IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

The Impact of Exchange Rate Volatility on Foreign Direct Investment (FDI) Empirical Evidence from Egypt

Submitted By Researcher

Emad Said Khalil Abdallah

20215175

Supervised By:

Prof. Dr Ashraf Salah Eldin Saleh, Prof. Dr. Marwa El Sherif

College of Management and Technology Post-Graduate Department

Abstract

The present research objective is to investigate the impact of real exchange rate volatility on foreign direct investment (FDI) in Egypt, utilizing quarterly data from the Central Bank of Egypt (CBE) spanning the period 2001–2024, given Egypt's sequential currency devaluations intended to attract capital inflows and strengthen economic resilience, the study explores how exchange rate fluctuations influence investor decisions and the dynamics of FDI in the short-run and long-run. The study utilizes a comprehensive econometric framework. Stationarity is examined using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests, while asymmetric volatility responses are captured using the EGARCH model. Long-run cointegration with macro-financial variables is assessed using the ARDL approach, supported by Error Correction Models (ECMs). Robustness of the estimated models is validated through extensive diagnostics, including Durbin–Watson and Breusch–Pagan–Godfrey for serial correlation, White's test for heteroscedasticity, Jarque–Bera for normality, and Variance Inflation Factor (VIF) for multicollinearity. Structural stability is further confirmed using CUSUM and CUSUM of squares, ensuring methodological credibility and reliability of the findings.

The ARDL cointegration analysis validates FDI sensitivity to REXR, confirming that real exchange rate volatility has a significantly negative impact on aggregate FDI in Egypt across both short- and long-run horizons. Diagnostic evaluations affirm the robustness of the model, which explains 79.3% of FDI variation when macroeconomic control variables are included. Market size (GDP) emerges as a key determinant, while inflation (CPI) and external debt (EXDBTG) impose destabilizing pressures on investment flows. Conversely, market capitalization (MCAP) exerts a positive influence, supporting the role of financial market development in attracting foreign capital. Overall, the findings highlight that exchange rate instability interacts with

macro-financial fundamentals, reinforcing the need for policy frameworks that mitigate volatility and strengthen structural conditions.

The study outlines key policy implications. The findings suggest that excessive volatility fluctuations diminish investor confidence, requiring intervention by the Central Bank of Egypt (CBE) through measures such as smoothing volatility, providing investment guarantees, and strengthening foreign exchange reserves. Credible coordination of fiscal, monetary, and macroeconomic frameworks is essential to secure financial and exchange rate stability. Ultimately, a consistent and sustainable comprehensive economic policy framework reduces uncertainty, enhances investor confidence, and fosters a predictable environment conducive to long-term investment decisions.

I: Introduction

FDI has become one of the most important drivers of economic growth in developing countries, serving not only as a source of external capital inflow to the host countries but also as a channel for knowledge and technology transfer beyond providing financial resources. FDI facilitates the diffusion of innovation and managerial expertise, contributing to sustainable economic growth Elmoghiar (2025). Moreover, FDI serves as a consistent source of foreign exchange, enabling central banks to maintain healthy reserve levels, thereby enhancing financial stability.

Exchange rate volatility is a fundamental financial macroeconomic variable influencing the dynamics of foreign direct investment (FDI), and its significance has grown among policymakers in recent decades, particularly as an increasing number of countries have transitioned to floating exchange rate regimes Elmoghiar,(2025). Exchange rate instability, characterized by unpredictable fluctuations, creates significant challenges for macroeconomic and financial stability, particularly in developing economies like Egypt that are highly integrated into the global system. Such volatility generates considerable uncertainty within financial markets, thereby affecting capital flows, altering asset valuations, and disrupting the broader equilibrium of financial and economic activity.

The recent academic literature has examined the impact of exchange rate volatility on FDI flows based on cross-country or country-specific data Elbadry and Mandour (2020); Kamal (2020); Moraghen et al. (2021); Abd El-Aal et al. (2021); Salah et al.(2021) Nguyen et al.(2022); Jamal & Bhat(2022); Shafique et al.(2022); Kaya and Erden(2022); Ezekiel and Temidayo(2023) and Erum et al.(2023), the empirical evidence remains inconclusive that exchange rate volatility have negative or positive impacts on economies activities. The empirical evidence showed that the influence of exchange rate volatility on FDI was negative and argued that the exchange rate depreciation produced the exchange rate volatility, which increased FDI flows to the host countries.

Some studies emphasize the negative effects of volatility on FDI Elbadry and Mandour, (2020); Moraghen et al. (2021); Nguyen et al. (2022); Jamal & Bhat (2022), and Erum et al. (2023). while others report a positive relationship between exchange rate volatility and FDI flows Kamal (2020); Abd El-Aal et al. (2021); Salah et

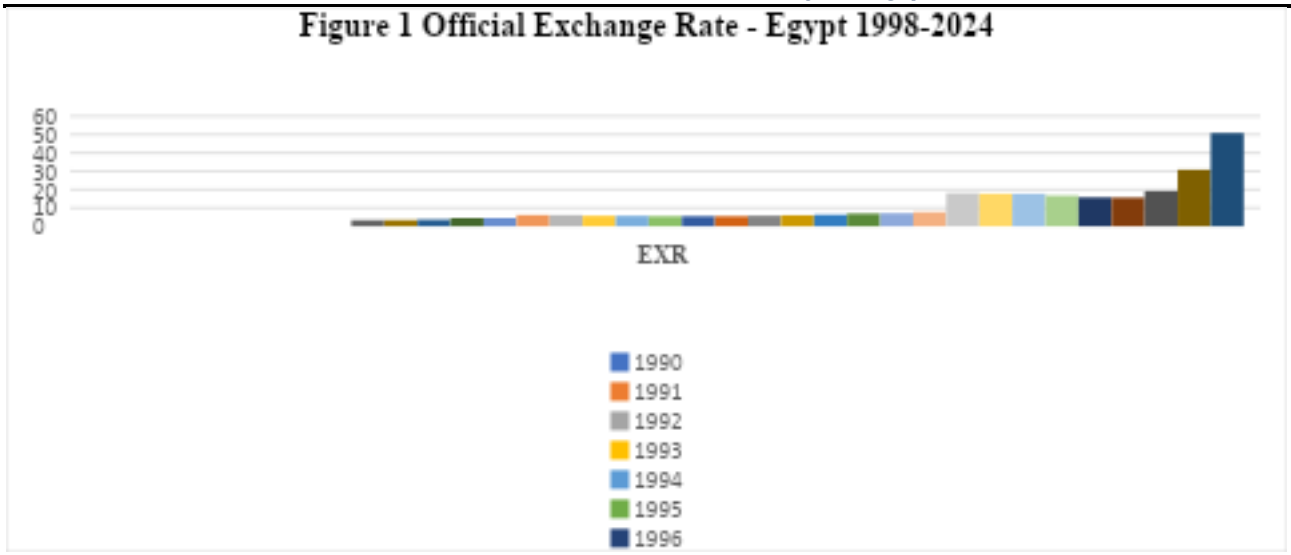
al. (2021); Shafique et al. (2022); Kaya and Erden (2022); and Ezekiel and Temidayo (2023). Yet, few studies report no significant relationship among the variables. This highlights the need for sector-specific and country-level analyses to clarify these differences in findings.

These inconsistencies in previous studies results are often attributed to differences in methodologies for computing volatility and inadequate analysis of the real exchange rate volatility effects on FDI, especially the majority of previous Egyptian studies, which masks the study results in addition add contribution to this study central problem addressed concerns the continuity of real exchange rate volatility and its implications on foreign direct investment (FDI) in Egypt during the period 2001-2024, using CBE quarterly data. This period was marked by recurrent economic and geopolitical shocks because Egypt's economy from 1998–2024 faced repeated shocks, terrorism, global crises, revolutions, and IMF-driven devaluations culminating in a severe currency collapse with the pound floating at 49.5 per USD in March 2024, FDI inflows fluctuated, turning negative in 2011, recovering gradually, then rebounding post-COVID to USD 10.04 billion in 2022. A historic surge in 2023/24 lifted inflows to USD 46.06 billion, dominated by the Ras El-Hekma project but concentrated in low-value-added sectors (Figure 1-1 shows the official exchange rate of Egypt 1998-2024) and (Figure 2 and Table 1 show the FDI Inflow and Net Inflow in Egypt from 2001-2024).

This research seeks to explore a developed understanding of how real exchange rate volatility affects FDI composition, providing evidence that can inform the financial, macroeconomic policy, and investment strategies in Egypt, and also builds on existing literature the study is designed to answer the following questions: (1) How does real exchange rate volatility impact the inflows of aggregate foreign direct investment (FDI) into Egypt in the short and long run during the period 2001–2024? And (2) What policy implications can be recommended to enhance FDI inflows and strengthen exchange rate stability in Egypt, based on the empirical findings of this study?

The research also seeks to add meaningful contributions to the literature; unlike many of the previous studies, it improves upon earlier methodological limitations by incorporating a more adequate treatment of real exchange rate volatility because the analysis considers both short-run and long-run fluctuations, recognizing that the effects of volatility on FDI may vary over different time horizons. To strengthen the robustness of the findings, several diagnostic procedures are applied to mitigate endogeneity concerns and ensure that the estimated models provide reliable and valid results. These insights can serve as a valuable resource for both policymakers and investors, offering evidence-based guidance for designing targeted strategies to attract and sustain FDI, ultimately enhancing Egypt's competitiveness in the global marketplace.

Figure 1 Official Exchange Rate - Egypt 1998-2024



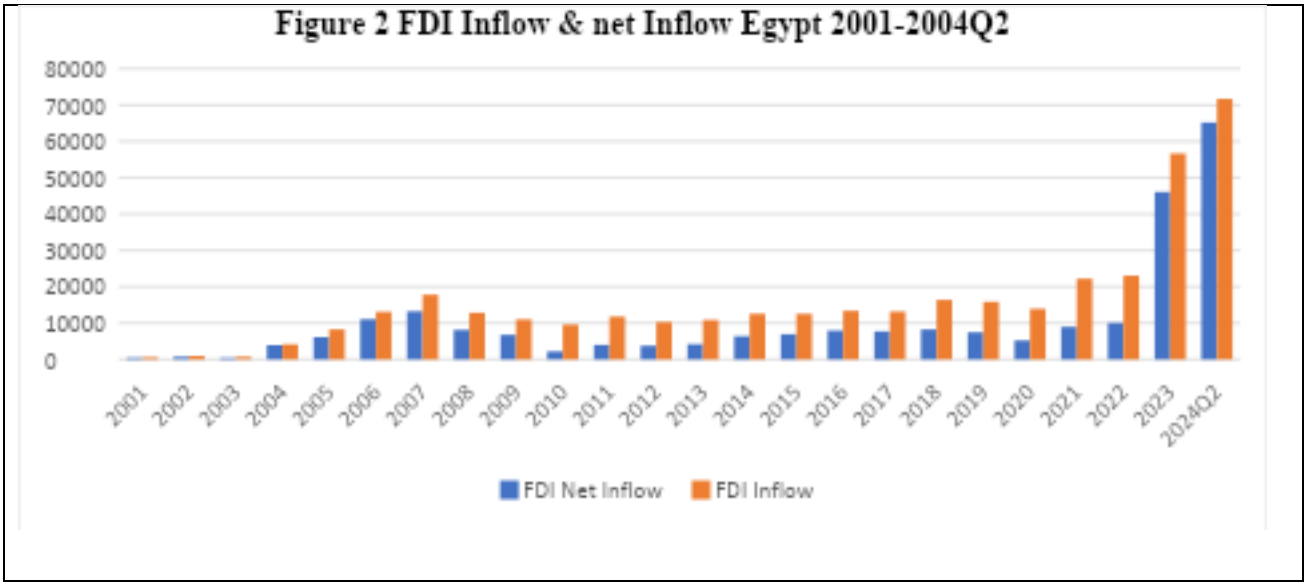
Sources prepared by researchers based on World Bank statistics.

Value In Million **Table 1** The FDI Inflow and Net Inflow in Egypt from 2001-2024

Year	**FDI Net Inflow**	*Year*	**FDI Net Inflow**	*Year*	**FDI Inflow**	*Year*	**FDI Inflow**
2001	**428.2**	*2014*	**6379.8**	*2001*	**578.7**	*2014*	**12546.2**
2002	**700.6**	*2015*	**6932.6**	*2002*	**945.8**	*2015*	**12528.7**
2003	**407.2**	*2016*	**7932.8**	*2003*	**692.3**	*2016*	**13366.1**
2004	**3901.8**	*2017*	**7719.5**	*2004*	**4134.5**	*2017*	**13163.1**
2005	**6111.4**	*2018*	**8236.3**	*2005*	**8250.4**	*2018*	**16393.5**
2006	**11053.2**	*2019*	**7453.0**	*2006*	**13084.3**	*2019*	**15836.6**
2007	**13236.5**	*2020*	**5214.2**	*2007*	**17802.2**	*2020*	**13914.8**
2008	**8113.4**	*2021*	**8937.4**	*2008*	**12836.1**	*2021*	**22205.5**
2009	**6758.2**	*2022*	**10038.6**	*2009*	**11008.1**	*2022*	**23053.0**
2010	**2188.6**	*2023*	**46064.5**	*2010*	**9574.4**	*2023*	**56654.0**
2011	**3982.2**	*2024Q2*	**65200.0**	*2011*	**11768.1**	*2024Q2*	**71720.0**
2012	**3753.3**	-	-	*2012*	**10273.6**	-	-
2013	**4178.2**	-	-	*2013*	**10855.8**	-	-

Source: CBE reports prepared by researchers in 2025.

Figure 2 FDI Inflow & net Inflow Egypt 2001-2004Q2



Sources: CBE reports prepared by researchers in 2025.

2. Literature Review:

2.1. Egyptian Studies:

Several studies examined the impact of exchange rate volatility on FDI, although the effects of the exchange rate on FDI are generally robust in the depreciation of the host currency, which promotes FDI inflows to that country. However, previous studies have indicated the uncertainty and inconclusive results about the impact on FDI compared with the studies analyzing the effects of exchange rate and other variables Alnaa & Ahiakpor (2020); Salah et al. (2021); Oladeji & Musa (2022). Meanwhile, the impact of exchange rate volatility is still ambiguous. Egyptian literature studies produced mixed results; there are studies finding that FDI has a negative relationship with volatility and a positive relationship with the Egyptian pound depreciation, but otherwise, few studies have found the relationship to be insignificant.

In this instance, Elbadry & Mandour (2020) investigated the relationship between exchange rate and exchange rate volatility on FDI in Egypt during 1990-2018, using ARDL cointegration and Granger causality to assess FDI dynamics. They found that exchange rate volatility significantly reduced FDI. The results in Egypt, consistent with Nada & Hebatallah (2020) during 1990-2015, using the least squares method, found a significant positive effect of the exchange rate on FDI in Egypt. Both studies attributed the significant positive relationship to the government's policy of devaluing the Egyptian pound, which they believe attracts foreign investment. Elbadry & Mandour (2020) emphasize that exchange rate volatility significantly reduces FDI, highlighting instability as a deterrent to long-term investment. In contrast, Nada & Hebatallah (2020) do not explicitly address volatility, focusing instead on the positive role of depreciation. Meanwhile, Nada & Hebatallah (2020) also noted that other variables like trade openness, GDP per capita growth, urban population, and natural resource endowment had a positive impact and recommended that government policy should focus on a depreciating currency to encourage and increase FDI. In addition, Abdelgany (2020) concluded that the Egyptian pound's depreciation encourages FDI, confirming a positive and significant impact of the real exchange rate on FDI exports in both the short and long run during 1980-2018, using the (ARDL) model. It also suggested that government policies should focus on increasing economic growth, improving infrastructure, and creating job opportunities to further enhance development and attract investment. The finding agreed with Al-Sayed (2020) covering 1977-2017, using the ARDL method, and found a positive and significant long-run relationship between the nominal exchange rate and FDI. In addition to the exchange rate, the study included other independent variables such as GDP growth, trade openness, foreign exchange reserves, inflation, and external debt. Kamal (2020) supported a long-run positive effect of the exchange rate on FDI in Egypt during 1977-2017, using the ARDL method.

Most of the previous Egyptian studies argued and agreed that the positive impact of the exchange rate devaluation policy increased foreign direct investment (FDI). In this context, Hend et al. (2021) investigated the effect of exchange rate devaluation on foreign direct investment (FDI) and foreign indirect investment in Egypt from 1990-2020, using multiple regression to assess exchange rate devaluation effects, the study found the devaluation positively attracted FDI but deterred indirect foreign investment, highlighting contrasting

impacts, and concludes that aligning fiscal and monetary policies with political and security stability is essential to boost investor confidence, also Abd El-Aal et al. (2021). was supported by the study investigated and predicted FDI inflows in Egypt for the decade of 2020-2030, using machine learning algorithms and the ARIMA model, the study also concluded that there's a positive relationship between the depreciation of the Egyptian pound and FDI and pointed out that a weaker pound makes Egyptian exports more competitive in international markets, which in turn attracts foreign investment. In another study, Salah et al. (2021) explored the impact of relative exchange rate volatility and other determinants on inward FDI to Egypt during 2005-2019, using the generalized method of moments (GMM) estimation approach, and revealed that exchange rate volatility had a positive impact on inward FDI highlighting that the market size of both home and host countries significantly and positively influenced FDI. Other statistically significant factors included geographic distance, bilateral trade, relative cost of borrowing, relative labor productivity, and relative corruption. Meanwhile Al-Ghiash (2022) provided a new approach by identifying an optimal range for the Egyptian pound's devaluation against the US dollar to attract FDI during 1990-2019, and determined that an optimal exchange rate for the Egyptian pound against the US dollar lies between 42.5 and 92.5 to attract FDI as a very important solution to Egypt's economic challenges and financial stability, the study recommended that the government should continue the policy of a floating exchange rate, which Egypt has been following since late 2016, to maintain an environment that attracts foreign investment.

The relationship between exchange rate volatility and foreign direct investment (FDI) in Egypt is very complex, whereas other studies show a negative relationship that contradicts the findings of others. In this context, Asamoah et al. (2022) investigated 40 African countries from 1990-2018, including Egypt, using GMM. The study argued that volatility discourages FDI and concluded that financial development is key to attracting FDI, recommending that stabilizing exchange rates through growth in manufacturing and industry, the same results supported by Elagouza (2023) for the period 2000-2018 using a multivariate vector error correction model (VEC), this study argued that exchange rate liberalization and the devaluation policy negatively affected the Egyptian economy, and argued that depreciation deter FDI.

These results empirically contradict those of Elbadry & Mandour (2020), Nada & Hebatallah (2020), Abdelgany (2020), Al-Sayed (2020), Kamal (2020), Hend et al. (2021), Abd El-Aal et al. (2021), Salah et al. (2021), and Al-Ghiash (2022).Whereas Abdallah (2023) found that the exchange rate was insignificant in attracting FDI using an (ARCH) model and confirmed with a Granger causality test that there was no causal relationship in Egypt, during 2000-2022, and concluded that despite the Egyptian pound's depreciation and high volatility, FDI inflows were not affected by the change in the value of local assets. Also, Marwasamy et al. (2024) added a study that found a negative impact of exchange rate fluctuations on FDI in Egypt, during 1990-2022, utilizing the ARDL model, and concluded the importance of exchange rate stability and political stability to build investor confidence and create a better investment climate. And, Abdelaziz et al. (2024) confirmed significant negative results between exchange rate variations and FDI inflows in Egypt during 2002-2024 using a GARCH model, reflecting investors' risk aversion, and stressed the importance of stable macroeconomic governance to improve Egypt's investment climate, thereby offering key insights for relevant

policy decisions in developing nations. The negative finding is consistent with the most recent empirical study, which analyzed the effect of exchange rate volatility on Egypt's net FDI inflows covering 1974-2023, using ARDL and ECM models, by Elmoghiar (2025), suggesting that the Egyptian Pound devaluation policies positively influence FDI attraction. whereas macroeconomic factors, GDP growth and trade openness, lending interest rates, and foreign reserves had a positive but not statistically significant correlation with FDI, while inflation had a negative and non-significant association.

2.2. International studies:

In the international context, Baudisch (2018) analyzed 66 emerging/developing and industrial economies (1995-2015), using GMM estimation and found sector-specific FDI responses to exchange rate movements and found that real depreciation increased manufacturing FDI but reduced services FDI, with no significant effect on the primary sector, highlighting that the exchange rate level and volatility exert distinct, as sometimes opposing, effects on FDI that vary across sectors, with manufacturing and services responding differently from primary industries.

Moraghen et al. (2021) and Jacob et al. (2021) both demonstrated that exchange rate volatility significantly reduces FDI, while real depreciation tends to attract investment. Their findings suggest that the level of the exchange rate and its volatility exert opposing influences, with depreciation encouraging inflows but instability deterring them.

Haniya (2021) found that exchange rate volatility reduces FDI in the short and long run in Tunisia during 1980–2018, highlighting the importance of distinguishing time-specific volatility on FDI dynamics. Nguyen et al. (2022) confirmed a negative impact of exchange rate volatility on FDI for a study analyzing 156 economies (2002–2017) using robust panel methods (OLS, FEM, REM, FD-GMM, SYS-GMM), highlighting the strong advocates of policy measures to reduce exchange rate uncertainty and improve business environments to attract FDI. Whereas El Rhadbane & El Moudden (2022) compared Morocco, Turkey, and Egypt during 1990–2020 using GARCH and ARDL. The volatility results in a negative impact on FDI in Morocco, a positive impact in Turkey, and has no significant effect in Egypt, highlighting how economic structures, policies, and shocks like COVID-19 shape opposing volatility-FDI outcomes. The results contradict those of Lin & Chen (2022), who analyzed Taiwan 1985–2010 using GARCH and found real exchange rate levels positively influenced FDI, while volatility effects vary, supporting the importance of investor motives and market competition in shaping FDI responses. Shafique et al. (2022) confirmed that long-run volatility is positively impacts FDI in Pakistan, driven by depreciation. Kaya & Erden (2022) similarly reported positive volatility-FDI effects across 16 emerging markets, supporting the depreciation-attraction. Ozigbo and Anuya (2023) analyzed the adverse impact was particularly evident in the short term, where heightened uncertainty deters investment, undermines investor confidence, and affects expected returns in Nigeria (1983–2022) using ECM and OLS, Erum et al. (2023) also supported that exchange rate uncertainty negatively impacts FDI across both OLS and Makai models in India 2000–2019. Abdel Aziz & Al-Ajrawi (2023) examined Iraq’s agriculture sector (1990–2021) using ADF and ARDL modeling. They found a

negative, statistically significant short-run relationship between the official exchange rate and FDI inflows. However, no significant long-run effect was observed, confirming sector-specific and time-sensitive analysis and dynamics in FDI responses.

Joel & Jeffrey (2023) examined Nigeria (1986–2021) using EGARCH and GMM to assess exchange rate volatility–FDI dynamics. They found no statistically significant impact of volatility on FDI inflows, despite persistent currency depreciation, and recommend stronger exchange rate management policies by monetary authorities to support investment stability. In addition, Kalu (2024) supported no significant relationship between exchange rate volatility and FDI in Nigeria, 1981–2018. Otherwise, Nathan & Nsikan (2024) reported a significant negative impact of volatility on FDI in both the short and long run, in Nigeria 1986–2021, utilizing ARDL and GARCH, recommending comprehensive policy measures to attract FDI, considering broader economic factors beyond exchange rate dynamics. The results are inconsistent with Zaharum et al. (2024) for a study investigating the impact of the exchange rate on macroeconomic variables on FDI in Malaysia, 1992-2021, using multiple regression. The study found positive effects of exchange rate levels, GDP growth, and moderate inflation on FDI inflows, concluding that stabilizing exchange rates and aligning policies with broader economic goals enhances the investment climate. Meanwhile, Sultana et al. (2024) found that exchange rates negatively affect FDI in the short run but positively in the long run, analyzing 11 emerging economies1993–2020, using ARDL. The study highlights the time-dependent nature of the relationship and recommends flexible regimes to enhance investor confidence.

Lajevardi & Chowdhury (2024) found that REER and its volatility positively influenced overall FDI inflows in both the short and long run in Canada (2007–2022) using ARDL, and Sectoral results showed extractive industries, manufacturing, and financial services were highly sensitive to REER movements, with long-run effects strongest in the extractive and manufacturing sectors. The study concludes that sector-specific asymmetries necessitate tailored policy strategies to manage exchange rate impacts and attract FDI. Whereas Imamboccus et al. (2024) examined Mauritius tourism 1999–2019 using ARDL with disaggregated data from 17 source markets. The short-run results showed that exchange rate volatility negatively impacted tourism demand, while other markets revealed mixed, mostly insignificant effects, recommending stronger monetary and fiscal regulation, with currency devaluation as a potential strategy to attract arrivals. The results supported by Khan et al. (2024) that exchange rate volatility significantly deters FDI inflows in the short run, but not the long-run effect, for a study that examined India (1990–2020) using Engle-Granger and VAR modeling, concluded that stabilizing short-term volatility is vital for sustaining foreign investment and economic growth. Shabbir et al. (2025) examined the impact of tax policies, inflation, trade openness, and exchange Rate Volatility on the foreign investment decisions in Pakistan during 1991-2024. using ADF, PP, and ARDL to assess FDI determinants. They found tax policies, inflation, and trade openness positively associated with FDI, while exchange rate volatility deterred investment. The study recommends effective tax reforms and stabilizing exchange rates to strengthen foreign investment decisions. Meanwhile, Ben-Obi et al. (2025) analyzed the asymmetric impacts of exchange rate volatility on Foreign Direct Investment (FDI), inflation, and the balance of trade in Nigeria, 1995-2022 by applying the NARDL and found no significant long-run

asymmetric impact on FDI, while volatility had a direct influence on inflation, the study recommended improving the ease of doing business and security infrastructure to attract FDI and stabilize inflation.

2.3. Conclusion:

Existing literature on the exchange rate volatility effect on FDI remains inconclusive. Some of those studies identified currency depreciation as beneficial, lowering asset prices and stimulating investment, while others emphasize the detrimental effects of heightened uncertainty or report no meaningful effect. Critically, distinctions between short-run and long-run dynamics further complicate the overall picture. The methodological differences, the choice of volatility measurement (GARCH) family, utilizing different sophisticated econometric techniques (ARDL, NARDL, VAR, VCEM, GMM, etc.), and model specifications can yield different results, and included control variables (GDP, interest rates) demonstrably shape results; varying sample sizes and diverse time periods also contribute to unreliable conclusions. Empirical literature consistently demonstrates a negative correlation between exchange rate volatility and FDI, a relationship that aligns with classical economic theory. This theoretical framework suggests that increased exchange rate uncertainty heightens investment risk and diminishes the predictability of returns, thereby deterring foreign capital inflows Kiliçarslan, (2018). Such findings are corroborated by numerous studies focused on Egypt, including those by Elbadry and Mandour (2020), Asamoah et al. (2022), Elagouza (2023), Marwasamy et al. (2024), Abdelaziz et al. (2025), and Elmoghiar (2025), which support the critical role of currency stability in fostering FDI, particularly salient during Egypt's transition to a more flexible exchange rate regime.

Comparable evidence has emerged from international contexts, reinforcing the negative results that exchange rate volatility poses a significant barrier to foreign investment. Studies by Jannat (2020), Akinlo and Onatunji (2020, 2021), Rashid et al. (2020), Jacob et al. (2021), Md. Qamruzzaman et al. (2021), Hniya et al. (2021), El Rhadbane and El Moudden (2022), Jamal and Bhat (2022), Ozigbo and Anuya (2023), Erum et al. (2023), Abdel Aziz and Al-Ajrawi (2023), Nathan and Nsikan (2024), Imamboccus et al. (2024), Khan et al. (2024), Hamida (2024), and Zongo et al. (2024) all support this conclusion. Conversely, another subset of the literature identifies a positive association between exchange rate volatility and FDI. These studies often attribute such outcomes to the emergence of speculative or arbitrage-driven investment opportunities during periods of currency fluctuation. Within the Egyptian context, this perspective is reflected in the work of Nada and Hebatallah (2020), Abdelgany (2020), Al-Sayed (2020), Hend et al. (2021), El-Aal et al. (2021), Salah et al. (2021), and Al-Ghiash (2022). Internationally, similar conclusions are drawn by Khushaiba and Rawda (2020), Houng et al. (2020), Thujiyanthan (2021), Okonkwo et al. (2021), Lin and Chen (2022), Shafique et al. (2022), Kaya and Erden (2022), Ezekiel and Temidayo (2023), Zaharum et al. (2024), Ejaz and Azam (2024), Sultana et al. (2024), and Lajevardi and Chowdhury (2024).

Given the inconclusive nature of existing literature on the impact of exchange rate volatility on foreign direct investment (FDI), particularly the differences in short-run and long-run effects, this study proposes a structured hypothesis framework to empirically investigate these dynamics within the Egyptian context. Building on these insights, the research formulates hypotheses that differentiate between short-run and long-

run dynamic responses to real exchange rate volatility. Furthermore, the role of control variables such as market size, GDP growth, inflation, market capitalization, and external debt is examined to assess their moderating effects on FDI performance across time horizons.

3. Methodology

3.1. Data Collection

This study adopts a descriptive and analytical approach, relying exclusively on secondary time-series data. The dataset was obtained from the Central Bank of Egypt (CBE), including economic reports and external position statements. The dataset consists of 94 quarterly observations covering the period 2001–2024. Such a dataset provides a comprehensive overview of FDI dynamics in Egypt, capturing both historical fluctuations and recent developments.Table 3.1 explores the description of research variables.

Table 3.1 Description of Research Variables

Variables	Description	Unit Of Measurement	Source Of Data
$FDI_{i,t}$	Foreign Direct Investment (DV)	Aggregate FDI	Central Bank of Egypt **(CBE)**
$VOLREXR_{i,t}$	Real Exchange Rate Volatility (IDV)	EGARCH to generate the Real exchange rate volatility series	
$GDP_{i,t}$	Market Size (Control Variable)	(GDP) It is a widely used and robust measure of market size.	
$CPI_{i,t}$	Consumer Price Index (Control Variable)	It is a key macroeconomic indicator used to measure inflation	
$MCAP_{imp}$	Market Capitalization (Control Variable)	Efficient financial markets with higher capitalization, lower costs, enhance stability, and strengthen foreign investor confidence.	
$EXDBTG_{i,t}$	External Debt (Control Variable)	External debt serves as a critical signal of financial and macroeconomic stability in attracting FDI. Excessive debt burdens increase uncertainty, discourage capital inflows, and weaken long-term investor confidence.	

Source: prepared by researcher to provide Description of Variables 2025.

3.2. Data analysis:

To investigate the impact of real exchange rate volatility on foreign direct investment (FDI) in Egypt, this study adopts panel estimation techniques aimed at minimizing bias and enhancing the robustness of econometric models. The inclusion of key macroeconomic indicators reflects their established role in guiding investor assessments of economic performance and financial stability, thereby influencing investment decisions Kiliçarslan (2018) & Abdelaziz et al. (2025). The study starts with modeling the real exchange rate volatility using the (EGARCH) framework introduced by Nelson (1991), which is particularly effective in capturing asymmetric responses to market shocks where positive and negative news exerts differing influences on future volatility and in overcoming the limitations inherent in symmetric volatility models, Elbadry & Mandour (2020). In addition to EGARCH, the study employs the Autoregressive Distributed Lag (ARDL) models to examine cointegration relationships, which is supported by recent empirical literature, Akinlo & Onatunji (2020), Elbadry & Mandour (2020), Abdelgany (2020), Al-Sayed (2020), Akinlo & Onatunji (2021), Jacob et al. (2021), Md. Qamruzzaman et al.(2021), Haniya (2021), Bouzid et al. (2022), El Rhadbane & El

Moudden (2022), Jamal & Bhat (2022), Abdel Aziz & Al-Ajrawi (2023), Ezekiel &Temidayo (2023), Sultana et al. (2024), Lajevardi & Chowdhury (2024), Imamboccus et al. (2024) and, Marwasamy et al. (2024), Asamoah et al. (2022) and Elmoghiar (2025), highlighting their efficiency in analyzing the dynamic properties of macroeconomic and financial time-series data, especially in contexts characterized by structural shifts and volatility clustering, particularly, the flexibility with variables of differing integration orders, simultaneous estimation of short-run dynamics and long-run equilibrium and robustness in smaller samples. To ensure the reliability and validity of the regression estimates, a series of diagnostic tests were conducted. Specifically, the Durbin–Watson d-statistic and the Breusch–Pagan–Godfrey autocorrelation tests, which are applied to the model's residuals to assess whether they are serially correlated. The white heteroscedasticity test, the Jarque–Bera normality test, the variance inflation factor (VIF) to test multicollinearity, and the structural stability by CUSUM and CUSUM of square stability tests.

3.3. Testing Stationarity by (ADF and PP):

To ensure the validity of econometric estimations, the study first assesses the stationarity of the time series data using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. These tests are widely recognized in time series econometrics for evaluating the presence of unit roots and confirming the stability of data over time. Employing both ADF and PP tests enhances the robustness of the stationarity assessment, as convergent results from both methods increase confidence in the reliability of the findings Kiliçarslan (2018).

The Autoregressive Distributed Lag (ARDL) model, as proposed by Pesaran et al. (1999), is particularly advantageous in this context due to its flexibility in handling variables that are integrated of order zero [I(0)] or order one [I (1)]. This feature allows the ARDL framework to be applied even when the underlying variables exhibit mixed levels of integration, thereby avoiding the limitations of traditional cointegration techniques that require uniform stationarity and ensuring stationarity before model estimation is essential to avoid misleading regression results and to maintain the integrity of the empirical analysis, Elbadry & Mandour (2020) and Asamoah et al. (2022).

3.4. Modelling Exchange Rate Volatility Series by EGARCH:

The Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model, introduced by Nelson (1991), has become a preferred tool in most of the recent empirical research on exchange rate behavior. Its methodological strength lies in its ability to incorporate historical volatility patterns to predict future fluctuations, offering a precise approach to volatility estimation that exceeds symmetric GARCH models in capturing real-world financial dynamics. Jokosenumi & Adesete (2018), Mackton et al. (2018), Latief & Lefen (2018), Asmae & Ahmed (2019), Ignatius et al. (2019), Balaban et.al (2019), Jannat (2020), Alnaa & Ahiakpor (2020), Thujiyanthan (2021) Salah et.al., (2021), El Rhadbane & El Moudden (2022), Lin & Chen (2022), Shafique et al. (2022), Joel & Jeffrey (2023), Abdallah (2023), and Nathan & Nsikan (2024), were utilized the EGRACH to generate the volatility series to estimate conditional variance and prediction of

future real exchange rate volatility due to its effectiveness in modeling conditional variance and forecasting volatility.

3.5. EGARCH Model specifications:

The EGARCH process involves modeling the logarithm of the conditional variance, generating a robust volatility series that accurately reflects the asymmetric nature of market responses to shocks. The derived volatility series serves as a key explanatory variable in the main regression analysis investigating its impact on investment flows. The conditional variance for the EGARCH (p,q) model is specified as follows in equation (1) :

$$log\ log\ (h_t) = \varphi + \sum_{i=1}^{q} \eta_i \left|\frac{u_{t-i}}{\sqrt{h_{t-i}}}\right| + \sum_{i=1}^{q} \lambda_i \frac{u_{t-i}}{\sqrt{h_{t-i}}} + \sum_{k=1}^{q} \theta_k\ log\ (h_{t-k}). \qquad (1)$$

Whereas:

- LHS is the log of the variance series (h_t), which makes the leverage effect exponential rather than quadratic. This ensures that the estimates are non-negative.
- φ = Constant, η = ARCH effects, λ = asymmetric effects and θ = GARCH effects.
- If $\lambda_1 = \lambda_2 = \ldots\ldots = 0$, the model is symmetric.
    - ➢ But if $\lambda_1 < 0$, it implies that bad news (negative shocks) generates larger volatility than good news (positive shocks).

3.5. ADRL Model specification

The research applies the ARDL model on a quarterly dataset spanning 2001–2024 for 94 observations, the ARDL bound test, because of its ability to deal with small data samples, Muhammad and Abdullahi (2020). Besides, it provides that the bound test does not need our variables to be of the same order but rather a combination of integration at levels – I (0) and order one – I (1), and the bound test eliminates issues of serial correlation and endogeneity of variables Rahman and Kashem (2017), the generalized form of the study model is represented as follows:

FDI (DV) = $f(VOLREXR\ (IDV)\ ,\ GDP\ ,\ CPI\ ,MCAP\ ,EXDBTG\ (Control\ Variables)\ )$ **(1)**

Whereas the dependent FDI is Foreign Direct Investment, the independent variable VOLREXR is real exchange rate volatility; meanwhile, the control variables are the market size, GDP, Inflation, consumer price index CPI, Market Capitalization MCAP, and Eternal Debt is EXDBTG.

Ambala & Amewu (2022) correctly specify the linear ARDL model; the lags of both the dependent variable and control variables must be included. For p lags of our dependent variable, real exchange rate volatility (VOLREXR), and k lags of control variables, the research constructed the following ARDL equation (2):

$$FDI_t=\beta_0 + \sum_{i=1}^{P} \beta i\, FDI\ t-i + \sum_{i=0}^{K1} \gamma_0\, VOLREXR\ t-i + \sum_{i=0}^{K2} \delta_i\, GDP\ t-i + \sum_{i=0}^{K3} \delta_i\, CPI\ t-i + \sum_{i=0}^{K4} \rho_i\, MCAP\ t-i + \sum_{i=0}^{K3} \tau_i\, EXDBTG\ t-i + \varepsilon_t \quad (2)$$

Here, kq for q = 1,2,3 ..., 5 denote the maximum number of lags for VOLREXR, GDP, CPI, MCAP, and EXDBTG, respectively. This research uses EViews 12 software, and the optimal lag for each variable is automatically selected by the software. The ARDL bound test is formulated as follows in equation (3):

$$\Delta \ln FDI_t=\beta_0 + \sum_{i=1}^{P} \beta i\Delta\, lnFDIt-i + \sum_{i=0}^{K1} \gamma_0\, \Delta\, lnVOLREXR\ t-i + \sum_{i=0}^{K2} \delta_i \Delta\, ln\, GDP\ t-i + \sum_{i=0}^{K3} \delta_i\, \Delta\, lnCPI\ t-i + \sum_{i=0}^{K4} \rho_i\, \Delta\, lnMCAP\ t-i + \sum_{i=0}^{K5} \tau_i\, \Delta\, lnEXDBTG\ t-i + \lambda_1 ln\ ln\ GDP\ t-1 + ln\ \lambda_2 ln\ CPI\ t-1 + \lambda_3\ ln\ ln\ MCAP\ t-1 + \lambda_3\ ln\ ln\ MCAP\ t-1 + \lambda_3 ln\ ln\ EXDBTGt-1 + \varepsilon_t \quad (3)$$

Δ is the difference operator, and ln is the natural log of the variables. From equation (3), the short-run dynamics are captured by λi; for i = 1, 2,3 ..., 5, and the long-run dynamics are captured by βi; γi; δi; ρi; τi; and σi, and for i = 1, 2, 3, ..., p. Using a shorter and an error correction model (ECM), equation (4) could be written as follows:

$$\Delta \ln FDI_t=\beta_0 + \sum_{i=1}^{P} \beta i\Delta\, lnFDIt-i + \sum_{i=0}^{K1} \gamma_0\, \Delta\, lnVOLREXR\ t-i + \sum_{i=0}^{K2} \delta_i \Delta\, ln\, GDP\ t-i + \sum_{i=0}^{K3} \delta_i\, \Delta\, lnCPI\ t-i + \sum_{i=0}^{K4} \rho_i\, \Delta\, lnMCAP\ t-i + \sum_{i=0}^{K5} \tau_i\, \Delta\, lnEXDBTG\ t-i + \lambda ECTt-1 + \varepsilon_t \quad (4)$$

ECT is the error correction term that captures the long-run relationship between the variables, and its coefficient, λ, measures the speed of adjustment to the long-run equilibrium given any shock to the system. In addition, the contribution of the research in creating more accurate customized models for better predicting future movements to extend the literature database of the FDI determinants and provide better insights to academics and policymakers for better understanding the relationship to support the economic and financial stability.

3.6. Results and Aggregate FDI Econometric Analysis:

3.6.1 Formulating real exchange rate volatility series (2001-2024):

The research explored in part three the equation (1) used in modelling the volatility by GARCH, exponential EGARCH, and also the data used, quarterly returns of exchange rates on the Egyptian Pound, in generating the real exchange rate volatility (REXR) series. As in most empirical literature, the variable to be modelled is the percentage daily exchange rate return, which is the first difference of the natural logarithm of the exchange rate and is given by the following equation: Suliman (2012),

$$REXR_t = 100*\log\left(\frac{RER_t}{RER_{t-1}}\right) \quad (1)$$

where $REXR_t$ is the quarterly percentage return of the exchange rate RER_t, and RER_{t-1} denotes the exchange rate at the current quarter and the previous quarter, respectively.

3.6.2.ADF Stationarity test for real exchange rate series:

The Augmented Dickey-Fuller (ADF) test, as shown in Table 3.2, the test results for the real exchange rate volatility (REXR) indicate that the series is stationary at level (0) with no trend and intercept, and the following table summarizes these results as follows.

Table 3.2 EViews output (ADF) stationary test for REXR

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.731098	0.0000
Test critical values:	1% level	-2.590340	
	5% level	-1.944364	
	10% level	-1.614441	

Source: prepared by researcher eviews12 computation, 2025.

The ADF statistic of −7.731 is markedly lower than the critical values at the 1%, 5%, and 10% levels (−2.590, −1.944, and 1.614), the associated p-value of 0.0000, which is well below the 1% significance level, provides strong statistical evidence against the null hypothesis and confirms the suitability of the series for regression analysis, meaning that the real exchange rate (REXR) series is stationary at level (0), requiring no differencing, and exhibits a constant mean and variance over time, thereby excluding the presence of a unit root, establishing stationarity is validated the dataset for econometric applications in both short-run and long-run estimations, which is particularly critical for volatility modeling and robust time-series regression analysis.

3.6.3 Testing volatility returns by the EGRCH model:

The EGARCH in Table 3.3 shows that the estimation results indicate a pattern characterized by relatively low long-run variance, pronounced persistence in volatility, an unusual weakening effect in response to large shocks, and evidence of reverse-leverage asymmetry. These dynamics appear to be shaped, at least in part, by the Central Bank of Egypt's exchange rate management strategies. Such findings are consistent with earlier empirical studies, which demonstrate that financial time series frequently display persistent volatility and asymmetric responses to shocks Bollerslev (1986) ,Nelson (1991).

Table 3.3. EViews12 output Modelling Exchange Rate Volatility

Mean Equation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.028383	0.002119	13.39510	0.0000
REXR (-1)	0.091670	0.030964	2.960550	0.0031

Variance Equation

C(3)	-0.072203	0.026973	-2.676875	0.0074
C(4)	-0.564960	0.071967	-7.850217	0.0000
C(5)	0.424394	0.044146	9.613446	0.0000
C(6)	0.907589	1.2E-104	7.7E+103	0.0000

Source: prepared by researcher eviews12 computation, 2025.

The diagnostic test analysis in Table 3.4 confirms that the EGARCH model is both well-specified and effective in modeling real exchange rate volatility. The results confirm that high-volatility periods tend to occur in clusters, an important feature for risk modeling, and the model demonstrates a strong overall fit, with a log-likelihood value of 85.28, indicating a satisfactory alignment between the estimated specification and the observed data. The Akaike Information Criterion (AIC = −1.7236) and Schwarz Information Criterion (SIC = −1.5591) values suggest that the suggest the model is both efficient and well-fitted without unnecessary complexity. Diagnostic checks by Durbin–Watson statistic of 1.822, being close to the ideal value of 2, indicate the absence of significant serial correlation in the residuals of the mean equation, supporting correct model specification. Meanwhile, R^2 for the mean equation is very low (0.025).

Table 3.4 EGARCH Model Diagnostic Test Results

R-squared	0.025139	Mean dependent var	0.027136
Adjusted R-squared	0.014307	S.D. dependent var	0.166848
S.E. of regression	0.165651	Akaike info criterion	-1.723585
Sum squared resid	2.469609	Schwarz criterion	-1.559120
Log likelihood	85.28489	Hannan-Quinn criter.	-1.657205
Durbin-Watson stat	1.822289		

Source: prepared by researcher eviews12 computation, 2025.

The residuals remained from the estimated EGARCH model. The Autoregressive Conditional Heteroskedasticity (ARCH) test, a key diagnostic tool proposed by Engle (1982), was conducted to determine if any time-varying volatility, or "volatility clustering", the tests assess whether conditional heteroskedasticity persists after modeling; results show no evidence of ARCH effects, indicating the variance dynamics have been adequately captured. Table 3.5, exploring the ARCH test.

Table 3.5 Heteroskedasticity Test: ARCH

F-statistic	0.024322	Prob. F (1,89)	0.8764
Obs*R-squared	0.024862	Prob. Chi-Square (1)	0.8747

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.024630	0.286288	3.579013	0.0006
WGT_RESID^2(-1)	0.016524	0.105951	0.155956	0.8764

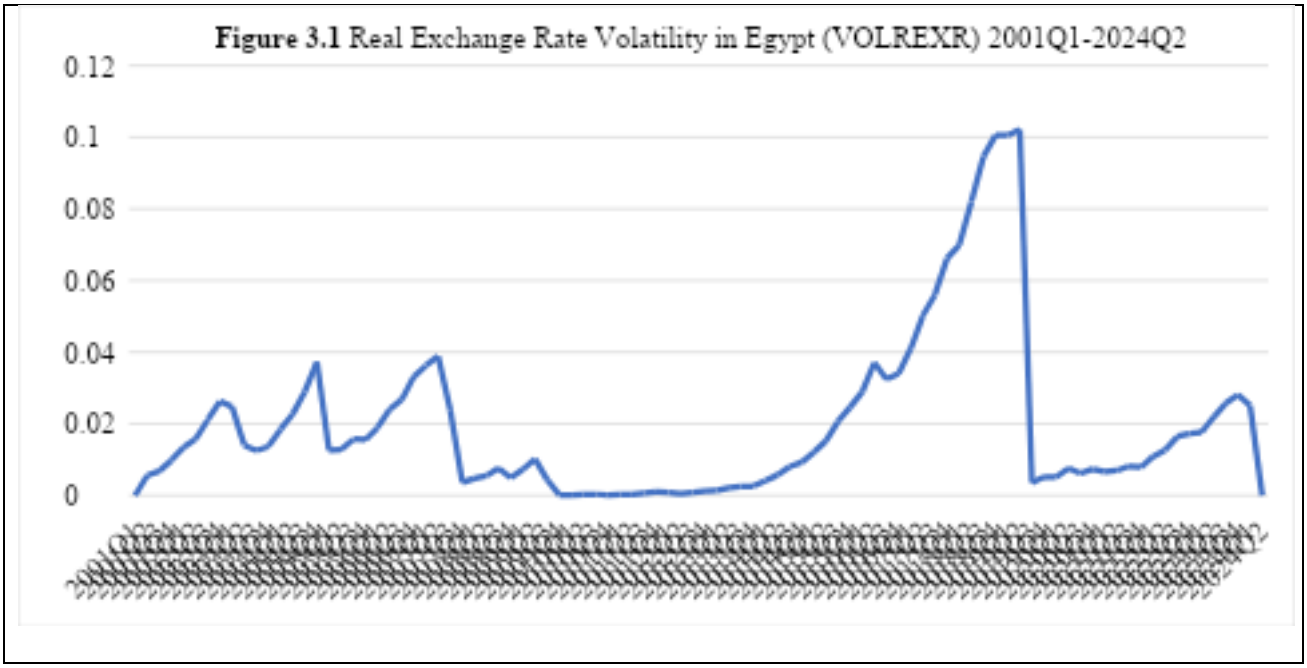
R-squared	0.000273	Mean dependent var	1.041808
Adjusted R-squared	-0.010960	S.D. dependent var	2.507105
S.E. of regression	2.520806	Akaike info criterion	4.708768
Sum squared resid	565.5473	Schwarz criterion	4.763951
Log likelihood	-212.2489	Hannan-Quinn criter.	4.731031
F-statistic	0.024322	Durbin-Watson stat	1.997625
Prob(F-statistic)	0.876421		

Source: prepared by researcher eviews12 computation, 2025.

The presence of autoregressive conditional heteroskedasticity (ARCH) effects was assessed using the Lagrange Multiplier (LM) test. The computed ARCH F-statistic (0.0243) and its p-value (0.8764) indicate a failure to reject the null hypothesis of homoscedastic residuals, which was tested against the alternative of ARCH effects, providing no evidence of ARCH effects. Similarly, the ARCH (Obs × R^2) statistic (0.0249) with a p-value of 0.8747 confirmed the absence of conditional heteroskedasticity. These results suggest that the residuals are well-behaved, validating the variance specification of the estimated model. To further evaluate model adequacy, the Durbin–Watson statistic was applied to detect serial correlation in the squared residuals being close to the benchmark of 2.0, revealing no significant autocorrelation, thereby reinforcing the robustness of the specification.

3.6.4 Generating the Volatility Conditional Variance Series:

The analysis supports evidence that the EGARCH model is well-specified. Due to the absence of significant autocorrelation in the residuals, this confirmed that the model has successfully captured the dynamic structure to generate the real exchange rate volatility (VOLREXR) series, the independent variable in this research. This finding, combined with the earlier ARCH test results (which indicated no remaining heteroscedasticity), consequently the EGARCH framework, is validates the model's empirical adequacy and its suitability for forecasting and subsequent econometric analysis of real exchange rate volatility, Engle (1982) and Bollerslev (1986). In this research, a new time-series variable, VOLREXR, was developed to capture the volatility of Egypt's real exchange rate. Figure 3.1 presents the VOLREXR series, generated in EViews 12, which is later used to assess the impact of real exchange rate volatility on Egypt's aggregate FDI inflows, 2001–2024.



Source: prepared by researcher eviews12 computation, 2025.

4.3. ADRL Co-integration Analysis in the short run:

4.3.1 Unit Root (ADF and PP) testing the stationarities Results:

To assess the time-series properties of the variables, the analysis employed the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests, which are essential for verifying stationarity before conducting robust econometric estimations. The similarity between ADF and PP test results reinforces the reliability of these stationarity conclusions, Lajevardi & Chowdhury (2024). Applying conventional significance levels of 1%, 5%, and 10%, the results from both tests uniformly reject the null hypothesis of a unit root for aggregate foreign direct investment (FDI) and the associated control variables. This outcome suggests that these series are stationary after first difference, indicating integration of order one, I (1), as reflected in the empirical results presented in Table 3.6.

Table 3.6 ADF and PP unit root test stationary results.

Variables	Description	Test Statistic	p-Value	Stationary Status
LFDI	Aggregate FDI	-11.98781	0.0000	Stationary at (I(1)).
VOLREXR	Exchange Rate Volatility	-9.000846	0.0000	Stationary at (I(1)).
LCPI	Proxy of Inflation	-8.950739	0.0000	Stationary at (I(1)).
LGDP	Proxy of Market Size	-11.00335	0.0000	Stationary at (I(1)).
LMCAP	Market Capitalization	-8.714731	0.0000	Stationary at (I(1)).
LEXDBTG	External Debit	-9.206613	0.0000	Stationary at (I(1)).

Results are significant at 1%, 5 % and 10 % levels, respectively. Source: Prepared by researcher EViews12 computation, 2025.

4.3.2. The Optimal Lag Length Selection:

Optimal lag selection is critical for cointegration analysis. AIC and LR criteria suggest extending lags to 2–3 periods, better capturing interdependencies between aggregate/sectoral FDI and real exchange rate volatility (VOLREXR), compared to the initially specified ARDL (1,0) model. These extended lags appear to better represent the short- and medium-run dynamics of the system. Consequently, these findings inform the specification of alternative ARDL models for subsequent estimation, as summarized in Table 3.7 based on AIC-driven model selection. FPE is lowest at lag 2, AIC is lowest at lag 3, and SC (BIC) is lowest at lag 1. HQ is lowest at lag 2, and the LR test favors lag 3.

Table 3.7 VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	145.6238	NA	9.25e-10	-3.773615	-3.586799	-3.699092
1	632.1082	880.9312	4.79e-15	-15.94887	-14.64116*	-15.42721
2	695.8932	105.1591	2.30e-15*	-16.69982	-14.27121	-15.73101*
3	732.1426	53.88431*	2.40e-15	-16.70656*	-13.15705	-15.29062
4	765.7761	44.54162	2.81e-15	-16.64260	-11.97220	-14.77952
5	797.2884	36.62237	3.74e-15	-16.52131	-10.73001	-14.21109
6	832.4483	35.15993	4.98e-15	-16.49860	-9.586408	-13.74124
7	858.0692	21.46618	9.87e-15	-16.21809	-8.184996	-13.01359

Source: prepared by researcher EViews12 computation, 2025. *Optimal Lag length Selection.

4.3.3. The Short Run Dynamic ADRL of Real Exchange Rate Volatility (VOLREXR) on FDI:

The short-run estimates from the ARDL (1,0) specification, as reported in Table 3.8, indicate a statistically significant and negative relationship between real exchange rate volatility (VOLREXR) and aggregate FDI in Egypt. Specifically, the coefficient of −11.52 ($p = 0.009$) suggests that, holding other factors constant, a one-unit rise in real exchange rate volatility is associated with an immediate reduction of approximately 11.52 units in aggregate FDI inflows during the 2001–2004 period. Furthermore, in Table 3.8, the lagged dependent variable, LFDI (−1), exhibits a positive and highly significant coefficient of 0.4938 ($t = 5.7165$, $p < 0.001$), implying that nearly 49.4% of the previous quarter's FDI continues in the current period, reflecting a high degree of persistence in FDI flows highlighting the role of historical FDI in shaping current inflows. These findings confirm a robust short-run association between real exchange rate volatility and FDI, validating the ARDL framework as an appropriate econometric approach for modeling the dynamic interactions between variables.

Table 3.8 The short-run ADRL Model Co-integration of aggregate FDI

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LFDI (-1)	0.493793	0.086380	5.716502	0.0000
VOLREXR	-11.51935	4.304712	-2.675986	0.0090
LGDP	0.569726	0.141814	4.017412	0.0001
LCPI	1.288605	0.352939	3.651073	0.0005
LMCAP	1.042517	0.237238	4.394399	0.0000
LEXDBTG	5.729818	1.818813	3.150305	0.0023
C	-16.43180	4.121816	-3.986543	0.0001

R-squared	0.792816	Mean dependent var	7.194481
Adjusted R-squared	0.777469	S.D. dependent var	1.264922
S.E. of regression	0.596704	Akaike info criterion	1.881413
Sum squared resid	28.84052	Schwarz criterion	2.078474
Log likelihood	-75.78216	Hannan-Quinn criter.	1.960804
F-statistic	51.65945	Durbin-Watson stat	2.023522
Prob(F-statistic)	0.000000		

Source: prepared by researcher EViews12 computation, 2025,

Within the ARDL framework presented in Table 3.9 and 3.10, the estimated error correction term, ECT(−1), is negative and highly significant ($p < 0.001$), satisfying key diagnostic requirements and confirming the existence of a stable long-run cointegrating relationship between foreign direct investment (FDI), real exchange rate volatility (VOLREXR), and other control variables gross domestic product (GDP), consumer price index (CPI), market capitalization (MCAP), and external debt (EXDBTG). The ECT (−1) coefficient of −0.5062 indicates that approximately 50.6% of any disequilibrium from the preceding period is corrected within the current period, reflecting a relatively rapid adjustment toward the long-run equilibrium. This finding highlights the strong tendency of FDI to revert to its equilibrium path in response to deviations driven by real exchange rate volatility. In contrast, the short-run coefficients capture the immediate directional effects of changes in (VOLREXR) on FDI flows, reflecting the distinction between temporary impacts and the long-term adjustment process.

Table 3.9 ADRL ECM Regression Dependent variable D(LFDI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.569726	0.134722	4.228896	0.0001
LCPI	1.288605	0.292873	4.399877	0.0000
LMCAP	1.042517	0.182061	5.726182	0.0000
LEXDBTG	5.729818	1.184015	4.839313	0.0000
CointEq(-1)*	-0.506207	0.080501	-6.288202	0.0000

Source: prepared by researcher eviews12 computation, 2025,

The negative association identified in this study is consistent with classical economic theory, which posits that heightened exchange rate uncertainty elevates investment risk and reduces the predictability of returns, thereby discouraging foreign capital inflows Kiliçarslan (2018). This outcome aligns with prior empirical evidence from Egypt, including Elbadry and Mandour (2020), Asamoah et al. (2022), Elagouza (2023), Marwasamy et al. (2024), Abdelaziz et al. (2025), and Elmoghiar (2025), all of which emphasize the importance of currency stability in attracting FDI, particularly relevant during Egypt's transition toward a more flexible exchange rate regime. Comparable findings have been reported in international contexts, such as Jannat (2020), Akinlo and Onatunji (2020, 2021), Rashid et al. (2020), Jacob et al. (2021), Md. Qamruzzaman et al. (2021), Hniya et al. (2021), El Rhadbane and El Moudden (2022), Jamal and Bhat (2022), Ozigbo and Anuya (2023), Erum et al. (2023), Abdel Aziz and Al-Ajrawi (2023), Nathan and Nsikan (2024), Imamboccus et al. (2024), Khan et al. (2024), Hamida (2024), and Zongo et al. (2024).

In contrast, other literature reports a positive relationship between real exchange rate volatility and FDI, often attributing it to increased investment opportunities during periods of currency fluctuation. Within Egypt, such evidence is provided by Nada and Hebatallah (2020), Abdelgany (2020), Al-Sayed (2020), Hend et al. (2021), El-Aal et al. (2021), Salah et al. (2021), and Al-Ghiash (2022). Internationally, similar results are reported by Khushaiba and Rawda (2020), Houng et al. (2020), Thujiyanthan (2021), Okonkwo et al. (2021), Lin and Chen (2022), Shafique et al. (2022), Kaya and Erden (2022), Ezekiel and Temidayo (2023), Zaharum et al. (2024), Ejaz and Azam (2024), Sultana et al. (2024), and Lajevardi and Chowdhury (2024).

Table 3.10 Short-run dynamics in the ARDL model for net FDI inflows.

Variables	**Coefficient**	**STD Error**	**T-Statistic**	**p-Value**
ECT (-1) *	-0.506207	0.086380	-5.860221*	0.0000
LFDI (-1)	0.493793	0.086380	5.716502*	0.0000
VOLREXR*	-11.51935	4.304712	-2.675986*	0.0090
LGDP	0.569726	0.141814	4.017412*	0.0001
LCPI	1.288605	0.352939	3.651073*	0.0005
LMCAP	1.042517	0.237238	4.394399*	0.0000
LEXDBTG	5.729818	1.818813	3.150305*	0.0023
C	-16.43180	4.121816	-3.986543*	0.0001
R-squared	**0.792816**	**Adjusted R-squared**		**0.777469**

Source: prepared by researcher eviews12 computation, 2025, Note: * significant at 1%, 5%, and 10% levels, respectively

4.3.4. Co-integration Analysis using ADRL F-Bounds Test:

To address potential issues of model misspecification and serial correlation, this study employs the autoregressive distributed lag (ARDL) bound testing methodology developed by Pesaran, Shin, and Smith (2001). Model specification was guided by the Akaike Information Criterion (AIC), which identified an optimal lag structure of one period for both dependent and independent variables.

The F-bounds test was applied to evaluate the null hypothesis of no long-run equilibrium impact of the real exchange rate volatility on foreign direct investment (FDI) alongside key macroeconomic control variables. As reported in Tables 3.11 and 3.12, the computed F-statistic (12.8629) substantially exceeds the upper-bound critical values at all conventional significance levels. Otherwise, exceeding the 1% upper-bound thresholds for both asymptotic (5.58) and finite-sample (5.917) distributions, thereby leading to rejection of the null hypothesis at the 1% significance level. These results provide robust empirical evidence of a stable long-run cointegrating relationship between FDI and real exchange rate volatility, a relationship that remains significant even after controlling for market size (GDP), inflation (CPI), financial market capitalization (MCAP), and external debt (EXDBTG).

Table 3.11 Upper and Lower Bound Test Statistic

Significance Level	**Asymptotic Critical Values (n=1000)**		**Finite Sample Critical Values (n=80, approximation for n=88)**	
	Lower Bound (I (0))	**Upper Bound (I (1))**	**Lower Bound (I (0))**	**Upper Bound (I (1))**
10%	3.02	3.51	3.113	3.61
5%	3.62	4.16	3.74	4.303
2.5%	4.18	4.79	-	-
1%	4.94	**5.58**	5.157	**5.917**
Compare the upper and Lower bounds with the Test Statistic F-statistic				**12.86289**

Source: prepared by researcher eviews12 computation, 2025, F-Bounds Test: F-statistics (12.86289) is greater than the upper bound critical values at all conventional significance levels (10%, 5%, 2.5%, 1%) for both I(0) and I(1) variables.

4.3.5. The Long Run Dynamic ADRL of real exchange rate volatility on Aggregate FDI:

The study examines the long-run dynamics of foreign direct investment (FDI) in Egypt using a Conditional Error Correction Model (CECM). The long-run coefficients were estimated using real exchange rate volatility as the primary explanatory variable, with the adjustment speed captured by the negative coefficient of the lagged dependent variable, LFDI (–1) (–0.506207).

Empirical results, as presented in Table 4.13, the long-run reveal a statistically significant and negative impact of real exchange rate volatility (VOLREXR) on aggregate FDI inflows. Specifically, the estimated coefficient of –22.75619 (t = –2.676, p = 0.009) indicates that a 1% rise in real exchange rate volatility corresponds to an approximate 22.76% decline in FDI over the long run (see Table 4.12).

Table 4.12 ARDL Long Run Form and Bounds Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VOLREXR	-22.75619	8.962496	-2.539047	0.0130
C	-32.46062	6.682087	-4.857856	0.0000

EC = LFDI - (-22.7562*VOLREXR - 32.4606)

Source: prepared by researcher eviews12 computation, 2025,

The results align with theoretical perspective expectations and corroborate prior empirical findings for Egypt, as documented by Elbadry and Mandour (2020), Asamoah et al. (2022), Elagouza (2023), Marwasamy et al. (2024), Abdelaziz et al. (2025), and Elmoghiar (2025). Over the period 2001Q1–2024Q2, sustained real exchange rate volatility and recurrent macroeconomic instability appear to have hindered the attraction of aggregate FDI inflows. This negative impact is reasonably attributable to heightened transaction and currency conversion costs, which increase operational uncertainty and reduce the long-term appeal of investment in the Egyptian market.

Table 3.13 F-bounds test for Co-integration

Variable	**Conditional Error Correction Coefficient**	**Calculation (Coefficient /-(-0.506207))**	**Long-Run Coefficient**	**Prob. (Significance Level)**
C	-16.43180	-16.43180 / 0.506207	32.46062	0.0001*
VOLREXR	-11.51935	-11.51935 / 0.506207	-22.75619	0.0090*
LGDP	0.569726	0.569726 / 0.506207	1.12544	0.0001*
LCPI	1.288605	1.288605 / 0.506207	2.54561	0.0005*
LMCAP	1.042517	1.042517 / 0.506207	2.05942	0.0000*
LEXDBTG	5.729818	5.729818 / 0.506207	11.31911	0.0023*

Source: Prepared by researcher eviews12 computation, 2025. Significance Level: All long-run coefficients derived are statistically significant at commonly accepted levels (e.g., 1% or 5%), as indicated by their corresponding p-values. The long-run coefficients are obtained by dividing the coefficients of the independent variables by the negative of the coefficient of LFDI (−1) ∗. Coefficient of LFDI (−1) ∗ = -0.506207.

Generally, the empirical evidence supports the hypothesis that real exchange rate volatility has a significant and negative impact on Egypt's aggregate foreign direct investment (FDI) inflows over the long run. Offering critical policy implications for promoting macroeconomic stability and enhancing Egypt's investment climate.

However, these results contradict a subset of studies on the Egyptian economy, where several studies (FDI), such as Nada & Hebatallah (2020), Abdelgany (2020), Al-Sayed (2020), Hend et al. (2021), El-Aal et al. (2021), Salah et al. (2021), and Al-Ghiash (2022). These studies reported that a positive exchange rate volatility effect on FDI; in these cases, domestic currency depreciation is argued to enhance the competitiveness of local assets and production inputs, thereby attracting foreign investors seeking cost advantages.

The adverse relationship identified in this study is consistent with a broad body of international researchers such as Jokosenumi & Adesete (2018), Latief & Lefen (2018), Ndanu & Kennedy (2018), Yugang He (2018), Rashid et al. (2020),Akinlo & Onatunji (2020), Akinlo & Onatunji (2021) Jacob et al. (2021) Md.Qamruzzaman et al.(2021) Hniya et al. (2021), El Rhadbane & El Moudden (2022), Jamal & Bhat (2022), Erum et al. (2023), Abdel Aziz & Al-Ajrawi (2023), Ozigbo & Anuya (2023), Nathan & Nsikan (2024) , Imamboccus et al. (2024),Khan et al. (2024) and Zongo et al. (2024).

Moreover, an economy's demonstrated ability to absorb and adapt to exchange rate fluctuations can signal structural resilience, potentially distorting investor confidence and continuing FDI inflows. This perspective is supported by evidence from various international contexts, such as Khushaiba & Rawda (2020), Okonkwo et al. (2021), Lin & Chen (2022), Shafique et al. (2022), Kaya and Erden (2022), Ezekiel &Temidayo (2023), and Lajevardi & Chowdhury (2024).

4.3.6. Control Variables Effect in The Short-Long Run on FDI in Egypt:

A. Market Size (GDP) Effect in the Short and Long Run:

The ARDL estimation results demonstrate that Egypt's market size during 2001-2024, measured by gross domestic product (GDP), is a significant determinant of FDI inflows in both the short and long term. In the short run, the positive and statistically significant coefficient (0.5697; $t = 4.017$, $p < 0.01$) suggests that a one-unit increase in GDP corresponds to an approximate 0.57 unit rise in logged FDI, holding other factors constant. This supports the market-seeking FDI hypothesis, indicating that economic expansion strengthens investor confidence by signaling higher domestic demand, greater sales potential, and improved profitability prospects Hamida (2024); Lajevardi & Chowdhury (2024); and Elmoghiar (2025).

Meanwhile, the results in the long-run estimates reinforce this conclusion, with a coefficient of 1.1254 ($t = 4.017$, $p = 0.0001$) confirming that sustained economic growth is a core driver of FDI inflows. A larger and expanding market offers foreign investors access to a broader consumer base and opportunities for economies of scale. These findings are consistent with the broader empirical literature on FDI determinants Arvin et al. (2021) and are strongly supported by both Egyptian-specific evidence Salah et al. (2021) and Elmoghiar (2025). Overall, the results highlight the critical role of macroeconomic stability and growth in attracting market-oriented investment to emerging economies such as Egypt.

B. Consumer price index CPI (Proxy for Inflation) impact in the Short and Long Run:

The ARDL analysis highlights a significant role for inflation, proxied by the consumer price index (CPI), in shaping services sector FDI inflows in Egypt across the study period (2001–2024). In the short run, the positive and significant coefficient (1.2886; $t = 3.65$, $p < 0.01$) suggests that higher inflation rates were associated with increased FDI inflows. In the long run, ADRL estimates reinforce the positive association, with a coefficient of 2.5456 ($t = 3.651$, $p = 0.0005$), indicating that continuous inflation was associated with FDI growth. The positive relationship between exchange rate volatility and FDI in Egypt during 2001–2004 can be explained

by the investment opportunities created through currency depreciation, structural reforms, and enhanced export competitiveness. Volatility, rather than deterring investors, acted as a signal of transition and reform, encouraging inflows of FDI.

This outcome is different from the prevailing theoretical perspective, which typically views inflation as a deterrent to investment due to heightened uncertainty and reduced real returns. In Egypt's case, the result may reflect the CBE's consistent inflation-targeting framework, where moderate and stable inflation signaled policy credibility, thereby mitigating perceived investment risk. This finding contrasts with empirical literature, as studies such as Imamboccus et al. (2024) reported that inflation discourages FDI.

In Egypt, during 2001Q1-2024Q2, an increase in GDP stimulates higher demand for goods and services, which raises domestic prices and reflects short-run inflationary tendencies, which is interpreted positively as a growing market with profitable FDI opportunities, entering to capture share despite rising costs, in addition to GDP growth is linked to improved infrastructure and stronger macroeconomic fundamentals, which reduce investment risk and enhance the Egyptian economy attractiveness. Thus, despite inflationary pressures, overall growth encourages greater FDI inflows, as investors seek long-term returns in a dynamic, expanding market.

C. Market Capitalization (MCAP):

In the short run, the empirical results show a significant positive relationship between market capitalization and foreign direct investment net inflows. In the short run, the estimated coefficient (1.0425; $t = 4.394$, $p < 0.01$) indicates that rising equity market valuations substantially enhance foreign investment. Meanwhile, long-run estimates further strengthen this conclusion, with a coefficient of 2.0594 ($t = 4.394$, $p < 0.01$) suggesting that sustained growth in market capitalization is linked to persistent FDI inflows.

This supports theoretical perspectives that emphasize the role of deep, liquid capital markets in attracting international capital by offering improved access to financing, portfolio diversification opportunities, and efficient exit mechanisms. Reforms implemented by the Egyptian exchange to strengthen secondary markets have likely reinforced this effect by increasing asset allocation flexibility and lowering transaction costs for foreign investors. A mature capital market signals macroeconomic resilience, strong corporate performance, and policy stability, factors that encourage long-run foreign investment.

These findings align with previous studies by Razia et al. (2025), who highlight a mutually reinforcing relationship between equity market development and FDI. However, contrasting evidence from Farooq et al. (2023) suggests that in some contexts, high market capitalization may crowd out FDI by absorbing domestic investment opportunities.

D. External Debt (EXDBTG):

The ARDL estimates indicate that external debt dynamics significantly influence Egypt's FDI inflows, with contrasting short- and long-term effects. In the short run, the external debt growth exhibits a negative and statistically significant impact ($\beta = -5.71$, $p = 0.048$), implying that increased borrowing may initially deter foreign investors by heightening concerns over sovereign risk, repayment capacity, and macroeconomic stability ElMahdy et al.(2022). This aligns with prior evidence suggesting that elevated debt burdens can raise investor risk perceptions and reduce capital inflows in emerging markets Ayoub (2024).

Conversely, the long-run results reveal a positive and significant association ($\beta = 11.32$, $t = 3.15$, $p = 0.002$), indicating that external debt can support sustained FDI inflows when strategically prevailed. This finding is consistent with theoretical perspectives that highlight the role of debt-financed resources in funding infrastructure, energy transition, and large-scale development projects that enhance the investment climate. A notable example occurred in 2024, when the Central Bank of Egypt reported a US$11.8 billion (7.2%) reduction in external debt, largely due to converting approximately US$11 billion in UAE deposits into equity for the Ras El Hekma development project. This transaction enhanced FDI by converting debt into productive investment, demonstrating that reasonable borrowing can reinforce macroeconomic stability, stimulate domestic savings, and attract further private capital flow.

4.3.7. Diagnostic ADRL Test Statistics for Aggregate FDI:

Following the methodological frameworks outlined in the literature by Abdel Aziz & Al-Ajrawi (2023), Lajevardi and Chowdhury (2024), and Elmoghiar (2025), this research categorizes its diagnostic procedures to investigate the impact of real exchange rate volatility on aggregate foreign direct investment (FDI). The econometric evaluation employed the Durbin–Watson d-statistic and the Breusch–Pagan–Godfrey test to detect serial correlation in model residuals and the variance inflation factor (VIF) to test multicollinearity. Heteroscedasticity was assessed using the White test, while the Jarque–Bera statistic was applied to examine the normality of residual distributions. Furthermore, the structural stability of ADRL model parameters was evaluated through the cumulative sum (CUSUM) and CUSUM of squares tests. Collectively, these diagnostic measures were implemented to ensure the robustness, validity, and reliability of empirical findings.

4.3.7.1. The ADRL Model Diagnostic Test and Goodness of Fit:

Consistent with drawing on methodological practices adopted in prior empirical research, the present autoregressive distributed lag (ARDL) analysis in Table 3.14 of aggregate foreign direct investment (FDI) in Egypt indicates strong model adequacy. The Durbin–Watson statistic ($d = 2.0235$) was approximately close to the benchmark value of 2, suggesting the absence of significant positive or negative autocorrelation in the residuals. The coefficient of determination ($R^2 = 0.7928$) implies that real exchange rate volatility (VOLREXR), alongside key control variables, explains approximately 79% of the variation in aggregate FDI, reflecting a high degree of explanatory power. The adjusted R^2 (0.7775) further confirmed the robustness of this fit after accounting for the number of predictors.

Table 3.14 ADRL Model Co-integration Result

R-squared	0.792816	Mean dependent var	7.194481
Adjusted R-squared	0.777469	S.D. dependent var	1.264922
S.E. of regression	0.596704	Akaike info criterion	1.881413
Sum squared resid	28.84052	Schwarz criterion	2.078474
Log likelihood	-75.78216	Hannan-Quinn criter.	1.960804
F-statistic	51.65945	Durbin-Watson stat	2.023522
Prob(F-statistic)	0.000000		

=========

Source: prepared by researcher eviews12 computation, 2025.

The F-statistic (51.659, $p < 0.001$) demonstrated that VOLREXR, along with gross domestic product (GDP), consumer price index (CPI), market capitalization (MCAP), and external debt (EXDBTG), exerts a statistically significant joint influence on aggregate FDI inflows. Additionally, model selection metrics, including the Akaike Information Criterion (AIC = 1.8814) and Schwarz Criterion (SC = 2.0785), provided further evidence of the model's suitability for capturing variations in FDI flows.

4.3.7.2. Autocorrelation Test (Breusch–Pagan–Godfrey):

In line with the methodology proposed by Breusch and Godfrey (1978), the Breusch–Godfrey Serial Correlation Lagrange Multiplier (LM) test was applied to evaluate whether the regression residuals were independent, thereby ensuring the reliability of parameter estimates. This diagnostic is widely recognized in econometric analysis for verifying the assumption of independently distributed errors, which is essential for producing unbiased coefficients and valid statistical inference. For the autoregressive distributed lag (ARDL) model examining the impact of real exchange rate volatility and foreign direct investment (FDI) in Egypt, the test results for lag orders one and two yielded p-values of 0.5005 and 0.4657, respectively, both exceeding the 0.05 significance level. Consequently, the null hypothesis of no serial correlation could not be rejected. This finding in Table 3.15 indicates that residuals are free from statistically significant autocorrelation up to two lags, thereby fulfilling a fundamental regression assumption.

Table 3.15 Serial correlation test. Breusch–Godfrey Serial Correlation LM Test Results

F-statistic	0.698258	Prob.F(2,79)	0.5005
Obs*R-squared	1.528592	Prob. Chi-Square (2)	0.4657

Source: prepared by researcher eviews12 computation, 2025.

The absence of autocorrelation enhances the credibility of the parameter estimates and reinforces the robustness of the ARDL model's conclusions regarding the impact of real exchange rate volatility on FDI in Egypt over the period 2001–2024.

4.3.7.3. Multicollinearity Test Analysis of VIF Results:

The research employed the Variance Inflation Factor (VIF) method as a diagnostic tool for multicollinearity to ensure the reliability of the data of the estimated impact of real exchange rate volatility on foreign direct investment (FDI) in Egypt, (VIF) can detect the independent variables that are highly correlated to each other because the multicollinear variables can affect the robustness of the estimated model by generating biased coefficients. The results in Table 3.16 indicate that all centered VIF values fall below the conventional

threshold of 10, suggesting that multicollinearity is not a serious concern in the model. Specifically, the lagged dependent variable (LFDI (-1)) recorded a VIF of 2.86, while the exchange rate volatility variable (VOLREXR) showed a value of 2.52. Other control variables, including GDP (1.89), consumer prices CPI (2.37), market capitalization MCAP (3.14), and external debt EXDBTG (2.71), also remained within acceptable ranges. These findings confirm that the explanatory variables are sufficiently independent, thereby ensuring that the estimated coefficients are not inflated by hidden correlations. This is particularly important in finance and macroeconomic models, where variables such as exchange rates, inflation, and external debt often exhibit interdependence ,Salmerón & García (2022).

Table 3.16 Variance Inflation Factors (VIF)

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LFDI (-1)	0.007462	96.37530	2.858288
VOLREXR	18.53054	4.495327	2.520305
LGDP	0.020111	85.18579	1.894349
LCPI	0.124566	7.417539	2.374715
LMCAP	0.056282	1629.723	3.136444
LEXDBTG	3.308082	966.7996	2.707930
C	16.98937	4198.960	NA

Source: prepared by researcher eviews12 computation, 2025.

By incorporating VIF alongside other diagnostic tests, including Durbin–Watson for autocorrelation, the study provides a comprehensive robustness framework. Thus, the inclusion of VIF strengthens the validity of the econometric results by confirming that the observed effects of real exchange rate volatility on aggregate FDI flow in Egypt, 2001-2024, are not distortions of multicollinearity but reflect valid economic relationships.

4.3.7.4. Heteroskedasticity test (Breusch-Pagan-Godfrey):

In accordance with standard econometric procedures, the Breusch–Pagan–Godfrey test was applied to determine whether the variance of the regression error term remained constant across observations. This diagnostic assesses whether residual variability is systematically related to the explanatory variable, the real exchange rate volatility, a condition that, if present, could distort statistical inference. As presented in Table 3.16, the p-values for the F-statistic (0.0528) and the Obs*R^2 statistic (0.0565) were slightly above the conventional 5% significance threshold. Consequently, the null hypothesis of homoskedasticity could not be rejected, indicating no statistically significant evidence of heteroskedasticity in the residuals. This finding affirms the reliability of the estimated standard errors and supports the validity of the empirical results derived from the ARDL model examining the impact of real exchange rate volatility on foreign direct investment (FDI) in Egypt, 2001-2024. Furthermore, all estimations incorporated heteroskedasticity-robust standard errors to mitigate any potential effects of variance misspecification.

Table 3.16 Heteroskedasticity Test: Breusch-Pagan-Godfrey Test Results

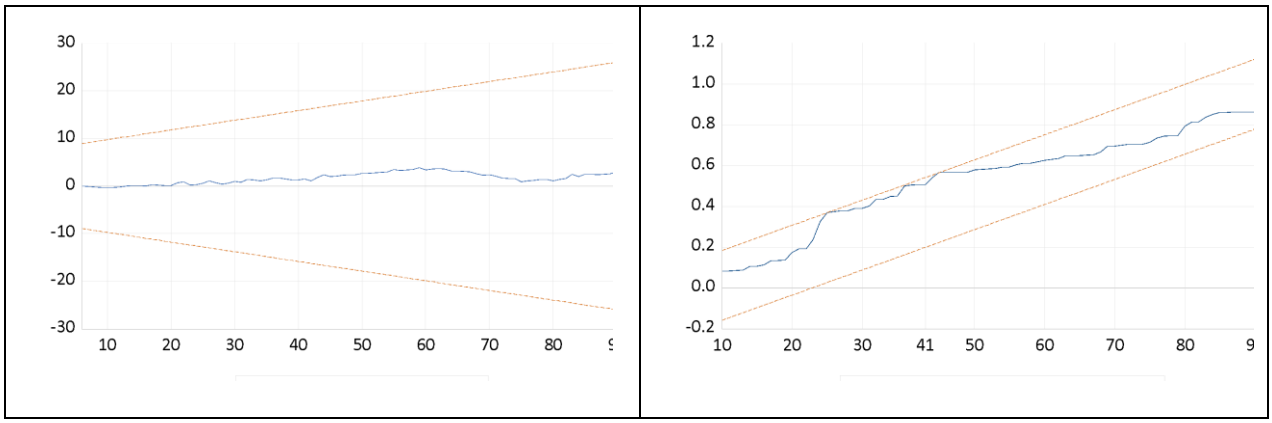
F-statistic	2.184314	Prob. F (6,81)	0.0528
Obs*R-squared	12.25553	Prob. Chi-Square (6)	0.0565
Scaled explained SS	13.84892	Prob. Chi-Square (6)	0.0314

Source: prepared by researcher eviews12 computation, 2025.

4.3.7.5. CUSUM Structural Stability Test:

Following established econometric diagnostics procedures for assessing parameter constancy, the cumulative sum (CUSUM) test was employed to examine the stability of the estimated regression coefficients for Egypt over the period 2001Q1–2024Q2. This technique evaluates the cumulative sum of recursive residuals to identify potential structural breaks, abrupt shifts in the relationships among variables that could undermine model validity. Inspection of the CUSUM plot (Figure 3.2) showed that the cumulative sum trajectory (blue line) remained entirely within the 5% significance bounds (red lines) throughout the study period. This result provides statistical evidence of parameter stability, indicating that the autoregressive distributed lag (ARDL) model is structurally sound and free from detectable structural breaks at conventional significance levels.

Figure 3.2 CUSUM of Squares (CUSUMQ)

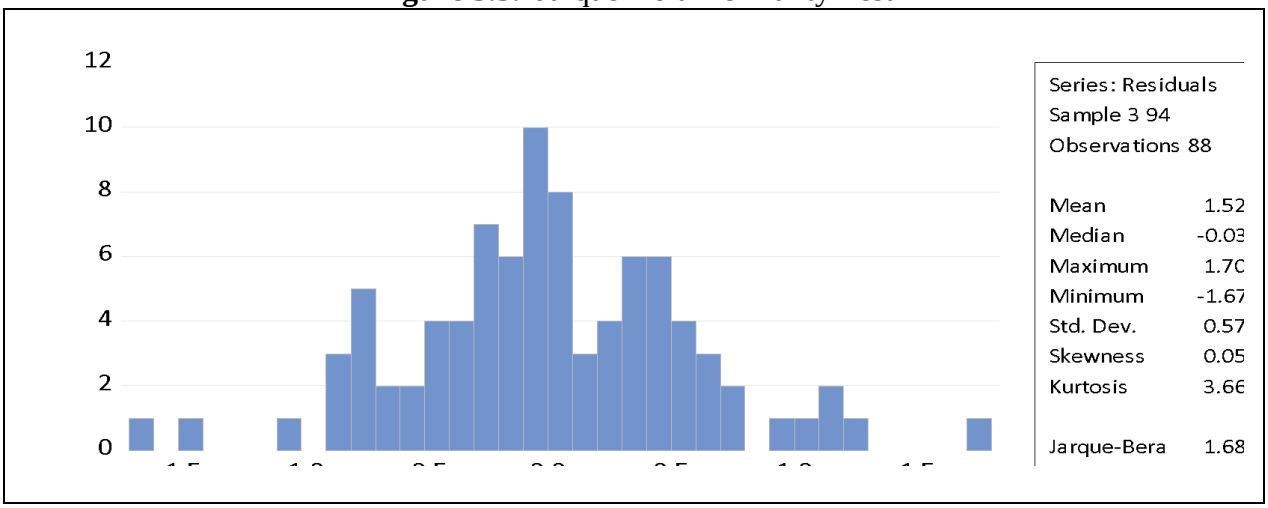


Source: prepared by researcher eviews12 computation, 2025.

4.3.7.6. Analysis of Residual Normality (Jarque-Bera Test):

Following established econometric diagnostic procedures Jarque & Bera (1980), the Jarque–Bera test was applied to examine whether the residuals of the ARDL model were compatible with the assumption of normal distribution. This parametric test evaluates deviations from normality by jointly considering skewness and kurtosis in the data illustrated in Figure 3.2, both of which are critical for ensuring the validity of empirical statistics. The descriptive statistics indicated skewness values near zero and kurtosis close to the Gaussian benchmark of 3.3. The computed Jarque–Bera statistic was 1.683, with an associated p-value of 0.432, exceeding the standard 5% level of statistical significance. These findings suggest that the null hypothesis of residual normality cannot be rejected, implying that the ADRL model's residuals are consistent with the normality assumption and that statistical constructs derived from the ADRL model are reliable.

Figure 3.3. Jarque-Bera Normality Test



Source: prepared by researcher eviews12 computation, 2025.

Conclusion and Recommendations

Conclusion

The aggregate FDI empirical results ADRL co-integration confirm the analysis hypothesis testing H1, demonstrating that real exchange rate volatility has a statistically significant negative impact on aggregate FDI in both the short and long run in Egypt, offering critical policy implications for promoting macroeconomic stability and enhancing Egypt's investment climate. This adverse impact is consistent with classical economic theory, which argues that elevated exchange rate uncertainty increases investment risk and reduces the predictability of returns, thereby discouraging foreign capital inflows.

The short-run ARDL model demonstrates a strong fit, explaining approximately 79.28% of the variation in aggregate FDI. This indicates that most of the movements in FDI are explained by the real exchange rate volatility and other related control variables, market size (GDP), inflation (CPI), market capitalization (MCAP), and external debt (EXDBTG). while the remaining 20.72% of unexplained variation likely reflects the influence of omitted structural factors, or random shocks beyond the model's specification. In addition, the short-run ARDL analysis shows that real exchange rate volatility significantly influences FDI, with the ECT (−1) coefficient of −0.5062 indicating that 50.6% of disequilibrium is corrected within the current period. This reflects a relatively rapid adjustment process, confirming the model's ability to capture short-run dynamics while ensuring adjustment toward long-run equilibrium.

These negative findings are aligned with prior empirical evidence on Egypt, reinforcing the view that exchange rate instability remains a critical barrier to sustaining foreign investment, including Elbadry and Mandour (2020), Asamoah et al. (2022), Elagouza (2023), Marwasamy et al. (2024), Abdelaziz et al. (2025), and Elmoghiar (2025), all of which emphasize the importance of exchange rate stability in attracting FDI, particularly relevant during Egypt's transition toward a more flexible exchange rate regime. Comparable findings have been reported in international contexts, such as Jannat (2020), Akinlo and Onatunji (2020, 2021), Rashid et al. (2020), Jacob et al. (2021), Md. Qamruzzaman et al. (2021), Hniya et al. (2021), El Rhadbane and El Moudden (2022), Jamal and Bhat (2022), Ozigbo and Anuya (2023), Erum et al. (2023),

Abdel Aziz and Al-Ajrawi (2023), Nathan and Nsikan (2024), Imamboccus et al. (2024), Khan et al. (2024), Hamida (2024), and Zongo et al. (2024).

In contrast, other literature reports a positive relationship between real exchange rate volatility and FDI, often attributing it to increased investment opportunities during periods of currency fluctuation. Within Egypt, such evidence is provided by Nada and Hebatallah (2020), Abdelgany (2020), Al-Sayed (2020), Hend et al. (2021), El-Aal et al. (2021), Salah et al. (2021), and Al-Ghiash (2022). Internationally, similar positive results are reported by Khushaiba and Rawda (2020), Houng et al. (2020), Thujiyanthan (2021), Okonkwo et al. (2021), Lin and Chen (2022), Shafique et al. (2022), Kaya and Erden (2022), Ezekiel and Temidayo (2023), Zaharum et al. (2024), Ejaz and Azam (2024), Sultana et al. (2024), and Lajevardi and Chowdhury (2024).

The macroeconomic control variables, market size (GDP), significantly drive FDI in both the short and long term, supporting the market-seeking FDI hypothesis; sustained economic growth expands investor opportunities and aligns with global and Egyptian empirical evidence. The positive results established the nature of this relation in economic theory and empirical validation, such as Salah et al. (2021), Hamida (2024), Lajevardi & Chowdhury (2024), Zaharum et al. (2024), and Elmoghiar (2025).

Inflation, as measured by the Consumer Price Index (CPI), shows a positive, statistically significant relationship with foreign direct investment (FDI) at both short- and long-term horizons, contrary to conventional economic expectations. Meanwhile, the result is aligned with Jaiblai & Shenai (2019) found inflation was significant and positive with FDI. Most of the previous empirical studies found that the inflation rate has a negative sign and is statistically significant for foreign direct investment (FDI). Elsherif (2016), Grace (2019), and Jahan and Paul (2021). In the Egyptian context, Exchange rate volatility in Egypt (2001–2004) fostered FDI inflows through currency depreciation, structural reforms, and enhanced export competitiveness, signaling transition and reform to investors, in addition, the expanding GDP growth raised demand and prices, yet improved infrastructure and stability, where overall expansion encouraged FDI as investors pursued long-term returns in a dynamic market.

Market capitalization exerts a positive influence on foreign direct investment (FDI) in both the short and long term, supporting the importance of deep and liquid equity markets in attracting foreign capital. This result is consistent with previous studies like Razia et al. (2025) where a stronger market attracts FDI, meanwhile Farooq et al. (2023) indicated that negative findings FDI reduces corporate investment and lowers the level of market capitalization, this suggests that the relationship can be complex and clarified that FDI crowded out domestic investment in developing countries was reflected by high market capitalization absorbs available investment opportunities, it could potentially crowd out FDI in certain sectors.

External debt has a negative short-term impact on foreign direct investment (FDI), primarily due to heightened sovereign risk of the possibility that the government may default or face repayment difficulties, and the results are consistent withLau et al. (2010), Omorokunwa & Ikponmwosa (2014), Awan et al. (2014), and Puah et al. (2016). However, when leveraged strategically to finance infrastructure and development initiatives, it can

generate positive long-term effects. This dynamic is exemplified by the 2024 Ras El-Hekma equity conversion, which demonstrates how external liabilities can be transformed into investment opportunities that strengthen economic attractiveness.

The research evaluates the robustness of the ADRL results by applying methodological diagnostic test statistics for aggregate FDI frameworks, as outlined in the literature by Abdel Aziz and Al-Ajrawi (2023), Lajevardi and Chowdhury (2024), and Elmoghiar (2025). The coefficient of determination ($R^2 = 0.7928$) implies that real exchange rate volatility (VOLREXR), together with key control variables, explains approximately 79% of the variation in aggregate FDI. The econometric evaluation employed the Durbin–Watson d-statistic ($d = 2.0235$) was approximately close to the benchmark value of 2, suggesting the absence of significant positive or negative autocorrelation in the residuals.

The Breusch–Pagan–Godfrey diagnostic results confirm that the residuals are free from statistically significant autocorrelation up to two lags, thereby satisfying a fundamental assumption of regression analysis. The absence of autocorrelation strengthens the reliability of the parameter estimates and enhances the robustness of the ARDL model's conclusions regarding the impact of exchange rate volatility on FDI in Egypt during the period 2001–2024. Furthermore, the heteroscedasticity tests reveal no statistically significant evidence of heteroscedasticity in the residuals, providing additional support for the adequacy and stability of the estimated model.

While the application of the Jarque–Bera statistic, as illustrated in (Diagram 4.2), confirms that the ARDL model's residuals conform to the normality assumption, thereby ensuring the reliability of the statistical inferences derived from the model. The inclusion of VIF enhances the validity of the econometric results by confirming that the estimated effects are not artifacts of multicollinearity but rather reflect genuine and reliable economic relationships. In addition, the structural stability of the ARDL parameters was assessed using the cumulative sum (CUSUM) and CUSUM of squares tests, the results of which (Figure 4.2) provide strong evidence of parameter stability.

These goodness-of-fit findings indicate that the model is robust and structurally sound and free from detectable structural breaks at conventional significance levels. Taking the econometric evaluation together, these diagnostic checks reinforce the robustness, validity, and reliability of the ADRL tests' aggregate FDI and the provided empirical results.

The ADRL co-integration analysis confirms that real exchange rate volatility exerts a significant negative influence on foreign direct investment (FDI) in Egypt in both the short and long run. This outcome supports classical economic theory, which suggests that heightened exchange rate uncertainty raises investment risk, reduces return predictability, and discourages foreign capital inflows.

The short-run ARDL model demonstrates strong explanatory power, accounting for nearly 79% of the variation in FDI. The error correction term (−0.5062) indicates that about half of any disequilibrium is corrected within the same period, reflecting a relatively fast adjustment process and validating the model's ability to capture short-run dynamics while converging toward long-run equilibrium.

These findings are consistent with prior empirical studies on Egypt and international evidence, which highlight exchange rate instability as a major obstacle to attracting FDI. Nonetheless, some literature reports a positive relationship, attributing it to investment opportunities created during currency fluctuations.

Macroeconomic variables also play a crucial role: GDP growth positively drives FDI, supporting the market-seeking hypothesis; inflation shows a positive and significant effect, contrary to conventional expectations but aligned with certain studies; market capitalization generally attracts foreign capital, though in some cases it may crowd out domestic investment; and external debt negatively affects FDI in the short term due to sovereign risk, but can yield long-term benefits when strategically managed.

Robustness checks—including Durbin–Watson, Breusch–Pagan–Godfrey, Jarque–Bera, VIF, and CUSUM tests—confirm that the model is statistically reliable, stable, and free from autocorrelation, heteroscedasticity, and structural breaks.

Overall, the study demonstrates that real exchange rate volatility is a critical determinant of FDI in Egypt. Stabilizing exchange rates, ensuring macroeconomic stability, and strengthening financial markets are essential policy measures to attract and sustain foreign investment.

5.4 Limitations

Evidence indicates that FDI inflows respond in ways distinct from sector-specific investment to another, highlighting the importance of disaggregation in empirical analysis. Recognizing these variations not only clarifies inconsistencies observed in earlier scholarship but also reduces the risk of aggregation bias. While the research addresses methodological gaps, the analysis remains constrained by its focus on short- and long-run volatility dynamics, leaving scope for future research to integrate additional macroeconomic determinants.

5.5 recommendations

Based on the aggregate and sectoral findings of this research and within the scope of its objectives, several recommendations can be proposed to improve the sectoral foreign direct investment climate in Egypt. Several policy implications are as follows:

5.5.1 Strengthening Exchange Rate Stability:

Action: The Central Bank of Egypt (CBE) should intervene as necessary to smooth out excessive fluctuations or provide investment guarantees to strategic sectors during periods of exchange rate volatility, to stabilize expectations, particularly for risk-averse investors, necessitating reinforced policy credibility, in addition to publishing regular updates on exchange rate policy and macroeconomic outlook to avoid excessive real exchange rate fluctuations that discourage FDI, especially in non-oil sectors.

Policy strategy: policymakers should prioritize exchange rate stabilization and adopt a flexible but well-managed exchange rate regime and intervene in currency markets during speculative shocks, also improve FX reserves to support market confidence, through credible coordinating fiscal, monetary, and macroeconomic frameworks to secure financial, macroeconomic and exchange rate stability, the existence of a consistent and sustainable comprehensive economic polic framework that is a fundamental requirement for attracting (FDI) reduces uncertainty, enhances investor confidence, and provides a predictable environment in which long-run investment decisions can be made.

5.5.2 Stimulating Economic Growth through Macroeconomic Policy:

Action: Strengthen macroeconomic fundamentals to expand market size and improve investor confidence; on the other hand, FDI flows towards underdeveloped sectors beyond petroleum and attract investment in sectors aligned with national development goals, in addition to helping investors hedge against exchange rate risks.

Strategy: Policymakers should adopt appropriate comprehensive macroeconomic strategies that strengthen the economy and accelerate GDP growth resilience by expanding public investment in infrastructure and productivity-enhancing sectors such as transport and energy, while simultaneously promoting private sector participation through deregulation and fiscal incentives and maintaining macro-fiscal discipline to reduce debt and inflationary pressures; together, these measures will generate stronger growth prospects and market expansion, thereby attracting long-term foreign direct investment, particularly service-oriented and knowledge-based industries, reflecting a shift away from resource-dependent investment sectors.

5.5.3 Inflation Targeting as a National Priority:

Action: Quantify the relationship between inflation volatility, exchange rate movements, and sectoral FDI inflows using econometric models to test whether inflation targeting as a central objective of macroeconomic policy reduces uncertainty and improves investor confidence in Egypt's context.

Policy strategy: Policymakers should maintain a clear and transparent inflation target in addition to using interest rate policy to anchor inflation expectations; furthermore, coordinate with fiscal policy to reduce budget deficits, which affect inflation and currency volatility. This requires addressing structural and real distortions that intensify inflationary pressures, and establishing a clear and stable target for a reduced inflation rate will enhance competitiveness and contain expected inflation, thereby reinforcing macroeconomic credibility and supporting sustainable investment flows.

5.5.3 The Egyptian Capital Market Authority (CMA):

Action: Strengthen the CMA's regulatory role in stabilizing capital markets and channeling foreign capital into long-term productive investment. Incentivize Sectoral Diversification of FDI. Coordinate with CMA and the General Authority for Investment (GAFI) to design investment products and frameworks that channel FDI into manufacturing, services, and tech sectors, away from traditional petroleum-dominated flows.

Strategy: Policymakers should adopt a comprehensive set of measures commonly recommended for Egyptian economy, including the implementation of structural reforms before capital market liberalization, the gradual sequencing of capital account opening, and the exercise of prudent oversight over financial flows; such oversight entails analyzing the behavior of foreign investors to design policies that discourage speculative activity and encourage the transformation of short-term capital movements into long-term investment commitments, thereby stabilizing the investment environment and enhancing the capacity to attract sustainable foreign direct investment in line with broader institutional reform and regulatory oversight frameworks emphasized in the literature.

5.5.4 Strategic External Debt Management:

Action: Adopt a medium-term debt strategy that balances external debt accumulation with repayment capacity, focusing on cost-risk tradeoffs, maturity lengthening, and currency composition, and enhance risk metrics and thresholds, monitor debt service-to-exports, average time to refix rates, and FX-denominated share; set prudential limits and publish annual debt sustainability analyses.

Strategy: policymakers must align debt with FDI and FX earnings and also prioritize borrowing for sector projects that generate foreign exchange (ports, export manufacturing, renewables) and avoid FX-denominated debt for purely domestic-revenue projects. Moreover, liability management operations conduct buybacks, exchanges, and reprofiling to smooth maturities; build precautionary buffers (reserves, contingent credit lines) to manage rollover risk during shocks. This impact strengthens debt sustainability, preserves macro credibility, lowers country risk, and reduces the volatility premium demanded by FDI, especially in non-extractive sectors.

5.5.7 Establishing a Dedicated Office for FDI Promotion:

Action: Establish a specialized FDI facilitation unit under GAFI and create a new office within GAFI's existing structure dedicated exclusively to foreign investor services. Assign this unit the responsibility for managing investor inquiries, providing pre-establishment guidance, and facilitating post-entry operations. enhance coordination with Egyptian commercial diplomacy, integrate the efforts of Egyptian commercial trade representatives in key partner countries with GAFI's investment promotion activities, and then provide embassies with up-to-date sectoral investment briefs aligned with national priorities. centralize regulatory guidance, establish one-stop advisory services within the new FDI Facilitation Unit to assist investors in navigating legal, tax, and licensing requirements.

Strategy: streamline the investment process by institutionalizing specialized support, thereby reducing administrative delays and enhancing investor confidence in Egypt's regulatory environment. ensure consistent promotion messages and targeted investor engagement abroad, leveraging diplomatic channels to attract strategic FDI inflows and strengthen Egypt's global investment profile. reduce bureaucratic complexity and

transaction costs by offering centralized regulatory guidance, thereby creating a more transparent and efficient environment for foreign investors.

5.5.8 Organizing an International Conference Promoting Investment in Egypt:

1. International Investment Conference and Promotion Strategy:

Action: Organize a high-profile international conference to showcase Egypt's economic transformations and launch a comprehensive investment promotion strategy. Establish a specialized institution under GAFI responsible for planning, organizing, and directing foreign investments, marketing projects domestically and internationally, and setting clear procedures for maximizing FDI returns.

Strategy: Strengthen Egypt's global visibility, institutionalize investment promotion capacity, and ensure that FDI inflows are systematically aligned with national priorities, thereby enhancing investor confidence and competitiveness in the global investment landscape.

2. Aligning FDI with National Development Objectives

Action: Design investment promotion mechanisms that explicitly link FDI projects to Egypt's developmental goals, including employment generation, foreign currency provision, technology transfer, and export expansion. Provide targeted sectoral briefs and transparent guidance to investors through centralized services.

Strategy: Guarantee that foreign capital contributes to sustainable and inclusive economic growth by channeling investment into priority sectors, reducing bureaucratic complexity, and fostering long-term economic resilience.

References:

Azzouzi Asmae & Bousselhami Ahmed (2019). Impact of the Exchange Rate and Price Volatility on FDI Inflows: Case of Morocco and Turkey. Applied Economics and Finance Vol. 6, No. 3; May 2019 ISSN 2332-7294 E-ISSN 2332-7308. doi:10.11114/aef.v6i3.4218.

Adokwe E. Ignatius, Agu A.Ogbonna & Maduka A.C. (2019). Exchange Rate Volatility and Foreign Direct Investment: The Nigerian Experience. Journal of Business & Economic Policy Vol. 6, No. 4, December 2019 doi:10.30845/jbep.v6n4p10.

Al-Sayed, Y.I.K. (2020). A standard model for the impact of the exchange rate on foreign direct investment in Egypt for the period (1977-2017), Journal of Strategic Studies for Disasters and Opportunity Management, 2(4):105-128.

Asmaa Mandour & Essam Elbadry., (2020). The impact of exchange rate on foreign direct investment (ADRL) in Egypt (1990-2018), Journal of Monofya University, Faculty of Commerce, Vol.12, No 4, 2020.

Anthony E. Akinlo & Olufemi G. Onatunji (2020). Exchange Rate Volatility and Domestic Investment: Evidence from Twelve ECOWAS Countries. African Journal of Economic Review, Volume VIII, Issue II, July 2020. Pp 176-189. EISSN: 2453-5966 print ISSN: 1821-8148.

Alnaa S. E. & F.Ahiakpor (2020). Exchange Rate Volatility and Foreign Direct Investment. Research in Applied Economics ISSN 1948-5433 2020, Vol. 12, No. 3. Doi: 10.5296/Rae. v12i3.17737.

Ashraf Salah, Nadine Abd-El Atti & Nagia Rashid (2021). The Impact of Relative Exchange Rate Volatility and Other Multidimensional Determinants on FDI in Egypt. American Journal of Industrial and Business Management, 2021, 11, 1163-1197 https://www.scirp.org/journal/ajibm ISSN Online: 2164-5175 ISSN Print: 2164-5167.

Anthony E. Akinlo & Olufemi G.Onatunji, (2021). Exchange Rate volatility and foreign direct investment In selected west African countries, The International Journal of Business and Finance.Research Vol. 15, No. 1, 2021, pp. 77-88 ISSN: 1931-0269 (print) ISSN: 2157-0698 (online).

Arvin, B., Pradhan, R. P., & Nair, M. (2021). The relationship between GDP and FDI: Evidence from emerging economies. Journal of Economic Studies, *48*(3), 456-472.

Ambala, R. N., & Amewu, G. (2022). Linear and non-linear ARDL estimation of financial innovation and economic growth in Ghana. Journal of Business and Socio-economic Development, 3(1), 36–49. https://doi.org/10.1108/JBSED-09-2021-0128

Al-Ghiash, M.M.I. (2022), The limit of the optimal exchange rate attractive direct foreign investment to Egypt, Journal of Politics and Economics, 15(14). https://jocu.journals.ekb.eg/article_229988.html.

Asmoah, M.E., Alagidede, I.P., &Adu,F.(2022). Exchange Rate Uncertainty and Foreign Direct Investment in Africa: Does Financial Development Matter? Review of development Economic, 26 878-898. https://doi.org/10.1111/rode.12858.

Ayyoub Ben El Rhadbane & Abdeslam El Moudden (2022), COVID-19 Pandemic, Real Effective Exchange Rate and Foreign Direct Investment Inflows: Evidence from Morocco, Turkey and Egypt. International Journal of Applied Economics, Finance and Accounting, ISSN2577-767XVol. 12, No. 2, pp. 38-51.2022 DOI: 10.33094/ijaefa.v12i2.543.

Adel El Mahdy, Neveen T., Rania O. Mohamed (2022). External Debt and Economic Growth in Egypt, a scientific journal for research and commercial studies. Faculty of Commerce & Business Administration – Helwan University, publisher 36 – 4, 153-177 pages.

Abdallah.R.T(2023). The impact of the exchange rate on foreign direct investment in Egypt. Scientific Journal Of Business and Environmental Studies. Article 93, Volume 14, Issue 3, July 2023, page 232 262.DOI:10.21608/jces.2023.323250.

A. Abdel Aziz & Y.Al-Ajrawi (2023) .The Impact of the Exchange Rate on Foreign Direct Investment in the Iraqi Agricultural Sector.Tikrit Journal for Agricultural Sciences (2023) 23 (1): 189-201 https://doi.org/10.25130/tjas.23.1.24.

Ayoub, A., Dahmani, M., & El Firdous, S. (2024). The dynamic interplay between external debt and FDI: Evidence from MENA countries. Journal of Economic Studies, 51(3), 450–475.

Aqsa Shabbir, Shahid Abbas, Imran Javed & Numair Nisar (2025). The Role of Tax Policies, Inflation, Trade Openness, and Exchange Rate Volatility on the Foreign Investment Decisions in Pakistan. Indus Journal of Social Sciences, Volume 3, Number 2, 2025 Online ISSN: 2960-219X.Print ISSN: 2960-2203. https://induspublishers.com/IJSS/about.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. Journal of Econometrics, 31(3), 307-327.

Basit Oladeji & Mistura Musa (2022). Effect Of Exchange Rate Volatility on Foreign Direct Investment In Nigeria DOI: 10.14293/S2199-1006.1.SOR-. PPBL3HY.v1.

Ben-Obi, O. A., Olaniyi, O., Okoroafor, D. O. K., & Obi, B. (2025). Asymmetric Effect of Exchange Rate Volatility on Foreign Direct Investment, Inflation and Balance of Trade in Nigeria. American Journal of Industrial and Business Management, 15, 681-698. doi.org/10.4236/ajibm.2025.155033.

Coletta F. Baudisch (2018). Sectoral FDI and the Real Exchange Rate: The Role of Financial Development. Joint Discussion Paper Series in Economics by the University of Giessen (Germany), Department of Economics. ISSN 1867-3678, No. 28-2018, http://www.unimarburg.de/fb02/makro/forschung/magkspapers.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. Econometrica, 50(4), 987–1007. https://doi.org/10.2307/1912773

El Rhadbane, A., & El Moudden, A. (2022). COVID-19 pandemic, real effective exchange rate and foreign direct investment inflows: Evidence from Morocco, Turkey and Egypt. International Journal of Economics and Financial Issues, 12(6), 1–15.

Erum Fatima, M.Asif, R.B. Sharma & A.Chaudhary (2023). Exchange Rate Volatility and Its Impact on FDI Inflows in India Using Maki Cointegration ApproachConference paper DOI:10.1007/978-3-031-26953-0_37 In book: Digitalisation: Opportunities and Challenges for Business (pp.392-406).

Ezekiel O. Abanikanda & Temidayo O.Akinbobola, (2023). Does Financial Deepening Matter in the Nexus between Exchange Rate Volatility and Foreign Investment? Insight from Nigeria, African Journal of Economic Review, Volume 11 (1).

Eman Elagouza (2023). The distribution effect of the exchange rate on the Egyptian economy during the period (1990-2018). Journal Arab for Management, Arab Organization for Administrative Development, volume 43, issue 4, pages 248-278, December 2023. DOI: 10.21608/AJA.2021.65107.1054.

Elmoghiar, M. S. (2025). The Effect of Exchange Rate Movements on Net Inflows of Foreign Direct Investment during the Period 1974-2023: An Empirical Study on Egypt. Journal of Alexandria University for Administrative Sciences, 62(2), 97-141.

Farooq, R., Ahmed, S., & Khan, M. (2023). Foreign direct investment and domestic capital in developing economies: Evidence from market capitalization effects. Journal of International Business Studies, 54(3), 412–430.

Ghoneim Hebatallah & Fadl Nada (2020). Impact of Foreign Exchange Rate on Foreign Direct Investment: Egypt Case. Revue du Lareiid , N°06-07 pages 138-159.https://www.researchgate.net/publication/348621223.

Gloria Chidubem Kalu (2024), the impact of exchange rate volatility on FDI in Nigeria (1981-2018), British International Journal of Applied Economics, Finance and Accounting, Advance Scholars Publication, Published by International Institute of Advanced Scholars Development, Volume: 8, Issue: 2, March-April,2024 ISSN2234-2418. https://aspjournals.org/Journals/index.php/bijaefa.

Hend M.A.El., Ahmed A.Z. & Hosni H.M. (2021), The Effects of currency devaluation on foreign investments in Egypt, Academic Journal of Research and Scientific Publishing, volume 19, pages 383-406, ISSN: 2706-6495. www.ajrsp.com.

Hamida, A. (2024). The impact of exchange rate volatility on foreign direct investment: ADRL testing Bound. International Journal of Islamic Business & Management, 8(1), 12-17.

Imamboccus, R., Seetanah, B., Nunkoo, R., & Jaffur, Z. K. (2024). The impact of exchange rate and exchange rate volatility on tourism demand using disaggregated data. International Journal of Tourism Research, 26(2), e2640. https://doi.org/10.1002/jtr.2640.

Jokosenumi S.O. & Adesete A. A. (2018). Modelling the effect of stock market volatility and exchange rate volatility on foreign direct investment. A new framework approach for the Asian Economic and Financial Review. Vol. 8, No. 12, 1482-1505, ISSN(e): 2222-6737, ISSN(p): 2305-2147. URL: www.aessweb.com.

Jacob, A., Kumar, S., & Thomas, P. (2021). Foreign direct investment and economic growth in emerging markets. International Journal of Economics and Finance, 13(4), 22–35.

Jamal & Bhat (2022). Disentangling the Nexus Between Exchange Rate Volatility, Exports, and FDI: Empirical Evidence from the Indian Economy, Global Journal of Emerging Market Economies 1–24 in.sagepub.com/journals-permissions-India DOI: 10.1177/09749101221108788.

Joel O. & Jeffrey O. E. (2023). Exchange Rate Volatility and Foreign Investment Growth in Nigeria. African Development Finance Journal, November. Volume 6 No.1, 2023 PP 105-123 ISSN 2522-3186. http://journals.uonbi.ac.ke/index.php/adfj.

Khushiba, Z. & Rawda J.(2020)., Measuring and analyzing the impact of the official exchange rate (the dinar-dollar) on foreign direct investment flows: a case study of Algeria for the period (1990-2018). Algeria magazine for Developing Economics,5(1) , pp. 141-154.EISSN: 2588-2457.PISSN 2392-5302.

Kaya, A. I., & Erden, L. (2022). Capital-flow volatility in emerging markets: A panel GARCH approach. International Finance, pages 1–17. https://doi.org/10.1111/infi.12427.

Latief, R., & Lefen, L. (2018). The effect of exchange rate volatility on international trade and foreign direct investment (FDI) in developing countries along "One Belt and One Road." International Journal of Financial Studies, 6(4), 86.; https://doi.org/10.3390/ijfs6040086

Lin, C.- C., & Chen, K.- M. (2022). Market competition, exchange rate uncertainty, and foreign direct investment. Review of Development Economics, 26, 405–422.https://doi.org/10.1111/rode.12813.

Lajevardi Hooman & Murshed Chowdhury (2024). How Does the Exchange Rate and Its Volatility Influence FDI to Canada? A Disaggregated Analysis. Journal of Risk and Financial Management 17: P 88. https://doi.org/10.3390/ jrfm17020088.

Mohamed Abdelgany (2020). The Impact of FDI on Exports in Egypt, Journal of Economic and Political, Faculty of Politics and Economics, Beni-Suef University, volume (5), issue (6), page 1-37 10.21608/JOCU.2020.46058.1066 https://jocu.journals.ekb.eg/article_125269.html.

Muhammad, M. A., & Abdullahi, K. (2020). Impact of external debt servicing on economic growth in Nigeria: An ARDL approach. International Journal of Business and Technopreneurship, 10(2), 257–268.

Mohamed F. Abd El-Aal, A.Algarni, A.Fayomi, R. Abdul Rahman &Khudir AL Rashidi,(2021).Forecasting Foreign Direct Investment Inflow to Egypt and Determinants: Using Machine Learning Algorithms and ARIMA Model. Journal of Advanced Transportation. Volume 2021, Article ID 9614101, 7 pages https://doi.org/10.1155/2021/9614101.

Moraghen, W., Seetanah, B., & Sookia, N. (2021). Impact of exchange rate and exchange rate volatility on foreign direct investment inflow for Mauritius: A dynamic time series approach. Afr Dev Rev, 33, 581–591. https://doi.org/10.1111/1467-8268.12596.

Md. Qamruzzaman, Ahmed M. M., Rimsha K., Ayesha S., Hina S. (2021), Symmetric and asymmetric effects of financial Innovation and FDI on Exchange Rate Volatility: Evidence from South Asian Countries. Journal of Asian Finance, Economics and Business Vol 8 No 1 (2021) 023–036. Print ISSN: 2288-4637 / Online ISSN 2288-4645. doi: 10.13106/jafeb.2021.vol8.no1.023.

Md Nesar Faizi, Md Imran Khan, Aas Mohammad & Quazi Shams Aghaz. (2024). An Empirical Analysis of Exchange Rate Volatility and Foreign Investment Inflows from the Post-Reform Period to 2020 in India. European Economic Letters (EEL), 14(1), 127–133. https://doi.org/10.52783/eel.v14i1.1006.

Marwa S. A, Hatem.A.El & Mervat.M.A (2024). The relationship between the exchange rate and the Foreign Direct Investment measuring model in Egypt (1990-2022). Scientific Journal of Business Research No (1), page 240-283.

Muhammad Ejaz, Ali Azam (2024), Impact of Capital Inflows on Exchange Rate in Developing Economies: A Panel Data Analysis, Pakistan Journal of Social Sciences, Vol. 44 (1) 2024, 41-52 March 2024 . ISSN (E) 2708-4175 ISSN (P) 2074-2061. https://pjss.bzu.edu.pk.

Munira Sultana, Md. Hasanur Rahman & Grzegorz Zimon (2024). The impact of external debt and exchange rate on foreign direct investment in emerging investment markets: new evidence using a PMG-ARDL panel data analysis, Cogent Economics & Finance, Vol,12:1, 2362780, DOI: 10.1080/23322039.2024.2362780.

Mohamed S. Elmoghiar(2025), The Effect of an Exchange Rate Movement on Net Inflows of Foreign Direct Investment during the Period 1974-2023.Journal of Alexandria University for Administrative Sciences. Vol. 62, No. 2, March 2025.

Nelson, D. B. (1991). Conditional heteroskedasticity in asset returns: A new approach. Econometrica, 59(2), 347–370. https://doi.org/10.2307/2938260

Ndanu M.& Kennedy N. O. (2018). The effect of real interest rates, exchange rate, inflation, and competitiveness on FDI in Kenya for the period 1970-2016.American Journal of Economics.Vol.3, Issue 1 No.1, pp 1-18, 2018. ISSN 2520-0453(Online). http://www.ajpojournals.org/.

Nguyen, T. T., Nasir, M. A., & Vo, X. V. (2022). Exchange rate dynamics of emerging and developing economies: Not all capital flows are alike. International Journal of Finance & Economics,1–10. https://doi.org/10. 1002/ijfe.2724.

Nduka, A. J., Nwankwor, V. A., and Egungwu, I. (2024). The Effect of Foreign Exchange Fluctuations on Foreign Direct Investment Inflows In Nigeria. Journal of Emerging Trends in Management Sciences and Entrepreneurship, Volume (6)1, pages 1-25, June 2024, ISSN:2384-762X, http://www.jetmase.com.

Okonkwo, J. J., Osakwe, C. I., & Nwadibe, E. C. (2021). Exchange Rate and Foreign Direct Investment in Nigeria 1981-2018. International Journal of Academic Research in Business and Social Sciences, 11(1), 213–232. E-ISSN: 2222-6990,2021 HRMARS.

Ozigbo, S. A., & Anuya, M. O. (2023). Exchange rate dynamics and foreign direct investment in Nigeria. Journal of Xidian University, 17(7), pages 1047 – 1061. https://doi.org/10.37896/jxu17.7/086.

Priyatharsiny Thujiyanthan (2021). The Impact of Exchange Rate and Exchange Rate Volatility on Foreign Direct Investment: An Econometric Investigation in Sri Lanka. Asian Journal of Managerial Science ISSN: 2249-6300 (P) Vol.10 No.2, 2021, pp.41-51. DOI: https://doi.org/10.51983/ajms-2021.10.2.2928.

Rahman, M. M., & Kashem, M. A. (2017). Exploring the linkage between financial development and economic growth: The ARDL bounds testing approach. International Journal of Financial Research, 8(4), 152–160. - https://doi.org/10.5430/ijfr.v8n4p152

Rashid Latief & Lin Lefen (2018). The Effect of Exchange Rate Volatility on International Trade and Foreign Direct Investment (FDI) in Developing Countries along "One Belt and One Road". International journal of financial studies. Int. J. Financial Stud. 2018, 6, 86; doi:10.3390/ijfs604008.

Rashid, R. A., Kamsin, A., & Abdullah, N. A. (2020). Challenges in the online component of blended learning: A systematic review. Computers & Education, 144,103701. https://doi.org/10.1016/j.compedu.2019.103701

Suliman Zakaria (2012), Modelling Exchange Rate Volatility using GARCH Models: Empirical Evidence from Arab Countries, International Journal of Economics and Finance Vol. 4, No. 3; doi:10.5539/ijef. v4n3p216.

S. Mackton,Alphonce O. & Destaings N.(2018). Real Effective Exchange Rate Volatility and Its Impact on Foreign Direct Investment in Kenya.Asian Journal of Economics, Business and Accounting 6(4): 1-20, 2018; Article no. AJEBA.38008 ISSN: 2456-639X.DOI: 10.9734/AJEBA/2018/38008.

Suzana Balaban, Dejan Živkov, Ivan Milenković.,(2019). Impact of an unexplained component of real exchange rate volatility on FDI: Evidence from transition countries,Economic Systems,Volume 43, Issues 3–4,2019,100719, ISSN 0939-3625, https://doi.org/10.1016/j.ecosys.2019.100719.

Samuel E.Alnaa & F.Ahiakpor (2020). Exchange Rate Volatility and Foreign Direct Investment, Research in Applied Economics ISSN 1948-5433 2020, Vol. 12, No. 3.

Sakli Hniya, Ahlem Boubker, Fatma Mrad, Sawssen Nafti (2021). The Impact of Real Exchange Rate Volatility on Foreign Direct Investment Inflows in Tunisia. International Journal of Economics and Financial Issues, 2021, 11(5), 52-67. DOI: https://doi.org/10.32479/ijefi.11882.

Shafique, A. Hassan, M. U. Shahzad, A. Ali, Q. M., & Saqlain, M. (2022). Exchange Rate Volatility and Its Relationship with Macroeconomic Variables in Pakistan. Bulletin of Business and Economics, 11(1), 121-131. https://doi.org/10.5281/zenodo.6412579.

Salmerón, R., & García, C. (2022). A redefined variance inflation factor: Overcoming the limitations of traditional VIF. Computational Economics, 59(2), 345–367.https://doi.org/10.1007/s10614-024-10575-8.

Tram Huong, My-Linh T.Nguyen & Nguyen T. Lien (2020). An empirical study of the real effective exchange rate and foreign direct investment in Vietnam. Investment Management and Financial Innovations, 17(4), 1-13. doi:10.21511/imfi.17(4).2020.01.

Tom Jacob, Rincy.R.& Stebya (2021). Impact of exchange rate volatility on foreign direct investment (FDI) in China: an empirical analysis. SJCC Management Research Review. Print ISSN-2249-4359. Volume 11 (3) December 2021. Page No.41-54.DOI:10.35737/sjccmrr/vl/i3/2021/144.

Udoinyang, N., & Udoinyang, N. (2024). The Influence of Exchange Rate Fluctuation on Foreign Direct Investment in Nigeria (1986-2022). Journal of Economics, Innovative Management and Entrepreneurship, 2(1). https://doi.org/10.59652/jeime.v2i1.139.

Yugang He (2018). A Study on the Impact of Real Exchange Rate Volatility of RMB on China's Foreign Direct Investment to Japan. East Asian Journal of Business Economics 6(3), pp.24-36. doi: http://dx.doi.org/10.20498/eajbe.2018.6.3.24.

Youssef I.K. Elsauid (2020). An Econometric model for the effect of exchange rate on foreign direct investment in Egypt, Journal of Strategic Studies for Disasters and Opportunity Management, vol 2, No 5, Page 105-128.

Zerrin Kiliçarslan (2018).The Relationship between Exchange Rate Volatility and Foreign Direct Investment in Turkey: Toda and Yamamoto Causality Analysis. International Journal of Economics and Financial Issues. Vol 8. Issue 4. ISSN: 2146-4138 available at http: www.econjournals.com.

Zerin Jannat (2020), The Impact of Exchange Rate Volatility on Foreign Direct Investment Inflow: Evidence from South Asia. International Journal of Finance, Insurance and Risk Management Volume X, Issue 3 (2020), pp. 101-116.

Zaibedah Z., Mohamad A. Md. Isa, Ruziah A Latif, and Muhammad F. Md Isa (2024), determinants of foreign direct investment in Malaysia. Insight Journal, Faculty of Business and Management, University Technology MARA, Volume 11 Issue 1, ISSN 2600-8564 pp. 86-96, https://ir.uitm.edu.my/id/eprint/95213.

Zongo, E., Dama, E., Yenyetou, D. et al. On-site evaluation as external quality assessment of microbiology laboratories involved in sentinel laboratory-based antimicrobial resistance surveillance network in Burkina Faso. Antimicrob Resist Infect Control 13, 3 (2024). https://doi.org/10.1186/s13756-023-01362-5