interest rate and exchange rate volatilities in Argentina, Chile and Uruguay. In other words, there is a positive link between the volatility of interest rates and the ER[3].

And those results agree with the results of Manar Ahmed in her work evaluating the effect of monetary policy in achieving ER stability in Egypt during the period of 1990–2017. And her study illustrates that there is a negative relationship between the ER and money supply in the short and long run. Since increasing the money supply by 10% decreases the value of the ER by 20%[4]. Since, increasing money supply leads to a decreasing in interest rate, which leads to a decreasing in the ER. Since, in case of I increases, the deposits in banks will increase, the imports will decrease, the amount of investment will decrease, the amount of production will decrease, and the exports will decrease. So, finally,the ER will increase as a final result.

[1]Suhadak, S., & Suciany, A. D. (2020). Brief Technical Note: The Influence of Exchange Rates on Inflation, Interest Rates and the Composite Stock Price Index: Indonesia 2015-2018. Australasian Accounting, Business and Finance Journal, 14(1), 105-120:p105.

[2]Tafa, J.op.cit.p163.

[3]Belke, A., Geisslreither, K., & Gros, D. (2004). On The Relationship Between Exchanges Rates and Interest Rates: Evidence from The Southern Cone. Cuadernos de economía, 41(122), 35-64:35-56.

[4]Morsy M.A. (٢٠١٧).The Evaluating of the Effectiveness of The Monetary Policy in Achieving the Stability of Exchange Rate in Egypt through the Period (1990-2017).JSEC. The Faculty of Commerce, Ain Shams University: (In Arabic) 485-544.

And the above results disagree with the findings of Elmotayam Mohamed, who pointed out the effect of monetary policy on the ER in Egypt through the period of (1976–2016). Since there is a negative effect of interest rate on the ER in Egypt in the long term[1]. If I increases, there will be an appreciation for the Egyptian pound in front of the USD, so the ER will decrease. Since, I is the price of using money. Therefore, once I increases, that means that the demand for using money is greater than supply, which leads to an increasing interest rate. So, there will be an appreciation of the currency in comparison with other foreign currencies. So, the ER will decrease.

In addition to the work of Marcelo Sánchez, which examines the effect of the ER depreciation on I in open economies and it distinguishes between depreciation in expansionary and contractionary cases, And he found that the link between the ER and I is negative for expansionary depreciations while it is positive for contractionary depreciations. So, the relationship between the ER and I is mainly based on the status of the economy.

The relationship between interest rate & inflation:

Interest rates are the core of monetary policy. It is not only a reflector of money supply, but it is also a key macroeconomic policy mechanism, especially in developing countries. Hence, a high rate of interest is a main element of numerous stabilization programs in many countries associated with chronic inflation through the 1980s[2], although some studies have an opposite viewpoint, as shown in the following part. Additionally, economic stability is basically a function of interest rate[3].So, it is important to address the link between interest rate and inflation.

[1]Ahmed A.M. (2018). Analyzing The Effect of Monetary Policy on The Exchange Rate on The Egyptian Economy.Jcsr.The Faculty of Commerce, Banha University.(In Arabic).

[2]Asgharpur, H., Kohnehshahri, L. A., and Karami, A. (2007). The relationships between interest rates and inflation changes: An analysis of long-term interest rate dynamics in developing countries: p1.

[3]Khumalo, L. C., Mutambara, E., and Assensoh-Kodua, A. (2017). Relationship between inflation and interest rates in Swaziland revisited. Banks & bank systems, (12,№ 4 (cont.)), 218-226:218

In particular, there are many studies that investigate the relationship between interest rate and inflation, such as the work of Azhdar Karami, Hossein Asgharpur, and Lotfali Agheli Kohnehshahri, which analyzed the links between inflation and interest rate in developing countries (a panel of forty Islamic nations). They illustrated that there was a unidirectional positive relationship between inflation and interest rate, starting with the interest rate and ending with inflation. Since raising production costs through raising interest rate causes an increase in product prices, which in turn leads to high inflation. So, it is recommended for banks to decrease interest rates to reduce inflation regardless depositor's interest[1].Those results are consistent with the results of Akwesi Assensoh-Kodua, Emmanuel Mutambara, and Lindiwe Catherine Khumalo, in their work which assessed the link between interest rate & inflation in Swaziland during the period from 2010 to 2014. They showed that there is a positive relationship between interest rate and inflation[2].

The relationship between interest rate & Economic growth:

This relationship is investigated through the literature review. Since, there are some studies that show that there is a negative relationship between interest rate and economic growth. According to the work of Megersa Daksa in 2020, which was about how the real interest rate affects per capita income growth. And he showed that financial development (FD) lowers real interest rate, which boosts per capita income growth by using panel data from 87 countries from 2000 to 2017. The study's findings support the notion of "high (FD)-high income growth". Hence, developing a financial sector, which can lower real interest rate, can let countries increase their income[3].

Although there was a different point of view, such as the work of Huw Pillin in 1997, which investigates the effect of real interest rate mismeasurement. He

[1]Asgharpur, H., Kohnehshahri, L. A, and Karami, A. Op.cit.p1

[2]Khumalo, L. C., Mutambara, E, and Assensoh-Kodua, A.op.cit.p218.

[3]Daksa, M. D. Financial development, real interest rate and per capita income growth Draft Paper:1

proved that increasing real interest rate (from 25% to 5%) will raise real annual growth of GDP per capita from zero to 2%[1].

Additionally, the work of Clement Moyo and Pierre Le Roux in 2018, which studied the Southern African Development Communityas a case study during 1990–2015. They used three phases; the first phase which is about the effect of the reforms on savings, the second which is about the impact of saving on investment, and finally, they looked into whether investments contributed to economic growth or not. They found that through savings and investments, the interest rate has a positive influence on economic growth, and decreasing the interest rate can harm economic growth.

Additionally they explained these findings as follows: increasing real deposit rates increases savings. Additionally, raising borrowing costs does not have a great effect on investments, and the impact of higher deposit rates is greater than the harmful outcome of higher borrowing costs. Consequently, interest rate liberalization positively affects economic growth through both investments and savings. So, decreasing interest rates, which is used to enhance economic growth through attracting savings and investments, are the key drivers of long-term economic growth decline[2].

The relationship between Exchange rate & inflation:

The relationship between the ER & inflation appears clearly through the literature review. Since there are many studies that examined this relationship, such as the work of Amanda Dwi, Suhadak, S, and Suciany, who found that the ER negatively affects inflation in Indonesia. Unlike the results of Monfared, S., & Akin, F. (2017), which illustrated a direct relationship between inflation & ER. So, the ER influences the inflation positively[3].

[1]Pill, H. (1997). Real interest rates and growth: Improving on some deflating experiences. The Journal of Development Studies, 34(1), 85-110:1

[2]Moyo, C., & Le Roux, P. (2018). Interest rate reforms and economic growth: the savings and investment channel:1

[3]Monfared, S., & Akin, F. (2017). The relationship between exchange rates and inflation: the case of Iran. European Journal of Sustainable Development, 6(4):329

And regarding the ER regime & its link with the inflation rate, there are many researchers who investigate this link, such as Mohamed G. (2013), who studies the influence of ER regimes on inflation using panel data covering 50 countries during the period 1980–2008. And he found that intermediate and fixed regimes give better results in controlling inflation[1]. Those findings are supported by Domac, I., Peters, K., &Yuzefovich, Y. (2001), which found that transition countries to a fixed regime can achieve a lower level of inflation rate[2].Those results agree with the findings of Fetai, B., Koku, P. S., Caushi, A., & Fetai, A. (2016), which illustrate that the ER creates inflationary pressures in Western Balkans countries. So, policy makers should not apply a flexible ER regime in open economies because costs are more than benefits[3].

Unlike the results of Ebeke, M. C., & Fouejieu, M. A. (2015), which showed that inflation-targeting countries have a more flexible ER regime on average than other emerging markets[4].

The relationship between the Exchange rate & Economic growth:

Economic strategies and policies differ among countries in a way to achieve high growth rate, and the ER is definitely an essential tool of economic policy. So, most decision-makers pursue implementing & applying strategies & policies that guarantee the stability of ER and that avoid the severe instabilities in currencies. Hence, it is important to know how the changes in the exchange

[1]Mohamed G. (2013). The effect of Exchange Rate on Inflation & Economic Growth. Theoretical & Econometrics study Using Panel Data Analysis. The Faculty of Economic Sciences:384 (In Arabic)

[2]Domac, I., Peters, K., & Yuzefovich, Y. (2001). Does the exchange rate regime affect macroeconomic performance? Evidence from transition economies. Evidence from Transition Economies (July 17, 2001):1

[3]Fetai, B., Koku, P. S., Caushi, A., &Fetai, A. (2016). The relationship between exchange rate and inflation: The case of Western Balkans countries. Journal of Business Economics and Finance, 5(4), 360-364:1

[4]Ebeke, M. C., & Fouejieu, M. A. (2015). Inflation targeting and exchange rate regimes in emerging markets. International Monetary Fund:2

rate affect economic growth[1]. So, there are lots of studies that analyze this relationship with two different viewpoints as follows:

- ✓ The first one shows that there is an adverse relationship between the economic growth rate & exchange rate, which appears through Abudeif, S. M., & Ali, S. H. (2021), which analyzes how the ER affects economic development in Egypt for the period of 1971–2018[2].And this also appears through Arratibel, O., Furceri, D., Martin, R., & Zdzienicka, A. (2011) for the 14 Central and Eastern European countries, over the period 2002–2018. And it is pointed out that the ER negatively influences real economic growth. So, it is recommended to keep the stability of ER to enhance economic growth[3].
- ✓ The second viewpoint is about the direct relationship between ER & economic growth, which appears through Kogid, M., Asid, R., Lily, J., Mulok, D., & Loganathan, N. (2012), which covers the period of (1971 - 2009) in Malaysia, since it is pointed that the ER positively influences the economic growth[4].

Therefore, the above results show that changes in the ER may affect economic growth negatively or positively, but may the exchange rate regime (ERR) affect economic growth? The answer to this question will be shown as follows:

- o The fixed ERR: The fixed ERR is the best one for economic growth, and this appeared clearly through the work of Jakob B in 2016, which examines which type of regime (flexible, fixed, or intermediate) promotes

[1]Mahfooz E.(2019).The Effect of the Deviation of the Real Exchange Rate from its Equilibrium Level on Economic Growth in Egypt. Algerian Scientific Journal Platform.(ASJP). 5(8), 143-169:144 (In Arabic).

[2]Abudeif, S. M., & Ali, S. H. (2021). Determinants of the exchange rate in Egypt and their implications for economic development econometrics study during the period (1971-2018): Journal of Economic, Administrative and Legal Sciences:1

[3]Arratibel, O., Furceri, D., Martin, R., & Zdzienicka, A. (2011). The effect of nominal exchange rate volatility on real macroeconomic performance in the CEE countries. Economic Systems, 35(2), 261-277:1

[4]Kogid, M., Asid, R., Lily, J., Mulok, D., & Loganathan, N. (2012). The Effect of Exchange Rates on Economic Growth: Empirical Testing on Nominal versus Real. IUP Journal of Financial Economics, 10(1):1

economic growth for 25 developing countries during 26 years starting from 1980. It is found that if the country applies a fixed ERR, it will raise the growth rate more than applying an intermediate or flexible one. Hence, the fixed ERR is the best ERR to the growth rate, then the flexible one, then the intermediate one[1].

- The intermediate ERR: the impact of intermediate ERR on economic growth is examined by Frenkel, R., & Ros, J. (2006), which investigated the influence of the ERR on economic growth rates for 145 countries. It is pointed out that, with the greatest significance, the intermediate ERR influences economic growth positively compared to the other regimes, and among regimes it seems less significant for high-income countries compared to low-income ones[2].

The stages of the exchange ratedevelopment in Egypt

As follows, there are 3 main phases for exchange rate systems in Egypt:

1- **First phase: 1990/1991 - 2001/2002**: In October 1991, the multiple exchange rate system was cancelled as a part of a comprehensive economic reform, and there was a uniform exchange rate in Egypt[3]. Hence, the value of the Egyptian pound against the USD is relatively constant, especially from 1991 to 1998. Since then, there were some fluctuations as the government has influenced the demand for foreign currency, and the exchange rate was about 4.3 L.E. as a real exchange rate and 3.4 L.E. as a nominal one. After that, the exchange rate was determined by the market forces of demand & supply, and the exchange rate moved into the next phase.

2- **Second phase: 2002/2003 - 2012/2013:** The exchange rate was liberalized in 2003, and the nominal exchange rate of USD has increased from 3.5 L.E. to 6 L.E., with a change of around 71% compared to its value before

[1]Jakob, B. (2016). Impact of exchange rate regimes on economic growth. Undergraduate Economic Review, 12(1), 11:1

[2]Frenkel, R., &Ros, J. (2006). Unemployment and the real exchange rate in Latin America. World development, 34(4), 631-646:1

[3] Mahfouz E. (2023). The effect of exchange rate liberalization on the rate of inflation in the Egyptian economy. Arab Journal of Adminstration:8 (In Arabic)

liberalization. And that is an important phase in the exchange rate in Egypt[1].

The reasons behind exchange rate liberalization in 2003[2]:

- The crisis in the southeast of Asia led to an increase in the value of imports from those countries, which also led to an increase in the local demand for USD. Above all of that, this crisis had led to the flight of foreign capital out of Egypt.
- In addition to the diminishing returns of tourism after the accident of killing tourists in Luxor in 1997,
- As well as the shrinking of foreign investment by 248M $ in 1998 and the transforming from having a surplus in 1991 to having a shortage in 1998.
- All of the above reasons led to exchange rate liberalization in 2003, besides connecting the exchange rate of money exchange companies with the exchange rate of the banks. And as a result of the above two phases, the USD had decreased by 14%, which causes the following:

- The value of the Egyptian pound had increased by 14%. The inflation rate had increased from 8% to 21%.
- The value of imports had increased on average from 50.2 billion pounds to 156 billion pounds, or by 211%, including materials, semi-finished products, consumer goods and investment goods.
- The real exchange rate of the USD had decreased, which led to increasing the value of exports by 307% as a result of many commercial agreements, such as qualifying Industrial Zones (QIZ), and as a result of the spread of economic blocs like COMESA.
- Capital accumulation had increased by 265%, and there was an increase in both interest rates & inflation rates, especially after moving to the second phase, which restricted the investment response to partial exchange rate liberalization[3].
- Increasing GDP by almost 300%.

[1]Eliwa.T.A. (2014). The Effect of Exchange Rate on The Economic Growth In Egypt. INP. 22(2):98. (In Arabic)

[2] Mahfouz E. Op.cit.p10

[3]Eliwa.T.A. Op.cit.p100 (In Arabic)

3- **Third phase: 2016 to 2021[1]:** Egypt adopted the second liberalization for exchange rate in 2016 in order to achieve the following goals:

- Continuing the economic reform and rationalization of expenditure, which was one of the requirement of the International Monetary Fund in order to offer the loan of 12B$.
- Decrease the value of imports, which was around 80B$.
- Eliminate the phenomena of dollarization and the black market.
- Illustrating the actual demand & supply of USD against the fake imagination that currency traders create in order to raise the prices of the currency.
- Targeting a low rate of inflation: after observing the shocks of liberalization the inflation rate will come back to its normal rates.

And it will be illustrated through the following statistical analysis whether the above targets have already been achieved or not, and if there is a link between ER & economic reform through the inflation rate, economic growth rate, and unemployment rate as follows.

2-Design/methodology/approach–The study analyses the effect of both the exchange rates and the interest rate on the selected macroeconomic indicators in Egypt through the period from 1991 to 2020 to get more reliable results for the purpose of the study. In order to do that, the time series technique will be used. This technique is known by allowing analysis of the data for N (a country) and T of time periods (it may be annual, semiannual, quarterly, or monthly to increase the number of views for analysis, in case it is needed) as shown in the statistical analysis as follows:

A- Statistical analysis:

The data were analyzed using some statistical techniques and tests to estimate the impact of the exchange rates and the interest rate on Egyptian economy through some selected macroeconomic indicators during the period from 1991 to 2020.

[1] Mahfouz E. Op.cit.p10 (In Arabic)

In the following model both exchange rate, and lending interest rate will be used as independent variables, and the macroeconomic indicators such as unemployment rate, economic growth rate, and inflation rate will be used as dependent variables. Since, the reason behind using these variables comes from the literature reviews as follows:

Econometric studies that analyzed the relationship between ER, and the macroeconomic variables, are a lot, and the same for the relationship between I, and the macroeconomic variables, such as the study of Eliwa.T.A. (2014), which was about the effect of the change of ER on economic growth in Egypt. And the researcher used exchange rate, GDP, inflation rate, & some other variables such as value of exports, value of imports, capital accumulation, and final consumption in the estimated model covering the time span from 1990/1991 to 2012/2013. And it is illustrated that overvaluation of the national currency by 10% decreases GDP growth rate by 0.08%[1].

In addition to the work of Mahfooz E. (2019), which was about the Effect of the deviation of the real exchange rate from its equilibrium level on economic growth in Egypt. The study uses GDP growth rate as an indicator of economic growth, as well as exchange rate index, ratio of consumption to GDP, terms of trade, and ratio of investment to GDP[2]. But using more than one indicators for economic growth may make a conflict (VIF) between these indicators and this may lead to misleading results. So, it is favorable to use one indicator. As well as the work of Domac, I., Peters, K., &Yuzefovich, Y. (2001), which is about the effect of exchange rate regime on macroeconomic performance in transition economies. The reasercher usesd to estimate the macroeconomic performance: economic growth rate, inflation rate, unemployment rate[3].

Besides, the work of Abudeif, S. M., & Ali, S. H. (2021), which is about determinants of the exchange rate in Egypt and their implications for economic development. The study uses GDP as an estimated dependent variable for economic growth, and exchange rate, inflation rate, interest rate

[1]Eliwa.T.A.op.cit.p103

[2]Mahfouz E. Op.cit.p157

[3]Domac, I., Peters, K., &Yuzefovich, Y.op.cit.p19.

as determinants of EX and they also may affect economic growth[1]. Since designing a successful model is not based on the number of variables, since one variable for exchange rate and a few variables like one or two variables to express the macroeconomic performance are enough. For instance, the work of Belharsh A (2014), which is about the equilibrium real exchange rate of the Algerian dinar. The researcher used the real EX as a dependent variable, in addition to oil prices & government expenditure as independent variable, and as determinants of exchange rates[2].

So the variables used in the following modelare some of the selected indicators from the above studies, and these indicators refer to the exchange rates, and interest rate as independent variables, plus unemployment rate, economic growth rate, and inflation rate as dependent macroeconomic variables. Table (1) gives a description of all the variables used in the statistical analyses as follows:

Table (1): Description of the variables

Variables Type	**Variables**		**Symbol**
Independent Variables	Exchange rate		EXCH
	Lending interest rate		INT
Dependent Variable	Macroeconomic Indicators	Unemployment rate	UNEMP
		Economic growth rate	GROW
		Inflation rate	INF

So, the statistical analysis will investigate the following hypotheses:

H_1: The exchange rate & the interest rate affect unemployment rate in Egypt.
H_2: The exchange rate & the interest rate affect economic growth rate in Egypt.
H_3: The exchange rate & the interest rate affect inflation rate in Egypt.

[1]Abudeif, S. M., & Ali, S. H.op.cit.p8.
[2]Abudeif, S. M., & Ali, S. H.ibid.p14.

Since the data are annual time series during the period from 1991 to 2020, the Engle-Granger two-steps Co-integration model was applied to estimate the short and long-term relationships between variables.

The reasons behind using the Engle-Granger two-steps Co-integration model are as follows:-

- The Engle-Granger two-steps Co-integration model refers to the co-integration between variables. For instance, in this paper there are two independent variables the ER & I and the researcher wants to estimate the mutual effect of the ER & I on the dependent variables (unemployment-inflation- economic growth).
- Additionally, the time series for the selected variables is stationary or stable at the first difference, and that is an indicator for the co-integration, which means that the Engle-Granger two-steps Co-integration model is the most appropriate model for this study.
- There are many studies in economics used the Engle-Granger two-steps Co-integration model for the same reasons such as Shimul, S. N. (2013), which analyses the mutual effect of remittance flow & FDI on GDP per capita in Bangladesh using time series of (1976 – 2007). And the study illustrates that the remittance is insignificant at the short & long term. Conversely, FDI is significant at the short term, although it is insignificant at the long term[1]. In addition to the study of Shimul, S. N., Abduallah, S. M., & Siddiqua, S. (2009), which tried to find the co-integration or in the other word the mutual effect of FDI & economic openness on economic growth in Bangladesh covering time series of (1973 – 2007). And it is pointed that, in the short run and in the long run, FDI & openness insignificantly affect GDP per capital[2].

[1]Shimul, S. N. (2013). Remittance and economic development: Evidence from Bangladesh using unrestricted error correction model and Engle-Granger co-integration approach. Business & Economic Horizons, 9(1):p15

[2]Shimul, S. N., Abduallah, S. M., & Siddiqua, S. (2009). An examination of FDI and growth nexus in Bangladesh: Engle Granger and bound testing cointegration approach:p2

So, according to this model, in the first stage, the multiple linear regression is estimated using the least squares method to estimate the relationship in the long run. Then testing whether there is a co-integration relationship between the variables in the long-run or not. This is done by testing the Stationarity of the residual series resulting from the estimated regression equation. If the residual series is stationary at level (in its original form), we move to the second stage. In this stage the Error Correction Model (ECM) is used to estimate the short-run relationship. But if the residual series is non-stationary, then it turns out that there is no co-integration relationship between the variables, and therefore the regression model that was estimated becomes a false model.

1- Descriptive statistics

Table (2) shows descriptive statistics for the variables using minimum value, maximum value, mean and standard deviation.

Table (2): Descriptive Statistics

Variables	Sample Size	Descriptive Statistics			
		Minimum	Maximum	Mean	Std. Dev.
EXCH	30	3.138	17.783	6.654	4.448
INT	30	11.008	20.328	14.127	2.665
UNEMP	30	7.950	13.150	10.296	1.576
GROW	30	1.125	7.156	4.354	1.577
INF	30	0.919	22.933	10.033	5.572

2- Time Series Stationarity test

Unit root tests is used to investigate the stationarity of the time series of the variables. Time series of the variables are stationary if the mean & the variance are constant over the time. Therefore, if the time series of the variables contain a unit root (e.g., variables are non-stationary at level), this will lead to a false regression and the results will be biased. So, if the variables series are non-stationary at level, the first difference will be taken, and if the time series of those variables are still non-stationary after taking the first difference the second difference will be taken, and so on until the time series of variables

become stationary. To investigate the stationarity of the time series of the variables, Augmented Dicky-Fuller (ADF) and Phillips–Perron (PP), will be applied. Table (3) shows the unit root tests for the variables at (the level), and after taking the first difference.

Table (3): Stationarity tests

Variables	**Stationarity**	**Augmented Dicky-Fuller test**		**PP - Fisher Chi-square test**	
		Test-value	***p-value***	**Test value**	***p-value***
EXCH	Level	0.099	0.960	0.1093	0.961
	1st Diff	-3.867	0.007	-3.639	0.011
INT	Level	-2.257	0.192	-2.426	0.144
	1st Diff	-3.124	0.003	-2.449	0.016
UNEMP	Level	-1.897	0.329	-2.196	0.212
	1st Diff	-4.478	0.000	-4.511	0.000
GROW	Level	-2.377	0.157	-0.655	0.425
	1st Diff	-6.179	0.000	-6.095	0.000
INF	Level	-2.009	0.281	-3.219	0.100
	1st Diff	-6.267	0.000	-6.991	0.000

It is clear from table (3) that the time series of all variables are non-stationary at Level that means it is non-stationary in its original form, whereas the probability value of all tests greater than the significance level (p-value > α = 0.05). So, the first difference for the time series was taken for all variables to get rid of the unit roots. Therefore, all the variables became stationary, whereas the probability value of all tests has become smaller than the significance level (p-value < α = 0.05). Since all the variables have become stationary at the first difference, so the time series of the variables became integrated at the same order, meaning that, they are integrated at first degree I(1). So, it is suitable to apply the Engle-Granger two-steps co-integration model.

3- Correlation Matrix

Correlation coefficients were calculated to investigate the relationship between variables. Note that the correlation coefficient is denoted by (r), and its value is ranges between (-1) and (+1). The closer the value of the correlation coefficient is to (1) (regardless of the sign), the stronger the relationship between the variables, and the farther the value of the correlation coefficient is from (1), the weaker the relationship between variables. On the other hand, the sign of the correlation coefficient describes whether the relationship is direct or indirect. Negative sign (-) means that increasing in one variable leads to a decrease in the other. Positive sign (+) means that increasing in one variable leads to anincrease in the other (the two variables move in the same direction). Table (4) shows a correlation coefficient matrix between variables using Pearson's correlation coefficient.

Table (4): Correlation matrix between variables

Variables	**Corr.**	EXCH	INT	UNEMP	GROW	INF
EXCH	**Corr.**	1				
	***p*-value**					
INT	**Corr.**	0.106	1			
	***p*-value**	0.577				
UNEMP	**Corr.**	0.272	-0.146	1		
	***p*-value**	0.147	0.440			
GROW	**Corr.**	0.039	-0.124	-0.565	1	
	***p*-value**	0.836	0.513	0.001		
INF	**Corr.**	0.453	0.470	0.212	-0.123	1
	***p*-value**	0.012	0.009	0.261	0.519	

From table (4) it is clear that:

1- There is no statistically significant relationship between UNEMP and both EXCH and INT at 5% significant level of, whereas *p*-value > α = 0.05.

2- There is no statistically significant relationship between GROW and both EXCH and INT at 5% significant level of, whereas *p*-value > α = 0.05.

3- There is a direct, statistically significant relationship between INF and both EXCH and INT at 5% significant level of, whereas *p*-value < α = 0.05.

4- Test of hypothesis

Statistical analysis will be made to test the hypothesis of the study (3 hypothesis) as follows:

4.1- Test of the 1st hypothesis

Through this section, Engle-Granger two-steps co-integration model has been appliedto test the first hypothesis, which is "The exchange rate & the interest rate affect unemployment rate in Egypt". In the first stage, the multiple regression relationship was estimated using the least squares method to estimate the long-term relationship between the variables, and then check the stationarity of the residuals resulting from the modelshown in equation (1):

$$UNEMP_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\, EXCH_t + \boldsymbol{\beta_2}\, INT_t + (1)$$

In the second stage, the error correction model (ECM) was applied to estimate the short-run relationship between the variablesby estimating the ECM using the first difference of the variables and lagged error ($\boldsymbol{e_{t-1}}$) as shown in equation (2):

$$\Delta UNEMP_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\Delta EXCH_t + \boldsymbol{\beta_2}\Delta INT_t + \boldsymbol{\beta_3}\, \boldsymbol{e_{t-1}} + \varepsilon_t,\ \boldsymbol{\beta_3} < 0 \qquad (2)$$

Where:

$UNEMP_t$	→	Unemployment rate during year *t*.
$EXCH_t$	→	Exchange rate during year *t*.
INT_t	→	Lending interest rate during year *t*.
$\Delta UNEMP_t$	→	1st difference of unemployment rate during year *t*.
$\Delta EXCH_t$	→	1st difference of exchange rate during year *t*.
ΔINT_t	→	1st difference of lending interest rate during year *t*.
$\boldsymbol{et}$	→	Error from long-run model during year *t*.
$\boldsymbol{e_{t-1}}$	→	Error correction model (ECM), lagged error.
ε_t	→	Error from short-run modelduring year *t*.

Table (5) shows regression coefficients, standard error (S.E.), *t*-test, coefficient of determination (R^2) and F-test. In addition, results of collinearity test using variance inflation factor (VIF), Normality test using Jarque-Bera test (JB), Heteroscedasticity using White test, stationarity of the error time series using Augmented Dicky-Fuller test (ADF) and the ECM (e_{t-1}).

Table (5): Regression model between EXCH, INT and UNEMP in long and short run

Variables	**Long-run Model**					**Short-run Model**				
	Coefficients		***t*-test**		**VIF**	**Coefficients**		***t*-test**		**VIF**
	Value	**S.E.**	***t***	***p*-value**		**Value**	**S.E.**	***t***	***p*-value**	
Constant	11.092	1.571	7.062	0.000	-----	-0.006	0.244	-0.023	0.982	-----
$EXCH_t$	0.103	0.065	1.585	0.125	1.011	0.070	0.209	0.336	0.740	2.569
INT_t	-0.104	0.108	-0.967	0.342	1.011	-0.071	0.211	-0.338	0.738	2.554
e_{t-1}						-0.244	0.144	-1.688	0.104	1.169
R^2	0.105					0.121				
S.E.	1.546					1.063				
***F*-test(*p*-value)**	1.579 (0.225)					1.151 (0.348)				
JB-test (*p*-value)	2.175 (0.337)					0.831 (0.660)				
White-test (*p*-value)	1.645 (0.186)					0.203 (0.991)				
ADF-test (*p*-value)	-3.458 (0.018)					----------				

From table (5) it is clear that:

- **At long-run**, there is no statistically significant impact of both the EXCH and the INT on UNEMP at 5% significance level, whereas the probability value of *t*-test for those variables is greater than significance level (*p–value*>α = 0.05). Moreover, the regression model is not statistically significant at 5% significance level, whereas the probability value of F-test is greater than the significance level (*p–value* = 0.225 >α = 0.05). Although, the variables forming the model can explain (10.5%) of the changes in UNEMP, and the remaining (89.5%) is because of the random error or other factors that may affect UNEMP and that influences are not studied in this research. In addition, there is no collinearity problem, as the value of the VIF for all variables less than 10 (e.g., 1.011). Moreover, there

is no Heteroskedasticity problem whereas the probability value of *White*-test greater than significance level (*p–value*= 0.186>α = 0.05). Also, there is error term (residuals) is normally distributed whereas the probability value of Jarque-Beratest greater than significance level (*p–value*= 0.337 >α = 0.05). Finally, the error term (residuals) is stationary at level, whereas the probability value of ADF test is smaller than the significance level (*p*-value = 0.018 < α = 0.05), meaning that there is a co-integration relationship between the variables in the long-run, in the other word, the variables will move together in the long-run.

- **<u>At short-run</u>**, there is no statistically significant impact of both the EXCH and the INTon UNEMP at 5% significance level, whereas the probability value of *t*-test for those variables is greater than significance level (*p–value*>α = 0.05). Moreover, the regression model is not statistically significant at 5% significance level, whereas the probability value of F-test is greater than the significance level (*p–value* 0.348 >α = 0.05). Although, the variables forming the model can explain (12.1%) of the changes in UNEMP, and the remaining (87.9%) is because of the random error or other factors that may affect UNEMP and that influences are not studied in this research. In addition, there is no collinearity problem, as the value of the VIF for all variables less than 10 (ranges between 1.169 and 2.569). Moreover, there is no Heteroskedasticity problem whereas the probability value of *White*-test greater than significance level (*p–value*= 0.991 >α = 0.05). Also, there is error term (residuals) is normally distributed whereas the probability value of Jarque-Beratest greater than significance level (*p–value*= 0.660 >α = 0.05). Finally, the error correction coefficient ($\boldsymbol{e}_{t-1}$) is not significant but less than zero (negative, less than 1 and close to 0.5), whereas the probability value of ECM is greater than the significance level (*p*-value = 0.104 > α = 0.05).
- Finally, both the exchange rate & the interest rate, each one of them in the presence of the other, had no effect on unemployment rate in Egypt, so the first hypothesis is rejected.

4.2- Test of the 2nd hypothesis

Through this section, Engle-Granger two-steps co-integration model has been appliedto test the second hypothesis, which is "The exchange rate & the interest rate affect economic growth rate in Egypt". In the first stage, the multiple regression relationship was estimated using the least squares method to estimate the long-term relationship between the variables, and then check the stationarity of the residuals resulting from the modelshown in equation (3):

$$GROW_t = \beta_0 + \beta_1 EXCH_t + \beta_2 INT_t + \quad (3)$$

In the second stage, the error correction model (ECM) was applied to estimate the short-run relationship between the variablesby estimating the ECM using the first difference of the variables and lagged error (e_{t-1}) as shown in equation (4):

$$\Delta GROW_t = \beta_0 + \beta_1 \Delta EXCH_t + \beta_2 \Delta INT_t + \beta_3 e_{t-1} + \varepsilon_t, \beta_3 < 0 \quad (4)$$

Where:

$GROW_t$	→	Economic growth rate during year *t*.
$EXCH_t$	→	Exchange rate during year *t*.
INT_t	→	Lending interest rate during year *t*.
$\Delta GROW_t$	→	1st difference of economic growth rate during year *t*.
$\Delta EXCH_t$	→	1st difference of exchange rate during year *t*.
ΔINT_t	→	1st difference of lending interest rate during year *t*.
et	→	Error from long-run model during year *t*.
e_{t-1}	→	Error correction model (ECM), lagged error.
ε_t	→	Error from short-run modelduring year *t*.

Table (6) shows regression coefficients, standard error (S.E.), *t*-test, coefficient of determination (R^2) and F-test. In addition, results of collinearity test using variance inflation factor (VIF), Normality test using Jarque-Bera test (JB), Heteroskedasticity using White test, stationarity of the error time series using Augmented Dicky-Fuller test (ADF) and the ECM (e_{t-1}).

Table (6): Regression model between EXCH, INT and GROW in long and short run

Variables	Long-run Model					Short-run Model				
	Coefficients		*t*-test		VIF	Coefficients		*t*-test		VIF
	Value	S.E.	*t*	*p*-value		Value	S.E.	*t*	*p*-value	
Constant	5.315	1.646	3.229	0.003	-----	0.293	0.295	0.990	0.332	-----
$EXCH_t$	0.019	0.068	0.273	0.787	1.011	-0.276	0.251	-1.098	0.283	2.515
INT_t	-0.077	0.113	-0.676	0.504	1.011	0.239	0.256	0.932	0.360	2.578
e_{t-1}						-0.455	0.159	-2.872	0.008	1.052
R^2	0.019					0.290				
S.E.	1.752					1.288				
F-test(*p*-value)	0.203 (0.991)					3.408 (0.033)				
JB-test (*p*-value)	0.902 (0.637)					3.189 (0.203)				
White-test (*p*-value)	1.029 (0.423)					0.306 (0.963)				
ADF-test (*p*-value)	-3.109 (0.037)					----------				

From table (6) it is clear that:

1- **At long-run**, there is no statistically significant impact of the EXCH and the INT on GROW at 5% significance level, whereas the probability value of *t*-test for those variables is greater than significance level (*p–value*>α = 0.05). Moreover, the regression model is not statistically significant at 5% significance level, whereas the probability value of F-test is greater than the significance level (*p–value* = 0.225 >α = 0.05). Although, the variables forming the model can explain (1.2%) of the changes in GROW, and the remaining (98.8%) is because of the random error or other factors that may affect GROW and that influences are not studied in this research. In addition, there is no collinearity problem, as the value of the VIF for all variables less than 10 (e.g., 1.011).

Moreover, there is no Heteroskedasticity problem whereas the probability value of *White*-test greater thansignificance level (*p–value*= 0.423 >α = 0.05). Also, there is error term (residuals) is normally distributed whereas the probability value of Jarque-Beratest greater than significance level (*p–value*= 0.637 >α = 0.05). Finally, the error term (residuals) is stationary at level, whereas the probability value of ADF test is smaller than the significance level (*p*-value = 0.037< α = 0.05), meaning that there is a co-

integration relationship between the variables in the long-run, in other word, the variables will move together in the long-run.

2- **At short-run**, there is no statistically significant impact of the EXCH and the INT on GROW at 5% significance level, whereas the probability value of *t*-test for those variables is greater than significance level (*p–value*>α = 0.05). Although, the regression model is statistically significant at 5% significance level, whereas the probability value of F-test is smaller than the significance level (*p–value* = 0.033 <α = 0.05). Moreover, the variables forming the model can explain (29%) of the changes in GROW, and the remaining (71%) is because of the random error or other factors that may affect GROW and that influences are not studied in this research. In addition, there is no collinearity problem, as the value of the VIF for all variables less than 10 (ranges between 1.052 and 2.578). Moreover, there is no Heteroskedasticity problem whereas the probability value of *White*-test greater than significance level (*p–value*= 0.963 >α = 0.05). Also, there is error term (residuals) is normally distributed whereas the probability value of Jarque-Beratest greater than significance level (*p–value*= 0.203 >α = 0.05). Finally, the error correction coefficient ($\boldsymbol{e_{t\text{-}1}}$) is significant and less than zero (negative, less than 1 and close to 0.5), whereas the probability value of ECM is smaller than the significance level (*p*-value = 0.008 < α = 0.05), indicating that the random error decrease over time.

3- Finally, both the exchange rate & the interest rate, each one of them in the presence of the other, had no effect on economic growth rate in Egypt, so the second hypothesis is rejected.

4.3- Test of the 3rdhypothesis

Through this section, Engle-Granger two-steps co-integration model has been appliedto test the third hypothesis, which is "The exchange rate & the interest rate affect inflation rate in Egypt". In the first stage, the multiple regression relationship was estimated using the least squares method to estimate the long-term relationship between the variables, and then check the stationarity of the residuals resulting from the model shown in equation (5):

$$INF_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\, EXCH_t + \boldsymbol{\beta_2}\, INT_t + \qquad (5)$$

In the second stage, the error correction model (ECM) was applied to estimate the short-run relationship between the variables by estimating the ECM using the first difference of the variables and lagged error ($\boldsymbol{e_{t-1}}$) as shown in equation (6):

$$\Delta INF_t = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\Delta EXCH_t + \boldsymbol{\beta_2}\Delta INT_t + \boldsymbol{\beta}_3\, \boldsymbol{e}_{t-1} + \varepsilon_t,\ \boldsymbol{\beta}_3 < 0 \qquad (6)$$

Where:

INF_t	→	Inflation rate during year *t*.
$EXCH_t$	→	Exchange rate during year *t*.
INT_t	→	Lending interest rate during year *t*.
ΔINF_t	→	1st difference of inflation rate during year *t*.
$\Delta EXCH_t$	→	1st difference of exchange rate during year *t*.
ΔINT_t	→	1st difference of lending interest rate during year *t*.
$\boldsymbol{et}$	→	Error from long-run model during year *t*.
$\boldsymbol{e}_{t-1}$	→	Error correction model (ECM), lagged error.
ε_t	→	Error from short-run modelduring year *t*.

Table (7) shows regression coefficients, standard error (S.E.), *t*-test, coefficient of determination (R^2), and F-test. In addition, results of collinearity test using variance inflation factor (VIF), Normality test using Jarque-Bera test (JB), Heteroskedasticity using White test, stationarity of the error time series using Augmented Dicky-Fuller test (ADF) and the ECM ($\boldsymbol{e}_{t-1}$).

Table (7): Regression model between EXCH, INTandINF in long and short run

Variables	Long-run Model					Short-run Model				
	Coefficients		*t*-test		VIF	Coefficients		*t*-test		VIF
	Value	S.E.	*t*	*p*-value		Value	S.E.	*t*	*p*-value	
Constant	-5.969	4.602	-1.297	0.206	-----	0.337	0.919	0.367	0.717	-----
$EXCH_t$	0.510	0.190	2.683	0.012	1.011	0.148	0.799	0.185	0.855	2.753
INT_t	0.892	0.317	2.812	0.009	1.011	2.161	0.788	2.740	0.011	2.637
e_{t-1}						-0.582	0.182	-3.197	0.004	1.096
R^2	0.385					0.579				
S.E.	4.529					3.919				
F-test(*p*-value)	8.449 (0.001)					11.487 (0.000)				
JB-test (*p*-value)	0.616 (0.735)					0.444 (0.801)				
White-test (*p*-value)	0.516 (0.762)					1.582 (0.191)				
ADF-test (*p*-value)	-3.130 (0.035)					----------				

From table (7) it is clear that:

- **At long-run**, there is a statistically significant impact of the EXCH and the INT on INF at 5% significance level, whereas the probability value of *t*-test for those variables is smaller than significance level ($p\text{–}value<\alpha = 0.05$). Moreover, the regression model is statistically significant at 5% significance level, whereas the probability value of F-test is smaller than the significance level ($p\text{–}value = 0.001<\alpha = 0.05$). Also, the variables forming the model can explain (38.4%) of the changes in INF, and the remaining (61.6%) is because of the random error or other factors that may affect INF and that influences are not studied in this research. In addition, there is no collinearity problem, as the value of the VIF for all variables less than 10 (e.g., 1.011). Moreover, there is no Heteroskedasticity problem whereas the probability value of *White*-test greater than significance level ($p\text{–}value= 0.762 >\alpha = 0.05$). Also, there is error term (residuals) is normally distributed whereas the probability value of Jarque-Beratest greater than significance level ($p\text{–}value= 0.735 >\alpha = 0.05$). Finally, the error term (residuals) is stationary at level, whereas the probability value of ADF test is smaller than the significance level (*p*-

value = 0.035< α = 0.05), meaning that there is a co-integration relationship between the variables in the long-run, in other word, the variables will move together in the long-run. Increasing in the EXCH and the INT together by 1 unit increases INF by 0.510 and 0.892 respectively.

- **At short-run**, there is a statistically significant impact of the INT only on INF at 5% significance level, whereas the probability value of *t*-test for this variable is smaller than significance level (*p–value* = 0.011 <*α* = 0.05). Moreover, the regression model is statistically significant at 5% significance level, whereas the probability value of F-test is smaller than the significance level (*p–value* = 0.000 >*α* = 0.05). Also, the variables forming the model can explain (57.9%) of the changes in INF, and the remaining (42.1%) is because of the random error or other factors that may affect INF and that influences are not studied in this research. In addition, there is no collinearity problem, as the value of the VIF for all variables less than 10 (ranges between 1.096 and 2.753). Moreover, there is no Heteroskedasticity problem whereas the probability value of *White*-test greater than significance level (*p–value* = 0.191 >*α* = 0.05). Also, there is error term (residuals) is normally distributed whereas the probability value of Jarque-Bera test greater than significance level (*p–value* = 0.801 >*α* = 0.05). Finally, the error correction coefficient ($\boldsymbol{e_{t-1}}$) is significant but less than zero (negative, less than 1 and close to 0.5), whereas the probability value of ECM is smaller than the significance level (*p*-value = 0.004< α = 0.05), indicating that the random error of the model will decrease over time. Increasing in the INT by 1 unit, in the presence of the exchange rate, increases INF by 2.161.
- Finally, the interest rate and exchange rate had an effect on Inflation rate in Egypt, so the third hypothesis is accepted in the long run. But interest rate only had an effect on Inflation rate in Egypt, so the third hypothesis is partly accepted in the short run.

• Summary of statistical analyses:

- Both the exchange rate & the interest rate, each one of them in the presence of the other, have no effect on the unemployment rate in Egypt, so the first hypothesis is rejected.

- Both the exchange rate & the interest rate, each one of them in the presence of the other, have no effect on the economic growth rate in Egypt, so the second hypothesis is rejected.
- Both the exchange rate & the interest rate, each one of them in the presence of the other, have an effect on the inflation rate in Egypt, so the third hypothesis is accepted in the long run. So, in the long run, increasing the exchange rate and the interest rate together by 1 unit increases inflation rate by 0.510 and 0.892 respectively. And the interest rate, in the presence of the exchange rate, has an effect on inflation rate, although the exchange rate has not any effect, so the third hypothesis is partly accepted in the short run. And in the short run, increasing interest rate by 1 unit increases inflation rate by 2.161.

3-Results & findings:

- **The interest rate affects the inflation rate positively;** once the lending interest rate increases, the price of making an investment also increases. So, the price of goods or service will also increase, and the general price level will also increase.
- **The exchange rate affects the inflation rate positively;** once there is an increase in the exchange rate, the general price level will also increase because the value of imported products will increase, either because these imports are fully finished products, semi-finished products, or raw materials. So, the prices will increase in all cases. At the same time, the demand of the Egyptian exports is inelastic, which means increasing the ER will not increase the demand of Egyptian exports, because most of them is raw materials & essentials.
- **Interest rate has no relationship with the economic growth rate:** it is known from the literature review, which is illustrated previously in this paper, that increasing interest rates have a negative impact on the economic growth rate because they discourage investors from investing more because of the high cost of borrowing money, which leads to a decrease in the growth rate at the end. But in some cases, increasing interest rates may increase growth rates because there are lots of factors that affect investment rather than the interest rate, such as the economic

status of the country, and the investment atmosphere such as the bureaucratic system, (which is a huge obstacle can be eliminated by digital transformation), the level of transparency, the infrastructure, and the technological advancement…etc.. In that case, the limited effect of interest rate on economic growth rate will shrink to the point that it has no effect on the growth rate.

And there is another influence that affects the relationship between economic growth & interest rates, which is the number of deposits on banks in Egypt, or the amount of savings in the banking sector. Since, the number of depositors is not enough to affect the growth rate, For example, the number of depositors with commercial banks (per 1,000 adults) is just 479.8[1]adults in 2020 which is less than 50% of the adults after all of the financial inclusion initiatives the government did[2].

That calls for the government to increase financial awareness and financial inclusion programs to increase the number of clients in the banking sector to achieve the targeted objectives, which of course one of them is a high growth rate.

- **The exchange rates have no effect on the economic growth rate;** the effect of the ER on the growth rate is based on two sides as follows:

  The first side: an increase in the ER means more cash flow from abroad, which means an increase in investment, which leads to an increase in the growth rate.

  The second side: an increase in the ER leads to an increase in inflation rate. Since, an increase in the inflation rate may increase the profit of the producers if the price increase is entirely borne by the customers, and at the same time, the producers may raise their prices more than the increase in the ER. For example, the price will increase by 10 pounds as a result of an increase in the ER, but the merchants will increase the price by more

[1]https://data.worldbank.org/indicator/FB.CBK.DPTR.P3?locations=EGaccess time on February 20, 2022.

[2]https://www.cbe.org.eg/ar/EconomicResearch/Publications/Pages/AnnualReport.aspx access time on February 20, 2022.

than 10 pounds to increase their profits by claiming that the ER has increased. In that case, production increases and the growth rate also increases. But the process depends on the strength of the consumer protection agency, consumer awareness, and it also depends on the necessity of the product for the customer, as well as the increase in the ER, plus the dependency of the production process on imported materials. All of the above factors may cancel the positive effect of the ER on the growth rate, but they all may lead to a slowing down of the growth rate. So, there are two opposite effects of the ER on the growth rate, which may cancel each other. So, the ER will have no effect on the growth rate.

- **The interest rates and the ER have no effect on unemployment;** since there is no impact of I & ER impact on the growth rate, they will also have no impact on employment. Since the growth rate will be the same (unaffected), there will be no more of goods and services, which also means there will be no new job generation, so the unemployment rate will be the same or unaffected.

4-Policies Implications:

1. It is recommended from the above findings that the decision markers use the ER & I as tools to target inflation to reach to the accepted level.
2. It is recommended for the government to keep creating an attractive atmosphere for local & foreign investment such as eliminating the bureaucratic system, building a strong infrastructure, spreading digital transformation, etc.
3. It is recommended to spread financial awareness and financial inclusion programs to increase the number of citizens in the banking sector to the limit that enables the government to achieve some of the economic targets.

Conclusion:

This paper focuses mainly on two specific tools of monetary policy which are the ER & I. since the ER can affect the economic stability, and at the same time the interest rate is used as a tool to encourage the economy to go into certain ways to accomplish the economic targets. So, the government should make an integration between these monetary policy tools to not get unwanted results. Since this paper is an attempt to test this integration & the impact of both the ER & I simultaneously on three specific indicators (economic growth rate - unemployment rate – inflation rate) as a sample of macroeconomic indicators to know the effect of ER & I on the macroeconomic performance, from different perspectives, especially lots of studies focus mainly on the effect of ER & I individually on economic growth rate.

The study started from the theoretical background which focused on the relationship between the ER, I and the three selected indicators individually to illustrate the literature review about these relationship and to paves the way to create a whole picture about these relationships theoretically, before creating the statistical model. And before designing the model, the researcher make a brief about the ER policies in Egypt to go in depth with these policies & their consequences. And it is found through covering the time period of (1991-2020) that ER & I have no effect on economic growth rate, and they also have no effect on unemployment rate. But they have an effect on inflation rate in the long term & only I has an impact on inflation rate in the short term.

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هل تستطيع أسعار الصرف وأسعار الفائدة التأثير على مؤشرات الاقتصاد الكلي (التضخم - والبطالة – والنمو الاقتصادي): دراسة حالة مصر

د. رغدة سعيد أحمد محمد

الملخص

قد قامت الدراسة بتحليل أثر كل من أسعار الفائدة وأسعار الصرف على بعض المؤشرات المختارة التي تعبر عن الآداء الاقتصادي الكلي في مصر خلال الفترة الزمنية (١٩٩١-٢٠٢٠). وقد تم استخدام نموذج التكامل المشترك المكون من خطوتين-the Engle integration model Granger two-step Co- لتقدير العلاقة بين المتغيرات محل الدراسة في الأجلين القصير والطويل، وقد وجد أن كل من سعر الصرف وسعر الفائدة (بدراسة تأثير كل منهما في وجود الآخر) ليس لهما أي تأثير على معدل النمو الاقتصادي. وعلي الرغم من أن كل من سعر الصرف وسعر الفائدة (بدراسة تأثير كل منهما في وجود الآخر) له تأثير علي معدل التضخم في الأجل الطويل ، إلا أن سعر الصرف (في ظل وجود سعر الفائدة) له تأثير علي معدل التضخم في الأجل الطويل فقط وليس له تأثير أي علي معدل التضخم في الأجل القصير ، علي عكس سعر الفائدة الذي له تأثير (في ظل وجود سعر الصرف) علي معدل التضخم في الأجلين الطويل والقصير، حيث نجد أن زيادة سعر الصرف وسعر الفائدة بوحدة واحدة يؤدي إلي زيادة معدل التضخم بـ ٠,٥١٠، و ٠,٨٩٢ علي التوالي في الأجل الطويل ،أما في الأجل القصير فزيادة سعر الفائدة بوحدة واحدة يؤدي إلي زيادة معدل التضخم بـ ٢,١٦١.

الكلمات الافتتاحية

النمو الاقتصادي- معدل البطالة – استهداف معدل التضخم – سعر الصرف – سعر الفائدة.