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RESEARCH ARTICLE

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The external debt-inflation nexus in Egypt

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Egypt has a long history with external financing dating back to the 19th century. Nevertheless, Egypt's external debt has been mounting remarkably in the past few years. This paper examines the impact of Egypt's external debt on its price level, a topic ignored by researchers. Nonetheless, as inflation is a hydra-headed problem, this paper develops several models which incorporate fiscal and monetary policies besides other inflation-inducing internal and external factors using monthly data extending from 2000M1 to 2020 M1. By employing ARDL cointegration analyses on monthly time series variables and using Egypt's wholesale price index to account for inflation, the paper concludes that external debt raises prices both in the short and long runs. Moreover, money supply and interest rate were also found to increase prices in the long run long despite decreasing them in the short run. Finally, upsurges in the international prices of primary products stimulate domestic prices both in the short and long terms, while depreciation in the local currency aggravates inflation in the short and long terms as well. As external debt raises inflation and affects many other inflation-inducing factors indirectly, the paper concludes that reducing Egypt's external debt may help in curbing Egypt's inflation.

KEYWORDS
ARDL cointegration, Egypt, external debt, fiscal policy, inflation, monetary policy

1 | INTRODUCTION

Ever since their independence, many developing countries have resorted to internal or external borrowing in order to finance investments necessary to achieving their growth targets, and Egypt was no exception. The main problem associated with debt—and especially external debt—is that if debt becomes unsustainable it may lead to severe exchange rate fluctuations, drive foreign capital abroad and debilitate future foreign direct investment (Hemming et al., 2003). While the link between a country's external debt and economic growth has been frequently scrutinized, much less has been written on the link between its external debt and inflation. In fact, external debt can drive inflation in a country upwards as higher external debt levels are correlated with substantially higher levels of inflation in emerging markets. Median inflation doubles as debt ascend from the low range up to the high range (Reinhart & Rogoff, 2010).

According to the World Bank, Egypt's external debt amounted to $134 billion in 2020. In fact, Egypt's recent external debt began in the 1970s with the launching of former president Sadat's Open Door policy in 1975 (Figure 1) although Egypt's historical inception with external borrowing dates backs to the 19th century. Not accompanied with an export-promotion strategy, integrating Egypt's economy with the world economy in the mid-1970s negatively impacted its weak industrial sector and led to de-industrializing the economy, with the share of manufacturing decreasing remarkably from 40% in 1967–1973 period to 19% in the years from 1981 to 1991. At the beginning of former president Mubarak era in the 1980s, the economy had shifted to a rentier economy depending on external sources of income while agriculture and manufacturing were disregarded (Farah, 2009). From 1975 to 1980, external debt amplified from $6.3 billion to $19 billion, rising to almost 90% of its GDP and 207% of its exports of goods and services in 1981 (Ikram, 2007). Egypt's dependence on volatile and unsustainable sources of foreign exchange such as the Suez Canal revenue, tourism, oil, and remittances of Egyptians working abroad meant that any slowdown in the world economy (as that which occurred in 1981) would decrease such resources. Fiscal deficits and mounting

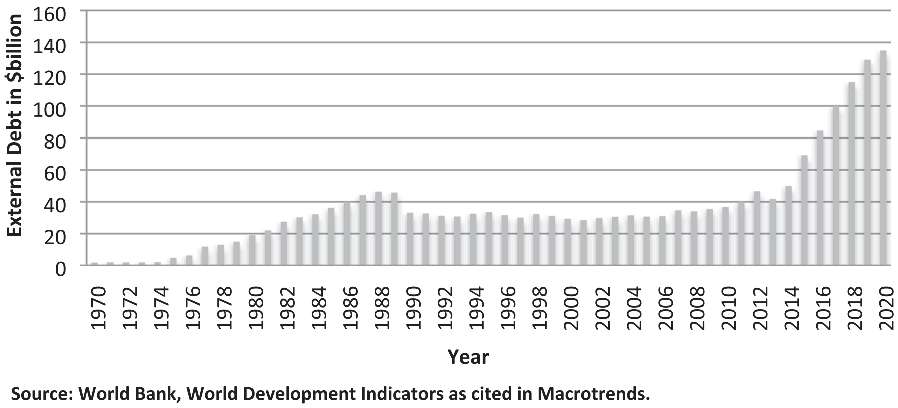

FIGURE 1 Egypt's external debt 1970–2020. *Source*: World Bank, World Development Indicators as cited in Macrotrends (n.d.)

structural imbalances forced Egypt to signing an agreement with the Paris Club in 1987 to reschedule public debts due June 1988. In 1992, Egypt's external debt amounted to $40 billion at a time when its GNP amounted to $34.6 billion (World Bank, 1993). A year earlier, Egypt signed for a loan with the International Monetary Fund (IMF) after agreeing to launch an Economic Reform and Structural Adjustment Program (ERSAP) along the Fund's conditions. Accordingly, Egypt's rescue from its financial impasse at that time came through the generous bailout plan of the IMF ($20 billion reduction of debt) and as a result of its contribution in the Gulf War in 1990 ($7 billion reduction of US military debt). Instead of investing the new money in productive sources, the government invested in infrastructure mega-projects such as the New Valley and the Toshka project. The share of exports in general and manufacturing exports in particular as percentages of GDP fell and the balance of trade remained in deficit, although the balance of payments was in some years rescued by the old traditional volatile sources of revenues such as the Suez Canal, tourism and workers' remittances (Richards et al., 2013). As with all IMF programs, inflation and structural imbalances were mitigated (for a short period) but economic growth and employment based on productive sectors were not achieved. Consequently, the economy's structural imbalances remained. The period 2000–2010 witnessed the falling back of the economy in the debt trap as a series of external political and economic shocks negatively impacted the traditional vulnerable sources of foreign exchange leading to successive devaluations of the pound. The government's fiscal deficit recurred and, resorting to foreign financing again, the country's external debt amounted $36 billion by the end of the Mubarak era in 2010 (Figure 1), an amount close to the pre-IMF-agreement debt levels.

The post-Mubarak era 2011 onwards witnessed a series of political developments that culminated finally in the reemergence of similar economic challenges as those faced by the country in the early-1990s; and which were addressed with more or less similar policies through investments in new mega-projects. To bridge the financing gap, the government signed a new agreement with the IMF in 2016 whereby the latter lent Egypt $12 billion over three phases. Additionally, Egypt accessed funding from COVID-19-related facilities amounting to $8 billion from the IMF—$2.8 billion from the coronavirus rapid financing initiative and $5.2 billion in a one-year stand-by arrangement—besides other loans from the African Development Bank, the World Bank and the international capital market (African Development Bank, 2021). Egypt's external debt alone rose from $36.8 billion in 2010 to $134.8 billion in 2020, representing 37.1% of Egypt's nominal GDP of $363.1 billion, but an alarmingly 285% of Egypt's exports of $47.8 billion, according to the World Bank, (2020) figures.

Although external debt has been increasing in Egypt this has not led to macroeconomic stability as inflation has been witnessing frequent upsurges, while the exchange rate has continued to depreciate systematically. As the case with external debt, Egypt's long history with double-digit inflation began also in the 1970s with the increase in its Consumer price Index (CPI) ranging around the 10% figure, but soaring to nearly 21% in 1980 and 24% in 1986 (Figure 2). Inflation figures slowed down gradually but escalated again reaching 18% in 2008 (World Bank). As per the Central Bank of Egypt (CBE), Egypt's monetary policy regime could be described as a "regime with implicit nominal anchor" as CBE does not assign an inflation target in advance. Starting 2005, CBE moved from its former "quantitative operational target" (excess reserves) to an "interest rate target" (overnight interbank rate) (Central Bank of Egypt, 2016, p. 3). Under the previous system of monetary targeting, broad money used to serve as an intermediate target providing information on the expected path of inflation. The monetary target regime was abandoned in 2005 as mentioned earlier for a variety of reasons mainly its inability to stabilize prices, and CBE launched its interbank rate which functions through the corridor system. Under that system, CBE assigns two interest rates, one for deposits and the other for lending, creating a corridor in which the interbank rate should fluctuate. The corridor system facilitated the control of the interbank rate volatility via open market operations. Nevertheless, inflation kept on rising in the post-Mubarak era, and by the end of 2012 and the beginning of 2013, a positive money gap has been taking place in Egypt; that is, the rate of growth of money has been exceeding the rate of growth of output, mainly as a result of the government borrowing from the banking system. According to the CBE official website, inflation reached 32.9% in July 2017 on a year-to-year basis (although the figure was later updated in the World Bank database to 29%). The rate fell again gradually to reach 5% in 2020 (Figure 2) (World Bank, n.d.-a). Despite the falling

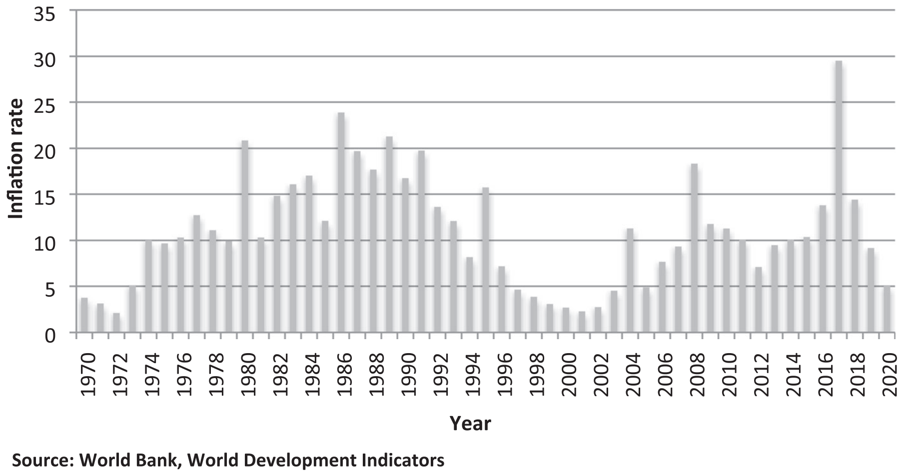

FIGURE 2 Egypt's inflation rate 1970–2020. *Source*: World Bank, n.d.-c, World Development Indicators

official inflation rate, Egyptians feel the pinch of the rising living costs especially with the recent successive removals of fuel and electricity subsidies on these products. In November 2016, the government allowed to free-float the Egyptian pound (LE), which witnessed a free fall from about 8 LEs per one US dollar to more than 18 LEs per one US dollar in a matter of days. Other internal factors such as the mounting internal government debt, usually financed by issuance of treasury bills and seignorage, were accused of increasing money supply and boosting inflation. Egypt's stock of domestic and external government debt soared from LE2.274 trillion in June 2015 to LE4.808 trillion in June 2019 (World Bank Group Macroeconomics, Trade and Investment, 2020).

Even though economic theory provides evidence on the external debt-inflation nexus, no study has attempted to assess whether Egypt's mounting external debt may be having a pass-through effect on Egypt's inflation. In addition, most previous studies used the CPI to evaluate inflation, which received several criticisms concerning its reflection of the actual inflation level in Egypt. Compared with the CPIs of other countries, Egypt's CPI was found to be not representative of all consumer expenditure items. Furthermore, some items such as housing were based on only rented housing rather than owned housing (Fares, 1997). Most importantly, some fundamental food items consumed by Egyptians have been subsidized by successive governments, thereby masking their true market prices. The present study—much recent and using an extended monthly time series of Egypt's wholesale price index (WPI) (rather than the conventional CPI) running from 2000 till 2020 M1—comes to address this deficiency and fill an important gap in the literature, namely to investigate the impact of Egypt's mounting external debt on inflation, besides the other inflation determinants. Following this introduction, Section 2 briefly discusses the theory behind the external debt-inflation nexus besides other economic theories on inflation, followed by a review on the literature on inflation in Egypt and the Middle East in Section 3. Section 4 explains the data sources and the different methodologies employed. Section 5 discusses the results of the paper, while Section 6 concludes.

2 | THEORETICAL BACKGROUND

2.1 | Theories on external debt-inflation nexus

According to Fiscal Theory of Price Level (FTPL) fiscal policy rather than monetary policy is the prime determinant of inflation. Developed and refined by Sargent and Wallace (1981) Leeper (1991), Sims (1994), Woodford (1995), the theory assumes that public debt generates a wealth effect which in turn creates a route to inflation. While monetarists emphasize the role of monetary policy, fiscal theory proponents believe, first, that the fiscal position represents a necessary condition for macroeconomic stability, second, that the incoordination between the fiscal and monetary policies can make monetary policy ineffective and, third, that controlling money supply alone may not curb inflation (Fanizza & Soderling, 2006). Increases in government deficits and debts increase a country overall wealth if bondholders of the new debt rule out the possibility of the potential use of future taxes to cover the deficit. In this non-Ricardian context, the rise in a nation's wealth raises demand for goods and services and drives prices up.

A second channel by which a rise in debt can lead to inflation is through the crowding-out effect. An increase in government deficit raises interest rate, which in turn depresses private domestic investment. As the country's future productive capacity decreases, aggregate supply decreases, and prices increase (Barth et al., 1987; Hoelscher, 1986; Koluri & Giannaros, 1987; Tanzi, 1985).

Debt can also lead to inflation through a third channel, which is the monetization of debt. An increase in government debt may result in an increase in seigniorage in order for the government to guarantee that its budget is balanced. Increases in the amount of printed money may prop up demand and increase prices.

Finally, the Olivera-Tanzi effect posits that the causality between government debt and inflation is bidirectional, as an increase in budget deficit increases inflation, which decreases the real value of tax revenues; consequently, this will instigate the second round of deficit financing through printing new money and a vicious cycle is created (Tanzi, 1991).

2.2 | Theories on inflation determinants

In contemporary economic literature, inflation is either attributed to demand factors known as demand-pull inflation, or supply factor known as supply-push inflation. Different schools of economic thought have split either side into sub-factors and assigned various weights to each factor depending on the conceptual framework underlying each school, and how each school explains the transmission mechanisms to inflation. The classical school attributed increases in prices to the growth of money supply (assuming velocity of money and real output to be constant), implying that inflation is a monetary phenomenon, and that controlling money supply would control inflation. The Keynesian school, on the other hand, which was based on the assumption of *sticky* wages in the short run, postulates that increasing effective demand through policies such as deficit financing, fiscal policy, monetary policy props up the prices of goods and the profits of firms, leading ultimately to increasing demand in the goods market. Even though some economists argue that Keynes attributed inflation so some cost-push factors (Humphrey, 1981), the Keynesian school primarily relates inflation to demand-pull factors. In the Keynesian approach, demand on money is determined by output and interest rates, while the supply of money is determined exogenously by the central bank.

In the second half of the 20th century, the monetarist approach reasserted inflation as a monetary phenomenon, with velocity of money being not totally constant but predictable (Mishkin, 2010). Additionally, there is no tradeoff between unemployment and inflation in the long run, a theory complemented later by Rational Expectations theory which denied the existence of this relation even in the short run. Expectations play a role in inflation as economic agents build their expectations of inflation on past levels or backward-looking expectations.

In the 1960s and 1970s, the Structuralist approach, one of the facets of cost-push inflation-linked inflation to structural factors inherent in any economy such as its level of industrialization or its agricultural resource base. As aggregate supply is assumed to lag behind aggregate demand, prices rise. Similarly, Post-Keynesians and Neo-Marxists lay emphasis on other cost-push factors such as markup pricing and distributional inequalities. Lately, political economy theorists added noneconomic factors influencing inflation such as the timing of elections and the performance of policymakers (Kibritcioglu, 2002).

3 | LITERATURE REVIEW

3.1 | The literature on the external debt-inflation nexus

Several studies have confirmed the upward pressure of public debt on inflation, positing that without a sound fiscal policy inflation pressures cannot be restrained (Arisa, 2020; Bleaney, 1996; Budina & Van Wijnbergen, 2000; Catao & Terrones, 2005; Fanizza & Soderling, 2006; Islam & Wetzel, 1991; Lin & Chu, 2013; Nastansky & Strohe, 2015; Romero & Marin, 2017). These studies provide ample evidence that macroeconomic stability necessitates a sound fiscal policy since a sound monetary policy is neither necessary nor sufficient.

On the other hand, many studies have negated, or at least not supported, the positive link between debt and inflation. Giannitsarou and Scott (2006) find a very modest statistical connection between fiscal imbalances and inflation refuting the conclusion that increases in fiscal deficits is inflationary. Kia (2006) tests the relationship with Iran and concludes that, with external financing, the demand on real balances falls and inflation rises but decreases again after two quarters. However, with sanctions imposed on Iran external debt exerts an upward pressure on inflation. Perkarski (2011) establishes that inflation can occur even without evident deterioration in public finance as rises in inflation can be alternatively attributed to other factors such as the Patinkin effect (inverse of the Olivera-Tanzi effect) and the wrong side of the inflation tax curve.

The third group of studies concludes that the impact of public debt on inflation is contingent on other factors. For example, an increase in public debt strongly boosts inflation in highly indebted countries, weakly influences it in other developing countries, and does not affect inflation in developed countries, according to Kwon et al. (2009). The findings are confirmed by a more recent study by Maitra (2019) which emphasizes that a high level of accumulated debt in a weak economy could possibly have an adverse impact on prices, income, and interest rate. Other factors comprise the location of debt. For example, Sunder-Plassmann (2020) concludes that nominal debt can raise inflation if held abroad, but decrease inflation if held at home country.

3.2 | The literature on inflation determinants in Egypt

While it is impossible to review all studies on inflation determinants due to space constraints, we review some of the major ones conducted to analyze the main determinants of inflation in Egypt and the Middle East. While Al-Mashat and Billmeier (2008) and Neaime (2008) believe that a strong pass-through causation takes place from the exchange rate to inflation in Egypt, Helmy (2008) lays more emphasis on the effect of government deficit and money supply. Monetary neutrality is established in Egypt with money supplied cointegrated with prices and not to GDP in the study by Tawadros (2007), while El-Sakka and Ghali (2005) acknowledge the positive impact of money supply, the exchange rate, the interest rate, and world prices on inflation with money supply accounting for the highest impact while the other three factors' impact follows in descending order. The impact of GDP was found to mitigate rather than increase inflation in the studies of Helmy and El-Sakka and Ghali. Hosny's (2013) study pinpoints to money supply and global commodity prices as the two main long run factors influencing inflation, while the short run factors comprise the exchange rate depreciation, supply-side bottlenecks in addition to previous inflation. Sharaf (2015) assesses the link between inflation

TABLE 1 Review of selected studies on inflation dynamics in Egypt and some middle eastern countries

Study	Country or countries examined	Period estimated	Variables estimated	Methodology used	Main finding
Abdelraouf et al. (2021)	Egypt		Money growth—relative price variability—exchange rate—energy prices—adverse supply—side shocks—international commodity prices		The excessive monetary growth, and a rise in the intensity of relative price variability are important long-run determinants of inflation. Money growth needs to be curbed, and price liberalization needs to be tackled using a holistic long-run plan as opposed to the piecemeal approach.
Al-Mashat and Billmeier (2008)	Egypt	1996–2005	GDP—Inflation rate—exchange rate—monetary policy stance—some exogenous variables such as oil price.	VAR	The exchange rate disseminates monetary shocks to prices. The interest rate channel—although still weak—appears to be getting stronger.
Al-Shawarby and Selim (2012)	Egypt	2000–2011 (Monthly)	International food price indices—omestic food price index—domestic CPI—output—exchange rate	Two-step regression—VAR	Long run pass through from international food prices to domestic prices is low; while spillovers from domestic price shock to nonfood inflation is high. Short-run pass through from international food price shock to domestic inflation is low.
Bahmani-Oskooee (1991)	96 countries	1973–1980	Inflation rate—exchange rate	OLS	Exchange rate variability is an important factor contributing to inflation rate variability
Deme and Fayissa (1995)	Egypt, Morocco and Tunisia	1964–1993 (annual)	Money supply—GDP—Effective exchange rate—imported inflation	Granger causality tests	Rise in money supply positively affect s inflation in Egypt and Morocco. No significant relationship exists between real output and inflation. Foreign inflation is conveyed to Morocco and Tunisia only through foreign interest rate.
El-Sakka and Ghali (2005)	Egypt	1969–2000 (annual)	GDP—inflation rate—exchange rate—interest rate—money supply—world prices	VECM	Money supply, the exchange rate, the interest rate have a significant positive impact on inflation, while real GDP has a significant negative impact on it. World prices push up prices but the magnitude of their impact is not large..
Helmy (2008)	Egypt	1981–2006	Consumer price index—government deficit—Net claims on government—GDP—broad money—exchange rate	Johansen cointergration—VECM	An increase in government deficit and money supply lead to an increase in inflation, while an appreciation of the pound and rising GDP decrease inflation.
Neaime (2008)	Egypt and MENA countries	1990Q1–2006Q4 (quarterly)	GDP—inflation rate—exchange rate—interest rate	VAR and IRF	The exchange rate is an important pass through channel to inflation. To control inflation, Egypt's economy should be immune to internal and external shocks.
Hosny (2013)	Egypt	2003 M1–2012 M12	CPI—Broad money—Overnight interbank rate—Credit to government—Global energy prices—Output gap—exchange rate—global commodity prices—global food prices	ARDL	Money supply and global commodity prices are the two main long run factors influencing inflation, while the short run factors comprise the exchange rate depreciation supply-side bottlenecks in addition to previous inflation.

(Continues)

TABLE 1 (Continued)

Study	Country or countries examined	Period estimated	Variables estimated	Methodology used	Main finding
Ragab (2021)	Egypt	2010 M01–2020 M12 (monthly)	Several internal and external factors	MIDAS	There is an asymmetric and de-anchored impact of exchange rate fluctuations on inflation advocating intervention in the foreign exchange market to reduce exchange rate fluctuations and restrain inflationary pressures
Samir and Tarek (2014)	Tunisia	1994:1–2010:2 (quarterly)	Consumer price level—nominal exchange rate—output gap—foreign price level	Maximum likelihood through the Kalman filter iterative algorithms	Exchange rate pass-through to domestic prices confirms an upward trend
Sharaf (2015)	Egypt	1974 M1–2015M4	Inflation-Inflation Uncertainty	Standard two step approach—M-Garch	An inflation shock results in a high level of inflation volatility persistence
Tawadros (2007)	Egypt, Morocco, and Jordan	1972:1–2002:4 (Quarterly)	Money supply—prices—GDP	Seasonal cointegration	Money supply is cointegrated to prices but not to GDP in Morocco, Jordan and Egypt, implying that money is neutral.

Source: Compiled by the author and listed in alphabetical order.

and inflation uncertainty; while Abdelraouf et al. (2021) evaluate the structural determinants of inflation in Egypt versus transitory shocks. Finally, Ragab (2021) emphasizes the asymmetric and de-anchored impact of exchange rate fluctuations on inflation, advocating intervention in the foreign exchange market to reduce exchange rate fluctuations and restrain inflationary pressures. Table 1 highlights the methodology and findings of the main previous studies (listed alphabetically according to author's name).

As evident from the compiled literature, most studies on inflation in Egypt are either relatively old or have not specifically assessed the impact of external debt on inflation. This study aims to address this gap in the literature especially with the unprecedented rise in Egypt's external debt.

4 | EMPIRICAL ANALYSIS

4.1 | Variables selected and data sources

In order to evaluate the impact of external debt in Egypt on its inflation rate, we propose the following model which incorporates besides external debt, the most significant demand-pull and supply-push determinants of inflation emphasized in economic theories, and the primary control variables identified by the previous literature to have an inflation impact. The time series variables included in the model are monthly and extend from 2000 until 2020 M1.

$$\text{WPI} = f(\text{M2}, \text{EXDEBT GDP\_GAP}, \text{DR}, \text{WPI}_{t-1}, \text{NEER}, \text{REER}, \text{WP}, \text{PRIM\_PR}) \quad (1)$$

Where,

4.1.1 | LWPI

LWPI is the natural log of the monthly wholesale price index (WPI) in Egypt. Data were obtained from the International Financial Statistics (IFS) of the IMF, n.d.-a and Egypt's official statistical agency, the Central Agency for Public Mobilization and Statistics (CAPMAS), n.d., online database. The latest index 2016 = 100 was interpolated backward using previous indexes (based in 2004/5 and 2010) to obtain the index for the whole period at the 2016 base year.

4.1.2 | LEXDEBT

LEXDEBT is the natural log of the total external debt owed to nonresidents repayable in currency, goods, or services. It is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, short-term debt, and use of IMF credit. Data are in current US dollars. Data were obtained from the World Bank as cited in Macrotrends. As data on external debt was available only on an annual basis, monthly observations were interpolated using the statistical process developed by EViews software.

4.1.3 | LM2

LM2 is the natural log of monthly broad money or M2. Broad money is defined as

> the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper

(IMF, n.d.-b online) and the data are obtained from the International Financial Statistics (IFS) and the Monetary and Financial Statistics (MFS) online databases of the IMF.

4.1.4 | GDP_GAP

To calculate GDP_GAP we deducted GDP from its long-run trend using the Hodrick-Prescott filter. However, since we are using monthly data, and GDP values are not published monthly, we first interpolated the frequency of the annual GDP of Egypt (obtained from IMF, n.d.-c, World Economic Outlook [WEO] online database) to monthly data using the statistical process developed by EViews software before deducting its long-run trend. According to WEO, original figures are obtained from Egypt's Ministry of Planning latest actual data.

4.1.5 | LDR

LDR is the natural log of the monthly discount rate by the Central Bank of Egypt. Data are obtained from the IFS of the IMF online database. The discount rate was selected to represent the interest rate.

4.1.6 | LWP

LWP is the natural log of the World Consumer Price Index. Data were obtained from FAO. The FAOSTAT monthly General CPI database was based on the ILO CPI data until December 2014. In 2014, IMF-ILO-FAO agreed to transfer global CPI data compilation from ILO to IMF. Upon agreement, CPIs for all items and its sub-components originate from the IMF, and the UN Statistics Division (UNSD) for countries not covered by the IMF.[1]

4.1.7 | LNEER

LNEER is the natural log of the monthly nominal effective exchange rate. The nominal effective exchange rate (NEER) is an unadjusted (for inflation) weighted average rate at which one country's currency exchanges for a basket of multiple foreign currencies. The data includes the updated nominal exchange rates obtained from Bruegel's database (Darvas, 2012a; Darvas, 2012b; Darvas, 2012c). NEER is thus a measure of the value of the domestic currency against a weighted basket of currencies for its trading partners. Any increase in the index denotes appreciation of the domestic currency against the basket of currencies of the trading partners.

4.1.8 | LREER

LREER is the natural log of the monthly real effective exchange rate (CPI-based). The real effective exchange rate measures the value of a currency against a basket of other currencies; it takes into account changes in relative prices and shows what can actually be bought. The data includes the updated real exchange rates obtained from Bruegel's database (Darvas, 2012a; Darvas, 2012b; Darvas, 2012c). As the case with NEER, an increase in the index signifies appreciation of the domestic currency against the basket of currencies of the trading partners.

4.1.9 | LPRIM_PR

LPRIM_PR is the natural log of the monthly indices of fuel and nonfuel commodities. Precisely, it reflects the

> indices in terms of dollars or SDRs, indices of market prices for non-fuel commodities and petroleum, actual market prices for non-fuel commodities and petroleum, and average weekly prices for non-fuel commodities and petroleum (IMF online).

They represent the benchmark prices which are representative of the global market and are determined by the largest import markets of a given commodity. Data were obtained from the International Financial Statistics (IFS) of the IMF (2010 = 100).

In brief, our model assumes that a change in Egypt's inflation rate is a function of money supply, external debt, real output gap, the interest rate, the exchange rate, index of world prices in general, and index of world primary goods prices. The graphical representation for the selected variables appears in Figure 3.

4.2 | Methodology

After investigating the data by looking at its descriptive statistics, and after conducting the necessary correlation tests among the independent variables, we examine whether the variables selected are cointegrated in a long-term relationship. Cointegration exists if all

[1]The FAOSTAT monthly General CPI database was based on the ILO CPI data until December 2014. In 2014, IMF-ILO-FAO agreed to transfer global CPI data compilation from ILO to IMF (for further details see FAOSTAT website). As FAO used a new index for the world 2015 = 100, the previous indexes was interpolated by the author to adapt the previous numbers according to the new 2015 = 100 index.

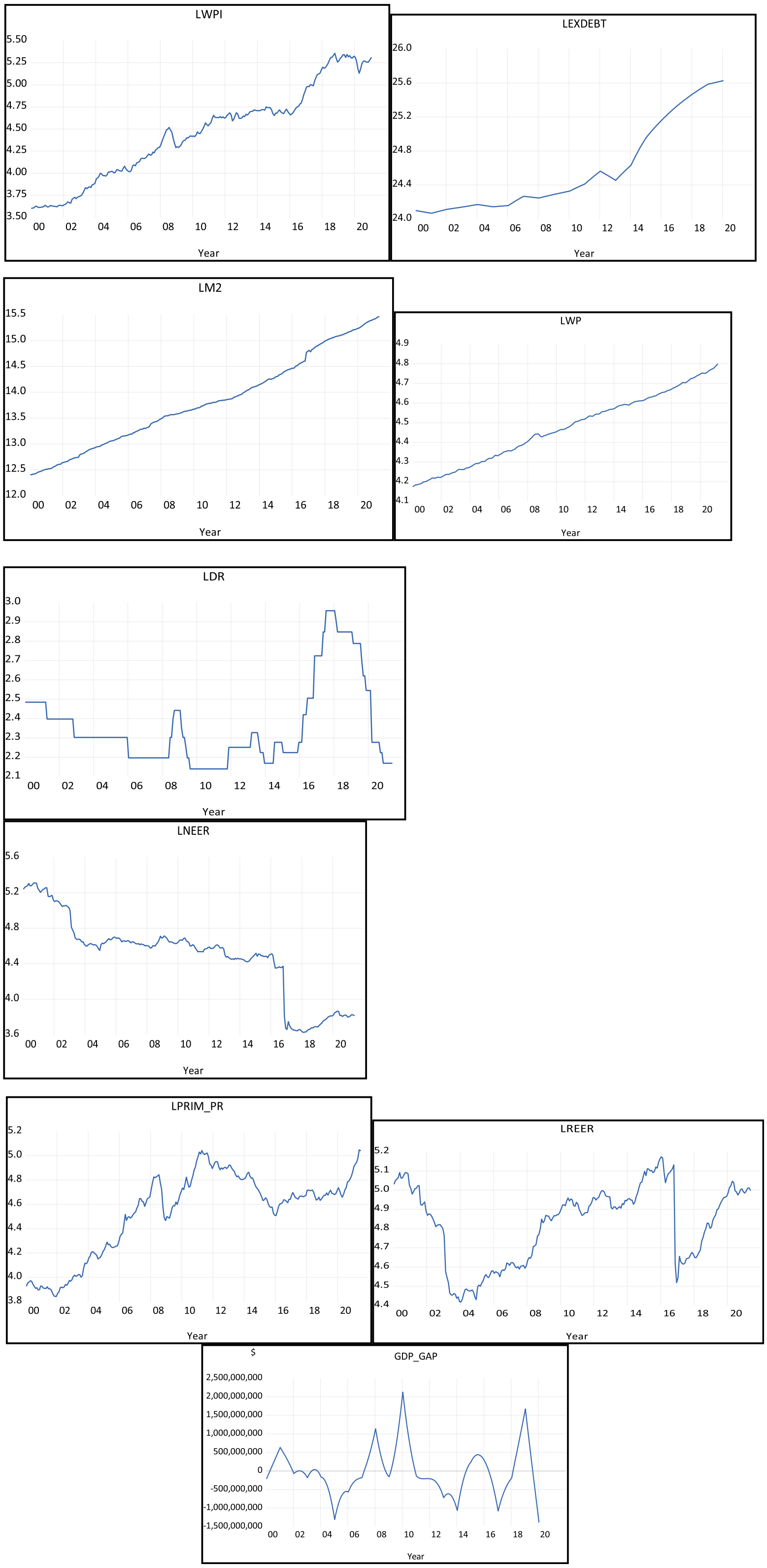

FIGURE 3 Graphical representation of the selected variables in Egypt. *Source*: Data obtained from the International Financial Statistics (IFS) and Monetary and Financial Statistics (MFS) databases of the International Monetary Fund for the variables WPI, M2, DR, ER, and PRIM_PR; and from the World Economic Outlook (WEO) of the International Monetary Fund for the variable GDP. GDP_GAP was then calculated according to the methodology explained in text. Both NEER and REER were obtained from Bruegel's database (Darvas, 2012a; Darvas, 2012b; Darvas, 2012c). External debt was obtained from the World Development Indicators database of the World Bank as cited in Macrotrends (n.d.)

variables are nonstationary or integrated of order (1) and become stationary when first differenced. This implies conducting the usual unit root test to check the stationarity of the variables. In case cointegration exists, we estimate a vector error correction model (VECM), whereas if cointegration fails to exist, we undergo a variance autoregressive model (VAR). If some of the variables were stationary while others were integrated of order (I) we test for cointegration using Pesaran (2001)) Autoregressive Distributed Lag (ARDL) technique which allows for cointegration testing of mixed I(0) and I(I) variables by constructing a bounds test. All variables with the exception of the GDP_GAP were transformed to natural logs prior to unit root testing. All variables in their natural logs forms now hold the letter “L” before their abbreviated names with the exception of GDP_GAP which was not transformed due to the inclusion of negative values.[2]

4.2.1 | Testing the stationarity of the variables

All variables were tested for stationarity using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Some variables were tested using breakpoint unit root tests wherever relevant.

4.2.2 | The autoregressive distributed lag model

The autoregressive distributed lag model (ARDL) model proposed by Pesaran (2001) differentiates between the long-run and the short-run dynamics in the relation between the dependent variable and the regressors. The general form of the long-run equation of our model appears in Equation (1). Several different models are extracted from this general model (besides world prices [or WP] was excluded as will be explained later).

$$LWPI_t = a_0 + a_1 LM2 + a_2 GDP\_GAP + a_3 LDR + a_4 LNEER + a_5 LREER + a_6 LPRIM\_PR + a_7 LEXDEBT \quad (1)$$

In order to distinguish between the short-run and the long-run equations, the previous equation can be written in an Error Correction Model (ECM) format. Specifically the short-run equation can be written as:

$$\Delta LWPI_t = \alpha + \sum_{k=1}^{n} \beta_k \Delta LWPI_{t-k} + \sum_{k=1}^{n} \gamma_k \Delta LM2_{t-k} + \sum_{k=1}^{n} \lambda_k \Delta GDP\_GAP_{t-k} + \sum_{k=1}^{n} \phi_k \Delta LDR_{t-k} + \sum_{k=1}^{n} \varphi_k \Delta LNEER_{t-k} + \sum_{k=1}^{n} \psi_k \Delta LREER_{t-k} + \sum_{k=1}^{n} \delta_k \Delta LPRIM\_PR_{t-k} + \sum_{k=1}^{n} \xi_k \Delta LEXDEBT_{t-k} + \omega_1 LWPI_{t-1} + \omega_2 LM2_{t-1} + \omega_3 GDP\_GAP_{t-1} + \omega_4 LDR_{t-1} + \omega_5 LNEER_{t-1} + \omega_6 LREER_{t-1} + \omega_7 LPRIM\_PR_{t-1} + \omega_8 LEXDEBT_{t-1} + u_t \quad (2)$$

According to this equation, the coefficients of the first differenced variables represent the short-run coefficients, while the long-run coefficients are attached to the lagged level variables. Variables are cointegrated if their linear combination is stationary and they have a common stochastic trend. A standard F-test with lower and upper critical bounds is used to test for cointegration of the mixed I(0) and I(1) variables, which can either be endogenous or exogenous in the ARDL model (Pesaran, 2001). The linear combination of the lagged level variables can be replaced by the lagged error correction term (ECT_{t-1}), (Equation (3)) which explains how the variables adjust in the long-run in response to any movement away from the long-run equilibrium resulting from short-run shock.

$$\Delta LWPI_t = \alpha + \sum_{k=1}^{n} \beta_k \Delta LWPI_{t-k} + \sum_{k=1}^{n} \gamma_k \Delta LM2_{t-k} + \sum_{k=1}^{n} \lambda_k \Delta GDP\_GAP_{t-k} + \sum_{k=1}^{n} \phi_k \Delta LDR_{t-k} + \sum_{k=1}^{n} \varphi_k \Delta LNEER_{t-k} + \sum_{k=1}^{n} \psi_k \Delta LREER_{t-k} + \sum_{k=1}^{n} \delta_k \Delta LPRIM\_PR_{t-k} + \sum_{k=1}^{n} \xi_k \Delta LEXDEBT_{t-k} + \omega_1 ECT_{t-1} \quad (3)$$

5 | RESULTS

5.1 | Descriptive statistics and correlation tests

Table 2 illustrates the descriptive statistics of the selected variables. All descriptive data manifest consistency in data and smoothness in pattern. For all variables, adding or subtracting two standard deviations from the mean of any variable places the mean within the maximum-minimum range.

We further test for multicollinearity among our regressors. Table 3 shows the multicollinearity matrix. As evident from the table, no perfect multicollinearity exists between the independent variables.

However, due to the high multicollinearity between the logged values of the average CPI of all goods worldwide (LWP) and both the money supply (LM2) and external debt (LEXDEBT) (0.99 and 0.91, respectively) we decide to drop LWP variable and substitute it with LPRIM_PR. This variable which comprises nonfuel commodities and petroleum can in fact be more representative of the impact of international prices on inflation in Egypt than the former, as Egypt's main imports are refined petroleum, wheat, and crude petroleum. In 2019, Egypt was the world's largest importer of wheat (OEC, n.d.). High—though not perfect—multicollinearity still exists between our focus variable external debt and money supply (0.94) a very important control variable as per the literature and previous empirical studies. We treat this problem through several approaches. First, we estimate our models using *either* external debt *or* money supply in each of the first four models, and then conduct Granger causality tests to detect the direction of causality. Second, assuming no perfect multicollinearity we use both variables in the same model (in models 5 and 6).

5.2 | Testing the stationarity of the variables

Results of the tests on the stationarity of our eight dependent and independent variables through the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were consistent in proving that all the variables—with the only exception of GDP_GAP—were non-stationary at levels, and turned stationary when first differenced. GDP_GAP was the only variable that was stationary at levels (Table 4). The unit root test for the external debt variable displayed its stationarity at first difference, but at the 10% significance level when only an intercept was included in the test equation.

Since the graphical representation of the lagged external debt variable displayed the possible existence of breakpoints in the time

[2]The model was initially estimated in a linear-linear form but suffered from instability and non-normality. Such problems were eliminated when the models were estimated in the log–log form.

TABLE 2 Descriptive statistics

	LWPI	LWP	LPRIM_PR	LNEER	LREER	LEXDEBT	LM2	GDP_GAP
Mean	4.410069	4.456112	4.512242	4.531966	4.813869	24.57027	13.72366	0.065785
Median	4.467081	4.455974	4.634608	4.603669	4.868611	24.32809	13.67398	−64,193,762
Maximum	5.356586	4.749694	5.043322	5.310592	5.172641	25.62706	15.23632	2.13E+09
Minimum	3.604095	4.175531	3.841332	3.628333	4.417635	24.06725	12.40460	−1.38E+09
Std. Dev.	0.505369	0.164472	0.342631	0.431371	0.203591	0.506947	0.807888	6.16E+08

Source: Authors calculations.

TABLE 3 Correlation matrix

	LWP	LPRIM_PR	LNEER	LREER	LEXDEBT	LM2	GDP_GAP
LWP	1.000000						
LPRIM_PR	0.786908	1.000000					
LNEER	−0.867517	−0.584997	1.000000				
LREER	0.288400	0.202187	0.165470	1.000000			
LEXDEBT	0.910400	0.489553	−0.883614	0.247931	1.000000		
LM2	0.991098	0.725065	−0.914488	0.218840	0.945916	1.000000	
GDP_GAP	0.004172	0.010273	0.069203	0.233275	0.027700	0.014619	1.000000

Source: Author's calculations.

series, we additionally examined the variables which displayed structural breaks in their time series (all except for LWP and LM2) using breakpoint unit root tests. According to Perron (1989), the existence of breakpoints may affect the results of unit root estimations leading to estimation bias. The results of the breakpoint unit root tests (Table 5) confirmed the stationarity of the variables at their first differences. LNEER proved stationary both at levels and at first differences.

Since there is a possibility that the variables were integrated at different I(0) and I(1) orders, we proceed by estimating cointegration using the ARDL model, which in our case is preferred over other cointegration methods as previously explained.

5.3 | Long-run determinants of inflation

The long-run results from the ARDL estimation appear in Table 6. In models (1) and (2), EXDEBT is used rather than M2, with NEER and REER used in models (1) and (2), respectively. In models (3) and (4), M2 is used rather than external debt with NEER and REER used in models (3) and (4), respectively. In models (5) and (6) both EXDEBT and M2 are used in the same models with NEER and REER used in models (5) and (6), respectively. The model selection criteria was based on the Akaike information criterion which has a tendency to increase the number of lags compared with the Schwartz criterion; however, it was preferred over other models to ensure the nonexistence of autocorrelation which was achieved in the six models. Additionally, the six models passed the Jarque-Bera normality test, the Breusch-Pagan-Godfrey heteroskedasticity test and both the cumulative sum (CUSUM) (Figures A1–A6) and the cumulative sum of squares (CUSUMSQ) stability tests. Moreover, cointegration as evident from the value of the F-test existed in all six models, as the F-statistic was significant at the 1% significance level (Table 6).

Results of Table 6 highlight the fundamental importance of external debt which is always economically and statistically significant in the first two models, as a 1% rise in EXDEBT raises the wholesale price level by 0.48% in model (1) and 0.69% in model (2) in the long run. International prices of primary products play a fundamental role in determining prices in Egypt, as an increase of 1% in PRIM_PR is associated with an increase of 0.67% of wholesale prices in Egypt in model (1) and 0.77% in model (2), all in the long run. The coefficients are justifiable given that Egypt not only ranks first globally in wheat imports ($4.67 billion in 2019) but also imports most of its food and petroleum needs (OEC, n.d.). As a result, any rises in global oil and food prices have major knock-on effects on Egypt's inflation. Exchange rate fluctuations play another integral role in determining long-run wholesale prices in Egypt, with a 1% rise in NEER leading to a 0.3 decrease in wholesale prices, while a 1% rise in REER leading to a 0.22 decrease in wholesale prices. The results are logical given continuous balance of trade deficit. Interest rate proved insignificant in these two models which excluded the money supply variable.

In models (3) and (4) money supply is included while external debt is excluded. The results highlight its importance with M2 carrying significantly positive coefficients amounting to 0.38 and 0.44 in models (3) and (4), respectively. Interest rate turned significant and accounted for another 0.30 and 0.36 in the two models, respectively. The positive relation between interest rate and prices underscores the importance of interest rate as a cost of production in the long-run, rather than a deterrent of consumption and demand. The negative relation

TABLE 4 Unit root tests for the selected variables

	ADF		PP	
	At levels	At first dif	At levels	At first dif
LWPI				
Intercept	−0.462033	−10.89851[a]	−0.375163	−10.52787[a]
Trend/intercept	−2.911899	−10.87659[a]	−2.425797	−10.50397[a]
None	3.035868	−10.26578[a]	3.749058	−10.33418[a]
LEXDEBT				
Intercept	0.225720	−2.745175[b]	2.404876	−2.812587[b]
Trend/intercept	−1.785086	−2.930029	−1.154071	−3.056673
None	1.813442	−2.060359[c]	4.070280	−2.079811[c]
LNEER				
Intercept	−1.157064	−12.87036[a]	−1.026615	−12.85093[a]
Trend/intercept	−2.124730	−12.84842[a]	−1.930639	−12.82849[a]
None	−1.818719[b]	−12.70821[a]	−1.957160[c]	−12.72359[a]
LREER				
Intercept	−2.015045	−13.26275[a]	−1.820062	−13.15156[a]
Trend/intercept	−2.474030	−13.28756[a]	−2.239013	−13.17227[a]
None	−0.156562	−13.28867[a]	−0.121465	−13.17894[a]
GDP_GAP				
Intercept	−4.367094[a]	−4.308443[a]	−2.957956[c]	−4.501744[a]
Trend/intercept	−4.344604[a]	−4.345565[a]	−2.942135	−4.539739[a]
None	−4.381729[a]	−4.301828[a]	−2.963001[a]	−4.497499[a]
LDR				
Intercept	−1.232094	−14.78852[a]	−1.718072	−15.28283[a]
Trend/intercept	−1.228688	−14.76129[a]	−1.757923	−15.25982[a]
None	−0.664566	−14.80102[a]	−0.567583	−15.29778[a]
LM2				
Intercept	1.860282	−15.68682[a]	1.877585	−15.70858[a]
Trend/intercept	−0.686321	−15.87444[a]	−0.703879	−15.87495[a]
None	15.21316	−2.025397[c]	15.05558	−11.89198[a]
LPRIM_PR				
intercept	−1.162920	−10.09528[a]	−1.187486	−10.12573[a]
Trend/intercept	−1.610768	−10.07744[a]	−1.555890	−10.10779[a]
none	1.439633	−9.952320[a]	1.629712	−10.05190[a]

Note: The lag length for the Augmented Dickey-Fuller test was automatically selected using the Schwartz criterion. The Phillips-Perron test the Bartlett kernel spectral estimation method was selected, while the bandwidth was automatically selected using Newey-West Bandwidth.
[a]Significant at the 1% significance level.
[b]Significant at the 10% significance level.
[c]Significant at the 5% significance level.

between the exchange rate and prices is also confirmed even though NEER (in model 3) and REER (in model 4) had relatively lower coefficients compared with the first two models. The same was the case with PRIM_PR variable which has a relatively lower coefficient of 0.48 compared with the first two models of 0.57 and 0.77.

In the last two comprehensive models which included EXDEBT and M2, the coefficients of the two variables decreased. The impact of EXDEBT fell significantly from 0.48 and 0.69 in the first two models to nearly 0.24 in the last two models, while M2 fell from 0.38 and 0.44 in the first two to 0.21 and 0.29 in the last two. The coefficients of PRIM_PR, NEER, and REER settled at intermediate value of 0.58, 0.17 and 0.11 compared with precious models' values.

Comparing all six models reveals that models (5) and (6) are more representative as money is an important determinant and control variable of inflation according to the monetarist theory and the previous literature. Finally, as the F-statistic is higher in model (5) which includes NEER rather than REER, we believe that model (5) best explains the weights of the long-run determinants of inflation in

Egypt, namely primary products prices (+0.59), external debt (+0.25), interest rate (+0.23), money supply (+0.21), and nominal effective exchange rate (−0.17) in descending order of importance.

Comparing the first two models (including external debt) with the second two models (including money supply) raises an important question as to which of the two variables may be impacting the other given that there is high multicollinearity among them. Conducting a pairwise Granger Causality test (Table 7) discloses how external debt is one of the main reasons for increasing money supply and not vice versa, attesting to the importance external financing in driving up prices.

TABLE 5 Breakpoint unit root tests for the selected variables

	At levels	At first dif
LEXDEBT		
Trend/intercept	−3.996931	−6.389981[a]
LNEER		
Trend/intercept	−6.140493[a]	−13.51011[a]
LREER		
Trend/intercept	−3.868757	−21.77575[a]
GDP_GAP		
Trend/intercept	−4.867045	−5.715221[b]
LDR		
Trend/intercept	−4.081500	−16.67677[a]
LPRIM_PR		
Trend/intercept	−3.210391	−11.26172[a]

Note: An intercept and a trend were included in both the specification and in the breaking point tests. The lag length for the test was automatically selected using the Schwartz criterion. The breakpoint selection was determined according to Dickey Fuller minimum *t*-statistics.
[a]Significant at the 1% significance level.
[b]Significant at the 5% significance level.

5.4 | Short-run determinants of inflation

Moving to the short-run determinants of inflation, the coefficients from the ARDL estimation of the different regressors in the short run appear in (Table 8).

As evident from Table 8, inflation's own lags are significant in the short run especially the first, forth, and the sixth lags even though their impact on current month inflation may be alternating, with the first lag driving inflation upwards while the fourth lag seems to have a negative relation with current level of prices, and so on. The impact of world primary product prices on wholesale prices in Egypt is both statistically and economically significant in both models raising wholesale prices instantaneously between 0.3 and 0.38 in all models for every 1% increase in average world primary products' prices.

Unlike its impact in driving up prices in the long run (being a rising production cost), a rise of 1% in interest rate drives prices down around 0.1 after 3 and 6 months in the short run in all models. There is also an instantaneous impact of a rise in money supply and the nominal effective exchange rate in driving wholesale prices down. The

TABLE 6 Long run results of ARDL models

Dependent variable LWPI	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	−9.101912***	−15.23256***	−2.916444***	−4.230587***	−6.808411***	−8.169408***
LM2			0.375754***	0.440953***	0.204538***	0.292727***
LNEER	−0.302175***		−0.146232***		−0.170114***	
LREER		−0.216398***		−0.086714**		−0.104700***
LPRIM_PR	0.667937***	0.769887***	0.479532***	0.485290***	0.585778***	0.578902***
LDR	0.074016	0.119199	0.300465***	0.357914***	0.227119***	0.277780***
LEXDEBT	0.478488***	0.691662***			0.246517***	0.237679**
ARDL	(5,0,11,11,10)	(7,0,2,11,10)	(8,1,2,8,1)	(8.0.2.8.1)	(5,1,2,8,10,1)	(7,0,2,8,10,1)
F-statistic	7.239921***	7.323828***	12.23626***	10.64400***	12.05408***	10.19693***
Obs.	230	230	233	233	231	231
Model selection	Akaike	Akaike	Akaike	Akaike	Akaike	Akaike

Note: Lag selection criterion was done automatically using Akaike Information Criterion with a maximum selection of 12 lags for all models to ensure the nonexistence of autocorrelation.
Source: Author's calculations.
***Significant at the 1% significance level. ** Significant at the 5% significance level.

TABLE 7 Granger causality tests

Null hypothesis	Direction of causality	F-statistic	*p*-value
EXDEBT does not Granger Cause M2	EXDEBT to M2	3.74620	0.0057
M2 does not Granger Cause EXDEBT	EXDEBT to M2	1.38789	0.2389

Source: Author's calculations.

TABLE 8 Short run results of ARDL models

Dependent variable LWPI	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
D(LWPI[−1])	0.166117***	0.212014***	0.273403***	0.285872***	0.258253***	0.278245***
D(LWPI[−2])	−0.135915**	−0.117729**	−0.051838	−0.058583	−0.082488	−0.075550
D(LWPI[−3])	−0.028914	−0.005135	−0.014738	0.004784	−0.029791	−0.008015
D(LWPI[−4])	−0.157472***	−0.146990**	−0.100396*	−0.102741*	−0.138434***	−0.142866**
D(LWPI[−5])		0.019065	9.21E-06	0.013729		0.031620
D(LWPI[−6])		0.111979**	0.129533**	0.142972**		0.100262*
D(LWPI[−7])			−0.105739*	−0.081299		
D(LPRIM_PR)	0.382712***	0.387025***	0.295648***	0.330723***	0.334953***	0.365547***
D(LPRIM_PR[−1])	−0.144811**	−0.147960***	−0.135378***	−0.132590**	−0.160494***	−0.164474***
D(LPRIM_PR[−2])	−0.014447					
D(LPRIM_PR[−3])	0.006797					
D(LPRIM_PR[−4])	−0.024627					
D(LPRIM_PR[−5])	0.028295					
D(LPRIM_PR[−6])	0.102021**					
D(LPRIM_PR[−7])	0.035265					
D(LPRIM_PR[−8])	−0.036057					
D(LPRIM_PR[−9])	−0.067561					
D(LPRIM_PR[−10])	−0.084237*					
D(LDR)	0.014556	0.014238	0.044090	0.062991*	0.035524	0.046483
D(LDR[−1])	−0.020579	−0.025677	−0.066297*	−0.055837	−0.061044*	−0.053771
D(LDR[−2])	−0.005744	−0.000764	−0.024229	−0.026932	−0.028467	−0.031312
D(LDR[−3])	−0.080011**	−0.094826***	−0.098795***	−0.115568***	−0.115332 ***	−0.137590***
D(LDR[−4])	0.001648	−0.025765	−0.021036	−0.036542	−0.034664	−0.048416
D(LDR[−5])	0.007939	−0.023916	−0.050444	−0.051838	−0.046632	−0.049654
D(LDR[−6])	−0.072441*	−0.086978**	−0.114542***	−0.121146***	−0.120140***	−0.125435***
D(LDR[−7])	−0.041307	−0.034063	−0.053245	−0.058257	−0.070348*	−0.071636*
D(LDR(−8)	0.009062	0.028816				
D(LDR[−9])	0.083102**	0.098633***				
D(LDR[−10])	0.095848**	0.092965**				
D(EXDEBT)	−0.316902	−0.226448			−0.477254	−0.597418
D(EXDEBT[−1])	−0.199053	−0.107760			−0.089486	−0.119040
D(EXDEBT[−2])	0.761399	0.784417			0.674469	0.804260
D(EXDEBT[−3])	−0.546173	−0.599210			−0.773754	−0.653610
D(EXDEBT[−4])	1.419172***	1.396428**			1.518317***	1.445988***
D(EXDEBT[−5])	−0.958724*	−1.069312*			−0.858748	−0.961269*
D(EXDEBT[−6])	−0.329656	−0.385960			−0.432388	−0.355146
D(EXDEBT[−7])	0.561436	0.492046			0.451421	0.467248
D(EXDEBT(−8))	0.519308	0.504026			0.679032	0.675040
D(EXDEBT[−9])	−1.462326***	−1.366406***			−1.132219***	−1.176243***
D(LM2)			−0.346968***	−0.107893	−0.349081***	−0.140418*
D(NEER)			−0.125586***		−0.115953***	
D(GDP_GAP)	4.60E-12**	3.90E-12**	1.63E-12	7.30E-13		
CointEq(−1)*	−0.165720**	−0.142173***	−0.214298***	−0.211837***	−0.235540***	−0.233817***
Adj. R^2	0.503498	0.475057	0.462749	0.441950	0.496454	0.487223
Jarque-Bera normality test	1.253700	0.765927	1.527323	1.566293	1.588546	1.284904
Serial correlation LM test (Obs. R^2)	12.75357	9.022588	8.540622	8.001409	13.64961	11.28048

(Continues)

TABLE 8 (Continued)

Dependent variable LWPI	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Breusch-Pagan-Godfrey heteroskedasticity test (Obs. R^2)	53.90817	39.05957	41.34872	42.61880	40.32747	41.11030
CUSUM	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	S	S

Source: Author's calculations.
***Significant at the 1% significance level.
** Significant at the 5% significance level.
* Significant at the 10% significance level.

fall in the price level resulting from an increase in money supply in the short run might be explained through the role of money in temporarily expanding nominal output, thereby decreasing prices.

What deserves special attention is our variable of interest the external debt and especially its seasonal impact on inflation. Inflation increases more than 1% for a 1% increase in external debt after nearly 4 months, but decreases it more than 1% after 9 months of a rise in external debt. This might be attributed to the repayment of 3 months treasury bills which the government probably attempts to repay by borrowing new loans. Inflation is known to be sensitive to the maturity of the debt (Reinhart & Rogoff, 2010). Finally, it is worth noting that the cointegrating equation is negative as required, and the speed of adjustment is relatively quick (−0.23 in model 5) given that the data is monthly.

6 | CONCLUSION

Is Egypt's mounting external debt partially responsible for Egypt's inflation? This paper attempts to investigate the impact of external debt on inflation in Egypt by developing several models which incorporate fiscal and monetary variables, besides other internal and external factors, using monthly data extending from 2000 M1 to 2020 M1. While some previous studies may have probed the impact of internal debt, this study is the first contribution with respect to the impact of external debt up to our knowledge. The study found clearly that external debt raises the price level over the long run. In the short-run, external debt raises the price level after 4 months but decreases it after 9 months. As stated by Barth et al. (1987), to eschew debt problems a country's external debt must grow less promptly than exports and domestic output. If a country satisfies this long-run condition then it is solvent (Barth et al., 1987). But Egypt's external debt has in recent years been growing faster than both. In 2010, Egypt's external debt amounted to 36 billion, or 17% of its GDP and 79% of its exports of goods and services. Ten years later, and specifically in 2020, Egypt's external debt amounted to $134.8 billion or 37% of its GDP, and an alarming 285% of its exports of goods and services, according to the World Bank figures.[3] As a rule of thumb a country that has an external debt that exceeds 200% of its exports of goods and services suffers from a debt overhang problem (Richards et al., 2013); that is, a high-risk level that deters private investors from investing and jeopardizing their capital. There might be several routes to Egypt's external debt pass-through to inflation. One route may be through the FTPL and the wealth effect with the new capital from loans driving up demand and prices. A second channel by which a rise in debt can lead to inflation is through the crowding-out effect. An increase in government debt raises interest rate, which in turn depresses private domestic investment, decreases aggregate supply, and raises prices.

Our study also found that a higher money supply might decrease prices in the very short run, but results in a permanent rise in prices in the long run due to its effect on aggregate demand. The same trend existed with interest rate where its increase would decrease pieces after 3 or 6 months, implying that it may be an efficient anti-inflation tool in the short run, but permanently raises prices in the long run probably due to its impact on production costs. Additionally, external debt was found to indirectly increase demand and prices through its impact on money supply, as the Granger causality tests identified the direction of causation going from the external debt to money supply.

Prices of imported primary products are also an important source of inflation in Egypt, yet their influence is higher in the long than in the short run. Since the government has decreased subsidies substantially during the last few years, and plans to phase out gradually all food and energy subsidies (Farouk, 2018), resonance from international inflation is expected to be transmitted more explicitly to domestic inflation especially if the Egyptian pound depreciates again in the future. Since the government has no control on world prices, the government could mitigate the impact of rising world prices by increasing production of local substitutes for critically needed imported products.

A rise in the nominal and real effective exchange rate decreases prices in the long run; while a rise in the nominal exchange rate decrease prices in the short run as well, with no clear impact of the real effective exchange rate in the short run. This is logical as Egypt has been suffering from a chronic merchandise trade balance which is sometimes compensated by a surplus in the balance of services (through Suez Canal revenues and tourism) and remittances from Egyptians working abroad. Additionally, as Egypt's mounting external debt requires a substantial amount of debt servicing, this will further drive an upward pressure on foreign currency and a downward pressure on the Egyptian pound, which may be forced to

[3]These ratios are calculated by the author based on the World Bank's, n.d.-b, World Development Indicators. According to the World Bank database, in 2010 Egypt's nominal GDP was $218.984 billion; the value of its exports of goods and services was $46.751 billion while its external debt was $36.775 billion, all in current US dollars. In 2020, Egypt's nominal GDP was $363.1 billion; the value of its exports of goods and services was $47.8 billion, while its external debt was $134.8 billion in current US dollars.

depreciate again in the future similar to its previous sharp depreciations in 2003 and 2016. This is probable since Egypt's higher inflation rates compared with its trading partners are raising the real effective exchange rate again. As inflation and all internal and external factors are integrated in a long-run relationship, mitigating Egypt's external debt, especially as a ratio to its exports of goods and services, might decrease inflationary pressures in the future. Furthermore, prudent management of external debt implies using external debt in sectors that boost productive capacity and stimulate high value-added exports so as to increase aggregate supply, decrease prices and ensure a sustained flow of foreign exchange from permanent sources necessary to satisfy Egypt's domestic needs of foreign exchange and to repay its previously accumulated external debt.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available through the International Financial Statistics (IFS) and Monetary and Financial Statistics (MFS) databases of the International Monetary Fund; from the World Economic Outlook (WEO) of the International Monetary Fund; Bruegel's database and the World Development Indicators database of the World Bank.

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APPENDIX A.

Figures A1–A6

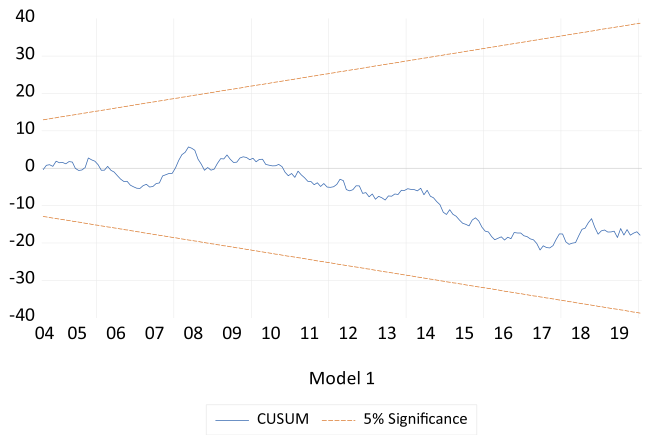

FIGURE A1 Cumulative Sum (CUSUM) stability test of Model 1

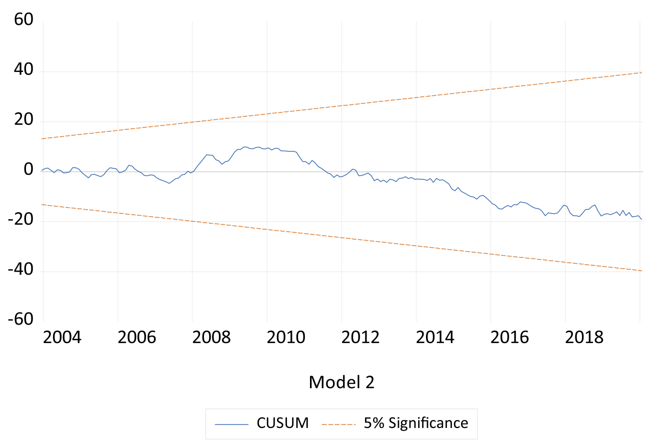

FIGURE A2 Cumulative Sum (CUSUM) stability test of Model 2

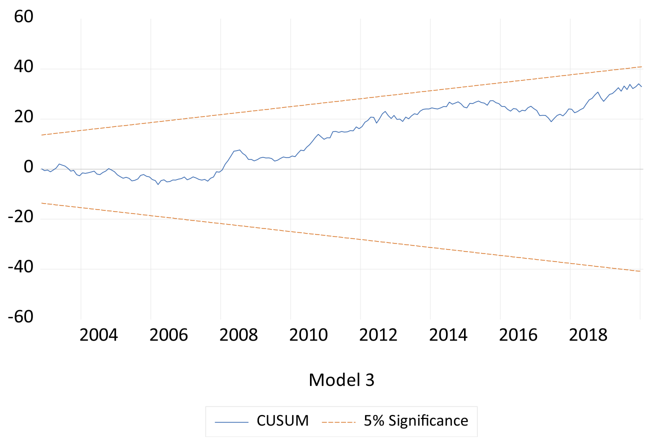

FIGURE A3 Cumulative Sum (CUSUM) stability test of Model 3

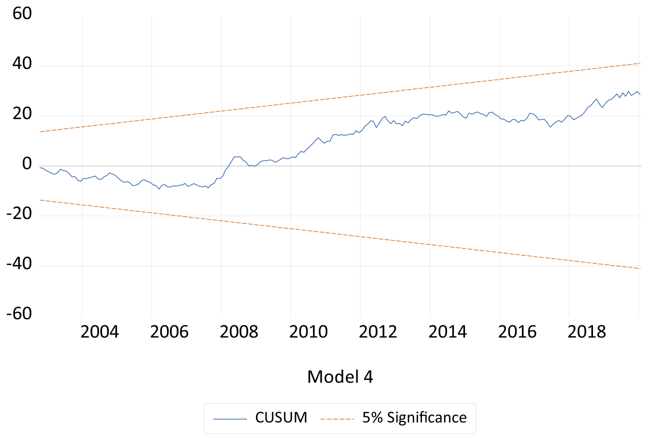

FIGURE A4 Cumulative Sum (CUSUM) stability test of Model 4

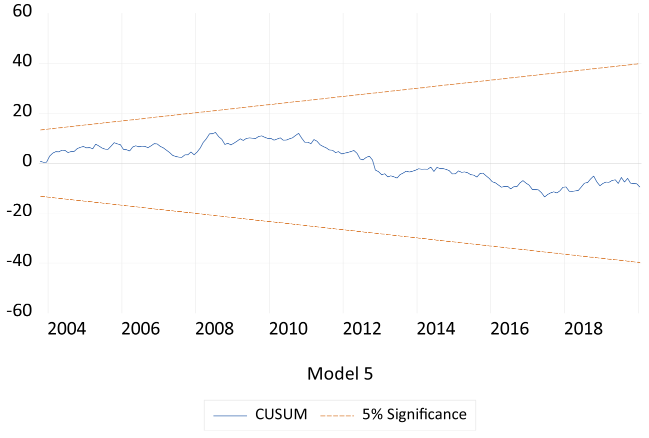

FIGURE A5 Cumulative Sum (CUSUM) stability test of Model 5

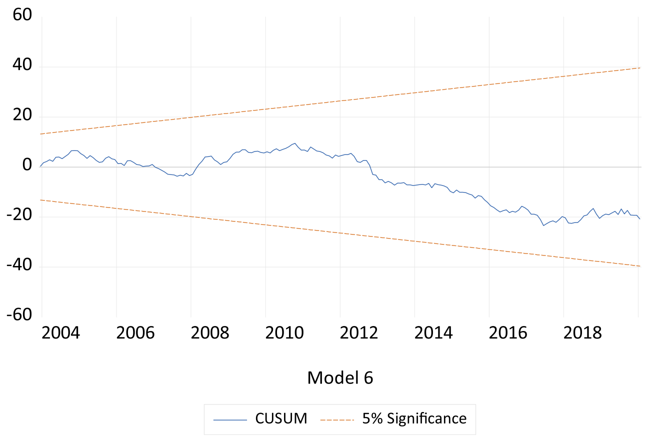

FIGURE A6 Cumulative Sum (CUSUM) stability test of Model 6