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IMPACT OF MONEY SUPPLY ON INFLATION RATE IN EGYPT: A VECM APPROACH

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Abstract. In this work, the research team employed a VECM regression model to evaluate the relationship between money supply and inflation rate (INF) in Egypt from 1990 to 2019. The model includes four independent variables: money supply (MS), imports (IMP), Gross Domestic Product (GDP), and exchange rate (EXCH). A Johansen-Juselius co-integration test and a Vector Error Correction Model were used to determine the existence of long-term and short-term links between the variables. The results demonstrated the existence of co-integrating links between the variables. Aside from the effects of GDP, all independent factors had a positive effect on the inflation rate. Depending on the results, the money supply is the primary long-term predictor of the inflation rate in Egypt.

Keywords: *Exchange rate, GDP, inflation rate, importations, money supply, VEC.*

JEL Classifications: C32, E51, P24, P44

INTRODUCTION

The objectives of monetary policy are set by the monetary authorities to achieve the economic balance of the country. These objectives are to stabilize the general level of prices (Wray, 2000), as instability means the propensity of a country to undermine major crises especially if the devaluation of the currency leads to inflation rate.

Hence, since the money supply also affects price levels, monetary stability can help maintain price stability (Ryczkowski, 2021). Inflation rate in the Egyptian economy is generally thought of as a complex phenomenon, which however tends to be greatly grown as a result of several factors. The recorded increase of inflation rate in the Egyptian economy shows clearly the failure of the existing economy policies in maintaining the stability of the general level of prices. Notwithstanding this fact, the average rate of inflation rate in Egypt reached 10.04 % during 2000–2019, which reflected the speed of product price change explaining the general rise in commodity and service prices. To sum up, it has been confirmed that there is a major effect of economic inflation rate on the Egyptian economy.

The aim of the present research is to investigate the relationship between money supply and inflation in Egypt. The VECM regression model is used to assess co-

integration and the Error Correction Model in order to determine short-run and long-run causation.

Money supply is one of the key factors of inflation, and many industrialized and emerging countries have faced and continue to face the enormous challenge of inflation throughout history. Higher inflation has severe negative impacts and must be kept within its limits. As a result, it should be investigated for policy development and implications in order to maintain it within bounds. Because of the positive influence on various income earning groups, creeping inflation is acceptable in the speed of economic expansion. Some economists feel that a low and constant inflation rate of 3 % carries a minor economic cost (Mankiw, 2011). According to available empirical evidence, Egypt has experienced moderate inflation.

This paper is organized into three sections: section one contains the literature review, section two presents the data and methods, and section three includes the results and discussion.

1. LITERATURE REVIEW

Reviewing of the available literature, there have been several research examining the determinants of the inflation rate using different methodologies, time spans, and geographical regions.

In this context, a study examines the trends of inflation in Egypt from 1980 to 2009 (Ali, 2012) in order to evaluate "Inflation Dynamics" in Egypt throughout three subperiods – the 1980s, the 1990s, and the first decade of the new millennium. The study used a Vector Auto Regressive model (VAR) and other econometrics models. The study concluded that Egypt's Inflation Dynamics were entirely distinct from those observed worldwide. Inflation rates in Egypt have become increasingly persistent, particularly since 2000; inflation shocks now have a long-term impact on future inflation rates.

El-Sakka & Ghali (2005) investigated the causes of Egypt's inflation. A vector error-correction model was used to examine the presence of a long-run link between the consumer price index, real gross domestic product (GDP), exchange rate, interest rate, money supply, and world prices. The key findings of this study that are relevant to Egypt's monetary policy indicated that structural changes aimed at enhancing the country's productive capacity, reducing the budget deficit, and limiting the government's access to credit were essential for containing inflation.

Using an Autoregressive Distributed Lag (ARDL) model, Mansoor et al. (2018) investigated the link between money supply, price level, and economic growth in Pakistan for the time period covered between 1980 and 2016. The findings found that there was no long link between the price and income modelling. Ofori-Frimpon et al. (2017) studied the effect of money supply on inflation rate in Ghana using annual data from 1967 to 2015 to test the model. The research was restricted to using money supply as an independent variable on the dependent variable, which was an inflation rate. The results showed that there was a long-run positive link between money supply and inflation rate based on an Ordinary Least Square (OLS) method. (Shelley & Wallace, 2005) investigated supply money growth/CPI

inflation rate link in the United States using an annual data collected during the period from 1900 through 1960. For this data sample, the authors found a strong negative link between filtered money growth and CPI inflation rate in all examined frequency. (Nyumuah et al., 2018) defined the impact of policy instruments for capturing the variations in inflation rate and economic growth in Ghana using Dynamic Ordinary Least Squares (DOLS) estimator and inflation rate targeting (IT) framework. The results provided insights as to why IT strategy was effective in sustaining price stability. (Bozkurt, 2014) addressed money, inflation rate and growth link in Turkey by using co-integration test. The author used quarterly data of money supply, GDP, velocity of money and deflator collected over a period of 1999.2–2012.2 (monthly). The findings confirmed that there was a strong positive link between inflation rate, money, and growth. They also assured that money supply and velocity of money were the main determinant of inflation rate in the long-run in Turkey.

According to the Fisher equation of exchange, the quantity of money multiplied by its velocity equals the price level multiplied by the quantity of products sold. It is sometimes expressed as $MV = PQ$, where M is the amount of money, V is the velocity of money (the number of times in a year a currency generates a currency's worth of revenue), P is the price level, and Q is the quantity of real commodities sold (real output) (Ajuzie et al., 2008).

Table 1. A Systematic Rapid Literature Review

Author	Study Title	Period & Sample	Technique	Results
(Hicham, 2020)	Money supply, Economic Growth and inflation rate: Co-Integration and Causality Analysis	1970–2018 in Algeria	Co-Integration and Causality Analysis	The findings lend credence to the monetarist theory of inflation rate on the grounds that an increase in the money supply has no effect on the rate of economic growth.
Mansoor et al., 2018	Keynesian and monetarist perspectives on the relationship between Pakistan's money supply, price level, and economic growth	1980–2016 Pakistan	ARDL Co-integration Technique	The results indicate that economic development is required for a nation's sound economic policies to stabilize the money supply and price level.
Ditimi et al., 2018	The Upshot of money supply and inflation rate inflation rate in Nigeria	1970–2016 Nigeria	ARDL-ECM Approach	The results indicate that money supply is not a significant factor in Nigeria's inflation rate.
Ezeibekwe, 2020	Domestic Investment and Monetary Policy in	1981–2018 Nigeria	VECM technique	The empirical findings indicate that the influence of interest

	Nigeria: The inflation rate's role			rates on investment is contingent on the amount of inflation rate.
Sultana, 2018	The influence of money supply, inflation rate, and interest rate on economic growth: A case study of Bangladesh	1981–2016 Bangladesh	Autoregressive Distributive Lag (ARDL) Cointegration Technique	The results reveal that money supply and economic growth exhibit a significant and positive relationship whereas the link between inflation rate and economic growth is positive but insignificant in the long-run.
Oruc, 2020	Evidence from Turkey on the relationship between inflation rate, interest rate, and money supply	monthly data for 2006–2018 Turkey	Johansen Cointegration and Granger Causality Tests	The findings reveal that monetary policies aimed at limiting aggregate demand within the context of anti-inflationary policies are not a viable economic choice for Turkey.
Joshi, 2021	Impact of money supply on inflation rate in Nepal: Empirical Evidence from ARDL Bounds Test	1964/65 to 2018/19 Nepal	ARDL Bounds test	The results show that the variables exhibit long-run co-integration, with the error correction term being negative (–0.98) and statistically significant (p=0.02).

Source: summary of the research team

Using the results shown in Table 1, there is a strong positive link between inflation rate, money supply, and economic growth.

Table 1 reveals a lack of studies measuring the effect of money supply on inflation rate in Egypt and the Arabic countries. The objective of the present study is therefore to fill this gap using various techniques and econometric methods. There is a significant link between the variables: money supply, inflation rate, and economic growth. The paper examines the impact of money supply on inflation rate with the use of a co-integration analysis in a panel of vector error-correction (VEC) models.

2. DATA AND METHODOLOGY

2.1. Source of Data

The examination of Egypt's annual time series data from 1990 to 2019 is utilized as a dependent variable. Inflation rate is measured using the Consumer Price Index (CPI) (annual %) (see Table 2). Gross Domestic Product (GDP) is

expressed in (current US$) money supply (current LCU). Importation is expressed in (current US$) and the exchange rate is expressed in official exchange rate (LCU per US$, period average) as independents variables.

Table 2. Variable Definition

Variable Name	Definition	Source
INFATION	Inflation rate, consumer prices (annual %)	Word Bank data
SUPPLY MONEY	Broad money (current LCU)	Word Bank data
IMPORTATIONS	Import of goods ($ US courants)	Word Bank data
GDP	Gross domestic product ($ US courants)	Word Bank data
EXCHANGE RATE	Exchange rate (Official exchange)	Word Bank data

Source: Summary of the research team

2.2. Model Specification

This study takes into account the guidance on the methodologies of Hicham (2020), Ezeibekwe (2020) and Oruc (2020) with just some modifications to the variables and technology employed to fit the data and the case study of Egypt. This study employed a unit-root test, co-integration test; vector error correction (VEC) model. The VECM model is a simplified version of the VAR model for variables. (Al-Qudah, 2019), which are co-integrated with OLS method to estimate the impact of money supply on inflation rate.

The following function is dependent on the general model employed in the study:

$$\mathrm{INF} = \mathrm{F}(\mathrm{MONEY}, \mathrm{GDP}, \mathrm{IMP}, \mathrm{EXCH}). \quad (1)$$

The study used a final form of VECM selected according to the proposed approach.

2.2.1. Equation of the Model

$$\Delta \mathrm{INF}_t = \beta 0 + \sum_{i=0}^{n} \beta 1 \Delta \mathrm{INF}_{t-1} + \sum_{i=0}^{n} \beta 2 \Delta \mathrm{MONEY}_{t-1} + \sum_{i=0}^{n} \beta 3 \Delta \mathrm{INF}_{t-1} + \sum_{i=0}^{n} \beta 4 \Delta \mathrm{GDP}_{t-1} + \sum_{i=0}^{n} \beta 5 \Delta \mathrm{EXCH}_{t-1} + \beta 6 \mathrm{EC}_{t-1} + U_t, \quad (2)$$

where

Δ is the 1st difference, t: time;

EC_{t-1} is the one-period lagged error-correction term;

$\beta 6$ is the long-run coefficient of error correction term;

U_t is the error term, t: time;

$\beta 0$ is the intercept (constant);

$\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$, $\beta 5$ are the coefficients; and U_t is the error term.

2.2.2. Trends in the Data

The gross domestic product has increased from 4.3 milliard ($ US) in 1990 to 303.08 milliard ($ US) in 2019. It had an upward rising trend throughout the study period (see Fig. 1). Money supply increased from 8.25 milliard ($ US) in 1990 to 411 milliard ($ US) in 2019. Inflation rate had a mixed trend of rise and fall during the study period. It was at the highest level of 29.5 % in 2017 while it was at the minimum level of 2.27 % during 2001 due to Egypt's abandonment of the Egyptian pound's peg to the US dollar, in addition to the rise in interest rates. Import increased from 9.22 milliard ($ US) in 1990 to 16.02 milliard ($ US) in 1999. It decreased to 12.95 milliard ($ US) in 2003. However, it had a rising trend from 2004 to 2015.

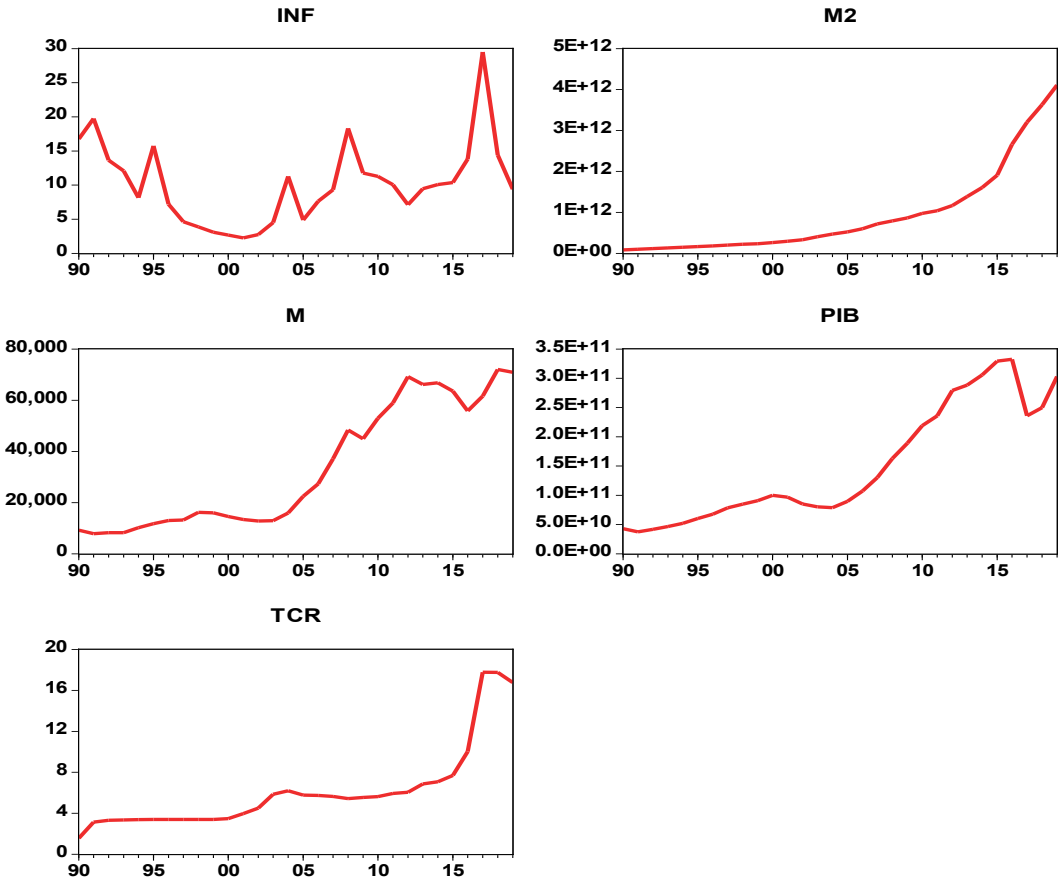

Fig. 1. Trend in INF, GDP, IMP, MS State Bank Publication, Economic Surveys of different years (Bozkurt, 2014; World Bank Open Data, n.d.).

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistics

This section begins with some preparatory work (descriptive statistics, unit-root test and co-integration test, VECM) analysis on the variables used herein in an

attempt to test whether or not money supply has an impact on the inflation rate in Egypt. As a result, the following findings are provided in Table 3.

Table 3. Descriptive Statistics of Variables in the Study Model

	Log(INF)	**Log(MONEY)**	**Log(IMP)**	**Log(GDP)**	**Log(EXCH)**
Mean	1.985410	9.650433	25.08718	26.32255*	1.383541
Median	2.066263	9.495011	25.13640	26.23319*	1.233561
Maximum	2.983080	10.78688	25.96579	27.48830*	1.823943
Minimum	0.819673	8.969796	24.34461	25.13606*	0.438255
Std. Dev.	0.700853	0.542397	0.438891	0.711317	0.335629
Skewness	−0.199433	0.834362	0.089395	0.108665	−0.785468
Kurtosis	1.710606	2.749446	2.483052	1.902185	4.099873
Jarque-Bera	1.518025	2.372850	0.249334	1.043692	3.064634
Probability	0.468128	0.305311	0.882791	0.593424	0.216035
Sum	39.70820	193.0087	501.7436	526.4511	27.67083
Observations	20	20	20	20	20

*Maximum values

Source: The author's computation using Eviews 10 software

Descriptive statistics demonstrate the unique properties of the data (Amassoma et al., 2018) in Table 3; for example, the average mean value of Log(GDP) is 26.32255, i.e. real gross domestic product, is the greatest (i.e. Log(INF) = 1.985410, Log(MONEY) = 9.650433, Log(IMP) = 25.08718, Log(EXCH) = 1.383541).

Table 3 also confirms that 27.48830 is the maximum and 0.438255 is the minimum. It is obvious that the Log(GDP) has the highest standard deviation and is very volatile.

Skewness and kurtosis were also calculated from 20 observations. The results show that all variables are positively skewed except for the values of Log(INF) and Log(EXCH), which are negative and hence imply that they are left long tail. The results of the Jarque-Bera (JB) test show that all variables in the model are normally distributed, and that the variables are first differentiated and then computed by a ratio relative to the prior observation.

3.2. Stationary Testing

To validate the unit-root test, the researchers used the Augmented Dickey-Fuller (ADF) test (Amassoma et al., 2018). The null hypothesis (H0) stating that the variables possess a unit-root was established (Amassoma et al., 2018). The null hypothesis (H0) of a unit-root was not rejected, as expected, after the test was completed and based on the p-value and t-statistics. As a result, none of the variables was stationary at the level. However, after calculating the first difference between these variables, they became stationary using the ADF test, as shown in Table 4. We proceed to establish if there any relationship between the variables in the long run.

Table 4. Phillips Perron Unit-Root Test Results

UNIT ROOT TEST TABLE (PP)						
	At Level					
		Log(INF)	Log(MONEY)	Log(IMP)	Log(GDP)	Log(EXCH)
With Constant	t-Statistic	–2.1306	1.2327	–0.4756	–0.7172	–1.1518
	Prob.	*0.2348*	*0.9976*	*0.8823*	*0.8269*	*0.6810*
With Constant & Trend	t-Statistic	–2.2038	–0.8653	–2.1228	–1.9909	–2.7579
	Prob.	*0.4700*	*0.9468*	*0.5123*	*0.5817*	*0.2229*
Without Constant & Trend	t-Statistic	–0.7852	11.6384	2.1808	2.4523	1.9889
	Prob.	*0.3672*	*1.0000*	*0.9913*	*0.9954*	*0.9867*
	At 1st Difference					
		d(Log(INF))	d(Log(MONEY))	d(Log(IMP)	d(Log(GDP))	d(Log(EXCH))
With Constant	t-Statistic	–5.9626	–3.2792	–3.7761	–3.6671	–5.7428
	Prob.	*0.0000****	*0.0257***	*0.0081****	*0.0105***	*0.0001****
With Constant & Trend	t-Statistic	–6.0630	–3.6245	–3.6664	–3.6844	–6.9982
	Prob.	*0.0002****	*0.0457***	*0.0419***	*0.0404***	*0.0000****
Without Constant & Trend	t-Statistic	–6.0647	–1.0767	–3.1168	–2.8274	–5.4323
	Prob.	*0.0000****	*0.2478*	*0.0030****	*0.0064****	*0.0000****

Source: The author's computation using Eviews 10 software

3.3. Johansen-Juselius Co-integration Test

This paper uses Johansen-Juselius Co-integration (Bozkurt, 2014) test to demonstrate if there is a long-run link among the variables. Because all the time series are non-stationary (Ferdousi & Qamruzzaman, 2017), we adopt the VAR (Vector Autoregressive) order of 2 as selected using Akaike Information Criterion (AIC) test based on the levels of VAR model (see Table 5). The findings from JJ co-integration tests propose that there is a unique long-term or equilibrium link between the used variables. There is only one co-integrating vector, according to both trace statistics and -max statistics at 5 % significance level (see Table 6).

Table 5. Optimally Selected Akaike Criteria of Model

Lag	LogL	LR	AIC	SC	FPE	HQ
1	146.8118	NA	–8.700842	–7.511373*	1.17e-10	–8.337209
2	180.4754	43.28185*	–9.319674*	–6.940738	7.27e-11*	–8.592410*

Source: The author's computation using Eviews 10 software

Johansen-Juselius test uses p-values given by MacKinnon et al. (1999). Only the trace statistics for estimating hypothesis was used. As it is clear from Table 6, when $r = 0$, the trace statistics exceeds the 5 % critical value which shows rejecting

null-hypothesis, i.e., a null hypothesis (H0) of having no co-integrating equation has been rejected and a null hypothesis (H0) of $r \leq 0$, i.e. there is one co-integrating equation, has been accepted. Thus, the long run link has been reached. The next process is to go through the VECM.

Table 6. Johansen-Juselius Co-integration Tests Results

Unrestricted Co-integration Rank Test (Trace)					
Hypothesized	Null hypothesis		Trace	0.05	
No. of CE(s)		Eigenvalue	Statistic	Critical Value	Prob.**
None*	$r = 0$	0.809066	90.10806	69.81889	0.0005
At most 1	$r \leq 1$	0.500004	43.74483	47.85613	0.1154
At most 2	$r \leq 2$	0.393669	24.33650	29.79707	0.1866
Trace test indicates 1 co-integrating eqn(s) at the 0.05 level					
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)					
Hypothesized	Null hypothesis		Max-Eigen	0.05	
No. of CE(s)		Eigenvalue	Statistic	Critical Value	Prob.**
None*	$r = 0$	0.809066	46.36323	33.87687	0.0010
At most 1	$r \leq 1$	0.500004	19.40833	27.58434	0.3836
At most 2	$r \leq 2$	0.393669	14.00922	21.13162	0.3643
Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level					

Source: The author's computation using Eviews 10 software

3.4. VECM Results

Based on stationary ADF tests and co-integration tests (maximum eigenvalue and trace), it is evident that the research variables were stationary at the 1st difference and had one co-integration equation, so the research employed vector error correction model (VECM).

As shown in Table 7, the VECM output offers us the coefficient, standard error and t-statistics for each independent variable (Al-Qudah, 2019).

By utilizing OLS to determine the probability for each independent variable, we use the model system and solely estimate the model associated with inflation rate as demonstrated below. The purpose is therefore limited to test the impact of money supply, and accordingly, the following model was only applied:

$$D(\log(INF)) = C(1)\cdot(\log(INF)(-1) + 3.51697647147E\text{-}13\cdot\log(MONEY)(-1) + 0.57630620825\cdot\log(GDP)(-1) - 0.757729057425\cdot\log(IMP)(-1) + 0.136395716713\cdot\log(EXCH)(-1) - 8.38411735453\ ) + C(2)\cdot D(\log(INF))(-1)) + C(3)\cdot D(\log(MONEY)(-1)) + C(4)\cdot D(GDP(-1)) + C(5)\cdot D(IMP(-1)) + C(6)\cdot D(\log(EXCH)(-1)) + C(7), \quad (3)$$

where

$D(\log(INF))$ is the dependent variable;

D(log(MONEY)(–1)), *D*(log(IMP)(–1)), *D*(log(GDP)(–1)), *D*(log(EXCH)(–1)) are the independents variables;
C(1) is the coefficient of co-integration;
C(2), *C*(3), *C*(4), *C*(5), *C*(6) are the coefficients;
C(7) is the constant.

Table 7. VECM Estimation Results

DEPENDENT variable: *D*(log(INF))				
D(log(INF)) = *C*(1)·(log(INF)(–1) + 3.51697647147E-13·log(MONEY)(–1) + 0.57630620825·log(GDP)(–1) – 0.757729057425·log(IMP)(–1) +0.136395716713·log(EXCH)(–1) – 8.38411735453) + *C*(2)·*D*(log(INF))(–1)) + *C*(3)·*D*(log(MONEY)(–1)) + *C*(4)·*D*(GDP(–1)) + *C*(5)·*D*(IMP(–1)) + *C*(6)·*D*(log(EXCH)(–1)) + C(7)				
	COEFF	Std. Error	t-Statistic	Prob.
C(1)	–0.388519	0.052809	–7.357004	0.0000
C(2)·log(INF)(–1)	–0.083313	0.057612	–1.446098	0.1492
C(3)·log(MONEY)	1.53E-12	3.99E-13	3.847309	0.0001
C(4)·log(GDP)	–1.211170	0.670390	–1.806665	0.0718
C(5)·log(IMP)	0.396637	0.583422	0.679846	0.4971
C(6)·log(EXCH)	1.184122	0.957544	1.236624	0.2172
C(7)·C	–0.171878	0.102846	–1.671222	0.0957
R-squared	0.234071	Mean dependent var		–0.063930
Adjusted R-squared	0.218803	S.D. dependent var		1.608617
Sum squared resid	608.4599	Schwarz criterion		3.648938
F-statistic	15.33114	Durbin-Watson stat		1.888131
Prob (F-statistic)	0.000000			

Source: The author's computation using Eviews 10 software

As can be seen from Table 7, *C*(1) (error correction term) is the coefficient of the co-integration equation (Al-Qudah, 2019). To accept the model findings, the coefficient signal must be negative and statistically significant, suggesting that there is long-run causality running from independent variables to inflation rate. The sign of the coefficient *C*(1) of co-integration equation is negative (–0.388519) and significative (Prob = 0.0000), with probability level of 5 %. As a result, there is long-run causality from independent variables to inflation rate. The co-integration coefficient (VECM (–1)) is –0.388519 with a probability of 5 %. This implies that short-term imbalances are corrected in the long run at a rate of 38.85 % each year. Accordingly, adjusting for imbalances requires more than two years to be corrected (1/0.388519 = 2.5738).

Money supply has a positive and significant impact on inflation rate in Egypt in short run since the coefficient of *C*(3) for *D*(log(MONEY)(–1) is (1.53^{-12}). This demonstrates if money supply increases by one unit, inflation rate will be increased

by (1.53^{-12}) unit in the short run. However, this is compatible with Fisher's quantitative theory of money (M.V = P.Y), which states that an increase in money supply leads to an increase in inflation rate. The result is consistent with the study results of Waingade (2011) who examined the connection between money supply and price level over a long-run period. His results demonstrate that there is a positive connection between growth in the cash supply and price level. In addition, the study by researchers (Ofori-Frimpon et al., 2017) reveals that there is a long-run positive link between money supply and inflation rate in Ghana based on Ordinary Least Squares.

Gross domestic product has a short-term negative impact on inflation rate in Egypt. The coefficient of *C*(5) for *D*(log(GDP)(−1) is −1.21, indicating that increasing GDP by one unit reduces inflation rate by 1.21 unit in the short run. Other factors stay constant. This is because of an increase in GDP results in an increase in total supply over total demand, which forces the government to increase overall demand by increasing consumer expenditure, such as raising wages or lowering the general level of prices.

Import has a significant and positive impact on inflation rate in the short term. The coefficient of *C*(4) for *D*(log(IMP)(−1) is 0.3966 and significant level of 1 %. This confirms that if import increases by one unit, inflation rate will be increased by (0.3966) in the short run. Other factors remain constant. This is illustrated by the fact that external prices play a prominent role in the economy, namely, in small countries with an open economy, wherever the level of external prices rose, there was a clear indication of a rise in imported inflation rate, and its reflection on domestic inflation rate and foreign trade.

Exchange rate has a positive effect on inflation rate in Egypt in the short run. The coefficient of *C*(6) for *D*(log(EXCH)(−1) is (1.1884), which means that if exchange rate increases by one unit, Egypt's inflation rate will increase by (1.1884) unit. Hoang et al. (2020) show that when the exchange rate increases, it leads to an increase in the cost of inputs. The aggregate supply (AS) line moves upwards to the left, causing inflationary pressures. In addition, a depreciation means the currency buys less foreign exchange; therefore, import is more expensive and export is cheaper. After a depreciation, imported inflation rate has been revealed. Thus, the price of imported goods will go up because they are more expensive to buy from abroad.

3.5. Granger Causality Test

The results of the causality test indicate that, at the 5 % level of significance, the null hypothesis (H0) of no causality was not rejected, as shown in Table 8. As a result, the money supply and inflation rate are causally related.

Given the P-value of acceptance, as shown in Table 8, it can be concluded that money supply causes the one-way exchange rate because the null hypothesis (H0) of no causality was rejected at 5 % level of significance and the alternative hypothesis was accepted.

The Granger causality test results show that the F-statistic value to test the H0 (null hypothesis that money supply does not cause inflation rate) is 8.64044 and statistically significant at the level less than 0.05 (0.00160.05). As a result, the null

hypothesis is rejected. Batarseh (2021) suggests that there is a short-term causal relationship between money supply and inflation rate.

Table 8. Granger Causality Test Findings

Null Hypothesis:	Obs	F-Statistic	Prob.	Decision
Log(MONEY) Causes Log(INF)	28	8.64044	0.0016	*Reject H0*
Log(INF) is not caused by Log(MONEY)		0.44606	0.6456	*Do not reject H0*
Log(INF) is not caused by Log(IMP)	28	0.74834	0.4843	*Do not reject H0*
Log(IMP) is not caused by Log(INF)		1.63491	0.2168	*Do not reject H0*
Log(INF) is not caused by Log(GDP)	28	0.83305	0.4474	*Do not reject H0*
Log(GDP) is not caused by Log(INF)		2.67222	0.0905	*Do not reject H0*
Log(INF) is not caused by Log(EXCH)	28	0.85794	0.4372	*Do not reject H0*
Log(EXCH) is not caused by Log(INF)		1.09160	0.3524	*Do not reject H0*
Log(MONEY) is not caused by Log(IMP)	28	2.17146	0.1368	*Do not reject H0*
Log(IMP) is not caused by Log(MONEY)		2.03669	0.1533	*Do not reject H0*
Log(MONEY) is not caused by Log(GDP)	28	0.73338	0.4912	*Do not reject H0*
Log(GDP) Causes Log(MONEY)		14.6998	8.E-05	*Reject H0*
Log(MONEY) is not caused by Log(EXCH)	28	0.91006	0.4165	*Do not reject H0*
Log(MONEY) Causes Log(EXCH)		14.0036	0.0001	*Reject H0*
Log(IMP) is not caused by Log(GDP)	28	0.65895	0.5269	*Do not reject H0*
Log(IMP) Causes Log(GDP)		24.8522	2.E-06	*Reject H0*
Log(IMP) is not caused by Log(EXCH)	28	1.49705	0.2448	*Do not reject H0*
Log(IMP) Causes Log(EXCH)		5.75313	0.0094	*Reject H0*
Log(GDP) is not caused by Log(EXCH)	28	2.39727	0.1133	*Do not reject H0*
Log(GDP) Causes Log(EXCH)		3.75591	0.0388	*Reject H0*

Source: The author's computation using Eviews 10 software

The value of the *F* statistic, as determined by the Granger causality test, is 0.44606, which is not statistically significant at the 0.05 level (0.6456>0.05), supporting the second hypothesis, according to which inflation rate does not cause money supply. As a result, it is impossible to rule out the null hypothesis that inflation rate does not cause money supply.

According to Table 8, there is a unidirectional causality running from money supply and inflation rate, which means that in the short term for the Egyptian economy, the money supply causes inflation rate rather than the other way around. This finding agrees with those of the following studies: Ghazali et al. (2009) in Malaysia; (Batarseh, 2021) in Jordan; (Kiganda, 2015) in Kenya, and (Sasongko & Huruta, 2018) in Indonesia.

However, this finding conflicts with the findings of the following studies, which found a negligible causal relationship between money and inflation rate at the 0.05 level: (Mishal & Abu-Dallo, 2014) in Jordan and (Amassoma et al., 2018) in Nigeria.

CONCLUSION AND POLICY IMPLICATIONS

Developing countries across the globe suffer, among other problems, from inflation rate due to its negative repercussions on the national economy and individual's standard of living. Monetary policy is considered one of the most important policies applied by governments for attaining the stability and control of inflation rate**.** The present research has investigated the influence of money supply on inflation rate in Egypt, in which an annual time series data covering the period from 1990 to 2019 have been employed. The variables have been found to be non-stationary at the significance level, but have become stationary after 1st differentiation. Co-integration tests indicate the appearance of a statistically significant long-run link between inflation rate and money supply. The VECM results suggest that $C(-1)$ coefficient is significant at the level of 5 % but it is nevertheless low (–0.3884). The Granger causality test in this study reveals a directional link for money supply to inflation rate in Egypt. The study recommends putting more emphasis on the following causes of inflation rate in Egypt other than money supply:

- Fighting the parallel market and trying to integrate it into the economic cycle to absorb the monetary mass outside the cycle;
- Reducing the parallel exchange rate, which led to the deterioration in the local currency value;
- Reducing the import bill to decrease imported inflation rate and encourage local production; and
- Establishing Islamic Banks because of their role in financing and accelerating the economy.

These findings suggest that further research would be of great interest.

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