



جامعة الإسكندرية
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المجلة العلمية
لكلية الدراسات الاقتصادية والعلوم السياسية

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دورية علمية محكمة

المجلد التاسع (العدد الثامن عشر، يوليو 2024)

The Nexus between Inflation Rate and Monetary Policy in Egypt ⁽¹⁾

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⁽¹⁾ تم تقديم البحث في 2023/12/27، وتم قبوله للنشر في 2024/3/17.

Abstract

This study examines the factors influencing inflation dynamics in Egypt, particularly amidst the successive crises facing the world, and offers an attempt to evaluate the monetary policy of the Central Bank of Egypt, which aims to reduce the high inflation rate in the country. The study uses the Autoregressive Distributed Lags (ARDL) model to assess the impact of using monetary policy tools on the inflation rate in Egypt (quarterly data for the period 2017-2021). It then suggests some tools to increase the effectiveness of the inflation-targeting monetary policy. The results indicate that the most significant factors affecting inflation in Egypt during the study period are the lagged values of inflation, interest rate decisions, gross domestic product (GDP), nominal exchange rate, money supply, and changes in relative prices. This implies that the factors leading to an increase in the inflation rate are not limited to the demand side alone but extend to include aspects of supply and monetary policy tools used in previous periods. The paper also discusses the impact of these tools on the process of absorbing excess liquidity from the economy and thereby curbing the inflation rate. The study concludes that effective strategies to mitigate inflation must include both monetary and fiscal policy tools.

Keywords: Inflation, Monetary policy, Egypt, ARDL, Fiscal policy.

العلاقة بين معدل التضخم والسياسة النقدية في مصر

المخلص

تبحث هذه الدراسة في العوامل المؤثرة على ديناميكيات التضخم في مصر، لاسيما في ظل الأزمات المتلاحقة التي يمر بها العالم، وتقدم محاولة لتقييم السياسة النقدية للبنك المركزي المصري، والتي تستهدف خفض معدل التضخم المرتفع في مصر. تستخدم الدراسة نموذج الانحدار الذاتي الموزع (ARDL) لتقييم أثر استخدام أدوات السياسة النقدية على معدل التضخم في مصر (بيانات ربع سنوية 2017-2021). ومن ثم تقترح بعض الأدوات لزيادة فعالية السياسة النقدية الموجهة نحو استهداف التضخم. وأظهرت النتائج أن أهم العوامل التي أثرت على التضخم في مصر خلال فترة الدراسة هي القيم المتأخرة للتضخم، وقرارات أسعار الفائدة، وحجم الناتج المحلي الإجمالي، وسعر الصرف الإسمي، وعرض النقود، والتغيرات في الأسعار النسبية. وتعني هذه النتيجة أن العوامل التي

تؤدي إلى زيادة معدل التضخم لا تقتصر على جانب الطلب فحسب، بل تمتد لتشمل جوانب العرض وأدوات السياسة النقدية المستخدمة في الفترات السابقة. كما تتعرض الورقة لتأثير هذه الأدوات في عملية امتصاص السيولة الفائضة من الاقتصاد وبالتالي كبح معدل التضخم. وانتهت الدراسة إلى أن الاستراتيجيات الفعالة لتخفيف التضخم لا بد أن تشمل أدوات السياستين المالية والنقدية معاً.

الكلمات الرئيسية: التضخم، السياسة النقدية، مصر، ARDL، السياسة المالية.

1 INTRODUCTION

The world has witnessed many changes in the last three years, because of succession of crises, starting with the outbreak of a pandemic Covid-19 and its mutations, then the Russian-Ukrainian war, whose consequences appeared in the form of many bottlenecks in the supply chains before the completion of the recovery from the Covid-19 crisis. Imbalances in a number of indicators of the global economy took place, the most important of which is the upsurge in inflation rate especially in developed economies, as the highest rates outbreak since 1982, and the economies of developing and emerging countries reached the highest rates since 1999. Worldwide, inflation reached its highest rate since 1996. Global inflation rate scored 2.81% at the end of 2020 then reached 6.39% and 9.06% at the end of 2021 and 2022, respectively. (IMF, 2022a).

In Egypt, the consumer price index increased on a monthly basis during March 2023, by 3.2% while annually it reached 33.9% in the year 2023 compared to 12.1% for the same month of the previous year 2022 (CAPMAS, 2023). In this regard, the Egyptian government has resorted to various solutions in order to mitigate the severity of the crisis. As Government has reduced spending, suspended high-cost national projects, (IDSC, 2023) in addition to the role of monetary policy, where the Central Bank raised interest by five times over the course of a year, from March 2022 to March 2023, to rein in inflation. (CBE, 2023a)

In order to obtain assistance from the international community, the Egyptian government reached an agreement with The International Monetary Fund in October 2022 to provide a loan of three billion dollars. One of the most important conditions of obtaining such a loan is to establish a relatively flexible exchange rate, which led to a further depreciation of the Egyptian pound, hence a higher inflation rate. The International Monetary Fund has ruled out that inflation will recede in Egypt before the end of 2024, expecting

a decline in rates inflation to the target rate by the Central Bank of $2 \pm (7\%)$ in the fiscal year 2024/2025. Thus, the Central Bank of Egypt has set its target to decrease inflation. (IMF, 2022b)

The research gap addressed by this study lies in evaluating the impact of monetary policy tools, specifically interest rates and money supply indicators, on the inflation rate in Egypt amidst a backdrop of significant economic challenges and policy responses. While previous studies have explored various aspects of inflation dynamics in Egypt, including its determinants, impacts on other macroeconomic variables, and the relationship with fiscal and monetary variables, there is a need for comprehensive analysis focusing on the effectiveness of monetary policy tools in curbing inflation.

This study aims to fill this gap by employing econometric analysis, particularly the Autoregressive Distributed Lag Model (ARDL), to assess the effectiveness of monetary policy tools in managing inflation in Egypt. By focusing specifically on interest rates and money supply indicators, the study seeks to provide insights into the role of monetary policy in controlling inflation amid complex economic dynamics, including supply and demand shocks, structural imbalances, and external factors such as the Russian-Ukrainian conflict and the COVID-19 pandemic.

Moreover, while previous research has examined the relationship between inflation and various macroeconomic variables, including fiscal deficit, stock market performance, exchange rate fluctuations, and energy prices, this study specifically delves into the impact of monetary policy tools on inflation, offering a more focused analysis that contributes to the understanding of inflation dynamics in Egypt.

By addressing this research gap, the study provides valuable insights for policymakers and economists to formulate effective monetary policy strategies aimed at achieving price stability and mitigating the adverse effects of inflation on the Egyptian economy. Furthermore, the findings of this study can inform policy decisions in other developing economies facing similar inflationary challenges, thereby contributing to broader discussions on monetary policy effectiveness. Therefore, this study consists of the following sections: Section 2 presents A literature review. Section 3 demonstrates an analysis for the possible reasons for the relatively high inflation rate in Egypt. Section 4 tackles the policies adopted to combat inflation. Lastly, section 5, evaluates the impact of monetary policy tools on achieving the inflation

targeting policy through employing Autoregressive Distributed Lag Model (ARDL).

2 LITERATURE REVIEW

Many studies discuss the phenomenon of inflation in Egypt with regards to analyzing its factors, impacts on other macroeconomic variables, and its relation with many fiscal and monetary variables. It's also noted that various econometric methods have been employed. This section reviews some of the extensive literature on the topic of inflation in Egypt with focus on its relationship with interest rate.

Two studies by Abdu (2022) and Abd Aljawad (2020) examined different aspects of Egypt's economic dynamics. Abdu's study focused on the relationship between fiscal deficit and inflation rates, analyzing data from 1981 to 2020. The study attributed the downward trend in both variables to COVID-19 and economic reforms since 2016. Using Vector Error Correction Model (VECM) and Granger causality test, it found a significant long-term impact of fiscal deficit on inflation. Moreover, it revealed a bidirectional relationship between fiscal deficit and inflation in the short term, mediated by money supply and interest rate effects. The study highlighted the fiscal rather than monetary roots of Egypt's inflation issues, emphasizing the importance of addressing fiscal deficit, money supply growth, and interest rate interconnections.

On the other hand, Abd Aljawad (2020) investigated the effects of inflation and currency rate changes on Egypt's stock market index from 2000 to 2020. Employing various econometric techniques including unit root tests, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) Model, the study revealed a long-term correlation between the stock market index (EGX30) and fluctuations in inflation and currency rates. The research also identified a substantial causal link between the variables, suggesting a five-month equilibrium adjustment period for the Egyptian stock market. Additionally, the study indicated volatility clustering in the Egyptian stock market, with risk and changes in inflation and currency rates significantly impacting volatility. According to the Random Walk Hypothesis, the presence of ARCH and GARCH effects suggested an inefficient operation of the Egyptian stock market.

Another study by (Dekkiche, 2022) used a Vector Error Correction Model (VECM) to examine the relationship between money supply and inflation rate (INF) in Egypt spanning from 1990 to 2019. The model incorporated four key independent variables: money supply (MS), imports (IMP), Gross Domestic Product (GDP), and exchange rate (EXCH). Through the application of a Johansen-Juselius co-integration test and Vector Error Correction Model, the study sought to ascertain both long-term and short-term connections among the variables. The findings revealed the presence of co-integrating links between the variables. With the exception of GDP effects, all independent factors exhibited a positive influence on the inflation rate. The study concluded that among the variables examined, money supply emerged as the primary long-term predictor of inflation rate movements in the Egyptian context.

Focusing on quarterly data, a study by (Omar & Yousri, 2023) discussed the monetary policy impact on Egypt's inflation and production. They used the interest rate as the instrument for monetary policy using both linear and non-linear Auto-regressive Distributed Lag (ARDL) models, using quarterly data from 2007Q3 to 2019Q3. In order to show asymmetric effects, they also computed dynamic multipliers and perform an F-bounds test for cointegration. Although both macroeconomic variables show a significant long-term influence, they uncovered evidence of asymmetric impacts on inflation but not production.

Shokr, Abdul Karim, and Zaidi (2019) investigated the repercussions of monetary policy on three key macroeconomic indicators: output, inflation, and exchange rate in Egypt. They employed a non-recursive structural vector-autoregression (SVAR) model with a block exogeneity approach, analyzing quarterly data sourced from the Central Bank of Egypt (CBE), the International Financial Statistics, and Data Stream spanning from 1991Q1 to 2011Q4. Their findings indicated a substantial influence of monetary policy on output, inflation, and exchange rate. The study consistently observed significant effects using two distinct instruments: interest rate and money supply, as measures of monetary policy.

Utilizing annual data spanning from 1991 to 2012, a study conducted by El-Baz (2014) employed the VAR approach to delve into the determinants impacting inflation within the Egyptian economy. The empirical findings of the model solidified that the inflation rate exhibits a positive response to

various shocks, including those affecting itself, the pace of domestic liquidity expansion, the output gap, exchange rate depreciation, and global food prices, particularly in the initial aftermath of such shocks. Moreover, expectations emerged as significant drivers; within the first year, the inflation rate responded positively to shocks, indicating that inflationary expectations often catalyze additional inflation. In the short term, inflation is primarily propelled by its own fluctuations, subsequently influenced by the production gap, the growth rate of domestic liquidity, and the nominal depreciation of the Egyptian pound against the US dollar. Notably, approximately 56% of the inflation dynamics over a 5-year period can be attributed to variables other than inflation expectations.

Additionally, Ali (2011) investigated the primary determinants influencing inflation dynamics in Egypt from 1980 to 2009, employing a Vector Auto Regression model. The study's outcomes revealed that inflation inertia accounts for approximately 33% of the fluctuations in inflation rates, followed by demand-pull inflation at 31%, supply-side shocks at 20%, fiscal deficit at 15%, and finally, the exchange rate pass-through effect, which held minor relative importance, not exceeding 1%.

Transitioning to the determinants influencing inflation, a study by (Ali, 2020) diverges from conventional linear methodologies to examine the asymmetric effects of oil price changes on inflation. research adopts a nonlinear approach to investigate asymmetric effects on inflation. While previous studies have documented linear autoregressive outcomes, this study emphasizes the nonlinear consequences of both negative and positive shifts in oil prices. Utilizing the Asymmetric Autoregressive Distributed Lag (ARDL) model, the research explores the existence of integration-co and the interplay among lag distributive variables, a fact that linear models struggle to capture adequately. The outcomes affirm the presence of a long-term equilibrium relationship, signifying integration-co within the Egyptian economy from 1960 to 2017. This comprehensive analysis captures both long-term and short-term asymmetric impacts of oil price escalations on variables like money supply, GDP, oil prices, and inflation. These findings present challenges to the Central Bank of Egypt's capacity to mitigate inflationary pressures stemming from oil price changes, particularly given their external determinants and positive impact on inflation across short and long timeframes. Thus, they underscore the imperative for monetary policies

that effectively address inflationary pressures originating from global factors, including oil price fluctuations.

While the existing literature on inflation in Egypt offers valuable insights into various aspects of the phenomenon, there are some notable gaps and limitations that warrant criticism and highlight areas for further research. **Firstly**, many studies focus on analyzing the determinants and impacts of inflation in Egypt using traditional econometric methods such as Vector Error Correction Models (VECM), VAR models, and Autoregressive Distributed Lag (ARDL) models. While these methods provide useful insights, they may overlook potential nonlinearities and asymmetries in the relationship between inflation and its determinants. As seen in Ali (2020), there is a growing recognition of the importance of nonlinear models, particularly in capturing the asymmetric effects of factors such as oil price changes on inflation. However, this area remains relatively underexplored in the context of Egypt's inflation dynamics.

Secondly, while some studies, such as Abdu (2022) and Shokr, Abdul Karim, and Zaidi (2019), address the relationship between fiscal policy, monetary policy, and inflation, there is a need for more comprehensive analyses that consider the interactions between these policies in shaping inflation outcomes. For example, while Abdu (2022) emphasizes the importance of fiscal deficit in driving inflation, the study does not fully explore how monetary policy responses to fiscal imbalances may exacerbate or mitigate inflationary pressures.

Furthermore, the existing literature predominantly focuses on analyzing the determinants of inflation and its impacts on macroeconomic variables such as output, exchange rates, and stock market indices. However, there is limited research specifically examining the effectiveness of monetary policy tools, such as interest rates and money supply indicators, in curbing inflation in Egypt. While studies like Omar & Yousri (2023) touch upon the impact of interest rates on inflation, there is a need for more focused analyses that evaluate the effectiveness of monetary policy interventions in achieving inflation targets, particularly in the context of recent economic challenges and policy responses.

In summary, while previous studies have contributed significantly to our understanding of inflation dynamics in Egypt, there are notable gaps and limitations, including the need for more sophisticated modeling techniques to

capture nonlinearities and asymmetries, a deeper exploration of the interactions between fiscal and monetary policies, and a more focused analysis of the effectiveness of monetary policy tools in controlling inflation. Addressing these gaps will enhance our understanding of inflation dynamics in Egypt and inform more effective policy responses to mitigate inflationary pressures.

3 REASONS FOR THE HIGH IN INFLATION RATES IN EGYPT

3.1 STRUCTURAL IMBALANCES IN THE EGYPTIAN ECONOMY

The Egyptian economy has faced a number of structural imbalances since 2011, the most prominent of which was the decline in productive sectors' performance. In addition, many imbalances have taken place in the Egyptian economy after the revolution of 25 January 2011; for instance, the low competitiveness of the industrial sector, high budget deficit, the increased liquidity gap, the upsurge of intermediate goods imports which lead to a chronic trade deficit. Moreover, most of the foreign direct investments at that time were directed to sectors with low value add (Zaki, 2017). The statistics of the Egyptian economy during the period (2011-2017) provide evidence of all the previously mentioned sorts of imbalances:

- a. Low GDP growth rate, reaching 3% on average.
- b. The fiscal deficit increased to 11.3%
- c. An increase in the inflation rate, reaching 14.1% in September 2016
- d. An increase in the unemployment rate to 12.8%
- e. Increasing the current account deficit from 3.7% of GDP in 2014/2015 to 6% in 2016/2017
- f. A devaluation of the official exchange rate by 13% in March 2016.
- g. International reserves recorded \$17.1 billion in June 2016, or an equivalent amount to cover only 3.1 months of imports.

Consequently, the government started to adopt programs and policies for economic reform and structural adjustment, through applying:

- a. Liberalization of the foreign exchange system, with the aim of achieving an increase in investments and exports.
- b. Monetary policy aimed at controlling inflation.
- c. Achieving strong fiscal control to ensure the sustainability of public debt.

- d. Strengthening social safety nets by increasing spending on food subsidies and cash transfers.
- e. Implementing far-reaching structural reforms to achieve inclusive growth, job creation, and access to new external financing to bridge any financing gaps (Massoud, 2021).

However, the period following the implementation of the decision to float the Egyptian pound against the dollar in November 2016 witnessed leaps and bounds. Figure (1) shows the upsurge of inflation rate that followed the decision of floating the official exchange rate that confirmed the existence of a relationship between the exchange rate and inflation rate (Abdul-Ghani, 2022). However, it is worth noting that the rate of increase in inflation was so sharp in 2017 (approximately 30%) that indicate the effect of other factors. These factors were represented in the rise in import prices, in addition to the rise in fuel prices as a result of the removal of subsidies (Figure 2), which began in 2014 and was implemented in several phases (Barsoum, 2020).

Figure (1) Nominal Exchange Rate and Inflation in Egypt (2016–2021)

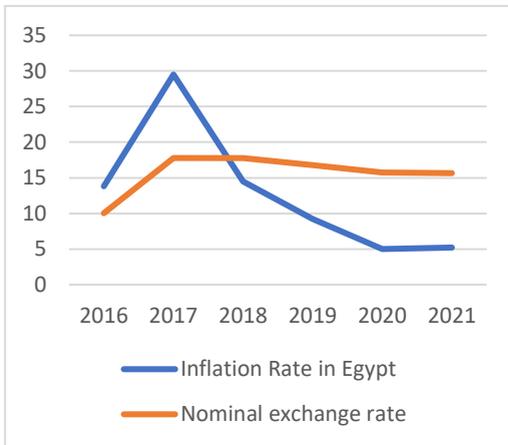
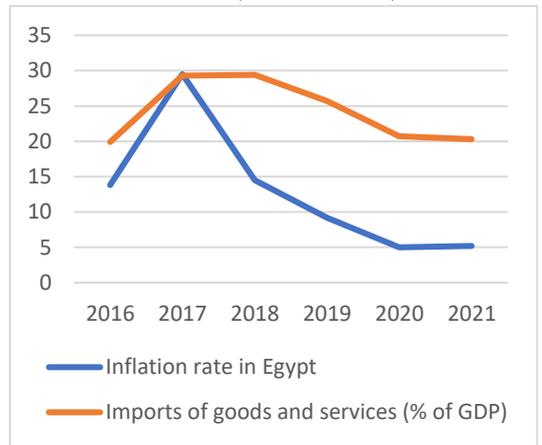


Figure (2) Imports of goods and services as a percentage of GDP and Inflation in Egypt (2016–2021)

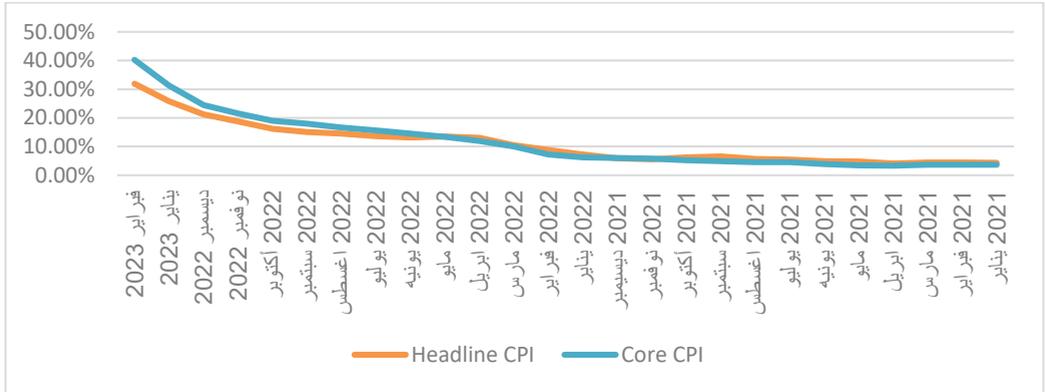


Source: The World Bank

At the beginning of 2021, the inflation rate of Egypt followed an upward trend (Figure 3). The annual urban inflation rate increased from 8.25% in February 2022 to 31.9% in February 2023, while the headline general inflation rate recorded a monthly rate of 6.5% in February 2023, compared to a rate of 1.6% in February 2022. In addition, the core inflation rate showed a sharp upward trend to reach 40.3% in February 2023 compared

to 31.2% in January 2023. The monthly core inflation rate has also increased to record 8.1% in February 2023 compared to 1.2% in February 2022. Following the same trend, the inflation rate of the total republic recorded 32.9% in February 2023 compared to 26.5% in January 2023.

Figure (3): Core and Headline Consumer Price Indices (CPI) (Annual percentage change) (January 2021 – February 2023)



Source: The Central Bank of Egypt and Central Agency for Public Mobilization and Statistics (CAPMAS)

3.2 SUPPLY AND DEMAND SHOCKS IN EGYPT

Inflation most often results from a shock on both the demand and supply sides. Importantly, a shock in one side causes imbalances in the other side. One of the main reasons of the recent inflation upsurge is when the central bank follows a contractionary monetary policy, then accompanied by a contraction in the fiscal policy tools, including increase in taxes and/or rationalization of public spending. This leads to a shrink in the supply of goods and services by either the domestic producers or importers. The impact becomes evident when producers resort to borrowing from banks in order to invest and increase production. Hence, producers face the burden of high interest rates because of the monetary tightening adopted. (Samak, 2022).

Eventually, the continuous depreciation of the local currency has put pressure on the domestic prices leading to a significant increase. This has occurred in the light of a series of decisions to devalue the currency began in March 2022, that took place to face the long-term shortage of foreign currencies, the emergence of Crisis of documentary credits, and detention of some goods in Egyptian ports. As a result, the Core inflation rate in February 2023 reached about 40.26% on an annual basis, (CBE, 2023b) which is the

highest since the index was launched in 2009. As a monetary complementary action to face this vast increase in domestic prices, the Central Bank of Egypt raised the interest rate on deposits and lending by 300 points basis to 16.25% and 17.25% respectively in December 2022 to absorb liquidity, (SIS, 2022) which is the highest rate since 2016. Another main reason is clear in the rise of energy costs due to the increase in fossil fuel and natural gas prices, which leads to quadrupling the prices of food grains in Europe since 2021.

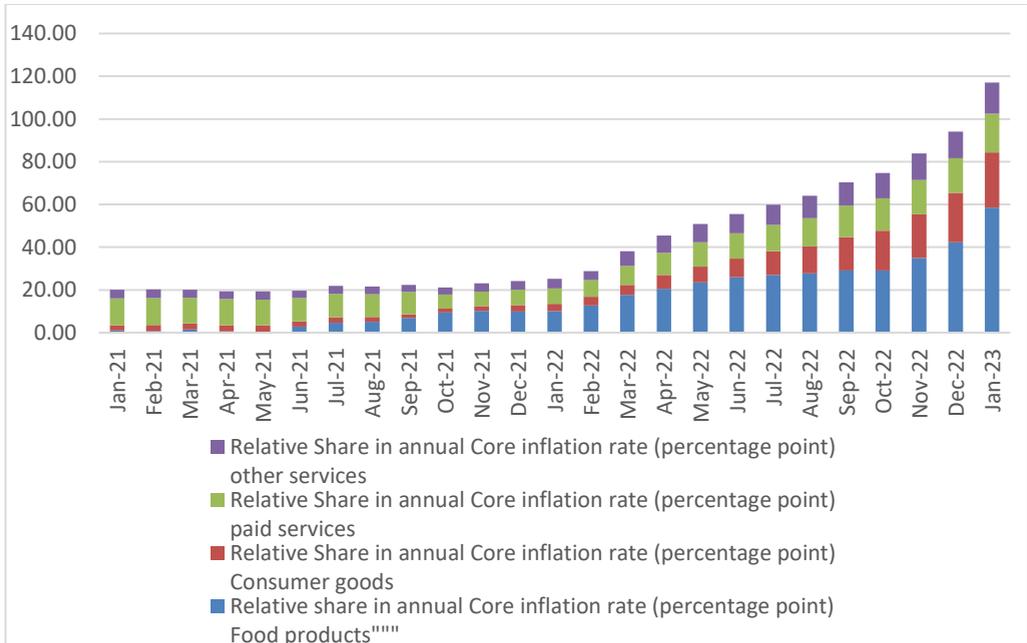
Noteworthy that the Egyptian domestic market depends on many imported commodities, especially food and energy commodities. The proportion of imports of food commodities in 2022 is about 18% of total merchandize imports. Moreover, the percentage of imports of fuel and crude oils specifically is about 4% of the total merchandise imports in the same year (CAPMAS, 2023). Comparing these figures to the proportion of food imports in developing countries, it averages about 17.15% in 2022. While the proportion of food imports in the group of developing countries classified as food importers solely reached about 15.67% in the same year (FAOSTAT, 2022). Hence, analyzing the reasons for inflation in Egypt calls for the need to analyze fluctuations in international prices of food commodities and petroleum materials.

The annual inflation rate for food commodities increased from 48% in January 2023 to 62.7% in March 2023. This upsurge in food prices is considered overwhelming and outpaced responses to any devaluation policy that has ever happened in Egypt (Ministry of Planning and Economic Development, 2023). This particularly can be referred to many reasons (figures 4 and 5) as:

- a. Rising food prices in global markets, due to the double crisis represented by the outbreak of the Covid-19 epidemic in the world and the Russian-Ukrainian war that result in a shortage of food supplements having Russia as a major supplier of food grains globally. Also, disruption of supplies due to the repercussions of the extreme weather waves affected food chains (2020-2022 La Niña weather episode). Egypt, specifically, constitutes about 80% of the wheat imports from Russia and Ukraine. In addition, the energy crisis has hit the Egyptian economy severely, as Egypt imports nearly 100 million barrels of crude oil annually.

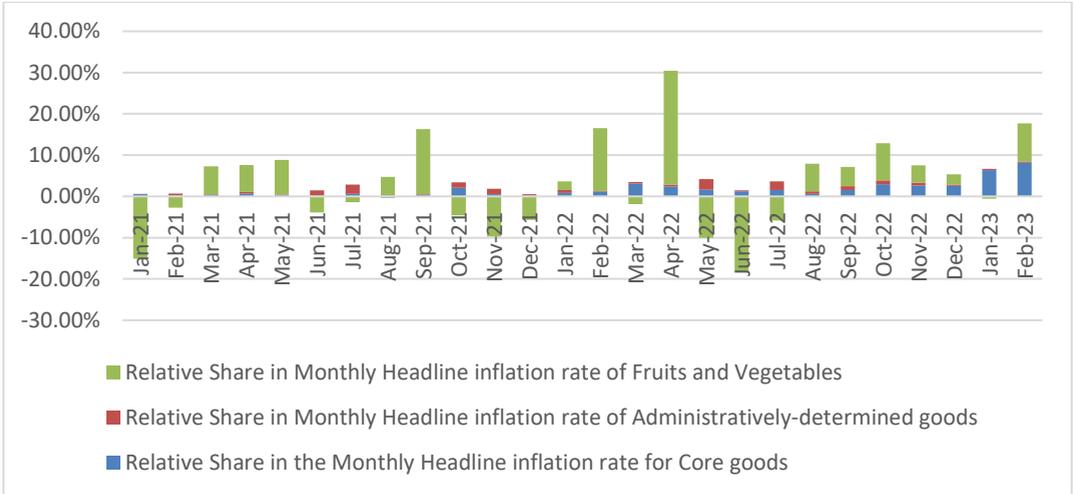
- b. Exchange rate fluctuations, as the value of the Egyptian pound decreased by about 25% against the US dollar. The decision of the central bank of Egypt to liberalize the exchange rate raised the bill for importing food commodities. This is literally transferred massively and directly to the basket of goods and services that establishes the consumer price index, where food and petroleum products represent the highest weight and constitute about 50% of it (CBE, 2023). This has also affected the prices of non-food commodities.
- c. Shortage of some commodities as a result of the disruption of the supply chain, and the accumulation of production requirements in the Egyptian ports after the documentary credits crisis, which began on February 13, 2022, and ended in December 2022. As a result of that crisis, there was a shortage of some commodities, such as poultry feed (CAPMAS, 2023).
- d. Wages' pressures in some sectors of the labor market.

Figure (4): The Sources of increasing the Annual Core inflation rate in Egypt (January 2021 – January 2023)



Source: The Central Bank of Egypt, Monthly Statistical Bulletin

Figure (5): The Sources of increasing the Monthly Headline inflation rate in Egypt (January 2021 – February 2023)



Source: The Central Bank of Egypt, Monthly Statistical Bulletin.

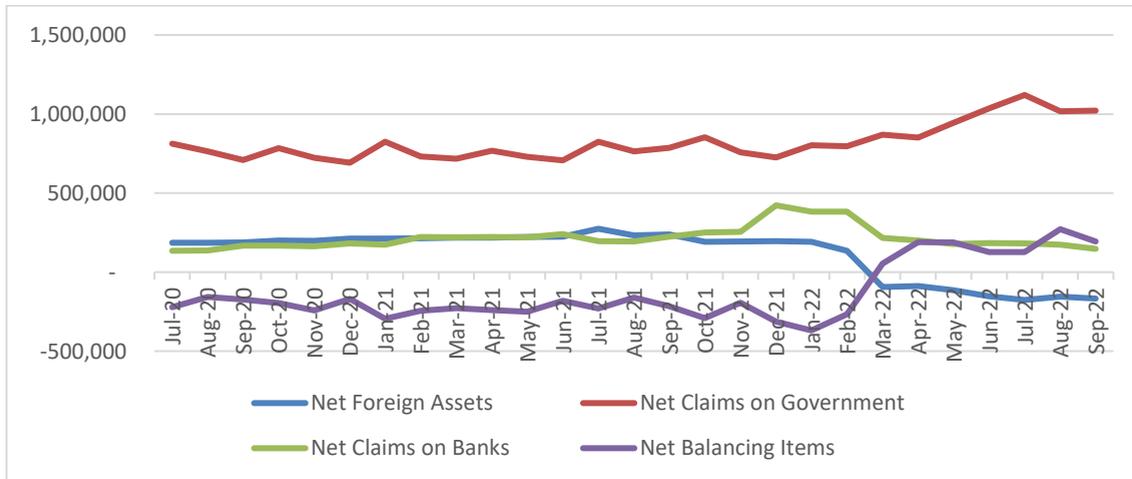
Concurrently, the volume of domestic liquidity increased during the fiscal year 2021/2022, which made the situation worse. As the volume of domestic liquidity in the Egyptian-banking sector increased by about 1.6 trillion pounds, to reach the level of 7.402 trillion pounds at the end of December 2022, compared to 5.822 trillion pounds at the end of the same month of the previous year. Looking at the components of domestic liquidity (money supply 1M + quasi-money), it is clear that the increase in the money supply came as a result of the increase in the volume of current deposits in local currency (227.655 billion pounds) at a higher rate compared to the increase in cash circulating outside the banking system (129.345 billion pounds) (CAPMAS, 2023).

As for the increase in quasi-money components, which include non-current deposits in local currency (non-governmental), and current and non-current deposits in foreign currency (non-governmental), it recorded a significant increase by about 965.2 billion pounds (50.27 billion dollars), with a growth rate of about 23.5% in the fiscal year 2021/22. This increase in quasi money came because of the increase in non-current deposits in local currency by 769.3 Billion pounds, at a rate of 23.3%, and foreign currency deposits amounted to 55.2 billion pounds, at a rate of 8.5%. Excluding the effect of the change in the exchange rate (CAPMAS, 2023).

Referring to the corresponding assets of domestic liquidity, the increase in domestic liquidity during the fiscal year 2021/2022, which greatly affected the inflation rate during the last months of 2022 and the beginning of the year 2023 came because of the increase in the net domestic assets and the decline in the net foreign assets. The bank’s net assets increased by about EGP 1.876 trillion, at a rate of 36.8%, as a result of the increase in domestic credit by about 1.365 billion pounds, and the net budget items, consisting of net assets and unclassified liabilities and open market operations, at about 511 billion pounds (CAPMAS, 2023).

By looking at Figure (6), it becomes clear that the increase in domestic credit is mainly due to the increase in net claims on government (933.9 billion pounds). This came to outweigh the increase in net claims on the private business sector (286.8 billion pounds), the family sector (139.1 billion pounds), in addition to net claims on the public business sector (5.9 billion pounds).

Figure (6): Net Foreign Assets and Local Credit (2020–2022)



Source: The Central Bank of Egypt

4 EFFORTS TO CONTROL INFLATION RATE IN EGYPT

Inflation occurs when spending on goods and services exceeds production within a country. Usually, prices rise due to supply constraints that increase the cost of producing goods and providing services, or because individuals spend their excess money faster than the ability of producers to increase their production. Inflation is often the result of a combination of these

two scenarios. There are many methods used to control inflation. Although there is no evidence on their effectiveness, some of them are more effective and less harmful compared to others.

Governments frequently use wage and price controls to fight inflation, but this policy has proved to be unfair in its implementation, thus governments seek other ways to control the upsurge in inflation rate. Monetary policy is one of the important deflationary tools that is used to absorb the excess liquidity in the economy depending on the tools interest rates and open market operations.

Monetary policy in Egypt seeks to maintain price stability, especially since the period following the 2011 revolution when the overall indicators of the Egyptian economy witnessed a deterioration, which prompted the Egyptian government to implement the reform program. This reform program was designed to boost economic growth under the supervision of the International Monetary Fund. However, 2016 witnessed inflationary waves as a result of the continued decline of the value of the pound against the dollar, and inflation rates reached 14% in 2016 and 29.5% in 2017. Therefore, following the November 2016 exchange rate floatation, the Central Bank resorted to applying the following measures (Abadir et al. 2021; Saleh 2021):

- A. Allowing banks to set the prices in the foreign exchange market freely depending on the interbank mechanism.
- B. Raising the overnight deposit and lending rate by three hundred basis points to record 14.75% and 15.75%.
- C. Raising the credit and discount rates by three hundred basis points to record 15.25%.
- D. Determine the maximum deposit and withdrawal limit for companies operating in the import of goods at \$50,000 and \$30,000, respectively.
- E. Encouraging banks to offer savings pots at high interest rates for a period of 3 years, in addition to absorbing excess liquidity by activating deposits in banks.

With the improvement witnessed in the value of the Egyptian pound and the gradual recovery of overall indicators due to political stability, the inflation rate decreased until it reached 9.15% in 2019, and in return, the interest rate on deposits reached 10.95% in the same year.

In the wake of the economic repercussions of the Covid-19 pandemic, monetary policy worked to stimulate the Egyptian economy. The Monetary

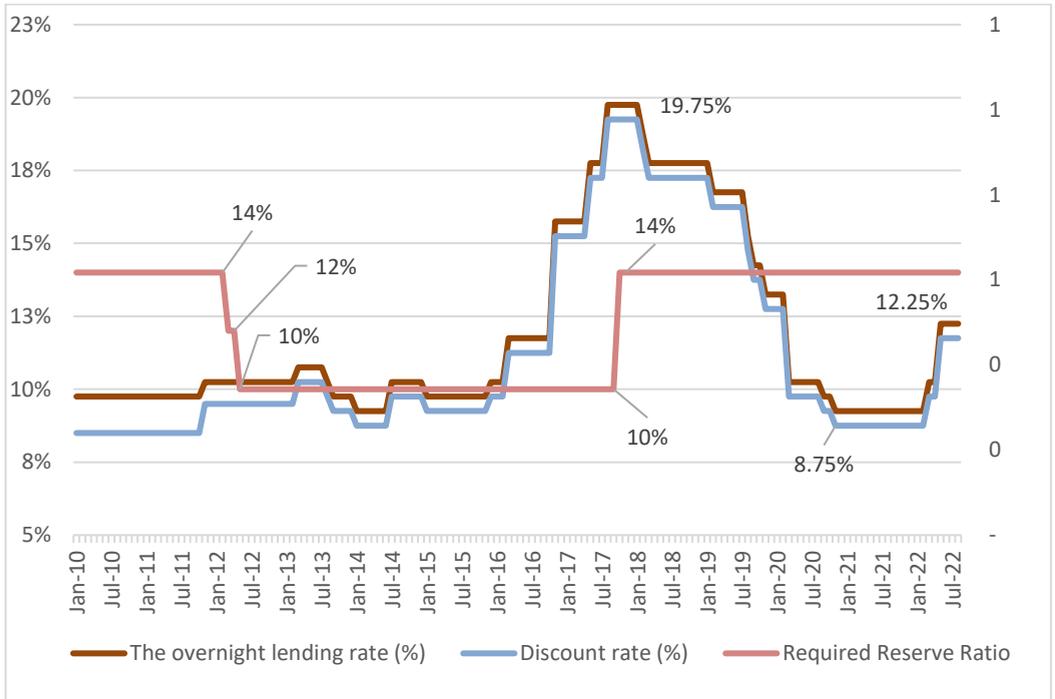
Policy Committee, twice in a row in September and November 2020, reduced both the overnight deposit and lending rate of returns. Moreover, the main transaction rate reached 8.25%, 9.25% and 8.75%, while the credit and discount rates hit the level of 8.75 (Central Bank, 2022). In the following two years, there was an improvement in the inflation rate, as it decreased from 9.2% in 2019 to 5% in 2020, and then it increased slightly in 2021 to score 5.2%.

However, in the wake of the negative repercussions of the Russian-Ukrainian conflict crisis, the policies of the Central Bank prevailed follows the way of being tightened, which is logical in light of the strict policies pursued by major countries to control inflation rates that were expected to continue to rise.

To confront severe inflationary pressures, the Central Bank set inflation target rates of a level of 7% (± 2) on average during the fourth quarter of 2024, and a level of 5% (± 2 points) on average during the fourth quarter of 2026, and to this end, the Central Bank used monetary policy tools to control the inflation rate (Figure 7) through:

- Moving interest rates through a series of decisions, which began in March 2022, when the interest increased by 100 basis points, to have the main transaction rate at 9.75% and the overnight lending rate becomes 10.25%. It was then followed by another decision in May 2022 to increase the interest rate by 200 basis points, so that the discount rate reaches 11.75% and the overnight lending rate reaches 12.25%. This was followed by other two decisions in October and December to raise interest rates by 200 points and 300 points, respectively. Thus, the discount rate rose to 13.75% for October 2022 decision, then to 16.75% for December 2022 decision. While the overnight lending rate rose to 14.25% and then to 17.25%.
- Increasing the required reserve ratio from 14% to 18% in September 2022.

Figure (7): Changes in Monetary Policy tools in the period (2010-2022)



Source: The Central Bank of Egypt

In this regard, table (1) shows the policies related to interest rates, which the Central Bank of Egypt has adopted since the beginning of the Russian-Ukrainian crisis.

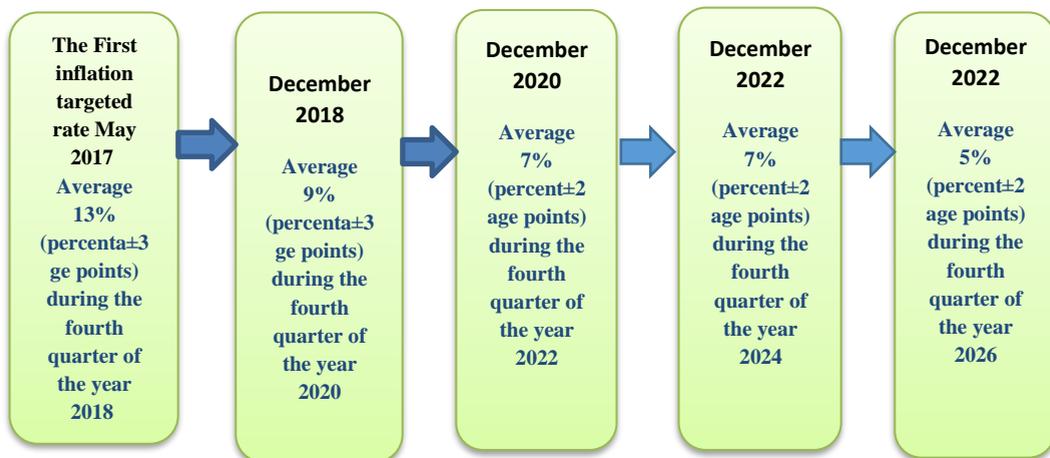
Table (1): The interest rate policy adopted by the Central Bank of Egypt since the beginning of the Russian-Ukrainian war (February 2022 – March 2023)

Meeting	Decree	The rate of return on Deposits (%)	The rate of return on loans (%)	The main Transaction rate in the Central Bank of Egypt (%)
February 2022	Fixing	8.25	9.25	8.75
March 2022 (exception)	Increase by 100 basis points	9.25	10.25	9.75
May 2022	Increase by 200 basis points	11.25	12.25	11.75
June 2022	Fixing	11.25	12.25	11.75
August 2022	Fixing	11.25	12.25	11.75
September 2022	Fixing	11.25	12.25	11.75
October 2022	Increase by 200 basis points	13.25	14.25	13.75
December 2022	Increase by 300 basis points	16.25	17.25	17.75
February 2023	Fixing	16.25	17.25	17.75
March 2023	Increase by 200 basis points	18.25	19.25	19.25

Source: Central Bank of Egypt, different publications

In the context of the central bank’s move to a flexible inflation-targeting framework, five announcements have been made so far to target inflation rates from the year 2017 to the year 2022, and they are shown in Figure (8):

Figure (8): The Framework of the Central Bank of Egypt to Target inflation in the period (2017-2022)



Source: Central Bank of Egypt.

5 EMPIRICAL ANALYSIS

5.1 DATA AND DATA SOURCE

The study depends on a time-series data that is extracted from different sources as follows:

Variable	Description	Data Source
GDP	The Gross Domestic Product of Egypt, Monthly (million LE)	The Central Bank of Egypt (the data was extracted as a quarterly data then the monthly data version was estimated using cubic spline interpolation method)
INFL	Inflation, Consumer Price Index, Monthly.	The Central Bank of Egypt
DISC	The Discount rate, Monthly	The Central Bank of Egypt

Variable	Description	Data Source
MG	The Growth rate of Broad money supply, Local currency, Monthly, (Million LE)	The daily data source is from the Central Bank of Egypt, then the monthly rate was estimated using the simple average method
NER	The Monthly average exchange rate to the prices of buying and selling of LE/\$, monthly	The daily data source is from the Central Bank of Egypt, then the monthly rate was estimated using the simple average method
RVP	The relative prices, monthly	Estimated using (Abdelraouf et al. 2021) method

In addition, a dummy variable is added to represent the lockdown period during the spread of Covid-19.

5.2 MODEL SPECIFICATIONS

The Autoregressive Distributed Lags (ARDL) model is used to study the factors that affect the inflation rate in Egypt. This model was developed by Shin and Pesaran (1999) and Pesaeen et al. (2001), and is described through the following equation:

$$y_t = \alpha_0 + \sum_{i=1}^p \alpha_{1i} y_{t-i} + \sum_{j=0}^q \beta_j' X_{t-j} + \gamma' Z_t + \varepsilon_t$$

Where it indicates that the dependent variable y_t is a function of the vector of dynamic explanatory variables and their lagged values x_t . In addition, a vector Z_t , which includes the fixed explanatory variables, is added to the equation. Finally, ε_t that represents an error term that is identically identified with a mean value of zero. This model is characterized by the fact that it allows the presence of a mixture of integrated variables of different degrees I (0) and I (1) that fits the case we have. The existence of

cointegration can be tested through implementing a bound test. It is worth mentioning that the following regression is performed:

$$INF_t = \alpha_0 + \sum_{i=1}^p \alpha_{1i} INF_{t-i} + \sum_{i=0}^{q_1} \beta_{1i} RVP_{t-i} + \sum_{i=0}^{q_2} \beta_{2i} NER_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} MG_{t-i} + \sum_{i=0}^{q_2} \beta_{4i} DISC_{t-i} + \varepsilon_t$$

5.3 RESULTS

The Study uses the Augmented Dickey-Fuller test to examine the stationarity of variables. The results of this test come to show that some variables are stationary at the first difference while others are stationary at level. This result supports the suitability of the use of the ARDL model, hence a test of AIC is performed to determine the suitable number of lags which comes to conclude that the lags would be distributed as: ARDL (1, 0, 3, 2, 3, 4, 1). The results of the model is shown as follows in table (2):

Table (2): Results of the ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INFL(-1)	0.302968	0.117405	2.580551	0.0156
DISC	-12.21472	1.969008	-6.203488	0.0000
GDP	-8.61E-06	4.07E-06	-2.114565	0.0438
GDP(-1)	1.42E-05	8.72E-06	1.629185	0.1149
GDP(-2)	-6.22E-06	7.94E-06	-0.783519	0.4401
GDP(-3)	-3.56E-06	3.29E-06	-1.081298	0.2891
COVID	-0.206609	0.085945	-2.403962	0.0234
COVID(-1)	0.003397	0.110955	0.030618	0.9758
COVID(-2)	-0.154334	0.085385	-1.807508	0.0818
NER	-0.190184	0.137823	-1.379914	0.1789
NER(-1)	-0.342454	0.207049	-1.653977	0.1097
NER(-2)	0.798473	0.177087	4.508923	0.0001
NER(-3)	0.167382	0.099375	1.684352	0.1036
MG	8.922735	3.371211	2.646745	0.0134
MG(-1)	3.456407	3.147046	1.098302	0.2818
MG(-2)	1.654350	3.087498	0.535822	0.5965
MG(-3)	0.097055	2.108135	0.046038	0.9636
MG(-4)	4.728419	1.978138	2.390339	0.0241
RVP	-0.004643	0.004367	-1.063239	0.2971
RVP(-1)	-0.006050	0.004568	-1.324485	0.1964
C	-1.405007	2.215137	-0.634276	0.5312

Source: Calculated by the Authors using E-views

The inflation parameter in the first lagged value is significant (p-value = 0.0156), and equal to 0.302968, meaning that an increase in inflation by one percentage point in the previous month leads to an increase in the current inflation rate by about 0.30. In addition, the discount rate parameter DISC, the gross domestic product (GDP), and the special dummy variable are shown to be significant and negative in their current value, which indicate that there is an inverse relationship between these variables and inflation. Conversely, the positive sign of the significant parameters of the variables related to the nominal exchange rate NER with a lag of 2 months and the money supply MG indicates that there is a positive relationship between these variables and the inflation rate in Egypt.

A step forward to provide a concrete analysis of the determinants of inflation in Egypt is to estimate the ARDL-Error Correction model to capture the existence of short-run relationships between variables. Results are represented in table (3) as follows:

Table (3): Results of the Error Correction Model

ARDL Error Correction Regression

Dependent Variable: D(INFL)

Selected Model: ARDL(1, 0, 3, 2, 3, 4, 1)

Case 2: Restricted Constant and No Trend

Sample: 2017M04 2021M03

Included observations: 48

ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP)	-8.61E-06	2.68E-06	-3.209444	0.0034
D(GDP(-1))	9.79E-06	3.84E-06	2.547866	0.0168
D(GDP(-2))	3.56E-06	2.63E-06	1.353909	0.1870
D(COVID)	-0.206609	0.066330	-3.114853	0.0043
D(COVID(-1))	0.154334	0.066305	2.327623	0.0277
D(NER)	-0.190184	0.107878	-1.762965	0.0892
D(NER(-1))	-0.965855	0.147980	-6.526912	0.0000
D(NER(-2))	-0.167382	0.081330	-2.058066	0.0494
D(MG)	8.922735	2.505044	3.561907	0.0014
D(MG(-1))	-6.479824	3.023581	-2.143096	0.0413
D(MG(-2))	-4.825474	2.438445	-1.978914	0.0581

The Nexus between Inflation Rate and Monetary Policy in Egypt
Fatma Khamis Al-Hamalawi Aya Najah Al-Sarsi Marina Adel Riad

D(MG(-3))	-4.728419	1.583489	-2.986077	0.0059
D(RVP)	-0.004643	0.002783	-1.668592	0.1068
CointEq(-1)*	-0.697032	0.085382	-8.163722	0.0000
<hr/>				
R-squared	0.793301	Mean dependent var		-0.005515
Adjusted R-squared	0.714270	S.D. dependent var		0.146488
S.E. of regression	0.078303	Akaike info criterion		-2.017967
Sum squared resid	0.208467	Schwarz criterion		-1.472200
Log likelihood	62.43120	Hannan-Quinn criter.		-1.811721
Durbin-Watson stat	1.803257			

* p-value incompatible with t-Bounds distribution.

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.615631	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

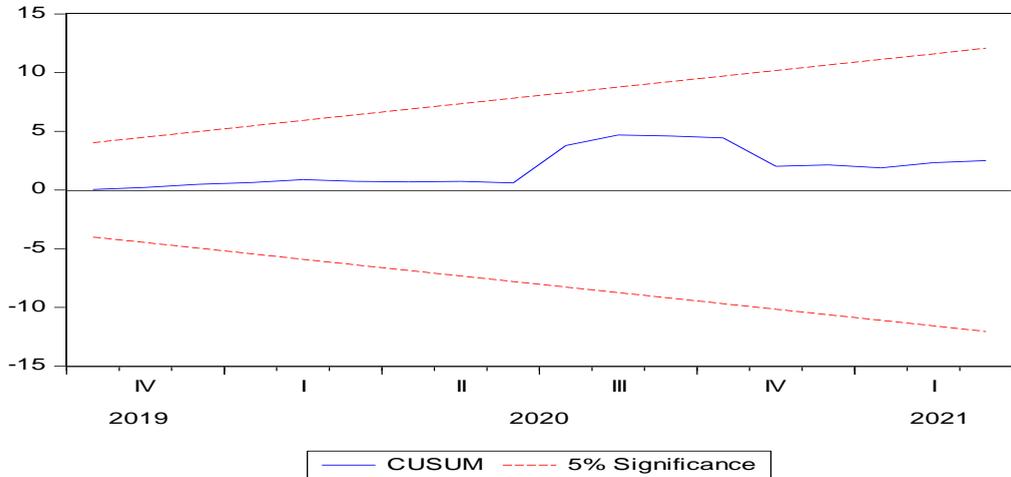
Source: Calculated by the Authors using E-views

The results shown above indicate that the error correction term is negative and significant, and its value is (-0.697032), which means that a return to equilibrium in the dynamic model is possible, and therefore the variation that occurs in the short term is corrected by 69% every month (given that the data are monthly).

To assure the robustness of the results, the model is checked for its validity using both Jarque-Berra test and Ramsey RESET test. The tests of the residuals were in favor of the estimated model, as the non-significance of the probability value (recorded as 0.09) for the calculated value of the Jarque-Bera test indicates rejection of the null hypothesis, which means that the residuals follow a normal distribution. This is also the case with the autocorrelation test between the residuals and heterogeneity of variance, where the probability value is recorded. They exhibit 0.8323 and 0.4828 respectively. Moreover, The Ramsey RESET test indicates that the model is well specified. Figure (9) shows that the model is stable, and the cumulative

sum of squares (CUSUM) of the residuals test statistic does not exceed the critical values of 5% at any point. Finally, a unit root test was performed for the residuals of the model, which approve that the trumpets are stable.

Figure (9): CUSUM of the residuals



Source: Calculated by the Authors using E-views

Like previous studies, this research identifies key determinants of inflation in Egypt, including GDP, the discount rate (monetary policy), the nominal exchange rate, and money supply. These variables have been consistently found to influence inflation in various economic contexts. The finding of a significant negative relationship between GDP and inflation aligns with previous research indicating that economic growth can mitigate inflationary pressures by increasing productivity and output levels.

Similarly, the inverse relationship between the discount rate and inflation is consistent with the notion that tighter monetary policy, reflected in higher interest rates, can help curb inflation by reducing aggregate demand. The positive relationship between inflation and both the nominal exchange rate and money supply is consistent with the understanding that currency depreciation and excessive money creation can fuel inflationary pressures.

6 CONCLUSION

The study depends on the previous economic theories and/or previous studies to extract the variables that influence the analysis of Inflation dynamics. Then, the study applied the model of Autoregressive Distributed Lags (ARDL) to implement the analysis. As mentioned before, the used variables are represented in: (1) GDP, monthly (in million pounds), (2) Discount rate, monthly, (3) Monthly growth rate of broad money supply, in local currency, monthly (in million pounds), (4) Average Monthly buying and selling rates for the Egyptian pound against the US dollar, monthly, (5) changes in relative prices, monthly, in addition to a dummy variable that expresses the period of closure during the outbreak of the Corona pandemic, and the dependent variable which is inflation (consumer price index), monthly.

The inflation parameter in the first lagged value was significant (probability value = 0.0156), and equal 0.30, meaning that an increase in inflation by one percentage point in the previous month leads to an increase in the current inflation rate by about 0.30. In addition, the parameters of the discount rate, the gross domestic product (GDP), and the dummy variable were significant with a negative sign showing an inverse relationship between these variables and inflation. On the contrary, the variables of the nominal exchange rate and the broad money supply exhibit positive significant signs indicating a positive relationship between them and inflation rate in Egypt at the same time.

Accordingly, the results of this quantitative model show that the most important factors that affected inflation in Egypt during the period studied are the lagged values of inflation, interest rate decisions, the volume of GDP, the nominal exchange rate and money supply. This result implies that the factors that lead to an increase in the inflation rate are not only from the demand side but they extend to form supply aspects as well as monetary policy tools used in previous periods. Therefore, the study suggests that the policies necessary to confront inflation must include both monetary and fiscal policy tools together.

In summary, while this study shares similarities with previous research in its exploration of inflation dynamics in Egypt, its unique methodological approach, focus on specific variables, examination of short-

run relationships, and rigorous validation procedures contribute to a nuanced understanding of inflation determinants in the Egyptian context.

It is necessary to complete future studies related to the topic of this research, such as evaluating the effectiveness of the inflation targeting framework in Egypt in achieving price stability and stabilizing inflation expectations. As well as evaluating the central bank's communication strategy, policy credibility, and operational framework in the context of inflation targeting. The importance of investigating the role of structural factors, supply-side constraints, inflation expectations, and wage price dynamics in shaping the inflationary environment in Egypt cannot be overlooked.

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