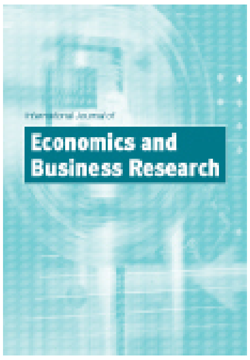

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The asymmetric impact of global economic policy uncertainty on inflation in Egypt

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Abstract: This paper investigates the impact of global economic policy uncertainty (EPU) on inflation in Egypt and explores whether this impact is symmetric or asymmetric. Using two decades of quarterly data on various determinants of inflation and a measure of global EPU, the paper employs linear and nonlinear autoregressive distributed lag (ARDL) regression models to analyse this relationship. Robustness checks, including recursive estimation of coefficients, and conducting forecasting analysis, are performed to support the findings. The results indicate that global EPU asymmetrically influences inflation in Egypt where increases in global EPU lead to a decrease in inflation by 20% and decreases in global EPU lead to an increase in inflation by 21%. This study contributes to the existing literature by examining the role of global EPU in driving domestic inflation in Egypt. Understanding global EPU's impact on inflation aids the Central Bank of Egypt when shaping monetary policy to manage inflation.

Keywords: inflation; economic policy uncertainty; EPU; NARDL; Egypt.

JEL codes: E31, F40.

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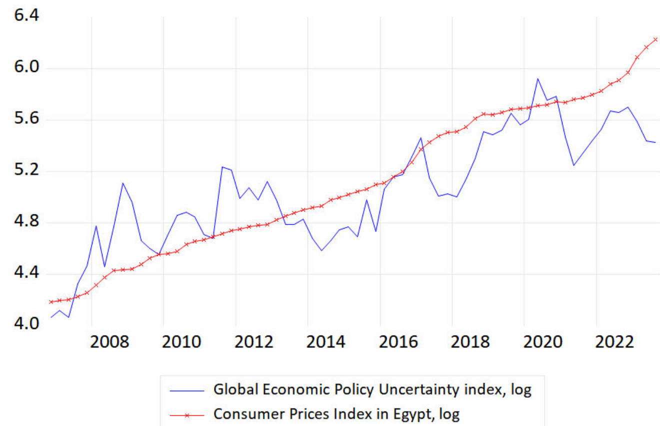
1 Introduction

Inflation in Egypt soared to a record high of over 40% recently. While domestic factors play a significant role in this inflation surge, the impact of global economic policy uncertainties cannot be ignored. Figure 1 illustrates a strong positive correlation coefficient of 0.85 between Egypt's consumer price index and the global EPU index developed by Baker et al. (2016). This raises the question of the extent to which global

EPU influences inflation in Egypt. Additionally, does inflation react differently during periods of high uncertainty compared to periods of lower uncertainty?

Figure 1 Global economic policy uncertainty (EPU) index and the consumer price index in Egypt (see online version for colours)



Note: Correlation coefficient 0.84 (t-ratio = 13.22).

Source: Prepared by the author

Several studies have investigated the inflation dynamics in Egypt, with some highlighting the foreign exchange rate as a key determinant of inflation (Abouelhassan, 2022; Helmy et al., 2019; Khodeir, 2012). Others have emphasised the significance of fiscal (Helmy, 2022, 2008) and monetary policies (Abdelraouf et al., 2021; Abonazel and Elnabawy, 2020) in influencing inflation. Additionally, external factors such as oil prices (Ali, 2020) and global prices (Hosny, 2013) have been identified as drivers of inflation. While some studies have explored inflation uncertainty as a determinant of inflation in Egypt (Sharaf, 2015), the impact of global EPU on inflation remains unexplored. This study aims to fill this research gap.

This paper investigates the impact of global EPU on inflation in Egypt and examines whether this impact is symmetric or asymmetric. It utilises quarterly data spanning the past two decades on real GDP, money supply, government budget deficit, interest rate, foreign exchange rate, and measure of global EPU. The study employs both linear and nonlinear autoregressive distributed lag (ARDL) regression models to address this issue. Furthermore, robustness checks are conducted to support the findings and ensure the stability of the results, including recursive estimation of coefficients, and forecasting analysis.

The findings of this paper reveal that global EPU has an asymmetric impact on inflation in Egypt, where heightened EPU tends to reduce inflation by 20%, while periods of reduced uncertainty tend to increase inflation by 21%. This pattern may be due to decreased economic activity and spending, as well as tighter monetary policy during times of heightened uncertainty, and increased economic confidence and spending, as well as looser monetary policy during periods of low uncertainty. The recursive regression analysis of the estimated nonlinear ARDL (NARDL) regression shows stable and significant coefficients. The forecasting analysis demonstrates that the estimated NARDL model accurately predicts actual inflation with minimal errors.

This paper contributes to the current literature by emphasising the asymmetric impact of global EPU on domestic inflation in a small open economy such as Egypt. The findings of this study have significant policy and practical implications. The Central Bank of Egypt should take into account global uncertainty when formulating monetary policy, adjusting interest rates in response to both domestic and global factors. Transparent communication regarding its monetary policy decisions is crucial for managing expectations and mitigating inflation caused by global uncertainties. Moreover, comprehending the influence of uncertainty on inflation can help make informed investment choices for businesses and individuals.

Following this introduction, the next section reviews some related literature. Sections 3 and 4 present empirical model and data, respectively. The discussion of results is presented in Section 5. Section 6 includes some robustness checks, and Section 7 concludes with policy recommendations.

2 Literature review

Recent inflation dynamics across global and emerging markets have prompted renewed scholarly attention, particularly in the aftermath of the COVID-19 pandemic and global supply chain disruptions. Multiple studies have attempted to model inflation under these evolving global conditions. For instance, Bonam and Smădu (2021) forecasted a positive inflationary effect of pandemic-induced fiscal and monetary expansion in Europe, while Ascari et al. (2024) identified global supply chain pressures as the primary driver of euro area inflation in 2022. Bobeica and Hartwig (2023), however, noted that the unprecedented nature of COVID-19 presents significant challenges for traditional inflation modelling approaches. Meanwhile, Łyziak (2019) found that global demand conditions are not significant predictors of domestic inflation in Poland, highlighting the heterogeneous nature of inflation drivers across economies.

Alongside these real-side shocks, global policy-related uncertainty has emerged as a critical factor influencing inflation expectations and outcomes. Selmi et al. (2020) found that EPU distorts the Federal Reserve's credibility and hampers the effectiveness of monetary policy transmission. Ghosh et al. (2021), using data from India, demonstrated that both domestic and global policy uncertainties play a key role in shaping inflation expectations. In South Africa, Ahiadorme (2022) provided empirical support for the impact of global uncertainty shocks on domestic inflation dynamics. Expanding the scope to a larger number of countries, Anderl and Caporale (2023) showed that EPU has an asymmetric impact on inflation across a panel of developed and emerging economies. Similarly, Iacoviello et al. (2024), using historical panel data from 44 countries since 1900, found that geopolitical risk has historically driven up inflation through supply-side disruptions and risk premia. Wang et al. (2025) applied the quantile-on-quantile approach to investigate the impact of EPU on food prices in the expanded BRICS countries, including Egypt. Their study found significant nonlinear effects of EPU on inflation across different quantiles, suggesting that the inflationary impact of uncertainty is contingent on the underlying inflation regime and country-specific vulnerabilities.

Despite the extensive research on inflation determinants in the broader emerging market context, studies focusing specifically on Egypt remain comparatively limited, particularly in relation to global uncertainty. Several recent works, however, shed light on the Egyptian experience with inflation under both domestic and external shocks. Kamara et al. (2025) used a NARDL approach to assess the asymmetric effects of oil prices and exchange rates on inflation in Egypt. Their findings indicate that while both appreciation and depreciation of the exchange rate affect inflation, the impact is notably stronger when the currency depreciates. This aligns with Abouelhassan (2022), who also emphasised the nonlinear nature of exchange rate transmission to inflation in the Egyptian context. Further evidence on exchange rate pass-through is provided by Elnagger and Richter (2022), who used VAR models to estimate the response of inflation before and after Egypt's 2016 currency floatation. Their results show that exchange rate shocks are a major driver of price volatility in both regimes. Similarly, Khodeir (2012) found that exchange rate fluctuations influence producer prices more strongly than consumer prices due to subsidy policies, while Helmy et al. (2019) argued the opposite, highlighting greater sensitivity in consumer prices and suggesting that measurement frameworks play a critical role in interpreting pass-through dynamics.

Monetary and fiscal variables have also been extensively studied as domestic drivers of inflation. Helmy (2008) identified budget deficits as inflationary in Egypt, while Helmy (2022) demonstrated that rising external debt exerts upward pressure on inflation in both the short and long run. Abdelraouf et al. (2021) and Abonazel and Elnabawy (2020) further reinforced this finding by linking inflation volatility to excessive liquidity expansion and loose fiscal discipline.

Beyond domestic factors, several studies have highlighted the role of external forces in driving inflation. Hosny (2013) established that global commodity price shocks feed into Egypt's domestic inflation, while Kia and Sotomayor (2020) found that US interest rate changes and global price levels influence inflation in emerging economies, including Egypt. Ali (2020) examined oil price volatility and concluded that it has a statistically significant effect on Egyptian inflation, especially in the short term. More recently, Iliyasu et al. (2023) showed that climate-induced disruptions also exacerbate inflation in African economies, including Egypt.

On the institutional side, ElHodaiby and Elsamman (2021) found that increasing the independence of the Central Bank of Egypt can lower inflation by enhancing policy credibility. Sharaf (2015) used an ARMA-GARCH model to demonstrate a bidirectional relationship between inflation and its uncertainty, validating both the Friedman-Ball and Cukierman-Meltzer hypotheses. This supports the argument that inflation expectations and volatility themselves can amplify inflationary pressures, especially in uncertain policy environments.

In summary, while the literature on Egypt's inflation determinants is extensive, ranging from monetary variables and fiscal imbalances to external shocks, the specific role of global EPU remains underexplored. No prior study has directly assessed the impact of EPU on inflation in Egypt, nor has any employed a nonlinear time-series framework to test for asymmetry in this relationship. This study seeks to fill this gap.

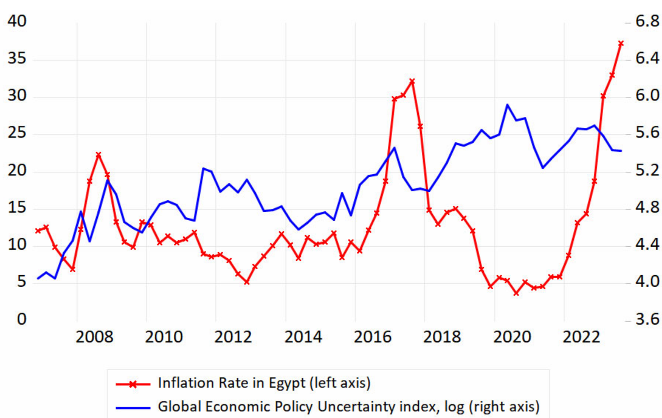
3 Methodology

3.1 Theoretical foundation

The literature on inflation dynamics has proposed several drivers of inflation such as money growth, interest rates, exchange rates, budget deficit, and inflation uncertainty. That is, the quantity theory of money posits that inflation is the difference between the growth rates of the money supply and real GDP (Fisher, 1911). The Taylor Principle underscores the significance of interest rates in managing inflation (Taylor, 1993). In small open economies like Egypt, the foreign exchange rate can impact inflation through its pass-through effects on domestic prices (Mundell, 1963). The fiscal theory of the price level suggests that the budget deficit is a key factor influencing inflation (Cochrane, 2023). Cukierman and Meltzer (1986) introduced the concept of inflation uncertainty as a determinant of inflation. According to their theory, an increase in inflation uncertainty, whether caused by external shocks, asymmetric information, or discretionary monetary policy, leads to higher actual inflation. While previous research has explored the impact of inflation uncertainty on actual inflation, the influence of EPU on inflation is still an evolving area of study.

Figure 2 highlights the co-movement between inflation and global EPU over the study period which shows that inflation tends to rise sharply following episodes of declining global uncertainty, while increases in uncertainty are often associated with subdued or declining inflation. This pattern aligns with theoretical expectations that global uncertainty shocks transmit into domestic inflation dynamics through multiple macroeconomic channels. On the one hand, heightened global EPU can lead to contractionary effects, such as capital flight and precautionary monetary tightening, which restrain aggregate demand and dampen inflationary pressures. On the other hand, a reduction in uncertainty may stimulate economic confidence, encourage investment and consumption, and support looser monetary policy, thereby increasing inflation. This divergence in inflation's response to positive versus negative changes in global EPU provides preliminary support for the hypothesis of asymmetric effects and motivating a nonlinear setup for analysis.

Figure 2 Historical inflation rate in Egypt and global EPU index (see online version for colours)



Source: Prepared by the author

This paper investigates the impact of global EPU on inflation by specifying the following model:

$$\begin{aligned} \ln CPI_t = {} & \beta_0 + \beta_1 \ln M0_t + \beta_2 \ln GDP_t + \beta_3 i_t \\ & + \beta_4 \ln FX_t + \beta_5 \ln cash_t + \beta_6 \ln EPU_t + \epsilon_t \end{aligned} \tag{1}$$

where *CPI* is the consumer price index, *M*0 is a measure of monetary aggregates, *GDP* is a gross domestic product, *i* is interest rate, *FX* is the foreign exchange rate (measured as EGP per USD), *cash* is the government cash deficit, and *EPU* is the global EPU index developed by Baker et al. (2016). This paper uses reserve money (*M*0) as a measure of monetary aggregates due to its reflection of monetary policy dynamics compared to M2, which is influenced by savers' behaviour. The central bank policy rate is utilised as a measure of interest rates as it better reflects monetary policy stance compared to other interest rate indicators. The government cash deficit is used to gauge fiscal pressures on inflation, chosen over the budget deficit due to its direct impact on liquidity and government borrowing, reflecting the difference between government expenditures and revenues without the influence of non-cash items.

The expected sign for β_1 is positive since an increase in money supply results in higher inflation. The demand-pull theory of inflation suggests a positive sign of β_2 where increases in economic activity drives inflation up. The Taylor principle suggests that raising interest rates will stabilise inflation, hence, a negative β_3. The pass-through effect of the exchange rate to inflation implies a positive β_4 coefficient. A higher budget deficit is likely to increase inflation, indicating an expected positive sign for β_5. The sign of β_6 is undetermined a prior. Increases in global EPU can drive up domestic inflation especially if this uncertainty is associated with disruption in global supply chains. Conversely, increases in global EPU can reduce domestic inflation if it leads to decreased domestic aggregate demand due to fears of an upcoming recession and potential job losses. Table 1 provides a summary of study variables, their definitions, and expected influence.

Table 1 Study variables, their definition, and expected influence

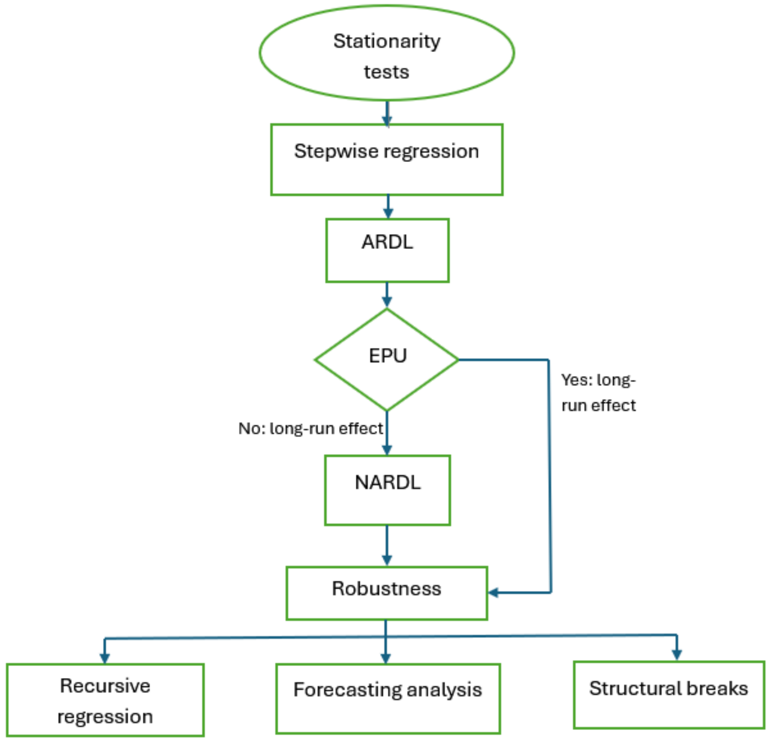
Variable	*Definition*	*Expected impact on CPI*
CPI	Consumer price index	
M_0	Reserve money	Positive
GDP	Real gross domestic product	Positive
i	Central Bank of Egypt policy rate	Negative
FX	EGP per USD	Positive
cash	Government cash deficit	Positive
EPU	Global EPU index	Asymmetric

Source: Prepared by the author

3.2 Empirical strategy

Figure 3 outlines the sequential methodological framework employed in this study to assess the impact of global EPU on inflation in Egypt. The empirical approach begins with stationarity tests, followed by a stepwise regression procedure to ensure the relevancy of included variables. Following a mixed integration order of included series with none is integrated of order two, the analysis proceeds with an estimation of a linear ARDL model. If no significant long-run effect of EPU is found, the NARDL framework is then applied to account for potential asymmetries. The final stage incorporates a robustness assessment, including recursive coefficient estimation, forecasting accuracy, and structural break analysis.

Figure 3 Diagrammatic flowchart of methodology (see online version for colours)



Source: Prepared by the author

3.2.1 Linear ARDL regression

For the long-run estimates in equation (1) to be meaningful, cointegration among its variables needs to be established. Conventional cointegration techniques such as Engle and Granger (1987) and Johansen and Juselius (1990) require all variables to be integrated of the same order. However, Pesaran et al. (2001) offer the bounds testing approach as an alternative to establish cointegration when using the ARDL regression, regardless of whether the underlying variables of interest are I(0), I(1), or a combination of both.

Given their flexibility with mixed integration orders and small samples, the ARDL framework is commonly used to model inflation in many economies. For example, Javed and Azim (2016) applied ARDL to inflation and political factors in Pakistan; and Nkegbe and Mumin (2014) used ARDL to link inflation to interest rates in Ghana. ARDL has also been used to examine inflation alongside banking development and trade in Vietnam (Phan et al., 2025), and to analyse agricultural inflation dynamics during COVID-19 in the USA (Ashraf et al., 2024).

To proceed with the ARDL framework, the unrestricted error correction form of equation (1) is specified as follows.

$$\begin{aligned}\Delta \ln CPI_t &= \alpha_0 + \sum_{j=1}^{p} \gamma_{0j} \Delta \ln CPI_{t-j} + \sum_{j=1}^{q1} \gamma_{1j} \Delta \ln M0_{t-j} \\ &\quad + \sum_{j=1}^{q2} \gamma_{2j} \Delta \ln GDP_{t-j} + \sum_{j=1}^{q3} \gamma_{3j} \Delta i_{t-j} + \sum_{j=1}^{q4} \gamma_{4j} \Delta \ln FX_{t-j} \\ &\quad + \sum_{j=1}^{q5} \gamma_{5j} \Delta \ln cash_{t-j} + \sum_{j=1}^{q6} \gamma_{6j} \Delta \ln EPU_{t-j} + \omega_0 \ln CPI_{t-1} \\ &\quad + \theta_1 \ln M0_{t-1} + \theta_2 \ln GDP_{t-1} + \theta_3 i_{t-1} + \theta_4 \ln FX_{t-1} + \theta_5 \ln cash_{t-1} \\ &\quad + \theta_6 \ln EPU_{t-1} + \epsilon_t \end{aligned} \tag{2}$$

where Δ is the first difference operator, and $\gamma_{0j}, \gamma_{1i}, \ldots, \gamma_{6j}$ captures short-run dynamics. With no serial correlation in the error term of equation (2), the bounds test can be applied. The bounds test is an F-test of no joint effects of lagged level variables in equation (2).[1] Once cointegration is established, long-run marginal effects [β_s in equation (1)] can be derived from $\theta_1, \theta_2, \ldots, \theta_6$ as follows: $\beta_s = \frac{\theta_s}{-\rho}$ where ρ represents the speed of adjustment to the long-run equilibrium following a shock to the system.

3.2.2 Nonlinear ARDL regression

Equation (2) assumes symmetry in the impact of EPU on inflation. However, it can be argued that changes in EPU could have asymmetric effects on inflation. For instance, during periods of increased global uncertainty, the Central Bank of Egypt might implement precautionary or reactive measures to dampen domestic inflation, such as tightening monetary policy to defend the Egyptian pound or stabilise economic activity. In contrast, easing policy during low uncertainty can boost inflation through increased liquidity, economic confidence, higher spending, and investment.

To assess the asymmetric impact of global EPU on inflation in Egypt, this paper employs the NARDL approach introduced by Shin et al. (2014) as an enhancement to the ARDL model by Pesaran et al. (2001). In this approach, the variable of interest is decomposed into positive and negative changes to capture increases and decreases in its values. Specifically, increases in EPU are represented by the sum of positive changes, denoted as $EPU^{+} = \sum_{k=1}^{t} \max(\Delta EPU_k, 0)$, while decreases in EPU are represented by the sum of negative changes, denoted as $EPU^{-} = \sum_{k=1}^{t} \min(\Delta EPU_k, 0)$. By decomposing changes in EPU into positive and negative components, equation (2) can be modified by substituting EPU_t with EPU^{+} and EPU^{-} as follows:

$$\begin{aligned}\Delta \ln CPI_t &= \alpha_0' + \sum_{j=1}^{p} \gamma_{0j}' \Delta \ln CPI_{t-j} + \sum_{j=1}^{q1} \gamma_{1j}' \Delta \ln M0_{t-j} \\ &\quad + \sum_{j=1}^{q2} \gamma_{2j}' \Delta \ln GDP_{t-j} + \sum_{j=1}^{q3} \gamma_{3j}' \Delta i_{t-j} + \sum_{j=1}^{q4} \gamma_{4j}' \Delta \ln FX_{t-j} \\ &\quad + \sum_{j=1}^{q5} \gamma_{5j}' \Delta \ln cash_{t-j} + \sum_{j=1}^{q6} \gamma_{6j}' \Delta \ln EPU_{t-j} + \omega_0 \ln CPI_{t-1} \\ &\quad + \omega_1 \ln M0_{t-1} + \omega_2 \ln GDP_{t-1} + \omega_3 i_{t-1} + \omega_4 \ln FX_{t-1} + \omega_5 \ln cash_{t-1} \\ &\quad + \omega_6^{+} \ln EPU_{t-1}^{+} + \omega_6^{-} \ln EPU_{t-1}^{-} + \epsilon_t \end{aligned} \tag{3}$$

Equation (3) can be estimated using ordinary least squares, following the same procedure outlined for ARDL regression above. The long-run asymmetric effects of policy uncertainty can be tested using a Wald test with the null hypothesis of $\frac{\omega_6^+}{-\omega_0} = \frac{\omega_6^-}{-\omega_0}$.

4 Data

The data for this study are sourced from various sources. The consumer price index, EGP per USD exchange rate, and the Central Bank of Egypt's policy rate data are obtained from the International Financial Statistics of the International Monetary Fund. Real GDP data are from the Egyptian Ministry of Planning and Economic Development. Reserve money (M0) and the government's cash deficit are sourced from the Central Bank of Egypt. Monthly global EPU index data are sourced from https://www.policyuncertainty.com and averaged quarterly. Seasonal adjustments for reserve money, cash deficit, and real GDP are made using the X13 ARIMA method. The study data cover the period from 2006Q4 to 2023Q3 and the analysis is carried out using EViews 10.

Table 2 Correlation matrix among study variables

	lnCPI	*lnEPU*	*lnM0*	*lnGDP*	*lnFX*	*i*	*lncash*
ln*CPI*	1						
ln*EPU*	0.85	1					
lnM_0	0.99	0.83	1				
ln*GDP*	0.99	0.85	0.99	1			
ln*FX*	0.95	0.78	0.93	0.92	1		
i	0.59	0.43	0.56	0.53	0.74	1	
ln*cash*	0.9	0.74	0.9	0.88	0.83	0.53	1

Source: Authors' calculations

Table 2 reports the correlation coefficients among all variables included in the analysis. The results reveal strong and statistically meaningful pairwise associations, most notably between the log of consumer price index and its key macroeconomic determinants. That is, consumer prices are highly correlated with global EPU (0.85), money supply (0.99), real GDP (0.99), and the exchange rate (0.95). These high correlations provide empirical support for the theoretical inclusion of global and domestic macroeconomic factors in the inflation equation. The observed 0.85 correlation between EPU and CPI is particularly notable, aligning with the study's central hypothesis regarding the influence of global policy uncertainty on domestic inflation dynamics.

5 Results

To apply the ARDL framework, it suffices that none of the included series to be integrated of order 2 or higher. The augmented Dickey-Fuller test (Table 3) shows that ln*CPI*, ln*GDP*, *i*, ln*FX*, and ln*EPU* are I(1), while ln*M*0 and ln*cash* are I(0). This mix of integration orders justifies using the ARDL framework, which accommodates a mix of I(0) and I(1) variables.

Table 3 Results of the augmented Dickey-Fuller unit roots test

Variable	*Level*	*Specification*	*1st diff*	*Specification*
ln*CPI*	–2.11	T	–4.41***	C
lnM_0	–3.54**	T	--	--
ln*GDP*	–2.35	T	–9.37***	C
i	–1.81	C	–3.67***	none
ln*FX*	–2.04	T	–7.63***	C
ln*cash*	–6.09***	T	--	--
ln*EPU*	–3.43*	T	–8.42***	none

Notes: ***, **, and * indicate that the estimated coefficient is statistically significant at the 1%, 5%, and 10%, respectively. Specification indicates whether the test specification included a constant (C), constant and Trend (T), or none (none). Schwarz Bayesian Criterion is used for lag selection.

Source: Authors' calculations

Table 4 Stepwise regression results for inflation equation in Egypt

Regressor	*Coefficient (t-ratio)*
Always included regressors	
lnM_0	0.56***
	(13.36)
ln*GDP*	0.06**
	(2.63)
i	0.001
	(0.40)
Search regressors	
ln*FX*	0.17***
	(3.51)
ln*cash*	0.03*
	(1.97)
ln*EPU*	0.11***
	(4.24)
Adjusted R^2	0.99

Notes: Estimation period: 2006Q4–2023Q3; selection method: stepwise forwards with p-value of 0.05. t-ratios in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Source: Author's calculation

5.1 Stepwise regression analysis

To ensure that the variables in equation (1) are relevant to the inflation equation for Egypt, a stepwise regression approach is employed (Table 4). Stepwise regression involves iteratively selecting independent variables and testing their statistical significance. In this study, money supply, real GDP, and interest rate are considered as essential regressors, while foreign exchange rate, government cash deficit, and EPU are included as search regressors. Although interest rate is statistically insignificant, it is retained in the estimated models based on theoretical grounds and to avoid mis-specification.

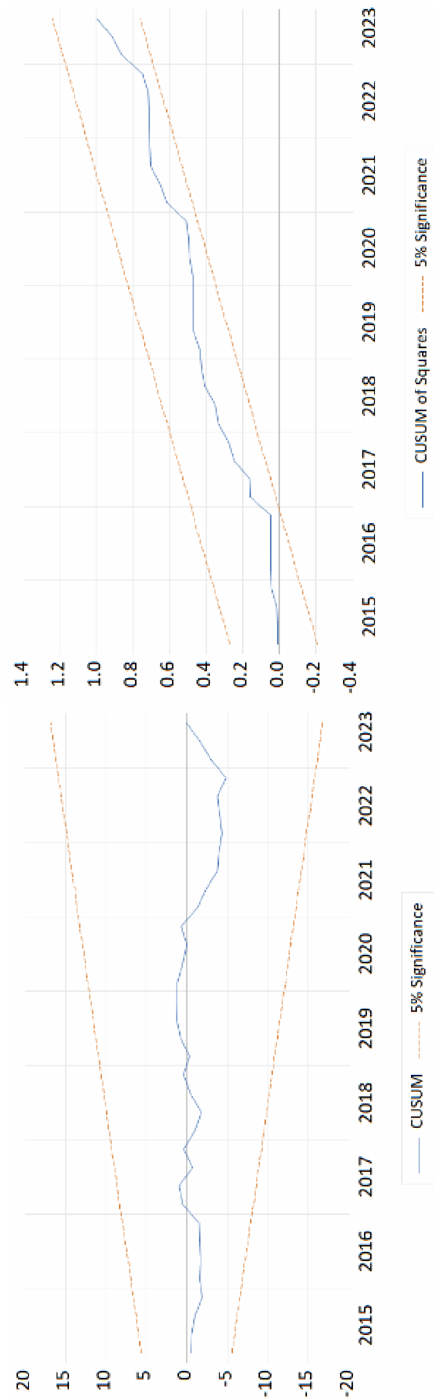
Table 5 Coefficient estimates of inflation dynamics in Egypt using linear ARDL regression

Panel A: Short-run coefficient estimates						
Lag order	*0*	*1*	*2*	*3*	*4*	*5*
Δ*lnCPI*		–0.16	–0.48***	–0.44***	-0.08	–0.15
		(–1.54)	(–5.08)	(–3.98)	(–0.85)	(–1.81)
$\Delta\ln M_0$	0.04					
	(1.66)					
Δln*GDP*	–0.18					
	(–1.67)					
Δ*i*						
Δln*FX*	0.04**	0.08***	0.05**	0.06***	0.005	–0.03
	(2.54)	(5.86)	(2.58)	(3.69)	(0.31)	(–1.87)
Δln*cash*	0.004	0.02***	0.01	0.02***	0.01**	
	(0.86)	(3.16)	(1.55)	(3.24)	(2.60)	
Δln*EPU*	–0.01					
	(–1.14)					
Panel B: Long-run coefficient estimates						
Constant	*lnM0*	*lnGDP*	*i*	*lnFX*	*lncash*	*lnEPU*
1.05	0.62***	0.26	0.03**	0.33***	–0.16	–0.13
(0.29)	(2.84)	(0.50)	(2.4)	(3.75)	(–1.51)	(–1.47)
Panel C: Diagnostics						
F-statistic[a]	ECM_{t-1}	*LM*[b]	*Adjust* R^2	*CUSUM*	*CUSUMQ*	
8.89***	–0.17***	4.87	0.84	Stable	Stable	
	(–9.24)					

Notes: ARDL model (6, 1, 1, 0, 6, 5, 1) with restricted constant and no trend; optimal lag-length selected by the AIC. t-ratios in parentheses. ***, ** indicate significance at 1%, 5%, respectively.
[a]The Narayan (2005) upper critical bound value for the F-statistic at 1% significance level with six regressors is 6.12.
[b]The LM test statistic for autocorrelation, distributed as χ^2 with two degrees of freedom. The critical value at 10% is 4.60.

Source: Author’s calculation

Figure 4 CUSUM and CUSUMQ stability tests for the linear ARDL regression (see online version for colours)



Source: Prepared by the author

5.2 Linear ARDL regression results

Table 5 presents the estimated results for the linear ARDL model specified in equation (2). In panel C, the estimated F-statistic value of 8.89 indicates a strong long-run relationship between the variables in equation (2). The significant coefficient for the error-correction term of –0.17 implies convergence to the steady state within approximately six quarters following a shock. The estimated LM test statistic suggests the presence of serial correlation at a 10% significance level. The model demonstrates a good fit with an adjusted R^2 of 0.84 and stable cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) tests of residuals (Figure 4).

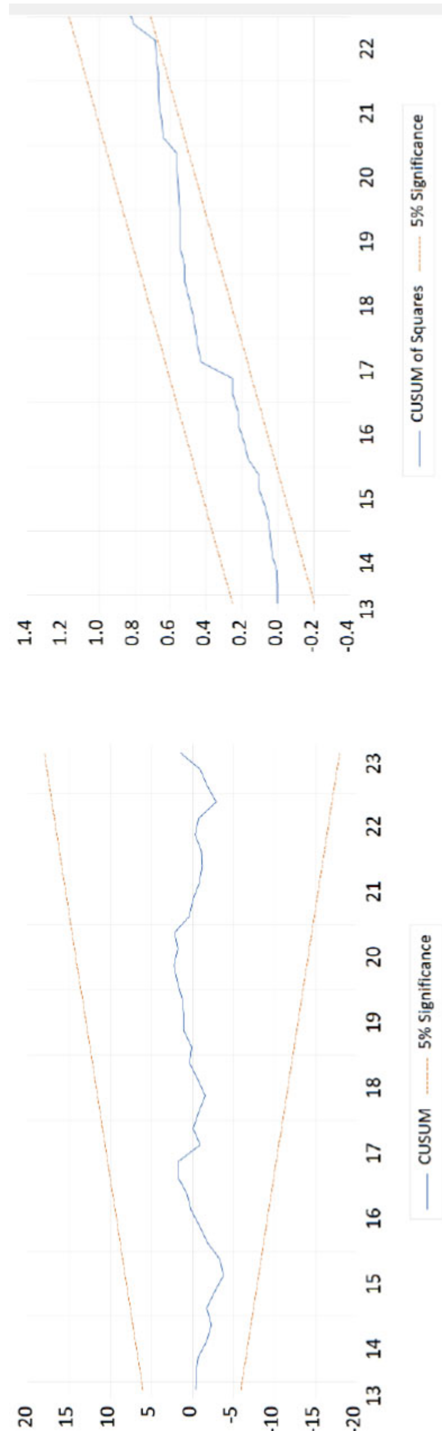
In panel A, the estimated short-run coefficients indicate that inflation's dynamics, exchange rate, and government cash deficit are the main drivers of inflation in the short run. Panel B shows that money growth, interest rate, and foreign exchange rate are the key determinants of inflation in Egypt in the long run. The positive and significant coefficient of money supply supports the classical view of inflation as a monetary phenomenon. However, the positive and significant coefficient of the interest rate is unexpected, suggesting that the central bank of Egypt may not be effectively managing inflation expectations. The positive and significant coefficient of the exchange rate indicates a pass-through effect of foreign exchange rates on domestic inflation. EPU does not have a significant impact on inflation in the linear ARDL model, raising the question whether the true underlying relationship is nonlinear. The next section delves into asymmetries in this relationship.

5.3 Nonlinear ARDL regression results

Table 6 presents the estimates of the NARDL regression specified in equation (3). In panel C, the estimated F-statistic value of 10.7 indicates a strong long-run relationship between the variables in equation (3). The significant coefficient for the error-correction term of –0.22 suggests convergence to the steady state within less than five quarters after a shock. The estimated LM test statistic of 1.56 indicates no evidence of serial correlation. The estimated Jarque-Bera test statistic of 0.32 suggests that the residuals are normally distributed. The model fits well with an adjusted R^2 of 0.87 and stable CUSUM and CUSUMQ tests of residuals (Figure 5). Comparing the diagnostic test results of the NARDL with those of the ARDL suggests that the NARDL regression provides a better statistical fit than the linear model.

In panel A, the estimated short-run coefficients suggest that inflation's own dynamics, interest rate, and exchange rate are the primary driving forces of inflation in the short run. In panel B, the estimated long-run coefficients show improved statistical significance compared to the linear ARDL model, and all control variables have the expected signs. Money supply has a positive and significant effect on inflation in Egypt, with a 1% increase in money supply resulting in a 0.82% increase in inflation. A 1% increase in real GDP leads to a 1.62% increase in inflation. Similar to the findings of the linear ARDL regression, an increase in the interest rate is associated with higher inflation, casting doubt on the effectiveness of the interest rate as a monetary transmission channel in Egypt. There is evidence of an exchange rate pass-through effect on domestic inflation, with a 10% depreciation of the Egyptian pound resulting in a 2.7% increase in domestic inflation. There is no evidence of fiscal pressures on inflation in the long run.

Figure 5 CUSUM and CUSUMQ stability tests for the nonlinear ARDL regression



Source: Prepared by the author

Table 6 Coefficient estimates of inflation dynamics in Egypt using nonlinear ARDL regression

Panel A: Short-run coefficient estimates						
Lag order	*0*	*1*	*2*	*3*	*4*	*5*
Δln*CPI*		–0.31***	–0.59***	–0.49***	–0.17**	–0.15**
		(–3.20)	(–7.16)	(–4.82)	(–2.21)	(–2.09)
ΔlnM_0	0.02	–0.07**				
	(1.13)	(–2.70)				
Δln*GDP*	0.10					
	(1.07)					
Δ*i*						
Δln*FX*		0.09***	0.08***	0.11***	0.06***	
		(6.72)	(5.27)	(7.38)	(3.43)	
Δln*cash*						
ΔlnEPU^+						
ΔlnEPU^-						

Panel B: Long-run coefficient estimates							
Constant	*lnM_0*	*lnGDP*	*i*	*lnFX*	*lncash*	*lnEPU^+*	*lnEPU^-*
–11.43***	0.82***	1.62***	0.03***	0.27***	0.03	–0.20**	0.21***
(–3.81)	(5.26)	(4.45)	(4.51)	(3.43)	(1.50)	(–2.62)	(3.17)

Panel C: Diagnostics							
F-statistic[a]	*ECM_{t-1}*	*LM*[b]	*Adjust R^2*	*JB*[c]	*CUSUM*	*CUSUMQ*	*Wald test*[d]
10.70***	–0.22***	1.56	0.87	0.32	Stable	Stable	12.93***
	(–10.75)						

Notes: NARDL model (6, 2, 1, 0, 5, 0, 0, 0) with restricted constant and no trend; optimal lag-length selected by the SBC. t-ratios in parentheses. ***, ** indicate significance at 1%, 5%, respectively.
[a]The Narayan (2005) upper critical bound value for the F-statistic at 1% significance level with seven regressors is 6.14.
[b]The LM test statistic for autocorrelation, distributed as χ^2 with two degrees of freedom. The critical value at the 5% level is 5.99.
[c]*JB* is the Jarque-Bera test for normality of residuals.
[d]The test statistic of the Wald test of no asymmetry distributed as χ^2 with 1 degree of freedom. The critical value at the 5% level is 3.84.

Source: Author's calculation

Both partial sum variables, EPU^+ and EPU^-, have significant coefficients, indicating the nonlinear adjustment of the EPU measure. The coefficient of the EPU^+ variable (reflecting increases in uncertainty) is negative 0.20 while the coefficient of the EPU^-, variable (reflecting decreases in uncertainty) is positive 0.21. This asymmetry is further supported by the Wald test (panel C). These findings suggest an asymmetry in the response of inflation to EPU, where increases in uncertainty lead to a decrease in inflation, and decreases in uncertainty lead to an increase in inflation. There could be several reasons for this asymmetric behaviour of inflation. One possible reason is that during periods of increased global uncertainty, the Central Bank of Egypt might implement precautionary or reactive measures to dampen domestic inflation, such as tightening monetary policy to defend the Egyptian pound or stabilise markets. In contrast, easing policy during low uncertainty can boost inflation through increased liquidity, economic confidence, higher spending, and investment. Another reason is that increases in global EPU can reduce confidence worldwide, affecting trade and investment flows into Egypt, potentially resulting in lower demand-pull inflation as businesses and consumers become more cautious. When global uncertainty decreases, confidence returns, boosting trade and investment, and thus driving up inflation.

6 Robustness

To ensure the robustness and reliability of the estimated NARDL findings, it is essential to conduct additional robustness analyses that test the model's stability and forecasting capabilities. This section employs recursive estimates to assess the consistency of parameter estimates across different sample periods, providing a dynamic perspective on the model's performance. Additionally, it evaluates the forecasting power of the model to validate its predictive accuracy and practical applicability in anticipating future inflation dynamics under varying conditions of EPU. These robustness checks are crucial for verifying the strength and credibility of this paper's conclusions.

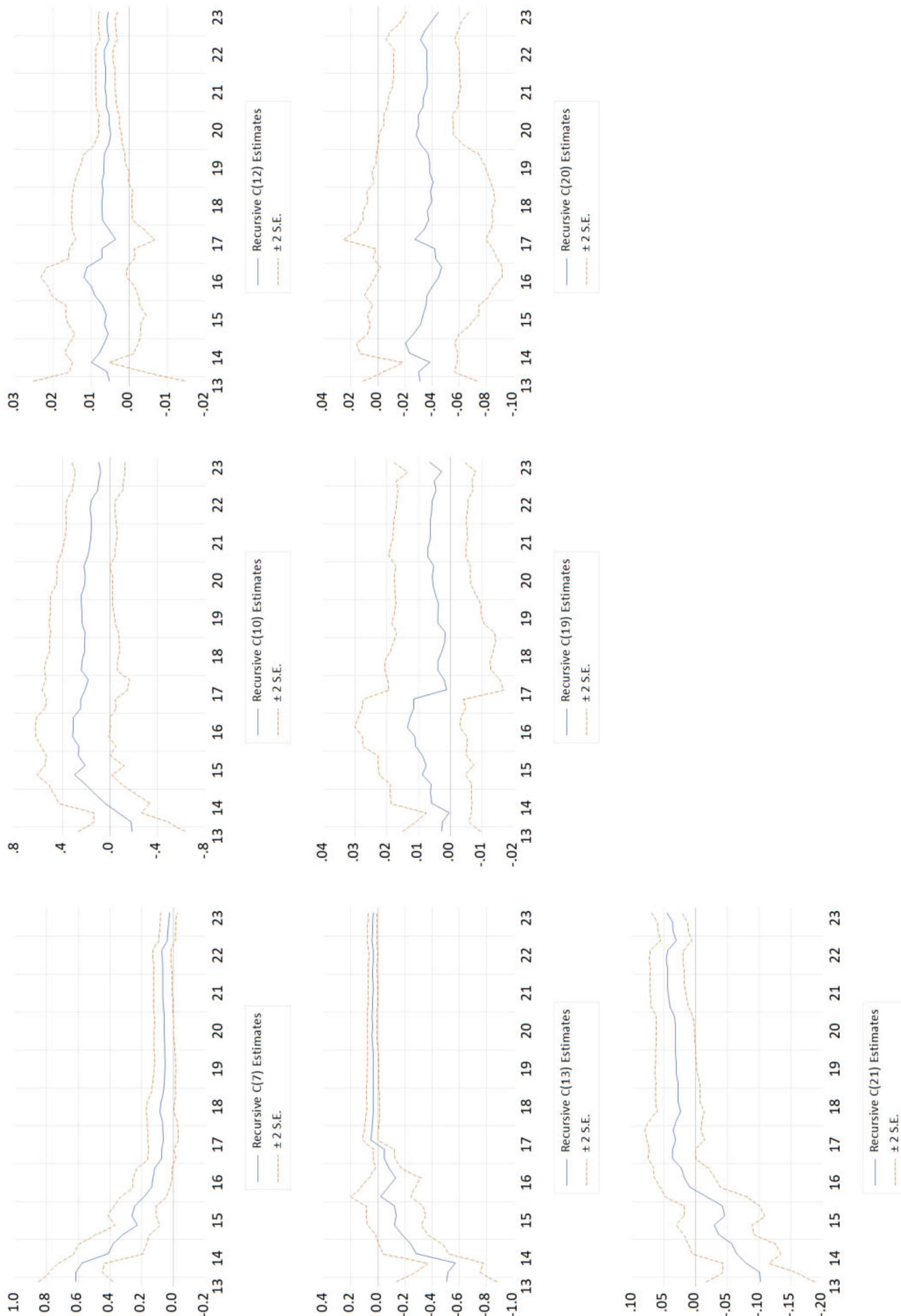
6.1 Recursive regression analysis

This subsection examines the possibility for unstable coefficients in the estimated relation by analysing the estimated coefficients through recursive regression (Figure 6). The coefficient of money supply initially starts high and gradually decreases, stabilising at a lower level after 2017. Real GDP has a small positive influence on inflation, while interest rates have a consistently negligible effect. The Foreign Exchange Rate exhibits a fluctuating but ultimately neutral impact on inflation, which is surprising given the association between recent devaluation episodes and higher inflation rates. Government cash deficit has a minimal long-term effect. The estimates indicate that EPU consistently has a negative impact on inflation. An increase in uncertainty leads to a decrease in inflation, while a decrease in uncertainty has a positive effect on inflation, suggesting an asymmetric effect. Overall, the results reveal stable and significant coefficients, aligning with the findings of the NARDL regression in Table 6.

6.2 Forecasting analysis

This subsection evaluates the forecasting performance of the estimated NARDL model during the study period. Figure 7 illustrates that the predicted inflation values closely follow the actual values, indicating the model's accuracy. Table 7 shows that the model exhibits low values of the root mean squared error (RMSE) at 0.83%, the mean absolute error (MAE) at 0.66%, and Theil's inequality coefficient at less than 0.001, suggesting a strong alignment between the forecasted and observed values. These metrics collectively indicate that the model effectively predicts inflation with minimal errors and high precision.

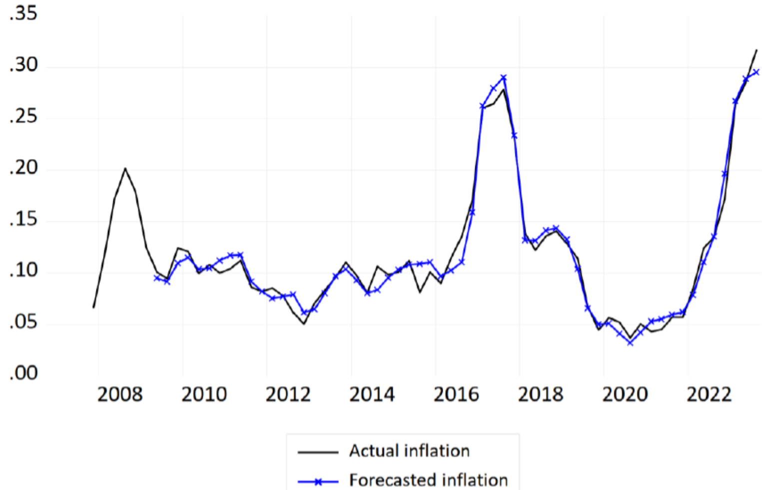
Figure 6 Recursive coefficients of the determinants of inflation in Egypt based on NARDL regression (see online version for colours)



Note: First row: ln*M*0, ln*GDP*, and *i*. Second row: ln*FX*, ln*cash*, and lnEPU^{+}. Third row: lnEPU^{-}.

Source: Prepared by the author

Figure 7 Actual and forecasted values of inflation based on the nonlinear ARDL regression specified in equation (3) (see online version for colours)



Note: Method: within-sample dynamic forecast.

Source: Prepared by the author

Table 7 Summary statistics for the forecast errors of ln*CPI*

Statistic	*Value*
Root mean squared error	0.008
Mean absolute error	0.006
Mean absolute percent error	0.128
Theil inequality coefficient	0.001

Source: Author's calculation

6.3 Least squares with breakpoints

To account for potential structural breaks in the estimated inflation relation over the study period, this subsection uses the least squares with breaks technique to estimate the inflation relation specified in equation (1), with breaks stemming from foreign exchange rate and EPU. Table 8 presents the regression results, revealing four breaks during the study periods corresponding to the 2011 revolution, a major depreciation of the Egyptian pound in 2016, and inflationary pressures due to easing monetary policy during COVID-19. While these breaks could potentially undermine the results of the NARDL regression, it is important to note that the primary objective of the paper is to understand asymmetric effects, which the nonlinear ARDL model effectively captures. Introducing structural breaks, particularly when some occur within a short two-year period, could complicate the model further due to the resulting small samples, potentially leading to overfitting and reduced interpretability. However, rigorous model diagnostics and stability tests are conducted to ensure the stability of the estimated NARDL model. Tables 5 and 6 indicate the absence of autocorrelation in the error term. Additionally, the estimated Jarque-Bera test statistic suggests that the error terms follow a normal distribution. Both CUSUM and CUSUMQ (Figure 3) indicate that the parameters remain stable over time despite structural breaks. The recursive coefficient analysis supports the stability of the estimated coefficients over time.

Table 8 Breakpoint least squares regression results

Non-breaking regressors				
C	–9.69***			
	(–8.42)			
lnM_0	0.15**			
	(2.18)			
ln*GDP*	1.89***			
	(8.77)			
i	0.01*			
	(2.0)			
Breaking regressors				
	06Q4-10Q4	*11Q1-16Q4*	*17Q1-21Q1*	*21Q2-23Q3*
ln*FX*	–0.06	0.05	–0.07	0.23***
	(–0.97)	(1.29)	(–0.77)	(2.82)
ln*EPU*	–0.01	–0.03	0.05	–0.12***
	(–0.44)	(–1.17)	(1.45)	(–2.69)
Diagnostics				
Adjusted R^2	0.99			
DW-statistic	1.29			
S.E. of regression	0.03			

Note: t-ratios in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Source: Author's calculation

7 Concluding remarks and policy recommendations

This paper examines the influence of global EPU on inflation in Egypt, taking into account variables such as money supply, real output, interest rates, exchange rates, and government deficits. Using quarterly data spanning the last two decades and employing linear ARDL regression, the paper does not find any significant impact of global EPU on inflation in Egypt. However, when asymmetry is introduced using nonlinear ARDL regression, an asymmetric effect emerges, showing that heightened EPU tends to dampen inflation by reducing economic activity and spending, perhaps due to tight monetary policies at times of high uncertainties. Conversely, periods of reduced uncertainty appear to boost inflation by fostering economic confidence, increased spending, and investment, due to loose monetary policies during low uncertainties periods.

The findings of this paper have significant policy implications. Given the positive impact of money supply on inflation, the Central Bank of Egypt should carefully monitor and manage money supply growth to maintain price stability. The unexpected result that higher interest rates are associated with higher inflation suggests that the central bank's interest rate policy may not be effectively controlling inflation expectations. This highlights the need to review the transmission mechanism of interest rates and consider more transparent communication strategies to align public expectations with policy objectives. Strong evidence of exchange rate pass-through to domestic inflation underscores the importance of policies to stabilise the exchange rate. This may involve interventions in the foreign exchange market or measures to strengthen the resilience of the Egyptian pound through increased foreign reserves. To mitigate the impact of global EPU, policymakers should strive for greater coordination between fiscal and monetary policies. Clear, consistent, and transparent communication about policy decisions can help manage expectations and reduce inflation. Additionally, the Central Bank of Egypt, should consider the asymmetric effects of global uncertainty when formulating monetary policy. They may need to adopt a more flexible approach where adjusting interest rates not only based on domestic conditions but also on the direction of global uncertainty changes.

The findings of this paper have also profound practical implications. For instance, businesses should establish robust risk management strategies to mitigate the impact of global EPU on inflation, which could erode the real value of their investments. This includes using financial instruments to safeguard against unfavourable fluctuations. Moreover, understanding the asymmetric effects of uncertainty on inflation can help businesses make well-informed investment decisions.

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Declarations

Author declares that there are no conflicts of interest.

During the preparation of this work, the author used scholar GPT in order to check grammar and improve readability of the manuscript. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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Notes

1 This paper compares the computed F-statistic to critical values proposed by Narayan (2005) since asymptotic critical values provided by Pesaran et al. (2001) could be misleading for small samples.