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Currency Devaluation and Macroeconomic Stability in Egypt: Evidence from SVAR Model

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خفض قيمة العملة والاستقرار الاقتصادي الكلي في مصر: دليل من نموذج الانحدار الذاتي الهيكلي (SVAR)

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Abstract

This study examines the impact of currency devaluation on macroeconomic stability in Egypt by using a Structural Vector Autoregression (SVAR) model. It focuses on the interactions between exchange rate movements, inflation, GDP, and interest rates over the period [1974-2023]. By applying this model, we identify structural shocks and analyze their effects on key macroeconomic variables. The findings reveal that currency devaluation leads to higher inflation in the short term and contributes to adjustments in interest rates as a tool to mitigate inflationary pressures in the medium and long terms. However, its impact on the real GDP and interest rates appears to be limited and depends on the prevailing monetary policy during that period. This study highlights the importance of coordinated economic policies in mitigating the adverse effects of devaluation and promoting economic resilience. It also presents an executive plan for policies aimed at balancing exchange rate flexibility with macroeconomic stability in Egypt.

Keywords: Exchange rate, currency devaluation, SVAR, interest rate, inflation in Egypt

Introduction

In recent decades, Egypt has experienced multiple episodes of currency devaluation as part of its broader economic reforms aimed at addressing external imbalances and fostering growth. While devaluation can enhance export competitiveness and correct balance of payments deficits, its broader macroeconomic impacts, particularly on inflation, Gross Domestic Product (GDP), and interest rates, remain contentious. For emerging economies, such as Egypt, where structural vulnerabilities and policy constraints are prevalent, the consequences of exchange rate adjustments warrant empirical investigation.

This study assesses the impact of currency devaluation on Egypt's macroeconomic stability using a Structural Vector Autoregression (SVAR) model. The SVAR model identifies structural shocks and traces their effects on the key macroeconomic variables. This study contributes to the literature on exchange rate policy in developing economies by focusing on Egypt, a country with a history of currency reforms.

Additionally, this study seeks to fill this research gap by relying on a long historical data series spanning the period 1974–2023, which provides a rare opportunity to examine the effects of currency devaluation on macroeconomic stability over multiple decades and policy shifts.

Primary Objectives

The primary objectives of this study are as follows:

1. Analyzing the dynamic effects of currency devaluation on inflation, output, and interest rates in Egypt.
2. Evaluating whether the combined effects of devaluation on these key variables ultimately contribute to broader macroeconomic stability or instability in the short and medium terms.
3. Providing evidence-based policy recommendations that mitigate the negative effects of devaluation and strengthen Egypt's economic resilience.

Research Questions

Accordingly, the study is designed to answer the following key research questions:

1. What are the dynamic effects of currency devaluation on inflation, output, and interest rates in Egypt?
2. Do the interactions of devaluation-induced changes in these variables translate into broader macroeconomic stability or instability in the short and medium term?
3. To what extent can a Structural VAR model effectively capture the transmission mechanisms of devaluation shocks and their impact on Egypt's macroeconomic environment?

4. What evidence-based policy recommendations can mitigate the negative effects of devaluation and enhance Egypt's economic resilience?

To achieve these objectives and answer the research questions, the structure of this paper is organized as follows: Section 1 introduces the study. Section 2 provides a comprehensive literature review on currency devaluation and macroeconomic stability. Section 3 outlines the research methodology and model specification, including the theoretical framework of the Structural VAR (SVAR) model (Section 3.1), data collection and econometric modeling (Section 3.2), diagnostic tests (Section 3.3), and the presentation and discussion of the results (Section 3.4). Finally, Section 4 presents empirical findings and offers evidence-based policy recommendations.

Literature Review of Currency Devaluation and Macroeconomic Stability

Several theoretical frameworks analyze the impact of currency devaluation on macroeconomic stability, including the elasticities, absorption, and monetary approaches to the balance of payments.

- Elasticities Approach and Marshall-Lerner Condition: This approach suggests that devaluation improves the trade balance if the combined price elasticities of exports and imports exceed one (Bahmani-Oskooee & Brooks, 1999). However, empirical evidence (Bernanke, 1986; Blanchard & Quah, 1989; Christiano et al., 2005; Stock & Watson, 2001; Uhlig, 2005) indicates that the Marshall-Lerner condition may only hold in the long run due to short-term price rigidities (Bahmani et al., 2013).
- The Absorption Approach: Alexander (1952) introduced the absorption approach, arguing that devaluation affects national income and expenditure. If an economy operates below full capacity, devaluation may stimulate output; otherwise, it may lead to inflationary pressure (Alexander, 1952).
- Monetary Approach to the Balance of Payments: Developed by Frenkel & Johnson (2013), this approach focuses on how devaluation impacts money supply and demand, leading to changes in inflation and foreign reserves. This is especially relevant in economies such as Egypt, where monetary and exchange rate policies interact (Frenkel & Johnson, 2013; Johnson, 1977).

These frameworks offer different perspectives on how currency devaluation affects economic stability. Additionally, the relationship between exchange rate fluctuations (currency devaluation) and key macroeconomic variables, such as inflation, output growth, and interest rates, has been widely explored in the economic literature.

Empirical Literature Review: Recent empirical studies have examined the multifaceted effects of currency devaluation on macroeconomic stability, highlighting both short-term adjustments and long-term structural changes.

ElGhorab (2025) examined the impact of real exchange rate depreciation on Egyptian firm-level exports using World Bank Enterprise Survey data (2008, 2013, 2016, 2020). The study found that depreciation significantly increased export performance at both intensive and extensive margins,

particularly for larger firms, foreign-owned firms, and firms with high import intensity, highlighting the role of complementary policies in maximizing competitiveness gains.

Abdelaziz et al. (2025) examined the impact of exchange rate volatility on FDI inflows in Egypt from 2002 to 2024. Using the GARCH model to measure volatility and a VAR model to assess its effects, this study finds that higher exchange rate volatility significantly reduces FDI inflows, reflecting the risk-averse behavior of foreign investors. The authors highlight the need for stable macroeconomic and exchange rate policies to enhance Egypt's investment attractiveness.

Ahmed et al. (2024) analyzed Egypt's exchange rate policies using PPP to estimate the equilibrium rate (EGP 38.5/USD) and a CGE model to assess the macroeconomic impacts. The study found limited gains in GDP and trade but significant risks of higher inflation and reduced consumption, stressing the need for balanced exchange rate policies aligned with broader economic strategies.

Ullah et al., (2024) examined the impact of governance and macroeconomic factors on financial stability in both developed and emerging countries, utilizing data from 122 countries between 2013 and 2020. The analysis revealed that factors such as interest rates, GDP growth, and governance indicators (such as political stability and control of corruption) positively impact financial stability, whereas inflation, money supply, and the rule of law have negative or insignificant effects. The findings also show the differences between developed and emerging nations. This study emphasizes the importance of effective governance and stable macroeconomic conditions in maintaining financial stability.

Sharaf and Shahen (2023) explored the asymmetric influence of the real effective exchange rate (REER) on Egypt's real domestic production between 1960 and 2020. A Nonlinear Autoregressive Distributed Lag (NARDL) model was employed to differentiate between real currency depreciation and appreciation of the REER. The findings indicate a long-term asymmetry in how changes in the REER affect output, where only real currency depreciation leads to a contractionary impact on output. In contrast, the REER has no immediate effect on output. The practical implication is that Egyptian monetary authorities cannot depend on domestic currency depreciation as a strategy to enhance domestic output.

Abonazel et al., (2023) employed an autoregressive distributed lag (ARDL) model to analyze the enduring connection between exchange rates and trade balance deficits in Egypt from 1990 to 2021. Their findings reveal a notable adverse influence of exchange rates on trade balance, aligning with established economic theories. The research suggests maintaining the exchange rate liberalization policy and focusing on broadening production capacity to boost exports.

Ekundayo et al. (2022) conducted a study on the influence of exchange rate imbalances on trade and economic growth in the eight largest African economies from 1970 to 2019, employing a nonlinear autoregressive distributed lag (NARDL) model. The findings reveal that currency appreciation and depreciation contribute to immediate trade and output enhancements in South

Africa, but lead to reductions in both aspects in Angola. In the cases of Egypt and Morocco, currency appreciation boosts short-term trade and growth, whereas depreciation diminishes them in the long term. This pattern is mirrored in Kenya and Nigeria, with the exception of the slight adverse impact of currency depreciation on trade. Generally, for most African countries, both currency appreciation and depreciation have detrimental effects on the long-term trade balance, while depreciation primarily yields short-term positive outcomes. Moreover, depreciation has a positive influence on short-term economic growth, whereas currency appreciation tends to have mostly negative effects. The study concludes by proposing policy recommendations for the continent.

Mahmoud (2022) examined the correlation between exchange rate devaluation and bilateral trade between Egypt and China from 1994 to 2019. Autoregressive Distributed Lag (ARDL) methodology was utilized for the analysis. The findings indicate that an increase in domestic income positively impacted Egypt's trade balance, while growth in China's income had a negative effect on bilateral trade. The J-curve phenomenon was observed over the long term. The implications for policymakers are twofold: first, enhancing Egypt's export promotion policies is crucial for enhancing the trade balance, and second, there are significant opportunities for Egyptian exports to expand the Chinese market.

Adams and Metwally (2021) investigated the extent to which evidence supports the presence of the Marshall–Lerner (ML) condition concerning Egypt's trade balances from 1965 to 2017. Using standard ordinary least squares models with coefficients representing elasticities, their study revealed that the export model strongly indicates that real exports of Egyptian goods and services exhibit elasticity in response to changes in the real effective exchange rate (REER), with a significant coefficient of -1.64 at the 1% level. However, in the import model, the coefficient for REER is -1.17 and is also significant at the 1% level. This outcome challenges ML theory, which posits that an increase in REER leads to cheaper imports, consequently causing their rise.

Ezzat (2018) examines the J-curve hypothesis in Egypt by analyzing the dynamics of the trade balance with Egypt's eight main trading partners. The study's findings indicate that the J-curve hypothesis is not supported in Egypt, particularly in the long term, which aligns with previous research in developing countries. The implications for policymakers can be summarized in two key points: First, the study confirms the short-term negative effects of the pound's depreciation against the US dollar, necessitating measures to alleviate these impacts, especially for vulnerable populations. Second, solely devaluing the Egyptian pound is insufficient to enhance the long-term trade balance; policies promoting domestic production and export development are essential to improve the trade balance following the pound devaluation.

Shokry & Bouaddi (2018) conducted a study on the impact of exchange rate fluctuations on sectoral output in Egypt. The research employed a MIDAS regression analysis to examine the effects of two different exchange rate measures on the production of 22 subsectors and four aggregate sectors from 1982 to 2014. The results highlight the importance of selecting an appropriate exchange rate measure for analyzing production dynamics. The real effective exchange rate provides a more

accurate reflection of a currency's true value. The findings indicate that sectors with low elasticity tend to be public, non-tradable, and have minimal contributions to GDP, while larger tradable sectors exhibit higher elasticity levels, irrespective of their import and export ratios.

Pourroy (2012) examines the role of currency rates in inflation-targeting emerging economies. We provide compelling evidence that hybrid inflation-targeting systems, in which the currency rate is regulated, provide a stronger nominal anchor because they are more resilient to the 2007–2008 inflation shock.

The aim of the research conducted by El-Ramly & Abdel-Haleim (2008) is to examine the correlation between alterations in the exchange rate and economic output in Egypt. We used a Vector Autoregression (VAR) model for annual data from 1982 to 2004. The findings reveal that devaluations initially led to a decrease in economic output in Egypt. This decline in output persists for up to four years before the anticipated positive impact of devaluation becomes evident. Furthermore, this study highlights that fluctuations in the real exchange rate play a significant role in driving changes in real output in Egypt. This indicates that it might be risky for the government to allow market forces to predominantly determine the value of the Egyptian pound. It may be necessary to intervene to rectify unfavorable movements in exchange rates. This intervention could be required until the economy fully transitions to a new flexible exchange rate system, in which monetary policy plays a more substantial role in stabilizing the economy.

Kandil and Dincer (2008) conducted a study that analyzed the impact of exchange rate variations on real output, price levels, and components of aggregate demand in Egypt and Turkey. Their research is based on a theoretical model that divides exchange rate movements into expected and unexpected components. The results show that, in Turkey, the expected appreciation of the exchange rate negatively affects real output growth, investment demand, and exports, while leading to higher inflation. In Egypt, the anticipated exchange rate appreciation hampers export growth. Due to asymmetry, the overall impact of unexpected exchange rate fluctuations in Egypt diminishes real output and consumption growth while increasing export growth on average over time.

Lord (2000) builds upon a previous elasticities-absorption framework for balance of payments analysis to investigate the impact of tariff reforms on the Egyptian macroeconomy with a specific focus on fiscal revenue implications. Using the Mundell-Fleming model from an analytical standpoint, this study delves into the effects of trade liberalization and fluctuations in exchange rates in an open macroeconomic setting. The model represents an open economy within the well-known IS-LM framework, encompassing the assessment of trade and capital accounts within the balance of payments.

Edwards (2006) examined the relationship between inflation targeting and exchange rates, focusing on three key issues. First, he explored the effectiveness of nominal exchange rates as shock absorbers in inflation-targeting countries, which is closely linked to the "pass-through" coefficient. Second, he compares the exchange rate volatility between countries with inflation targeting and those with alternative monetary policies. Third, Edwards discusses whether the exchange rate should

influence monetary policy decisions under inflation targeting, particularly whether it should play an independent role in the Taylor rule of an open economy.

Edwards (1985) discusses the debate on whether devaluations are contractionary, contrary to the traditional view. It extends the model to empirically analyze the impact of devaluations on aggregate output in developing countries. This study finds some support for the short-run contractionary devaluation hypothesis, with a subsequent expansionary effect occurring one year later. In the long run, evaluations have no effect on output.

Overall, there is a relationship between exchange rate devaluation and macroeconomic stability (GDP growth and inflation). GDP growth is not always straightforward and can depend on various factors, such as the structure of the economy, the extent of devaluation, and external demand conditions. The following section discusses these effects.

Unlike previous studies, this study differs in three main aspects: First, it covers a longer historical period and integrates recent structural reforms, which were not included in earlier works. Second, it applies a more comprehensive framework (a dynamic general equilibrium model) that goes beyond partial-equilibrium approaches, such as ARDL or NARDL. Third, it explicitly considers the joint role of monetary and fiscal policies in shaping the effects of currency devaluation, offering a more policy-relevant perspective than the previous literature.

Methodology and Model Specification

Data Collection and Econometric Modelling

Applying this methodology to Egypt's macroeconomic data from 1974 to 2023 (approximately 49 years) enables a systematic analysis of how devaluation shocks affect inflation, output, interest rate, and overall economic stability. This period includes several notable episodes of currency devaluation and structural adjustment reforms, such as those implemented in the 1990s and those following the 2016 and 2022 devaluations. By capturing the transmission mechanisms of exchange rate shocks, SVAR provides valuable policy-relevant insights, particularly for developing and emerging economies facing external vulnerabilities and inflationary pressures.

The model design and identification strategy in this study draws on established literature, including the work of Sims (1980) on VAR methodology, Bernanke (1986) on the identification of monetary policy shocks (exchange and interest rates), and Blanchard and Quah (1989) on long-run restrictions. Additional insights are provided by Kilian and Lütkepohl (2017), Enders (2014), and more recent applications in the Egyptian context, such as Helmy and Fayed (2018), Shokr, El-Shazly, and Hassan (2019), Shokr and Karim (2021), ElDepcy (2022) as well as comparative evidence from the broader MENA region by Alabdulwahab and Abou-Zaid (2024). Together, these studies provide comprehensive discussions on SVAR implementation and interpretation in empirical macroeconomics, reinforcing the robustness of the methodological framework adopted in this research.

These studies collectively underscore the utility of non-recursive SVAR models in capturing the complex interactions among monetary policy, exchange rate dynamics, and macroeconomic outcomes in Egypt. These findings provide valuable insights for policymakers aiming to enhance economic stability through informed monetary and exchange rate policies.

Given Egypt's economic structure, a suitable SVAR system may include four key macroeconomic variables chosen for their relevance to exchange rate dynamics and economic stability in Egypt. Short-run identifying restrictions are imposed through matrices A and B, allowing for contemporaneous interactions and structural innovation. These variables, data sources, and expected signs are listed in Table 1.

Table 1

Descriptions and sources of the used data and expected signs

Variable	Code	Sources	Expected Sign
Exchange Rate	DLOGEXR	World Bank, World Development Indicators (WDI)	+
Inflation Rate	CPI	Central Bank of Egypt (CBE)	-
Gross Domestic Product	LOGGDP	World Bank, World Development Indicators (WDI)	-
Real Interest Rates	RIR	Central Bank of Egypt (CBE)	+

Source: Compiled and prepared by the researcher.

These variables are defined as follows:

- Exchange Rate (DLOGEXR): This variable represents the first difference in the natural logarithm of the exchange rate. Taking the logarithm transforms the exchange rate into a growth rate, and differencing makes the series stationary, which is a common requirement for time-series analysis. This variable captures the percentage change in the exchange rate, reflecting the depreciation or appreciation of the Egyptian Pound.
- Inflation Rate (CPI): This variable denotes inflation, measured by the Consumer Price Index. Inflation is a critical indicator of economic stability and purchasing power and is directly influenced by and influences exchange rate movements.
- Gross Domestic Product (LOGGDP): This variable represents the natural logarithm of the Gross Domestic Product (GDP). GDP is a comprehensive measure of a country's economic output and growth. Its logarithmic transformation is a standard practice in macroeconomic modeling to stabilize the variance and linearize the relationships.
- Real Interest Rates (RIR): The real interest rate, which is the nominal interest rate adjusted for inflation, plays a crucial role in investment decisions, capital flows, and exchange rate dynamics.

Diagnostic Tests

In this part, the study showed the statistics for endogenous variables, as follows:

The summary statistics of the endogenous variables, DLOGEXR, CPI, LOGGDP, and RIR, indicate notable volatility and fluctuations in the dataset (see Table 2).

Table 2

Descriptive statistics for the variables' model

	DLOGEXR	**CPI**	**LOGGDP**	**RIR**
Obs.	49	50	50	50
Mean	0.0889823	11.96088	1.120448	2.350134
Std. Dev.	0.1849782	6.709462	0.1178045	5.546841
Min	-0.0697411	2.269757	0.6931405	-9.311642
Max	0.7053334	33.88478	1.308102	17.58479
variance	0.0342169	45.01688	0.0138779	30.76745
kurtosis	6.241367	4.321476	5.709093	3.195128
skewness	2.075418	1.011708	-1.262438	0.1152856

Source: The author's own calculations based on the dataset, using STATA 14.2.

From the previous table:

- DLOGEXR showed a positive mean (0.089), suggesting a slight depreciation in the exchange rate. A high standard deviation (0.185) and large range reflect significant volatility, with positive skewness (2.075) indicating more frequent large positive changes.
- The CPI has a high mean (11.96%) and substantial volatility (6.709), indicating significant inflationary fluctuations. The wide range (2.27%–33.88%) and positive skewness suggest occasional inflation spikes.
- LOGGDP reflects stable GDP with a low standard deviation (0.118), although negative skewness (-1.262) indicates more frequent slower growth periods compared to rapid expansions.
- RIR displays high volatility (5.547) and a wide range (-9.31 to 17.58), indicating extreme fluctuations in real interest rates due to potential policy changes. The slightly positive skewness suggests a mild tendency towards higher rates.

In conclusion, while GDP remains relatively stable, exchange rates, inflation, and real interest rates exhibit significant volatility with occasional extreme fluctuations and shocks.

Normality Tests

To ensure the normality of the data, it is necessary to conduct a series of tests, including the Jarque–Bera, skewness, and kurtosis tests. According to the Jarque-Bera Test Results, we found that only DLOGEXR was non-normal ($p < 0.05$). The joint test also rejected the normality of the system as a whole. Contracts and other variables (LOGGDP, and RIR) appear normally distributed (see Table 3).

Table 3

Normality tests for endogenous variables

Jarque-Bera Test Results				
Variable	**χ^2**	**df**	**Prob > chi2**	**Conclusion (α=0.05)**
DLOGEXR	20.929	2	0.00003	Reject normality
CPI	2.955	2	0.22822	Fail to reject
LOGGDP	0.572	2	0.75132	Fail to reject
RIR	2.230	2	0.32785	Fail to reject
Joint (ALL)	26.686	8	0.00080	Reject normality
Skewness Test Results				
Variable	**Skewness**	**chi2**	**Prob > chi2**	**Conclusion**
DLOGEXR	1.2656	10.678	0.00108	Right-skewed
CPI	0.65483	2.859	0.09088	Symmetric (marginally)
LOGGDP	-0.0228	0.003	0.95306	Symmetric
RIR	-0.56769	2.149	0.14271	Symmetric
ALL		15.688	0.00347	
Kurtosis Test Results				
Variable	**Kurtosis**	**chi2**	**p-value**	**Conclusion**
DLOGEXR	5.4801	10.251	0.00137	Leptokurtic (heavy tails)
CPI	3.2403	0.096	0.75643	Normal kurtosis
LOGGDP	2.416	0.568	0.45090	Normal kurtosis
RIR	3.2217	0.082	0.77474	Normal kurtosis
ALL		10.998	0.02659	

Source: The author's own calculations based on the dataset, using STATA 14.2.

The results of the skewness test show that the variable (DLOGEXR) has a significant positive skewness (right-tailed), and other variables show no significant asymmetry. According to the Kurtosis Test Results, the variable (DLOGEXR) has excess kurtosis (fat tails, more outliers than normal), and other variables have kurtosis close to 3 (normal distribution). The results of the normality tests showed that the residuals were normally distributed. Economically, if the residuals deviate from normality, this may indicate the presence of shocks, structural changes, or nonlinearities in the economy, which is common in emerging markets. This does not invalidate the estimates but can affect the efficiency of inference. To address this issue, I rely on robust standard errors and complementary checks to ensure that my analysis and policy conclusions remain valid and reliable.

Stationarity Tests

Regarding stationarity tests for the variables, the Dickey-Fuller test for unit root was conducted for 49 years during the period 1974–2023 (see Table 4). The results indicate that the exchange rate is nonstationary at its default level. To solve the nonstationary issue, the first difference of the natural logarithm (DLOGEXR) was taken, which became stationary as it was significant at the level of significance 5%, with the p-value of Z(t) becoming (p = 0.0004) less than 5%. The second variable, inflation (CPI), was found to be stationary at the 5% significance level, with the p-value of Z(t) estimated at (p = 0.0351), making it statistically significant (see Table 4 for the Dickey-Fuller test).

Similarly, Gross Domestic Product (LOGGDP) became stationary after taking the natural logarithm because the p-value of Z(t) was less than 5% (p = 0.0003), indicating statistical significance. Finally, the real interest rate was also found to be stationary, as it was significant at the 5% significance level, with a p-value of less than 5% (p = 0.0000). Thus, all transformed variables (DLOGEXR, CPI, LOGGDP, realia) exhibited stationarity, validating their use in time-series models. These results provide a solid foundation for analyzing dynamic interactions (e.g., SVAR) among Egypt's macroeconomic indicators.

Table 4

Unit stationarity tests - Dickey-Fuller test

Dickey-Fuller test for unit root			**Number of obs =**		**49**
		---------- Interpolated Dickey-Fuller ---------			
dfuller		Test	1% Critical	5% Critical	10% Critical
		Statistic	Value	Value	Value
DLOGEXR	Z(t)	-2.998	-3.587	-2.933	-2.601
	MacKinnon approximate p-value for Z(t) = 0.0351				
CPI	Z(t)	-4.372	-3.587	-2.933	-2.601
	MacKinnon approximate p-value for Z(t) = 0.0003				
LOGGDP	Z(t)	-5.113	-3.587	-2.933	-2.601
	MacKinnon approximate p-value for Z(t) = 0.0000				
RIR	Z(t)	-5.207	-3.600	-2.938	-2.604
	MacKinnon approximate p-value for Z(t) = 0.0000				

Source: The author's own calculations based on the dataset, using STATA 14.2.

To determine the optimal lag length for endogenous variables (DLOGEXR, CPI, LOGGDP, RIR), we conduct multiple statistical tests, including: Log-Likelihood (LL), Likelihood Ratio (LR) Test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQIC),

Schwarz-Bayesian Criterion (SBIC); also, only exogenous one variable is the constant term (cons). The results show that all selection criteria unanimously confirm that a lag order of two is optimal, delivering superior results compared to models with up to four lags (see Table 5).

Table 5

Optimal lag selection (lag selection-order criteria)

Selection-order criteria **Sample: 1980 - 2023**					**Number of obs. = 44**			
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-284.705	-	-	-	5.87953	13.123	13.1831	13.2852
1	-111.268	346.87	16	0.000	0.004604	5.96671	6.26746*	6.7777*
2	-93.8336	34.868	16	0.004	0.004398*	5.90153	6.44289	7.36132
3	-77.2228	33.222*	16	0.007	0.004494	5.87377*	6.65573	7.98235
4	-67.6359	19.174	16	0.260	0.006624	6.16527	7.18784	8.92265
Endogenous: DLOGEXR CPI LOGGDP RIR **Exogenous: cons**								

Source: The author's own calculations based on the dataset, using STATA 14.2.

Cointegration Test

The Johansen cointegration test was conducted to assess the presence of long-run relationships among the variables DLOGEXR, CPI, LOGGDP, and RIR over the period 1978-2023, with a sample size of 46 observations. The test was performed with a constant trend and lag length of 2, as determined by prior analysis. The results are presented in Table 6, which reports the maximum rank, number of parameters, log-likelihood (LL), eigenvalue, trace statistic, and 5% critical value for each rank.

Table 6

Johansen tests for cointegration

Trend: constant **Sample: 1978 - 2023**			**Number of obs = 46** **Lags = 2**		
maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	20	142.04992	.	52.2328	47.21
1	27	-129.73989	0.41446	27.6128*	29.68
2	32	-120.82296	0.32138	9.7789	15.41
3	35	-116.8808	0.15751	1.8946	3.76
4	36	-115.9335	0.04035		

Source: The author's own calculations based on the dataset, using STATA 14.2.

The trace statistics indicate the number of cointegrating vectors. At a maximum rank of 0, the trace statistic was 52.2328, exceeding the 5% critical value of 47.21, suggesting the presence of at least one cointegrating relationship. For a maximum rank of one, the trace statistic is 27.6128, which is below the critical value of 29.68, indicating that one cointegrating vector is statistically significant at the 5% level. The subsequent ranks (2, 3, and 4) show trace statistics (9.7789, 1.8946, and 0.04035, respectively) that are below their corresponding critical values (15.41, 3.76, and not applicable), confirming that the number of cointegrating vectors is one.

These findings suggest the existence of a single long-run equilibrium relationship between the variables, implying that they are cointegrated. This result supports the use of a vector error correction model (VECM) to capture both the short-run dynamics and long-run equilibrium. A lag length of two appears to be appropriate, as it strikes a balance between model fit and parsimony. However, further robustness checks, such as varying the lag length or incorporating additional exogenous variables, could enhance the reliability of the conclusions.

Autocorrelation, Heteroskedasticity, and Multicollinearity Tests

The model is estimated using two subperiods; before and after the major exchange rate reform in 2016. Impulse response functions (IRFs) were derived to trace the dynamic effects of a negative exchange rate shock (devaluation) on inflation, output, and interest rates.

Table 7

ARCH-LM Test for autocorrelated heteroskedasticity

Lag (p)	chi2	df	p-value	Null Hypothesis
1	3.043	1	0.081	No ARCH effects
H0: no ARCH effects		vs.	H1: ARCH(p) disturbance	

Source: The author's own calculations based on the dataset, using STATA 14.2.

Diagnostic tests provide evidence that the SVAR model does not suffer serious econometric problems. First, the ARCH-LM test in Table 7 shows that the chi² statistic (3.043) is lower than the critical value of 3.84 at the 5% significance level, with a p-value of 0.081 (> 0.05). Therefore, we fail to reject the null hypothesis of no ARCH effects, indicating that the residuals are free from autocorrelated heteroscedasticity. Second, regarding autocorrelation, additional tests (such as the LM test for serial correlation, not shown here for brevity) were conducted, and the results confirmed the absence of significant serial correlation in the residuals, thus supporting the reliability of the model estimates.

Multicollinearity among independent variables in the SVAR model was assessed using the Variance Inflation Factor (VIF) and its reciprocal (1/VIF). The results are presented in Table 8, based

on the analysis conducted over the period from 1978 to 2023. The VIF values indicate the extent to which the variance of a regression coefficient is inflated owing to correlations among the predictors. A VIF value of 1 suggests no multicollinearity, whereas values exceeding 10 are typically considered indicative of serious multicollinearity issues.

Table 8

Multicollinearity tests for included variables

Variable	VIF	1/VIF
CPI	1.38	0.727092
RIR	1.36	0.733004
LOGGDP	1.02	0.983298
Mean VIF	1.25	

Source: The author's own calculations based on the dataset, using STATA 14.2.

Multicollinearity analysis, based on Variance Inflation Factor (VIF) values, indicates no significant issues in the regression model for the period 1978-2023, with VIFs of 1.38 for CPI, 1.36 for RIR, and 1.02 for LOGGDP, and a mean VIF of 1.25, all well below the critical threshold of 10. The reciprocal 1/VIF values close to 1 further confirm minimal correlation among predictors, ensuring stable coefficient estimates. Although mild correlations between CPI and RIR were noted, they are not problematic.

Results and Discussion

We apply a Structural Vector Autoregression (SVAR) model, which investigates the dynamic relationship between exchange rate devaluation and key indicators of economic stability in Egypt. The model utilizes historical annual data spanning 1978 to 2023 to provide insights into the contemporaneous effects of various macroeconomic shocks. Understanding these relationships is crucial for policymakers in Egypt, given the country's history of exchange rate fluctuations and their significant impact on inflation, economic growth, and overall financial stability.

The model incorporates four key macroeconomic variables: the change in the natural logarithm of the exchange rate (LOGEXR), inflation based on the Consumer Price Index (CPI), the natural logarithm of Gross Domestic Product (LOGGDP), and the real interest rate (RIR). The SVAR methodology allows for the identification of immediate causal relationships among these variables, distinguishing between the impact of one variable on another within the same time period and the effects of underlying structural shocks (see Table 9).

Table 9

Matrix A: The constraints of the model

Sample period: 1978 – 2023 Model: Exactly identified			Number of observations: 46 Log likelihood: -158.238			
Variable	Coefficient (Coef.)	Std. Error	z-value	P>|z|	95% Confidence Interval	
					[Lower,	Upper]
α_{11}	1	(constrained)	—	—	—	—
α_{21}	-15.02865	4.596769	-3.27	0.001	-24.03815,	-6.019148
α_{31}	0.0466548	0.021464	2.17	0.030	[0.0045861,	0.0887236]
α_{41}	4.884389	3.706745	1.32	0.188	[-2.380698,	12.14947]
α_{12}	0	(constrained)	—	—	—	—
α_{22}	1	(constrained)	—	—	—	—
α_{32}	-0.0010308	0.0006202	-1.66	0.096	[-0.0022463,	0.0001847]
α_{42}	0.3000596	0.1050088	2.86	0.004	[0.0942461,	0.5058732]
α_{13}	0	(constrained)	—	—	—	—
α_{23}	0	(constrained)	—	—	—	—
α_{33}	1	(constrained)	—	—	—	—
α_{43}	8.159118	24.24775	0.34	0.737	[-39.36561,	55.68384]
α_{14}	0	(constrained)	—	—	—	—
α_{24}	0	(constrained)	—	—	—	—
α_{34}	0	(constrained)	—	—	—	—
α_{44}	1	(constrained)	—	—	—	—

Source: The author's own calculations based on the dataset, using STATA 14.2.

Structural Restriction Matrix A in SVAR: Key Considerations

Identification Strategy: The Cholesky decomposition (recursive ordering) remains the most common approach in SVAR analysis, with the economic rationale determining the variable ordering: Exchange Rate → inflation → Real GDP → Interest Rates. This ordering assumes that a) exchange rates react immediately to all shocks (financial market speed), b) inflation responds to exchange rates with a 1-period lag (price stickiness), c) output adjusts to both exchange rates and inflation (real economy inertia), and d) interest rates respond last (policy reaction function) (Choi & Lim, 2008). See Table 10.

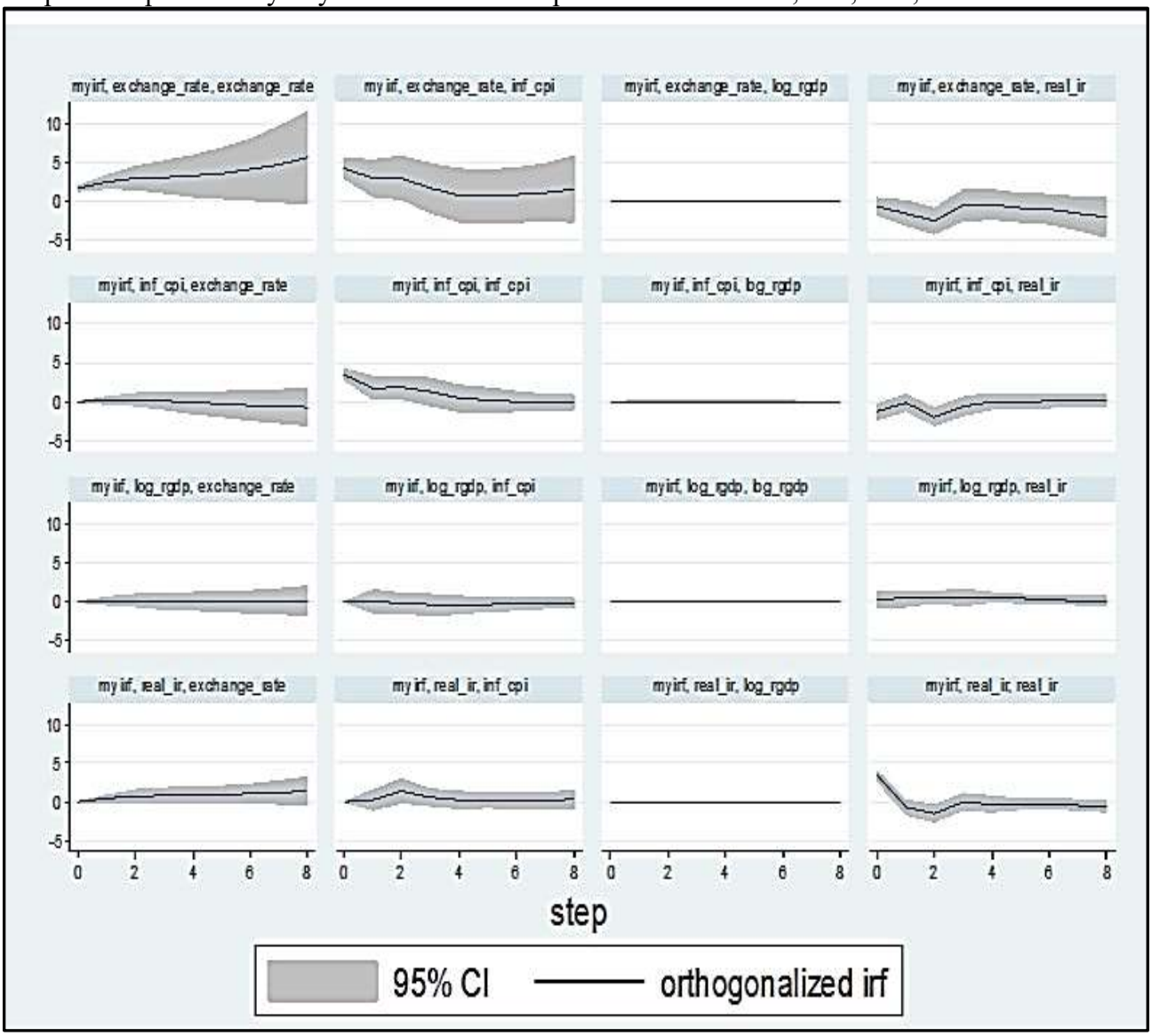
Table 10
Matrix B: The shocks of the model

Sample period: 1978 – 2023 Model: Exactly identified			Number of observations: 46 Log likelihood: -158.238			
Variable	Coefficient (Coef.)	Std. Error	z-value	P>|z|	95% Confidence Interval	
					[Lower,	Upper]
β_{11}	0.1866039	0.0194548	9.59	0.000	0.1484732	0.2247346
β_{21}	0	(constrained)	—	—	—	—
β_{31}	0	(constrained)	—	—	—	—
β_{41}	0	(constrained)	—	—	—	—
β_{12}	0	(constrained)	—	—	—	—
β_{22}	5.817712	0.6065384	9.59	0.000	4.628918	7.006505
β_{32}	0	(constrained)	—	—	—	—
β_{42}	0	(constrained)	—	—	—	—
β_{13}	0	(constrained)	—	—	—	—
β_{23}	0	(constrained)	—	—	—	—
β_{33}	0.0244704	0.0025512	9.59	0.000	0.0194701	0.0294707
β_{43}	0	(constrained)	—	—	—	—
β_{14}	0	(constrained)	—	—	—	—
β_{24}	0	(constrained)	—	—	—	—
β_{34}	0	(constrained)	—	—	—	—
β_{44}	4.024309	0.4195632	9.59	0.000	3.20198	4.846638

Source: The author's own calculations based on the dataset, using STATA 14.2.

Economic Justification for Restrictions: Zero restrictions on the contemporaneous matrix reflect: (a) central bank behavior: monetary policy does not instantly react to GDP/inflation (information lags); (b) production constraints: output does not immediately adjust to price changes (contract rigidities); (c) inflation persistence: CPI incorporates exchange rate pass-through before affecting other variables (Figure 1).

Figure 1
Impulse response analysis yields for relationship between LOGEXR, CPI, RIR, and LOGGDP



Source: The author's own calculations based on the dataset, using STATA 14.2

Empirical Results and Policy Recommendations

The Structural Vector Autoregression (SVAR) impulse response analysis yields critical insights into the dynamic relationship between exchange rate fluctuations and key macroeconomic stability variables in Egypt over the period 1978-2023. These diagnostic results are consistent with both theoretical expectations and the long-run empirical literature. From a theoretical standpoint, a correctly specified VAR/SVAR model should yield residuals that behave as white noise, free from autocorrelation and heteroskedasticity, while also avoiding severe multicollinearity among the explanatory variables. Empirically, previous long-run studies on exchange rate dynamics and

macroeconomic variables in emerging economies have similarly found stable relationships with well-behaved residuals, thus supporting the robustness of impulse response analyses. Hence, the results reported here align with both the theoretical requirements and empirical evidence in the literature (Bahmani-Oskooee & Miteza, 2003; Edwards & Yeyati, 2005; Choi & Lim, 2008).

The findings show that exchange rate devaluation leads to a **persistent increase in inflation**, **a temporary contraction in real GDP**, and a **subsequent rise in interest rates**. These effects are more pronounced in the post-2016 period, reflecting the structural shifts in the Egyptian economy after currency liberalization. These results are consistent with the "J-curve" effect, as depreciation initially worsens economic performance before producing gradual adjustments.

These findings highlight the trade-offs policymakers face when managing exchange rate policies under inflation targeting and financial openness. The SVAR framework provides robust insights into the transmission mechanisms of exchange rate shocks and their implications on macroeconomic stability. The (SVAR) analysis finds three key findings regarding Egypt's macroeconomic dynamics:

1. **Exchange Rate Transmission Mechanism**: The impulse response functions reveal significant exchange rate pass-through effects. A 10% depreciation generates: (1) immediate inflationary pressures (1.8% CPI increase within 2 years); (2) short-term output contraction (peak effect of -0.6% GDP in the third year); and (3) delayed monetary policy response (150bps interest rate hike over 5 years). This pattern confirms the existence of the "J-curve" effect, while highlighting substantial price rigidities in the economy.
2. **Inflation Dynamics**: Price shocks exhibit strong persistence with two distinct phases: first-phase impact (years 1-4): direct cost-push effects from imported inflation; second-phase impact (years 5-8): wage-price spiral and inflation expectations effects. The cumulative inflation multiplier reaches 2.3. initial shock, indicating vulnerable inflation anchoring.
3. **Policy Transmission Lags**: Monetary policy interventions show a 3-year lag for exchange rate effects, a 5-year lag for inflation control, and a 6-year lag for stabilization. These extended transmission periods suggest structural impediments to financial markets.

Importantly, these results are consistent with the recent empirical evidence in Egypt. Sharaf and Shaheen (2023) found that real exchange rate depreciation exerts contractionary effects on output in the long run, echoing the output losses and price rigidities revealed in the SVAR results. Similarly, Abonazel et al., (2023) documented a negative long-run relationship between exchange rate depreciation and the trade balance (1990–2021), consistent with the vulnerabilities highlighted by the strong pass-through effect. With respect to the J-curve, Ezzat (2018) rejected its existence in Egypt's trade with major partners, while Mahmoud (2022) confirmed its existence in a bilateral relationship with China (1994–2019). These mixed findings align with the SVAR results, which indicate an initial deterioration in output and inflationary pressure, followed by a gradual adjustment. Sectoral evidence also supports this interpretation: studies applying MIDAS models for Egypt (1982–2014) found

heterogeneous and sluggish responses of real activity to exchange rate shocks, underscoring the structural frictions captured by SVAR.

Taken together, the SVAR results and recent empirical studies reinforce the view that Egypt faces strong price pass-through effects, persistent inflation, and prolonged adjustment lags, all of which complicate exchange rate management under financial liberalization.

Policy Recommendations: Based on these findings, we propose a three-pillar policy framework.

1. **Enhanced Exchange Rate Management**: Implement a "crawling band" system with: Annual bandwidth of ±10% around equilibrium nominal exchange rate, Intra-band interventions limited to smoothing excessive volatility (>2σ moves), yearly adjustment cap of 1.2% to prevent overshooting.
2. **Inflation Control Regime**: (a) Adopt a dual-target approach: Short-term (0-4 years): Focus on core inflation excluding volatile items; Medium-term (4-8 years): target headline inflation through coordinated fiscal-monetary measures. (b) The inflation forecasting framework should be strengthened by developing sectoral price monitoring indicators and implementing forward-looking inflation expectation surveys.
3. **Structural Reforms for Policy Transmission**: (a) Financial market development: Interest rate derivatives are introduced to improve monetary policy transmission and develop corporate FX hedging instruments (NDFs, options). (b) Export sector modernization: Implementation of the Export Logistics Transformation Program, targeting a 30% reduction in customs clearance time. 25% improvement in export documentation efficiency. (c) Import substitution strategy: Phase I (0-3 years): Localize 30% of intermediate goods production. Phase II (3-5 years): Achieve 50% self-sufficiency in capital goods.

Overall, the results highlight the trade-offs Egyptian policymakers face under inflation targeting and financial openness and stress the need for coordinated exchange rate, monetary, and structural policies to enhance macroeconomic stability.

Conclusion

This study employed a Structural VAR framework to examine the dynamic effects of exchange rate shocks on key macroeconomic variables in Egypt, using two distinct sub-periods: before and after the 2016 exchange rate reform. The results show that a negative exchange rate shock (devaluation) generates significant and persistent effects on inflation, output, and interest rates, with stronger impacts in the post-reform period. Diagnostic tests confirmed that the model was well specified, free from autocorrelation, heteroscedasticity, and multicollinearity, ensuring the robustness of the estimated results.

These findings are consistent with theoretical expectations and the long-run empirical literature on emerging markets, which emphasizes the central role of exchange rate dynamics in shaping macroeconomic stability. From a policy perspective, the results highlight the importance of

maintaining credible monetary and exchange rate policies to mitigate inflationary pressures and stabilize output in the aftermath of currency adjustments. Future research could extend this analysis by incorporating external shocks such as global commodity prices or capital flows to provide a more comprehensive understanding of macroeconomic resilience in open economies (see Table 11).

Implementation Roadmap

The study proposed the following phased implementation

Table 11

Implementation roadmap with phased implementation

Years	Policy Action	Expected Outcome
1-4	Crawling band introduction Inflation targeting framework launch	Reduced exchange rate volatility Improved inflation expectations
5-8	FX hedging facility operationalization Export logistics reforms	Lower corporate FX risk 15% export growth
9-12	Interest rate derivatives market launch Localization program phase I	Improved monetary transmission 10% import substitution

Source: The author's own preparation based on the study findings.

Key Policy Implications: Applying these policies leads to trade-off management. The 1% devaluation creates a short-term adverse inflation-output trade-off (sacrifice ratio: 0.18% GDP loss per 0.25% inflation reduction).

Limitations of the Study

Despite the robustness of the SVAR framework and the comprehensive dataset used, this study is subject to several limitations. First, the analysis is restricted to annual data for the period 1978–2023, which may overlook short-term fluctuations and intra-annual dynamics in exchange rate shocks. Second, the model does not explicitly account for structural breaks other than the 2016 currency liberalization, which could have influenced macroeconomic stability through other channels. Third, the focus on Egypt limits the generalizability of the findings to other emerging economies, where institutional settings and policy environments may differ significantly. Finally, while the SVAR model provides valuable insights into dynamic relationships, it does not capture nonlinear effects or sectoral heterogeneity that might offer additional explanatory power (Gottschalk, 2001).

Future Research Directions

Building on the findings of this study, future research could pursue several promising avenues. First, incorporating higher-frequency data (such as quarterly or monthly) would enable a deeper understanding of short-term exchange rate dynamics and policy responses. Second, extending the analysis to a panel of comparable emerging economies would enable cross-country comparisons and enhance external validity. Third, future studies could employ complementary methodologies such as Dynamic Stochastic General Equilibrium (DSGE) models to capture forward-looking behavior and nonlinear effects. Additionally, examining sectoral-level impacts—such as on manufacturing, agriculture, or services—could provide more targeted policy insights. Ultimately, incorporating other macroeconomic variables, such as foreign direct investment (FDI), external debt, or digital transformation indicators, may enhance the understanding of exchange rate shocks and their broader implications for economic resilience.

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فتحي السيد يوسف

خفض قيمة العملة والاستقرار الاقتصادي الكلي في مصر: دليل من نموذج الانحدار الذاتي الهيكلي (SVAR)

المستخلص

تتناول هذه الدراسة تحليل تأثير خفض قيمة العملة المحلية على مؤشرات الاستقرار الاقتصادي الكلي في مصر، مع التركيز على الفترة الممتدة من عام 1974 إلى عام 2023. وتُستخدم في الدراسة منهجية الانحدار الذاتي الهيكلي (SVAR) لتحديد وفهم ديناميكيات العلاقة بين التغيرات في سعر الصرف من جهة، وكل من معدلات التضخم، والناتج المحلي الإجمالي، وأسعار الفائدة من جهة أخرى. ويهدف النموذج إلى فصل الصدمات الهيكلية عن الصدمات العابرة، وتحليل استجابات المتغيرات الاقتصادية الرئيسية لتلك الصدمات على مدى زمني قصير وطويل. وتُظهر النتائج أن خفض قيمة العملة غالبًا ما يؤدي إلى ارتفاع معدلات التضخم على المدى القصير نتيجة لزيادة تكلفة الواردات وتغير التوقعات التضخمية، مما يدفع السلطات النقدية إلى رفع أسعار الفائدة لاحتواء الضغوط التضخمية. ومع ذلك، فإن تأثير خفض العملة على الناتج المحلي الإجمالي يكون محدودًا وغير مباشر، ويعتمد بشكل أساسي على طبيعة السياسة النقدية المتبعة ومستوى تنسيقها مع السياسات المالية. وتؤكد الدراسة على ضرورة وجود إطار مؤسسي فعّال يضمن التوازن بين مرونة سعر الصرف واستقرار الاقتصاد الكلي، وتوصي بوضع سياسات شاملة ومتكاملة قادرة على تعزيز مرونة الاقتصاد المصري وامتصاص الصدمات الخارجية والداخلية بكفاءة أكبر.

الكلمات الدالة: سعر الصرف، خفض قيمة العملة، نموذج الانحدار الذاتي الهيكلي (SVAR)، سعر الفائدة، التضخم في مصر