

## Analyzing the relationship between Fiscal Deficit and Inflation: The Case of Egypt

Mohammed Ibrahim Abdu  
Associate Minister of Finance for  
Policies and Economic Affairs, Arab Republic of Egypt  
Ministry of Finance

**المستخلص:** على مدى عقود، كانت مصر تعاني من عجز مالي مزمن ومشكلة تضخم عالية. في الآونة الأخيرة، وكان كلا المتغيرين يتجهان نحو الانخفاض بسبب جائحة (كوفيد - 19) وتنفيذ برنامج الإصلاح الاقتصادي الذي بدأ في عام 2016. تعيد هذه الدراسة التحقيق في العلاقة بين العجز المالي والتضخم خلال الفترة من 1981 إلى 2020 باستخدام نموذج تصحيح الخطأ المتجه (VECM) واختبار جرانجر للسببية. وتشير النتائج إلى أن العجز المالي له تأثير كبير على التضخم على المدى الطويل، حيث يؤدي ارتفاع العجز المالي إلى زيادة معدل التضخم. كما تكشف نتائج اختبار جرانجر السببية عن علاقة سببية ثنائية الاتجاه بين العجز المالي والتضخم على المدى القصير. يتم رصد هذه العلاقة من خلال التأثير السببي لعرض النقود على معدل التضخم وسعر الفائدة. ويؤثر سعر الفائدة أيضاً على العجز المالي الذي يؤثر في النهاية على معدل التضخم. من ناحية أخرى، لا يبدو أن سعر الفائدة يؤثر على معدل التضخم على المدى القصير. تشير هذه النتائج إلى أن مشكلة التضخم في مصر تبدو ظاهرة مالية وليست نقدية. ويمثل كسر الحلقة المفرغة للعجز المالي ونمو المعروض النقدي وسعر الفائدة عاملاً حاسماً في التعامل مع التضخم والعجز المالي في مصر.

**الكلمات المفتاحية:** مصر، العجز المالي، السببية، التضخم، نموذج تصحيح الخطأ المتجه، سعر الفائدة، عرض النقود، الإصلاح الاقتصادي، سعر الصرف، النقد الموسع.

**Abstract:** *For decades, Egypt has had a chronic fiscal deficit and high inflation problem. Recently, both variables have been trending downward due to COVID-19 and the implementation of the economic reform programme in 2016. This study re-investigates the relationship between the fiscal deficit and inflation from 1981 to 2020 using the Vector Error Correction Model (VECM) and the Granger causality test. The results indicate that fiscal deficit has a significant effect on inflation in the long run, as the increase in fiscal deficit increases the inflation rate. The results of the Granger causality test reveal a two-way causality relationship between fiscal deficit and inflation in the short run. This relationship is captured through the causal effect of money supply on the inflation rate and the interest rate. The interest rate also affects the fiscal deficit which eventually affects the inflation rate. On the other hand, the interest rate does not seem to affect the inflation rate in the short run. These results indicate that the problem of inflation in Egypt seems to be a fiscal rather than a monetary phenomenon. Breaking the vicious circle of the fiscal deficit, money supply growth, and the interest rate represents a critical factor in dealing with Egypt's inflation and fiscal deficit.*

**Keywords:** Egypt, fiscal deficit, granger causality, inflation, vector error correction model, interest rate, money supply, economic reform, exchange rate, broad money

**JEL Codes:** C2, C3, E31, H62

## 1. Introduction

Economic policies are geared towards achieving high and sustainable economic growth while maintaining a moderate and stable rate of inflation. Over the past four decades, Egypt's economy experienced episodes of significant fiscal deficit and inflation rates. These two economic indicators carry out a significant role in influencing the whole economic dynamics. Due to COVID-19 and the adoption of the economic reform program

since 2016, both variables went on a downward trend. The fiscal deficit rates went on a downturn trend to register 7.2 percent in 2020, and the inflation rate reached 5.7 percent. Recent trends of both variables raise the question about the relationship between both variables, and whether the Egyptian government started to control the sustained problem of inflation and deficit. Despite being thoroughly established in the literature, the nexus between both variables is complicated, especially in emerging and developing countries (Catão & Terrones, 2003).

In the literature, there are two main approaches that explain inflationary pressures: the monetary approach and the fiscal approach. Nonetheless, there is a broad agreement on the role of money supply growth either as the primary driver of inflation or as a necessary component in accommodating inflation (El-Sakka & Ghali, 2005). Monetarists consider inflation a monetary phenomenon implying that increasing the money supply raises prices. When the amount of domestic credit or monetary base exceeds the required limits, monetary and real markets will be unbalanced. However, they will ultimately return to equilibrium as the general price level rises (Živkov et al., 2020). According to the fiscal approach, inflation is attributed to large fiscal imbalances. This approach illustrates the causes of inflation in two ways: First, through the wealth effect when government spending increases, while the tax collection decreases which increases the disposable income and, as a result, raises the aggregate demand and the inflation rate. Second, through attempting to finance the country's fiscal deficit by extending its monetary base (Erer & Erer, 2019). Literature on developing countries showed that the fiscal approach is prominent in explaining inflation and influencing economic trends (Asandului et al., 2021; Catão & Terrones, 2003).

Due to the chronic problem of inflation and deficit in Egypt, the nexus between the fiscal deficit and inflation has become a focus area for empirical studies. The findings of El-Sakka and Ghali

(2005) indicated that money supply is used to finance the fiscal deficit and also has a significant effect on the increase of inflation. However, the study did not estimate the relationship between the fiscal deficit and inflation, as it focused only on the determinants of inflation in Egypt. Hashem (2017) reported that fiscal deficit played an essential role in influencing inflation. Helmy (2008), Ali (2011), and Elhendawy (2019) concluded that inflation is related to the fiscal deficit in addition to its sources of financing.

Despite focusing on the relationship between the fiscal deficit and inflation, the studies of Helmy (2008), Ali (2011), and Hashem (2017) referred to former periods. Elhendawy (2019) study neglected some variables that play a critical role in directing inflation such as interest rate, trade openness, and exchange rate.

Using the vector error correction model (VECM) and the Granger causality test, this study investigates the long-run and the short-run relationship between Egypt's fiscal deficit and inflation as well as other relevant factors over the period from 1981 to 2020. The study contributes to the literature in three main ways: First, it subdivides the period of the study into four decades and provides deep descriptive analysis to each decade. Second, it employs longer datasets compared to previous studies. Third, the applied VECM added the interest rate and trade openness as two important variables that were neglected in some of the previous studies that tried to estimate the long-run relationship between fiscal deficit and inflation in Egypt. The inclusion of these variables provides a vivid vision of the relationship between inflation and fiscal deficit. The clear vision may also help policymakers adopt policies that can control the sustained problem of inflation and deficit in Egypt.

## 2. Literature Review

Several studies have examined the relationship between fiscal deficits and inflation in diversified economies. Table 1 focuses on selected studies that examined the relationship between the fiscal deficit and inflation in Egypt and diverse developing countries.

*Table 1: Surveyed empirical studies on the relationship between inflation and fiscal deficit in Egypt and diverse developing countries*

Author(s) (Year)	Methodology	Country	Variables (Period)	Results
Helmy (2008)	VECM	Egypt	CPI, Government budget deficit, Net claims on the government, Broad money, real GDP, nominal exchange rate. (1981/82 – 2005/06)	Budget deficits, broad money, net claims on government elevate inflation. The increase in the inflation rate increases the budget deficit.
Ali (2011)	VAR	Egypt	Change in CPI, lagged inflation, money aggregates, lending interest rate, exchange	Over the whole study period, several factors affected inflation, mainly inflation inertia, aggregate money,

Author(s) (Year)	Methodology	Country	Variables (Period)	Results
Hashem (2017)	SVAR	Egypt	rate, Net government claims (as a proxy for fiscal deficit), world oil price index, domestic oil price index, world food price index, world poultry price index. (January 1980 – December 2009) Real GDP, CPI, Central bank discount rate, and Budget balance. (Quarter data from 2005 to 2015)	lending interest rate, change in major commodity prices, and the net government claims (as a proxy for fiscal deficit). The fiscal deficit and public debt performed a crucial role in influencing the waves of inflation.
Elhendawy (2019)	Granger causality and VECM	Egypt	The ratio of the money supply to GDP, budget deficit, consumer price index. (1980 – 2017)	The budget deficit and money supply positively increase inflation.

Author(s) (Year)	Methodology	Country	Variables (Period)	Results
Nguyen (2015)	PMG and GMM	Nine developing Asian countries	Inflation rate, Fiscal deficit, Broad Money, real GDP per capita, government expenditure, Interest rate, Exchange rate, Trade openness. (1985 – 2012)	The government expenditure, fiscal deficit, and interest rate were statistically significant in influencing inflation.
Anantha Ramu and Gayithri (2017)	SVAR	India	Fiscal deficit, change in the wholesale price index of all commodities, per capita consumption expenditure, real GDP per capita at market price, imports, broad money supply (M3), commercial bank lending rate, and	The fiscal deficit represents the key factor behind the change in money supply and inflation.

Author(s) (Year)	Methodology	Country	Variables (Period)	Results
Ssebulime and Edward (2019)	ECM, and Granger causality	Uganda	capital inflow. (1980/1981 – 2012/2013)  Budget deficit, CPI, GDP growth, money supply (M2), nominal exchange rate, exports, and imports. (1980 – 2016)	The budget deficit was the only causal factor to inflation in Uganda over the study period in the short run. The effect was emphasized directly and indirectly through nominal exchange rate fluctuation and money supply.
ErdiL ŞAhİN (2019)	ADRL	Turkey	CPI, Budget deficit/GDP, Broad Money. (1980 – 2017)	The budget deficit had an influential effect on inflation in the short run and long run in Turkey over the study period.



Author(s) (Year)	Methodology	Country	Variables (Period)	Results
Khan et al. (2020)	ADRL	Malaysia	Fiscal deficit, GDP at the current price, CPI, Money supply (M2), Political instability, Central bank borrowing for budgetary support, Bank institution borrowing, Domestic borrowing, External borrowing. (2000 Q1 – 2018 Q4)	The fiscal deficit was inflationary in Malaysia. Political instability represented a substantial role in moderating the relationship between fiscal deficit source of financing and inflation.
Oyeleke (2021)	ADRL	Nigeria	Fiscal deficit, interest rate, real exchange rate, and consumers price index. (1980 – 2015)	The fiscal deficit represented a key factor in determining inflation in Nigeria through the wealth effect of financing debt.

Author(s) (Year)	Methodology	Country	Variables (Period)	Results
Eita et al. (2021)	ADRL and Granger Causality	Namibia	CPI, fiscal deficit as a percentage of GDP, prime lending rate, and South Africa inflation rate. (2008 Q2 –2017 Q4)	<p>There was a non-linear functional relationship between the fiscal deficit and inflation over the reviewed period.</p> <p>There was a long-run relationship between the inflation rate, real exchange rate, fiscal deficit squared, and the interest rate.</p> <p>There was a positive long-run and short-run relationship between the fiscal deficit and inflation.</p>

Author(s) (Year)	Methodology	Country	Variables (Period)	Results
Sharma and Mittal (2021)	ADRL and NARDL	India	Wholesale price index, Central government fiscal deficit as a percentage of GDP, Money supply growth rate, Crude oil price as US\$ per barrel, Lending interest rate. (1980/81 – 2016/17)	There was a unidirectional causality from fiscal deficit to inflation.  There was a non-linear relationship between the fiscal deficit and inflation.

### **3. Monitoring Inflation and Fiscal deficit in Egypt (1981 – 2020)**

This section reviews the development of Egypt's inflation rate and fiscal deficit between 1981 and 2020. The analysis is divided into four sub-periods. Each period depicts the economic situation and changes in both variables over each decade.

#### **3.1 The Dominance of Public Sector (the 1980s)**

Although inflation was relatively moderate in the 1960s and early 1970s, it was accelerated after the first oil shock between 1973 and the mid-1980s ((CIA), 1982; Al-Mashat, 2011). Throughout the 1980s, Egypt experienced high and volatile inflation because of some macroeconomic imbalances (Mabrouk & Hassan, 2012). Egypt's economy struggled, as many other developing countries, with chronic problems such as severe inflation, a trade deficit, a severe fiscal deficit, a substantial external debt, and an inefficient public sector (Richards, 1991; Subramanian, 1997). Economic growth slowed in the second half of the 1980s as export earnings, oil prices, and remittances from Egyptian workers in Gulf countries declined (Abdel-Khalek, 1987). Because of market inefficiencies caused by administrative restrictions, the private sector was crowded out because of large-scale public ownership and low investment in human capital (Handy, 1998).

Although resources were depleted, the economy did not respond to external shocks. As a consequence of rising government spending, energy subsidies, and public-sector support, the fiscal deficit remained in double digits of the GDP in the second half of the 1980s. As a result, the central bank pursued an expansionary monetary policy to finance the fiscal deficit. As a consequence, the inflation rate rose to 20 percent by the end of the decade, and the economy entered a period of stagflation (Ynceler, 2001). The successive governments for this decade postponed effective economic reform initiatives. By the end of the decade, the government's inability to service debts was the most visible and dangerous sign of economic instability in Egypt (Ibrahim & Lofgren, 1996).

Figure 1 shows that the 1980s decade had the highest rates of fiscal deficit over the study's monitored period. The deficit was at 19.6 percent of the GDP on average during that decade. Furthermore, the year 1982 had the highest rate of the fiscal deficit over the monitored period, as it represented 25.3 percent of the GDP. Furthermore, the inflation rate did not fall to a single digit during the 1980s decade, averaging 17.6 percent. The highest inflation rate was 25.2 percent in 1987, while the lowest rate was 10.4 percent in 1981.

### **3.2 The Economic Reform and Structural Adjustment Programme (the 1990s)**

Following the enlargement of economic imbalances at the end of the 1980s, Egypt began implementing the economic reform and structural adjustment program (ERSAP) in 1991 with the goal to restore economic stability (Korayem, 1997). Additionally, structural adjustments were required to maintain medium and long-term economic growth. The government mobilised the needed support through agreements with the IMF, World Bank, African Development Bank, and other donors as well as rescheduling the debt by the Paris Club (AfDB, 1999).

The economic reform philosophy attempted to contain domestic demand, reduce government dominance of economic activities, and improve methods for managing public finance and financing fiscal deficits. The program measures included substantial fiscal adjustments through rationalising expenditure, reducing subsidies, improving administration and tax collection, introducing a sales tax, and increasing user fees for public goods such as electricity and petroleum (Omran, 2002).

Furthermore, the monetary policies implemented in the 1990s aimed to control the increase in domestic liquidity and achieve price stability by using indirect rather than direct instruments (El-Eyoun, 2003). A key component of the economic reform programme was the fixed exchange rate. The Central Bank of Egypt pegged and fixed the national currency to the US dollar after 1992. In addition, the central bank began shifting to a more flexible exchange rate system at the beginning of the 2000s

(Panizza, 2001). The reforms also included moving towards liberalizing interest rates markets, applying conservative monetary policies, and introducing the government's weekly auction of treasury bills (Handoussa, 1994). In order to move towards a market orientation economy, a privatization aspect was embodied in addition to deregulating prices and markets (Nelson & Sharp, 2013). Moreover, a social policy component was taken into account to mitigate the reforms' transitory effects on the poor and other vulnerable groups (AfDB, 2000).

The implementation of the economic reform programme led to remarkable results. The economic growth gradually rebounded over the decade, and the unemployment rate decreased. The inflation rate began falling gradually over the 1990s because of the reform program's implementation. On the side of public finance, the fiscal deficit decreased significantly from 15.2 percent of the GDP at the beginning of the decade to 6.4 percent of the GDP in 1992, afterward, it gradually decreased to 0.9 percent of the GDP in 1997 (Youssf, 2007).

The decrease of the fiscal deficit could be attributed to Paris Club, as it wrote off approximately half of Egypt's debt in 1991. As a result, Egypt had low external debt and became one of the most financially assisted economies over that period (AfDB & OECD, 2003). Foreign debt services as a percentage of current account receipts dropped significantly from 25.8 percent in the fiscal year 1990/91 to 7.2 percent in the fiscal year 1998/99 (Mof, 2004).

Figure 1 depicts the significant decrease in the inflation rate during the 1990s when the average inflation rate represented 9 percent. If we excluded the first two years, the rate would have remained around 6.8 percent. The highest inflation rate during this decade was 21.1 percent in 1992, while the lowest rate reached 2.8 percent in 2000. The 1990s also witnessed the lowest rates of the fiscal deficit over the monitored period. As the decade registered on average a fiscal deficit of 3.9 percent of the GDP. In addition, the lowest fiscal deficit rate as a percentage of the GDP over the four decades was registered in the fiscal year 1997 at a rate of 0.9 percent of the GDP.

### **3.3 The Third Generation of the Economic Reform program (the 2000s)**

The Egyptian government implemented an effective and well-managed economic reform program in the 1990s. The program led to steady economic growth and a significant reduction in inflation, the fiscal deficit, and the balance of payment position. However, at the beginning of the 2000s, the Egyptian economy confronted adverse external situations such as the 11th of September attacks which introduced a world economic slowdown. The deceleration of the world economy affected the primary sources of foreign exchange and the key factors of economic growth at that time. As a result, the economic growth was sluggish, and the fiscal deficit rate started to elevate (AfDB & OECD, 2003).

Between 1998 and 2004, the government launched the second generation of reforms that concentrated on institutional and trade measures. Its landmarks were the liberalisation of the Egyptian pound in January 2003 and the introduction of the unified banking and central bank law in June 2003 (Alissa, 2007). In July 2004, a new government started to intensify the implementation of the third generation of the economic reform. The economic reform included several measures that aimed to improve the fiscal position on both the revenues and the expenditures sides along with other structural reforms. The reform process focused on tax and customs reform as well as the launch of comprehensive banking and financial sector reforms. This reform package aided in bolstering economic growth and mitigating the effects of the global financial crisis (Ali, 2011). The fuel subsidy was reduced twice in September 2004 and July 2006, and the price of electricity was increased in December 2004. Furthermore, in 2005, the income tax law was modified to broaden the tax base, simplifying the rate structure, setting a minimum and higher threshold, and cutting down corporate and personal income tax rates. The stamp tax was streamlined and broadened in August 2006. Other reforms included the merge of the indirect tax and the income tax departments in 2006, the establishment of the

treasury single account, and the upgrading of the budget classifications (Alissa, 2007). Figure 1 illustrates the impact of those measures across the first decade of the 2000s.

The initial years of the decade recorded the most moderate rates of inflation, as the inflation rate was about 2.3 percent in 2002, and it was considered the lowest rate over the decade and the whole monitored period. The most substantial inflation rate was 16.2 percent in 2009, while the average inflation rate for the entire decade was about eight percent. As a result, we can say that over the 2000s, the inflation rate gradually increased in both rate and volatility. This increase in inflation can be attributed to many factors including the devaluation of the national currency in early 2003, excessive monetary growth, the increase in global food prices caused by the Avian Flu virus outbreak, the adjustments of local oil price, the lack of competition, market concentration in some industries, and the tendency of producers to engage in ad hoc pricing (Noureldin, 2008). As for the fiscal deficit, the 2000s decade started by maintaining the upward trend in the fiscal deficit to GDP ratio. In 2003 it reached its peak when it registered 10.4 percent of GDP. After the pace of economic reforms started to intensity in 2004, the fiscal deficit rates went on a downturn trend to register 6.8 percent and 6.9 percent in 2008 and 2009 respectively. Only in 2010, the fiscal deficit widened to be 8.1 percent of GDP to reflect the effect of the stimulus package applied in response to the global financial crisis. It is worth mentioning that the wide range of reforms that were taken place since 2004, the limited integration with global financial markets, and the low level of exposure to structured products made Egypt's economy resilient to the global financial crisis. The fiscal and monetary responses had also helped cushion the impact of the crisis (IMF, 2010).



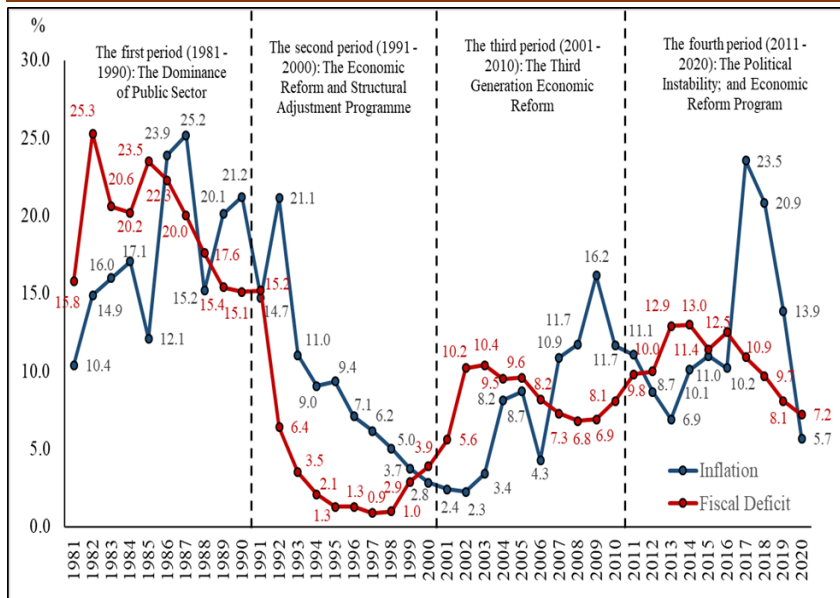


Figure 1: Inflation and fiscal deficit development in Egypt over the period of 1981 – 2020

Source:

EIP 2020. Egypt's Information Portal. In: THE CABINET, I. A. D. S. C. I. (ed.)

IMF 2020. World Economic Outlook Database. In: FUND, I. M. (ed.) October 2020.

WB 1986. Egypt - Current economic situation and economic reform program. Washington, D.C.: World Bank Group.

WB 1990. Arab Republic of Egypt Country Economic Memorandum

Economic Readjustment with Growth. The Main Report. Washington, D.C.: World Bank Group.

WB 1997. Arab Republic of Egypt Country Economic Memorandum. Statistical Annex. Washington, D.C.: World Bank Group.

WB 2020. World Bank Open Data. In: BANK, T. W. (ed.).

### **3.4 Political Instability and the new Economic Reform Programme (the 2010s)**

In the initial years of the second decade of the twenty-first century, Egypt experienced social and political tensions. The prolonged political transition and the underlying structural challenges led to major macroeconomic imbalances. The international reserves were depleted and competitiveness was weakened due to the significantly overvalued exchange rate. The large fiscal deficit, which was reflected in a high level of public debt, was a result of a growing public sector wage bill and poorly targeted subsidies combined with weak revenue (IMF, 2017). Following the 2011 uprising, the economic growth fell to less than two percent and averaged 2.9 percent in the first half of the decade. Moreover, the unemployment rate increased, particularly among the youth.

During this critical period, transitional governments focused on containing protests and appeasing the public through populist measures such as increasing government employment, wages and subsidies rather than implementing a meaningful economic plan and addressing the major economic problems. As a result, fiscal accounts deteriorated significantly resulting in an alarming increase in the fiscal deficit and government debt rates (Khan & Miller, 2016). However, in 2012 and 2013, the inflation rate fell to a single digit, and then it continued to rise afterward. In November 2016, the Egyptian government began implementing its economic reform agenda with the backing of a US\$12 billion (IMF extended fund facility). One of the key pillars of the economic reform program was the liberalization of the Egyptian pound in November 2016 (IMF, 2017). Furthermore, the fuel subsidy reform was completed in 2018 with the price of most products increased to cost recovery. At the end of 2018, the automatic fuel price indexation mechanism was also implemented. In addition, the program included replacing the sales tax with the value-added tax and taxing many goods and services which were exempt before. The reform also targeted substantial fiscal consolidation to ensure public debt

sustainability. Part of the fiscal savings was utilised to lessen the burden of the adjustments on the most vulnerable and the poor through expanding the social protection net. The economic reform programme, which started in 2016 and ended in 2019, led to a remarkable turnaround and corrected the large domestic and external imbalances.

In 2018, the inflation rate was 20.9 percent. However, the rate of inflation began slowing, reaching 13.9 percent in 2019 (IMF, 2019). Abdelraouf et al. (2019) study emphasised that excessive monetary growth and increased variability in relative prices were the major drivers of inflation in the first two decades of the twenty-first century in addition to the effects of currency depreciation and increases in energy prices.

In 2020, the outbreak of the COVID-19 pandemic has led to deep global recessions. However, the impact on Egypt's economy was less than expected compared to other MENA countries. The GDP continued to grow positively at 3.6 percent in 2020. The fiscal deficit and the public debt maintained their downward trajectory to register 7.2 percent and 88 percent of the GDP, respectively (IMF, 2021). Meanwhile, the inflation rate significantly decreased to 5.7 percent in 2020 (Figure 1).

Figure 1 depicts that the 2010s decade started by maintaining the upward trend in the fiscal deficit to GDP ratio. In 2014, it reached its peak when the fiscal deficit registered 13 percent of the GDP. After starting the implementation of the economic reform programme, the fiscal deficit rates went on a downturn trend even within the COVID-19 crisis to register 7.2 percent in 2020.

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

##### **4.1 Variables' Selection and Data**

This section analyses the long-run and the short-run relationships between the fiscal deficit and inflation in Egypt using the annual data from 1981 to 2020. The study involves seven variables: the annual inflation rate (average consumer prices percentage change) (I), the government's fiscal deficit as a percentage of GDP (Df), the real growth rate in domestic product denominated

in current local currency (GDP), the one local currency exchange rate to USD dollar (Ex), the broad money as a percentage of GDP (M2), the Interest rate (lending interest rate) (R), the country trade as a ratio of GDP (T), and the broad money annual growth (M2A). All the variables are transformed into their natural logs to avoid the heteroscedasticity problem (Gujarati et al., 2009).

The data for Ex, M2, R, T, GDP, and M2A were obtained from the World Bank's development indicators dataset. The data for I are sourced from the International Monetary Fund (the World Economic Outlook Database). Furthermore, the data for Df were obtained from various reports of the World Bank regional offices in Europe, the Middle East, and North Africa in addition to Egypt's Information Portal.

#### **4.2 Unit root tests**

All the variables' time series were examined for stationarity using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Table 2 shows the results of the ADF and PP tests for unit root. The results of the tests show that all variables have a unit root at levels and became stationary after taking the first difference.

Table 2: Results of ADF and PP unit root tests

Series	ADF			PP		
	At Levels	At First difference	Order of integration	At Levels	At first difference	Order of integration
I	-0.733527	-6.19022***	I(1)	-0.733527	-6.19022***	I(1)
Df	-0.895424	-2.99999***	I(1)	-0.903939	-4.06619***	I(1)
GDP	-1.089941	-3.08488***	I(1)	-1.029026	-10.09679***	I(1)
Ex	0.239395	-3.13165***	I(1)	1.201435	-3.02452***	I(1)
M2	0.009148	-5.09177***	I(1)	0.002614	-5.05407***	I(1)
T	-0.999138	-4.81073***	I(1)	-0.999138	-4.72201***	I(1)
R	-0.560781	-3.82031***	I(1)	-0.554049	-0.704824	I(1)

Notes: a. (\*\*\*) Denotes significant at one percent.

b. The interest rate unit root tests show mixed results. However, the researcher applied the Dickey-Fuller GLS (ERS) and tested the series for unit root at the first difference. The results indicate that the series is stationary at the first difference ( $t$ -statistic = -3.655579) (critical value at 5 percent = -3.770000)

### 4.3 The Co-Integration Analysis:

Since all the variables are integrated at the same level, checking for a long-term relationship among them is possible. The number of co-integration vectors is calculated using the Johansen co-integration test. According to the Maximum Eigenvalue and Trace tests, there is one co-integration vector among the variables (Table 3).

Table 3: Johansen Unrestricted Co-Integration Rank test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None*	0.7377	130.3552	111.7805	0.0020	50.8599	42.7722	0.0052
At most 1	0.6119	79.4952	83.9371	0.1005	35.9642	36.6302	0.0597
At most 2	0.3897	43.5309	60.0614	0.5402	18.7646	30.4396	0.6370

Note: (\*) Indicate one Co-integrating equation at the 0.01 level (Trace test) and 0.01 level (Maximum Eigenvalue).

#### 4.4 The Vector Error Correction Model (VECM)

After checking for co-integration between the variables, the vector error correction model was applied to analyse the short-run and long-run dynamics of the co-integrated series. The VECM equation is written as follows:

$$\Delta y_t = \Pi y_{t-1} + \Gamma_1 \Delta y_{t-1} + \dots + \Gamma_p \Delta y_{t-p} + u_t$$

Where  $\Pi = \alpha\beta'$ ;  $y_t = (I_t, Df_t, GDP_t, Ext, M2_t, T_t)$ ,  $\Delta$  is the differencing operator, and  $u_t$  is the white noise stochastic disturbance term. Matrix  $\alpha$  includes the speed of adjustment parameters, matrix  $\beta$  is the co-integrating matrix, and matrix  $\Gamma_i$  represents the short-run parameters. A lag length of (1) was chosen depending on minimising the LR (Sequential modified LR test), FPE (Final Prediction Error), HQ (Hannan-Quinn Information Criterion), and SC (Schwarz Information Criterion). The study also employed the Granger causality test to identify the relationship between inflation and fiscal deficit.

#### 4.5 Results

Table 4 shows the estimated long-run co-integration vector where the coefficient of inflation (I) is normalised to unity. The results of the co-integration vector indicate that there is a positive long-run relationship between inflation and deficit. The increase in the fiscal deficit elevates the inflation rate. Exchange rate, GDP and broad money also affect inflation positively in the long run. However, interest rate and trade openness tend to have a negative long-run effect on the inflation rate. The speed of adjustment coefficient shows that 0.29 percent of short-run disequilibrium tends to converge towards long-run equilibrium each year.

*Table 4: Estimated long-run co-integration vector*

$I_{t-1}$	$Df_{t-1}$	$GDP_{t-1}$	$Ex_{t-1}$	$M2_{t-1}$	$R_{t-1}$	$T_{t-1}$
1	-0.2856 (0.0871) [-3.2778]	-0.5211 (0.2042) [-2.5524]	-0.4652 (0.0953) [-4.8833]	-4.3540 (0.6357) [-6.8299]	3.0972 (0.5837) [5.3060]	2.5726 (0.5136) [ 5.0093]

**4.6 Diagnostic Tests:**

The study applied the LM test for serial correlation and residual White test for heteroscedasticity. The model diagnostic tests show no sign for residual serial correlation or heteroscedasticity (Table 5 and Table 6).



Table 5: VEC Residual Serial Correlation LM tests

Lags	LRE * Stat	Prob.
1	53.4268	0.3081
2	40.1795	0.8112

\* Degree of freedom is 49

Table 6: VEC Residual White Heteroscedasticity (No cross-terms) (Joint Test)

Chi-sq	Df	Prob.
456.8025	448	0.3766

To check the stability of the model, Figure 2 depicts the inverse roots of AR characteristic polynomial. All the points, except for one, lie within the circle which indicates that the model is stable.

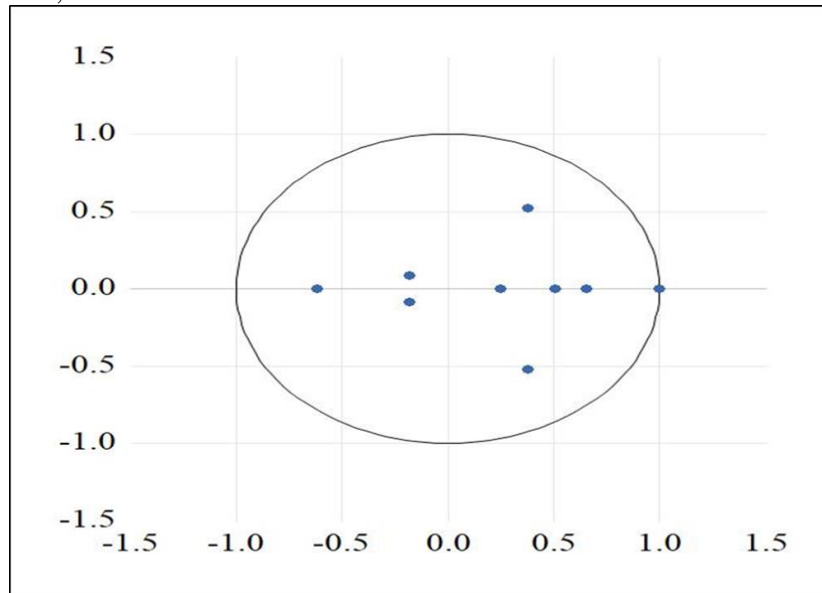


Figure 2: Inverse Roots of AR characteristic polynomial

#### 4.7 Causality Test:

Table 7 depicts the results of the Granger causality test among the variables of the study from 1981 to 2020 using the first lag period. To illustrate the relationship between fiscal deficit and broad money, the researcher preferred to use the annual growth of broad money (M2A) rather than using broad money as a percentage of

GDP (M2), since using the ratio of broad money to GDP may not precisely capture the casual relationship among money supply, deficit, and inflation. Having the GDP as a denominator to broad money may weaken the momentum of the yearly growth of broad money.

It is noted from table 7 that there is a mutual causal relationship in the first lag of the fiscal deficit as a percent of GDP (Df) and the inflation rate (I). The fiscal deficit as a percent of GDP (Df) also affects the annual growth of broad money (M2A) as well as the interest rate (R). Furthermore, the annual growth of broad money (M2A) affects the inflation rate (I) and the Interest rate (R) in the first lag. The results also show that the inflation rate (I) and the interest rate (R) do not have any relation in both directions, while the interest rate (R) has a causal effect on the fiscal deficit (Df).

Table 7: Granger Causality Results

Null hypothesis	Obs	F-statistic	Prob.
Df does not Granger Cause I	39	10.9767	0.0021
I does not Granger Cause Df		5.66630	0.0227
Df does not Granger Cause M2A	39	12.9535	0.0010
M2A does not Granger Cause Df		0.50063	0.4838
M2A does not Granger Cause I	39	17.9387	0.0002
I does not Granger Cause M2A		0.00356	0.9528
M2A does not Granger Cause R	39	10.3136	0.0028
R does not Granger Cause M2A		0.05778	0.8114
I does not Granger Cause R	39	0.47410	0.4955
R does not Granger Cause I		0.12923	0.7213
R does not Granger Cause Df	39	13.4828	0.0008
Df does not Granger Cause R		4.28730	0.0456

## 5. Discussion

Figure 3 simplifies and summarizes the relationship among the fiscal deficit, inflation, and other relevant variables used in the study depending on the results of the VECM and the Granger causality test. The results of the study suggest the existence of a positive long-run relationship between fiscal deficit and inflation

in Egypt, as the increase in fiscal deficit raises the inflation rate in the long run. In addition, the increase in GDP growth dominated in current local currency, broad money as a percentage of GDP, and the depreciation in local currency to GDP have a substantial increase on inflation in the long run, while interest rate and trade openness reduce inflation in the long run.

Furthermore, the Granger causality test results show that there is a clear two-way causality relation between the fiscal deficit and the inflation rate. It is also noted that the money supply reacts to the increase in fiscal deficit and becomes one of the sources that feed inflation. On the other hand, the interest rate responds to the change in fiscal deficit and money supply which also corresponds to the change in the fiscal deficit. Notably, there is no causal relationship between the change in inflation rate and interest rate. These results confirm the dominance of the fiscal policy on the monetary policy in Egypt.

Egypt's fiscal policy relied on financing a considerable part of the fiscal deficit through the growth in the money supply. Meanwhile, the central bank corresponds to the inflationary effect of the growth in money supply by changing the interest rate to content this effect. The increase in the interest rate elevates interest payment which is reflected in a further increase in the fiscal deficit. This creates a vicious circle among fiscal deficit, money supply growth, and interest rate (See figure 3).

The findings of the study are consistent with previously mentioned studies that demonstrated the direct relationship between fiscal deficit and inflation in Egypt, especially, the study of Elhendawy (2019) and Helmy (2008) that analysed the two-way relationship between both variables in Egypt (See table 1).

The present study has a limitation; it employed annual data rather than monthly or quarterly data. It is generally preferred to monitor changes in the inflation rate using monthly or quarterly data. However, the availability of data was the crucial factor in using annual data, and with a series of forty observations, we expect non-spurious results.

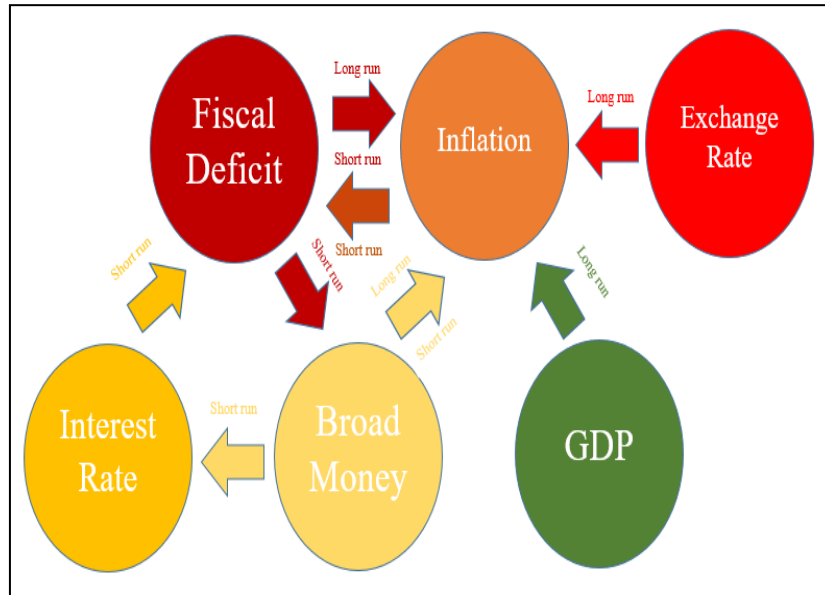


Figure 3: The long-run and the short-run interrelation among variables of the study

It is possible to build on that study by looking at breaking the vicious circle among the fiscal deficit, the money supply, and the interest rate to address the problem of inflation and fiscal deficit in Egypt. Such a study may include different scenarios to the impact of the change in the interest rate on fiscal deficit and inflation.

## 6. Conclusion

Egypt has struggled with a persistent fiscal imbalance and excessive inflation for decades. Due to COVID-19 and the launch of the economic reform programme in 2016, both variables have recently been going downward. The purpose of this study is to revisit the long-run and the short-run relationships between the fiscal deficit and inflation in addition to other relevant factors in Egypt's economy. The study applied the vector error correction model (VECM) and the Granger causality test using the data from 1981 to 2020. The findings show that, in the long run, the fiscal

deficit has a considerable impact on inflation, since the rate of inflation rises as the fiscal deficit rises. Fiscal deficit, money supply growth, GDP growth, and national currency devaluation have a direct impact on increasing inflation in the long run, while the interest rate and trade openness decreases inflation in the long run. The granger causality tests showed that there is a mutual effect between fiscal deficit and inflation in the short run. Moreover, the results of Granger causality tests showed that fiscal deficit, the growth in money supply, and interest rate are interacting in a vicious circle that worsening the situation of the fiscal deficit and inflation.

As a result, one of the prime keys to solving the problems of inflation and fiscal deficit in Egypt is to break the vicious circle among the fiscal deficit, the growth in the money supply, and the interest rate. Breaking such a circle requires considering the dominance of the fiscal policy on the monetary policy. Therefore, applying appropriate interest rates that enable the economy to grow sustainably while controlling the fiscal deficit and the money supply is a pivotal point in dealing with the chronic problem of inflation and deficit in Egypt.

### References

- [1]. (CIA), C. I. A. (1982). *Inflation in Egypt: Causes and Impact*. Retrieved from <https://www.cia.gov/library/readingroom/docs/CIA-RDP83S00854R000100080005-3.pdf>
- [2]. Abdel-Khalek, G. (1987). Country Study 9. In (Vol. 1987). Helsinki, Finland: UNU-WIDER.
- [3]. Abdelraouf, N., El-Abbadi, H., & Noureldin, D. (2019). Inflation Dynamics in Egypt: Structural Determinants Versus Transitory Shocks. *The Egyptian Centre for Economic Studies (ECES) Working Papers*(201).

- [4]. AfDB. (1999). *Arab Republic of Egypt Structural Adjustment Loan 1991-1994, Project Completion Report 1999-2001*. <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/ADB-BD-IF-99-130-EN-EGYPT-PCR-SAL.PDF>
- [5]. AfDB. (2000). *Egypt Economic Reform and Structural Adjustment Programme*. African Development Bank Group. <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Evaluation-Reports-Shared-With-OPEV/05092259-EN-EGYPT-ECONOMIC-REFORM-AND-SAP.PDF>
- [6]. AfDB, & OECD. (2003). *African Economic Outlook 2003*. African Development Bank/ OECD. <https://doi.org/doi:https://doi.org/10.1787/aeo-2003-en>
- [7]. Al-Mashat, R. (2011). The Evolution of Monetary Policy in Egypt and Steps towards Inflation Targeting. In M. Boughzala & D. Cobham (Eds.), *Inflation Targeting in MENA Countries: An Unfinished Journey* (pp. 230 - 255). Palgrave Macmillan. <https://doi.org/DOI 10.1057/9780230316560>
- [8]. Ali, H. A. M. (2011). Inflation Dynamics: The Case of Egypt. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1987425>
- [9]. Alissa, S. (2007). The political economy of reform in Egypt: understanding the role of institutions. In (Vol. 5). Washington DC: Carnegie Endowment for International Peace
- [10]. Anantha Ramu, M. R., & Gayithri, K. (2017). Fiscal deficit and inflation linkages in India: tracking the transmission channels. *Journal of Social and Economic Development*, 19(1), 1-24. <https://doi.org/10.1007/s40847-017-0042-2>
- [11]. Asandului, M., Lupu, D., Maha, L.-G., & Viorică, D. (2021). The asymmetric effects of fiscal policy on inflation and economic activity in post-communist European countries. *Post-Communist Economies*, 1-21. <https://doi.org/10.1080/14631377.2020.1867430>
- [12]. Catão, L., & Terrones, M. E. (2003). Fiscal Deficit and Inflation. *IMF Working Paper, WP/03/65*.

- [13]. EIP. (2020). *Egypt's Information Portal*. <https://www.eip.gov.eg/IDSC/DMS/View.aspx?id=3665>
- [14]. Eita, J. H., Manuel, V., Naimhwaka, E., & Nakusera, F. (2021). The Impact of Fiscal Deficit on Inflation in Namibia. *Journal of Central Banking Theory and Practice*, 10(1), 141-164. <https://doi.org/10.2478/jcbtp-2021-0007>
- [15]. El-Eyoun, M. A. (2003). Monetary Policy in Egypt: A Vision for the Future. *The Egyptian Centre for Economic Studies (ECES) Working Papers*(78). [http://www.eces.org.eg/cms/NewsUploads/Pdf/2019\\_1\\_12-15\\_42\\_723.pdf](http://www.eces.org.eg/cms/NewsUploads/Pdf/2019_1_12-15_42_723.pdf)
- [16]. El-Sakka, M. I. T., & Ghali, K. H. (2005). The Sources of Inflation in Egypt: A Multivariate Co-integration Analysis. *Review of Middle East Economics and Finance*, 3(3). <https://doi.org/10.2202/1475-3693.1046>
- [17]. Elhendawy, E. O. (2019). Coordination or Dominance of Fiscal and Monetary Policy in Egypt. *International Journal of Economics and Finance*, 11(12). <https://doi.org/10.5539/ijef.v11n12p28>
- [18]. ErdİL ŞAHİN, B. (2019). Analysis of the Relationship between Inflation, Budget Deficit and Money Supply in Turkey by Ardl Approach: 1980-2017. *Journal of Life Economics*, 6(3), 297-306. <https://doi.org/10.15637/jlecon.6.018>
- [19]. Erer, E., & Erer, D. (2019). The Role of Budget Deficit on Rise in The Inflation Rate in Non-Ricardian Fiscal Policies: An Approach of Time-Varying Parameters Model. *BRAND. Broad Research in Accounting, Negotiation and Distribution*, 10(1), 64 - 71.
- [20]. Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2009). *Basic econometrics* (Fifth Edition ed.). McGraw-Hill/Irwin. [https://cbpbu.ac.in/userfiles/file/2020/STUDY\\_MAT/ECO/1.pdf](https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ECO/1.pdf)
- [21]. Handoussa, H. (1994). Role of the state: the case of Egypt. Working paper series/Economic Research Forum; 9404,

- [22]. Handy, H. (1998). *Egypt Beyond Stabilization. Toward a Dynamic Market Economy* [Occasional Papers]. International Monetary Fund. <https://doi.org/https://doi.org/10.5089/9781557757203.084>
- [23]. Hashem, H. Y. M. (2017). Inflation in Egypt: A fiscal or monetary phenomenon? *Business and Economic Horizons*, 13(4), 522-535. <https://doi.org/10.15208/beh.2017.36>
- [24]. Helmy, O. A. (2008). The Impact of Budget Deficit on Inflation in Egypt. *The Egyptian Centre for Economic Studies (ECES) Working Papers*(141). [http://www.eces.org.eg/cms/NewsUploads/Pdf/2019\\_1\\_13-21\\_13\\_1616.pdf](http://www.eces.org.eg/cms/NewsUploads/Pdf/2019_1_13-21_13_1616.pdf)
- [25]. Ibrahim, S. E., & Lofgren, H. (1996). Successful Adjustment and Declining Governance? The Case of Egypt. [PSD Occasional Paper]. *World Bank Private Sector Development Department Essays on Governance, Leadership and Communication. Washington, DC: World Bank*(8), 74. <http://documents1.worldbank.org/curated/en/236971492969652301/pdf/multi0page.pdf>
- [26]. IMF. (2010). *Arab Republic of Egypt: 2010 Article IV Consultation—Staff Report; Public Information Notice on the Executive Board Discussion; and Statement by the Executive Director for the Arab Republic of Egypt* (IMF Country Report, Issue. IMF. [https://www.imf.org/~media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/scr/2010/\\_cr1094.ashx](https://www.imf.org/~media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/scr/2010/_cr1094.ashx)
- [27]. IMF. (2017). *Arab Republic of Egypt: Request for Extended Arrangement Under the Extended Fund Facility — Press Release; Staff Report; and Statement by the Executive Director for the Arab Republic of Egypt* (IMF Country Report, Issue. IMF. <https://www.imf.org/~media/Files/Publications/CR/2017/cr1717.ashx>



- [28]. IMF. (2019). *Arab Republic of Egypt: Fifth Review Under the Extended Arrangement Under the Extended Fund Facility—Press Release; Staff Report; and Statement by the Executive Director for the Arab Republic of Egypt* (IMF Country Report, Issue. IMF. <https://www.imf.org/en/Publications/CR/Issues/2019/10/10/Arab-Republic-of-Egypt-Fifth-Review%20Under-the-Extended-Arrangement-Under-the-Extended-Fund-48731>
- [29]. IMF. (2021). *Arab Republic of Egypt: First Review Under the Stand-by Arrangement and Monetary Policy Consultation—Press Release; Staff Report; and Statement by the Executive Director for the Arab Republic of Egypt* (IMF Country Report, Issue. IMF. <https://www.imf.org/-/media/Files/Publications/CR/2021/English/1EGYEA2021001.ashx>
- [30]. Khan, H., Marimuthu, M., & Lai, F.-W. (2020). Fiscal Deficit and Its Less Inflationary Sources of Borrowing with the Moderating Role of Political Instability: Evidence from Malaysia. *Sustainability*, 12(1). <https://doi.org/10.3390/su12010366>
- [31]. Khan, M., & Miller, E. (2016). The Economic Decline of Egypt After the 2011 Uprising. In: Atlantic Council.
- [32]. Korayem, K. (1997). Egypt's Economic Reform and Structural Adjustment (ERSAP). (19), 32. [http://www.eces.org.eg/cms/NewsUploads/Pdf/2019\\_1\\_7-9\\_50\\_21aaa.pdf](http://www.eces.org.eg/cms/NewsUploads/Pdf/2019_1_7-9_50_21aaa.pdf)
- [33]. Mabrouk, A. F., & Hassan, S. M. (2012). Evolution of Monetary Policy in Egypt: A Critical Review. *The International Journal of Social Sciences*, 4(1), 9 - 37.
- [34]. Mof. (2004). *Egyptian Economic Review*. Arab Republic of Egypt Ministry of Finance
- [35]. Nelson, R. M., & Sharp, J. M. (2013). *Egypt and the IMF: Overview and Issues for Congress* (Vol. 29). Congressional Research Service. <https://fas.org/sgp/crs/mideast/R43053.pdf?>

- [36]. Nguyen, V. B. (2015). Effects of fiscal deficit and money M2 supply on inflation: Evidence from selected economies of Asia. *Journal of Economics, Finance and Administrative Science*, 20(38), 49-53. <https://doi.org/10.1016/j.jefas.2015.01.002>
- [37]. Nouredin, D. (2008). Relative price adjustment and inflation dynamics: The case of Egypt. *The Egyptian Centre for Economic Studies (ECES) Working Papers*(133). [http://www.eces.org.eg/cms/NewsUploads/Pdf/2019\\_1\\_13-19\\_2\\_17.pdf](http://www.eces.org.eg/cms/NewsUploads/Pdf/2019_1_13-19_2_17.pdf)
- [38]. Omran, M. (2002). *Testing for a significant change in the Egyptian economy under the economic reform programme era*. WIDER Discussion Paper. <https://www.wider.unu.edu/sites/default/files/dp2002-59.pdf>
- [39]. Oyeleke, O. J. (2021). On the Non-Linear Relationship between Fiscal Deficit and Inflation: The Nigeria Experience. *International Advances in Economic Research*, 27(2), 105-117. <https://doi.org/10.1007/s11294-021-09822-7>
- [40]. Panizza, U. (2001). Macroeconomic Policies in Egypt: An Interpretation of the Past and Options for the Future. *The Egyptian Centre for Economic Studies (ECES) Working Papers*(61). [http://www.eces.org.eg/cms/NewsUploads/Pdf/2019\\_1\\_12-8\\_29\\_161.pdf](http://www.eces.org.eg/cms/NewsUploads/Pdf/2019_1_12-8_29_161.pdf)
- [41]. Richards, A. (1991). The political economy of dilatory reform: Egypt in the 1980s. *World Development*, 19(12), 1721-1730. [https://doi.org/https://doi.org/10.1016/0305-750X\(91\)90015-A](https://doi.org/https://doi.org/10.1016/0305-750X(91)90015-A)
- [42]. Sharma, V., & Mittal, A. (2021). Revisiting the Dynamics of the Fiscal Deficit and Inflation in India: the Nonlinear Autoregressive Distributed Lag Approach. *Economy of Region*, 17(1), 318-328. <https://doi.org/10.17059/ekon.reg.2021-1-24>
- [43]. Ssebulime, K., & Edward, B. (2019). Budget deficit and inflation nexus in Uganda 1980–2016: a cointegration and error correction modeling approach. *Journal of Economic Structures*, 8(1). <https://doi.org/10.1186/s40008-019-0136-4>

- [44]. Subramanian, A. (1997). The Egyptian Stabilization Experience : An Analytical Retrospective. *IMF Working Paper*, 97(105), 61.
- [45]. WB. (1986). *Egypt - Current economic situation and economic reform program* (6195-EGT). <http://documents.worldbank.org/curated/en/506061468262750003/Egypt-Current-economic-situation-and-economic-reform-program>
- [46]. WB. (1990). *Arab Republic of Egypt Country Economic Memorandum Economic Readjustment with Growth* (7447-EGT). (The Main Report, Issue. <http://documents.worldbank.org/curated/en/359861468023404932/Main-report>
- [47]. WB. (1997). *Arab Republic of Egypt Country Economic Memorandum* (7447-EGT). (Statistical Annex, Issue. <http://documents.worldbank.org/curated/en/359861468023404932/Main-report>
- [48]. WB. (2020). *World Bank Open Data*. <https://data.worldbank.org>
- [49]. Ýnceler, K. H. (2001). Financial Structure of Egypt. *Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC)*. <https://www.sesric.org/files/article/33.pdf>
- [50]. Youssf, H. A.-G. (2007). Towards Inflation Targeting in Egypt Fiscal and institutional reforms to support disinflation efforts. *Economic Paper*(288). <https://doi.org/doi.org/10.2139/ssrn.1715379> (European Commission)
- [51]. Živkov, D., Kovačević, J., & Lončar, S. (2020). Is Inflation a Monetary Phenomenon in the East European Economies? – Multifrequency Bayesian Quantile Inference. *Ekonomický časopis*, 68(8), 787-810. <https://doi.org/10.31577/ekoncas.2020.08.02>

