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Examining the Asymmetric Impacts of Interest and Exchange Rate on Investment in Egypt for the Period 1976-2020: Applying NARDL Model

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Abstract:

Most of the studies conducted in the past decades focused on the effect of interest rates and exchange rates on domestic investment under the assumption that the independent variables have the same effect on the dependent variable, but there were limited studies that investigated the unequal effects of changes in interest rates and exchange rates, both positive and negative, on domestic investment. This study used a nonlinear autoregressive distributed lag (NARDL) model to assess the unequal effects of the real interest rate and real exchange rate variables on domestic investment in Egypt for the period 1976 - 2020. The results revealed that positive and negative shocks for both exchange rates have unequal effects on investment in the long and short term. In addition, the stability of the nonlinear model was tested using recursive estimate tests and found to be stable.

Keywords: Asymmetry impacts, investment, Egypt, NARDL, real interest rate, real exchange rate.

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1. Introduction:

Creating investments in any country depends on many factors, and among these factors is the interest rate set by the country's central bank. Therefore, when studying the impact of rising the interest rate on investment, two essential things must be considered: the actual investment and the desired investment, which revolves around capital accumulation, improving the quality of resources, and the effectiveness of their use.

In addition, many other variables at the forefront are wage levels, inflation rate, and other variables that significantly impact investment. Therefore, rising or lowering the interest rate is accompanied by a difference in investment levels. As a result, the lower the interest rate, the lower the credit movement, and thus, this affects investment decisions.

Therefore, many countries trying to stimulate investment in specific sectors significantly increase the interest rate and encourage investors to invest in those sectors.

We know that the rise and fall in real interest rates impact investment in many ways, such as the valuation debts and the income on each asset class. Podkaminer et al. (2020).

The current study analyzes the asymmetric impact of the interest rate and exchange rate on domestic investment in Egypt from 1976 to 2020. Figure 1 shows the magnitude of the variables under consideration (domestic investment, interest rate, and exchange rate).

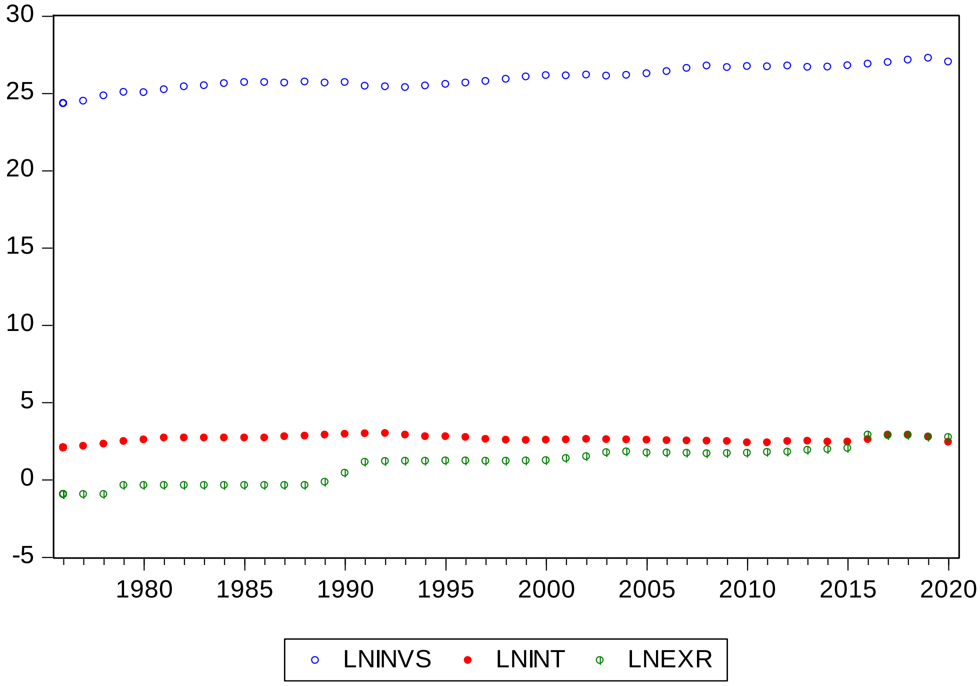

Figure 1

Over the past decades, many studies have strived to find out the similar effect of interest rateindividually or in combination with other macroeconomic variables such as exchange rate and inflation, on investment. However, a new line of research studies the unequal impact of interest rates and other macroeconomic variables on investment.

Podkaminer et al. (2020) reviewed the past and triggers of real interest rate variations through a straightforward, non-mathematical model and assessed the risks for each of the underlying asset classes. The study concluded that real interest rates have dropped in the long run with the improvements of political institutions and market development.

Gerstenberger, J. (2020) used data from German Small and Medium Enterprises (SMEs) and tested whether pessimistic business expectations have dampened the impact of interest rates during the post-crisis period (2008-2015). The results indicated that both SMEs responded significantly to changes in the user cost of capital (interest rate) during the post-crisis period.

Wu, F, and Mou, SS, (2017) discovered in their study on investment income of the Corporation's Annuity Fund that for the stock portfolio, the low-interest rate has a significant impact in enhancing the percentage of gain in the short term. However, this promotional effect will slow down in the long run and show a negative effect due to the overreaction of the stock market itself. They also showed that the effect of an interest rate increase on the rate of return of the equity portfolio is not significant.

Escobar et al. (2018)'s study provided a secure solution to the investor's investment dilemma who does not like to deal in perfectly competitive and imperfectly ambiguous markets with unexpected changes such as instability and fluctuations in interest rates. In addition, the study showed that investment in bonds responds to the uncertainty of interest rates in unfavorable markets, while the optimal portfolio is not affected significantly by the uncertainty of fluctuations in interest rates.

Stiglitz, JE, (1999) argued that many dilemmas could not fit into standard models, for example, the apparent stability of interest rates over long periods, changes unrelated to changes in technology and demography, cyclical changes in real interest rates, as well as the effect of unreal nominal changes. In interest rates on real variables and the cyclical pattern of movements in interest rate margins.

Bahmani-Oskooee et al. (2018) investigated the magnitude of investment responses to both depreciations as opposed to valuations by testing the impact of real exchange rate changes on investment domestically.

Bahmani-Oskooee, M., & Gelan, A. (2019) reviewed the experience of 18 countries in Africa, using a linear model and found that in the short run, the actual effective exchange rate had substantial impacts on national investment in three countries, but the effects in five countries in the long term. They also noticed that the number of countries increased to 13 when using a nonlinear model. In addition, they found that in nearly all countries, the short- and long-term effects were inconsistent.

Suhadak and Suciany, AD, (2020)'s study revealed that the interest rate plays a pivotal role among other variables that can assess the economical situation in Indonesia as one of the developing countries. They also discovered the interest rate's positive and influential role on inflation.

Belke et al. (2020) investigated whether uncertainty about future interest rates in the Eurozone hinders monetary policy transmission. They discovered that there are few effects on investment due to interest rate changes in most countries, and they also found that these effects vary in shape and size in most countries, making it difficult to standardize monetary policy.

Marinescu et al. (2019) studied the main factors that significantly impact the progress of investment in the European Union from 1995 to 2017. The results showed that the production and revenue gap and the demographic change positively affect public investment. On the other hand, investment was negatively affected due to changes in GDP growth, net lending, expenditures, total debt, interest rate, and population.

Gu et al. (2021) tried to determine if using monetary policy will help the stock market. They collected data on the interest rate and the stock market. The results showed a negative impact of the interest rate on the yields of stock prices, and it tends to have an irregular positive impact in the high market spots, taking a dynamic form that changes over time.

Gil, JMU, and Castillo, IE, (2018), analyzed the asymmetric effects of interest rate changes on companies in the Colombian manufacturing sector. The study reached results that prove the existence of an impact of the balance sheet on the Colombian manufacturing sector. In addition, small business investments show greater sensitivity to monetary policy shocks due to the higher cost of obtaining information than large companies.

Khundrakpam, JK (2017) The study used quarterly data on India from 1996 to 2013 to analyze the asymmetric effects of monetary policy on aggregate demand, its components, and inflation. The study found that unexpected fluctuations in the monetary policy rate have a disproportionate effect on aggregate demand but differently on the components. In addition, the study revealed that unexpected changes in interest rates have a negative and symmetric effect on inflation.

Qamruzzaman et al. (2019) aimed to determine what type of interactions, such as equal or unequal, between foreign direct investment, monetary policy, exchange rate, and fiscal policy by applying delayed distributed autoregressive (ARDL) nonlinear ARDL for Bangladesh. The results found an unequal long-term relationship between foreign direct investment, exchange rate, monetary policy, and fiscal policy.

Slanicay, M., (2011)'s study used a new method of historical shock analysis to know the effects of asymmetric shocks and structural differences between the Czech economy and the Eurozone 12. The results indicated that structural shocks have more impact and correlation than the estimated correlations between shocks alone, and the results also concluded that the effects of shocks on inflation and interest rates are among the most critical correlations.

BORDES et al. (1995) investigated the extent to which the impacts of fluctuations in short and long-term interest rates on elements of cumulative demand responded to financial deregulation in the halfway-1980s in France. The results revealed that lifting restrictions lowered the interest rate policy effectiveness in setting off a difference in the GDP. By distinction, the results showed that investment by households and firms was more responsive to interest rate changes.

2. Materials and Methods

Analyzing the asymmetric impact of interest rate changes on investment, we gathered the data from the World Bank and the Central Bank of Egypt databases from 1976 to 2020. The analysis starts with the following asymmetric long-run regression model:

$$LnINVS_t = \beta_0 + \beta_1^+ LnINT_t^+ + \beta_2^+ LnINT_t^- + \beta_3^+ LnEXR_t^+ + \beta_4^+ LnEXR_t^- + \mu_t \quad (1)$$

INVS stands for domestic Investment, INT stands for real interest rate changes (positive and negative), EXR stands for Official Exchange rate changes (positive and negative), Ln stands for the natural log, and μ is the disturbance term.

The independent variables $(LnINT_t, and\ LnEXR_t)$ decomposed into positive and negative partial sums as follows.

Table 1: Variables Decomposition

$LnINT$	$LnINT_t^+ = \sum_{j=1}^{t} \Delta LnINT_j^+ = \sum_{j=1}^{t} \max(\Delta LnINT_j, 0)$
	$LnINT_t^- = \sum_{j=1}^{t} \Delta LnINT_j^- = \sum_{j=1}^{t} \min(\Delta LnINT_j, 0)$
$LnEXR$	$LnEXR_t^+ = \sum_{j=1}^{t} \Delta LnEXR_j^+ = \sum_{j=1}^{t} \max(\Delta LnEXR_j, 0)$
	$LnEXR_t^- = \sum_{j=1}^{t} \Delta LnEXR_j^- = \sum_{j=1}^{t} \min(\Delta LnEXR_j, 0)$

To deliver the effects of positive and negative fluctuations in the interest rate and exchange rate on domestic investment in Egypt, the study builds the experimental assessment following Pesaran et al. (2001), who proposed the autoregressive distributed lag (ARDL) models and bound tests. The ARDL method makes it viable to use I(1) and I(0) variables to estimate error correction models.

This study follows Shin et al. (2014)'s approach in estimating a nonlinear autoregressive distributed lag model to examine if domestic investment responses differently from positive negative and negative changes coming from interest rates and exchange rate. The NARDL representation is as follow:

$$\Delta LnINVS_t = \beta_0 + \sum_{i=1}^{\rho-1}\gamma_i\,\Delta LnINVS_{t-i} + \sum_{i=0}^{q}\delta_i^+\,\Delta LnINT_{t-i}^+ + \sum_{i=0}^{q}\delta_i^-\,\Delta LnINT_{t-i}^- + \sum_{i=0}^{q}\delta_i^+\,\Delta LnEXR_{t-i}^+ + \sum_{i=0}^{q}\delta_i^-\,\Delta LnEXR_{t-i}^- + \rho LnINVS_{t-1} + \varphi^+ LnINT_{t-1}^+ + \varphi^- LnINT_{t-1}^- + \varphi^+ LnEXR_{t-1}^+ + \varphi^- LnEXR_{t-1}^- + \mu_t \quad (3)$$

NARDL short-run coefficients: $\gamma_i, \delta_i^+, \delta_i^-$
NARDL long-run coefficients: $\rho, \varphi^+, \varphi^-$
The disturbance term μ_t is white noise.
Specification (3) introduces nonlinearity by constructing the partial sum variables.

Bounds Test for Asymmetric Long-run Cointegration:
NARDL bounds test is a joint test of all lagged one-period levels of:

$LnINT^+, LnINT^-, LnEXR^+, LnEXR^- and\ LnINVS.$
F-test of pesaran et al (2001).

$H_0: \varphi = 0$

$H_A: \varphi < 0$

We can conclude that.

If we reject H_0 (of no cointegration), then we can conclude the existence of cointegration among variables in the presence of asymmetry. However, to make a judgment on asymmetry, there is a need to construct the asymmetric coefficients as follow:

$$\frac{The\ coefficient\ of\ LnINT^+}{The\ coefficient\ of\ LnINVS_{t-1}} \rightarrow \frac{-\varphi^+}{\rho};\ \frac{-\varphi^-}{\rho}$$

$$\frac{The\ coefficient\ of\ LnEXR^+}{The\ coefficient\ of\ LnINVS_{t-1}} \rightarrow \frac{-\varphi^+}{\rho};\ \frac{-\varphi^-}{\rho}$$

So, we perform the Wald test for long-run Symmetry, and based on the results; we can say the following:
If a long-run relation exists, we test if the difference in asymmetric coefficients is statistically significant based on the bound test.

$$H_0: \frac{-\varphi^+}{\rho} = \frac{-\varphi^-}{\rho}$$

$$H_A: \frac{-\varphi^+}{\rho} \neq \frac{-\varphi^-}{\rho}$$

If we reject H_0, it means we have long-run asymmetry. In other words, the magnitude of the changes in LnINVS when LnINT and LnEXR increase are not the same as when LnINT and LnEXR decrease.

Furthermore, we will construct an Asymmetric Dynamic Multiplier to show how $LnINVS_t$ adjusts to its new long-run equilibrium following NEG or POS shocks in $LnINT_t$, and $LnEXR$.

The cumulative dynamic multiplier effects of $LnINT_t^+$, $LnINT_t^-$, and $LnEXR_t^+$, $LnEXR_t^-$ on $LnINVS_t$ evaluated as:

$$M_h^+ = \sum_{j=0}^{h} \frac{\partial LnINVS_{t+j}}{\partial LnINT_t^+}, \quad M_h^- = \sum_{j=0}^{h} \frac{\partial LnINVS_{t+j}}{\partial LnINT_t^-}, \quad \text{for h = 0, 1, 2, ….}$$

$$M_h^+ = \sum_{j=0}^{h} \frac{\partial LnINVS_{t+j}}{\partial LnEXR_t^+}, \quad M_h^- = \sum_{j=0}^{h} \frac{\partial LnINVS_{t+j}}{\partial LnEXR_t^-}, \quad \text{for h = 0, 1, 2, ….}$$

Where, if $h \to \infty, then\ M_h^+ \to \frac{-\varphi^+}{\rho}$ **and** $M_h^- \to \frac{-\varphi^-}{\rho}$

3. Results and Discussion

Prior to proceed in the analysis, we examined stationarity of all variables via using ADF tests.

Table (2). ADF Test Results for LnINVS, LnINT, and LnEXR.

Variables	Level/ Δ	ADF Stat.	Prob. Value	I()
LnINVS	L	-2.260111	0.1891	
	Δ	-4.175535	0.0020	I(1)
LnINT	L	-2.389300	0.1508	
	Δ	-3.367046	0.0179	I(1)
next	L	-0.913957	0.7745	
	Δ	-5.152633	0.0001	I(1)

Source: Prepared by researchers using Eviews 10 program

Notes: Critical values calculated from MacKinnon's table.

Table 2 showed that the variables are non-stationary at level but became stationary in order one.

Thus, to estimate the NARDL model, we need to determine the optimal lag number. Using the VAR lag order selection criteria, table 3 shows the optimal lag as follows.

Table3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-49.91527	NA	0.002652	2.581233	2.706616	2.626891
1	98.26925	267.4550	2.99e-06	-4.208256	-3.706723	-4.025625
2	123.7146	42.20210*	1.35e-06*	-5.010470*	-4.132787*	-4.690866*
3	132.1486	12.75379	1.42e-06	-4.982858	-3.729025	-4.526281
4	139.4081	9.915446	1.60e-06	-4.897957	-3.267974	-4.304407

Source: Prepared by researchers using Eviews 10 program

The results in table 3 indicate that the optimal lag structure is two lags based on all selection criteria.

Having determined the stationarity and the optimal lag structure, we can estimate the NARDL model as stated in equation 3.

Table 4: NARDL Estimation results, Dependent Variable LnINVS.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LnINVS(-1)	0.633355	0.070096	9.035575	0.0000
LnINT_POS	0.254532	0.150164	1.695024	0.0998
LnINT_NEG	1.161702	0.258575	4.492710	0.0001
LnINT_NEG(-1)	-1.608695	0.276541	-5.817193	0.0000
LnEXR_POS	-0.091472	0.061711	-1.482272	0.1480
LnEXR_POS(-1)	-0.144209	0.091360	-1.578466	0.1243
LnEXR_POS(-2)	0.214735	0.066782	3.215472	0.0030
LnEXR_NEG	-1.864466	0.616605	-3.023759	0.0049
LnEXR_NEG(-1)	1.025850	0.682601	1.502853	0.1427
C	9.258253	1.747590	5.297725	0.0000
R-squared	0.989438	Akaike info criterion		-2.227022
Adjusted R-squared	0.986467			
F-statistic	333.0747	Hannan-Quinn criteria.		-2.075374
Prob(F-statistic)	0.000000	Durbin-Watson stat		2.226229

Source: Prepared by researchers using Eviews 10 program

Table 4 reports the results of LnINT POS and NEG forms at one lag.
With this, let us go ahead and do the Bounds Test for Asymmetric Long-run Cointegration. Table 5 reports the Bounds test.

Table 5: Bounds Test for Asymmetric Long-run Cointegration Results

Test Statistic	Value	Sign in.	Lower Bound	Upper Bound
			Asymptotic:	
			n=1000	
F-statistic	5.857813	10%	2.45	3.52
k	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06
			Finite Sample:	
Actual Sample Size	42		n=40	
		10%	2.638	3.772
		5%	3.202	4.544
		1%	4.428	6.25
CointEq(-1)*	-0.366645	0.063873	-5.740226	0.0000
t-Bounds Test	Null Hypothesis: No levels relationship			
Test Statistic	Value	Sign in.	Lower Bound	Upper Bound
t-statistic	-5.230635	10%	-2.57	-3.66
		5%	-2.86	-3.99
		2.5%	-3.13	-4.26
		1%	-3.43	-4.6

Source: Prepared by researchers using Eviews 10 program

Fortunately, the F-statistic is relatively higher than the upper bound of the critical values at the 1% level. So, we conclude that when asymmetry exists, the variables are cointegrated, and the reported error correction term (-0.366645) confirms that the speed of adjustment takes the correct sign and is statistically significant (Prob.=0.0000).

Furthermore, we can interpret the different parts of the conditional error correction model and the levels equation output as reported in table 6 below.

Table 6: Conditional Error Correction and Levels Equation

Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.258253	1.747590	5.297725	0.0000
LnINVS(-1)	-0.366645	0.070096	-5.230635	0.0000
LnINT_POS	0.254532	0.150164	1.695024	0.0998
LnINT_NEG(-1)	-0.446993	0.162116	-2.757243	0.0095
LnEXR_POS(-1)	-0.020946	0.046321	-0.452193	0.6542
LnEXR_NEG(-1)	-0.838617	0.398931	-2.102158	0.0435
D(LnINT_NEG)	1.161702	0.258575	4.492710	0.0001
D(LnEXR_POS)	-0.091472	0.061711	-1.482272	0.1480
D(LnEXR_POS(-1))	-0.214735	0.066782	-3.215472	0.0030
D(LnEXR_NEG)	-1.864466	0.616605	-3.023759	0.0049
Levels Equation				
Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnINT_POS	0.694220	0.369220	1.880232	0.0692
LnINT_NEG	-1.219143	0.380445	-3.204516	0.0031
LnEXR_POS	-0.057130	0.124498	-0.458881	0.6494
LnEXR_NEG	-2.287271	0.935064	-2.446112	0.0201
EC = LnINVS - (0.6942*LnINT_POS -1.2191*LnINT_NEG - 0.0571*LnEXR_POS - 2.2873*LnEXR_NEG)				

Source: Prepared by researchers using Eviews 10 program

As we see in table 6, the conditional error correction regression consists of two parts; the upper part is the long-run component, and the lower part is the short-run component with the difference operator in front of them.

So, concerning the long-run component, we find that positive change in LnINT has a positive causal impact on the dependent variable LnINVS (the coefficient =0.254532) in the current period. In contrast, the negative shock has a negative causality effect on the dependent variable LnINVS (the coefficient =-0.446993) in the past period.

As for the short-run, we can find a negative shock of LnINT in the current period has positive causality impacts on the dependent variable (the coefficient=1.161702) and is statically significant (P-value= 0.0001).

However, we find that positive and negative changes in LnEXR in the current period harm the dependent variable and are statically significant. In addition, the positive change of the past period harms the dependent variable (the coefficient=-0.214735) and is statically significant (P-value=0.003).

The long-run coefficients ($\rho, \varphi^{+}, \varphi^{-}$), as stated in equation three, were calculated for the level's equation.

$$\frac{The\ coefficient\ of\ LnINT^{+}}{The\ coefficient\ of\ LnINVS_{t-1}} \rightarrow \frac{-\varphi^{+}}{\rho}; \frac{-\varphi^{-}}{\rho}$$

$$\frac{The\ coefficient\ of\ LnEXR^{+}}{The\ coefficient\ of\ LnINVS_{t-1}} \rightarrow \frac{-\varphi^{+}}{\rho}; \frac{-\varphi^{-}}{\rho}$$

The results from the levels equation indicate that in the long run, a positive change in LnINT has a positive influence (0.694220) on the dependent variable, while an adverse change in LnINT has a negative effect (-1.219143) on the dependent variable (domestic investment).

As for exchange rate, the results show that, for both, positive and negative shocks in LnEXR have negative impacts on the dependent variable

So, the asymmetric cointegrating equations will look like this:

For Interest rate:

LnINVS=0.694LnINT_POS – -1.219LnINT_NEG

If LnINT increases, LnINVS will increase by about 69.42% and

If LNINT decreases, LINVS will decrease by about 121.9%.

For Exchange Rate:

LnINVS=-0.057130LnEXR_POS -2.287271LnEXR_NEG

If LnEXR increases, LnINVS will decrease by about 5.71% and

If LnEXR decreases, LnINVS will decrease by about 228.72%.

The task is to determine if the difference between the POS and NEG changes coefficients is statically significant. If significant, we conclude that the relationship between LnINVS and LnINT, LnEXR, is asymmetric.

Tests for long-run and short-run Asymmetries (Stepwise Regression) :

Table 7: Stepwise Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	9.884144	1.983323	4.983629	0.0000
LnINVS(-1)	-0.392812	0.079079	-4.967342	0.0000
LnINT_POS	0.301761	0.147734	2.042601	0.0497
LnINT_NEG(-1)	-0.488019	0.171450	-2.846424	0.0078
LnEXR_POS(-1)	-0.028585	0.045350	-0.630331	0.5331
LnEXR_NEG(-1)	-0.749229	0.417666	-1.793846	0.0826
D(LnEXR_NEG(-2))	-2.264602	0.990112	-2.287218	0.0292
D(LnINT_NEG)	1.092039	0.251637	4.339741	0.0001
D(LnEXR_POS(-1))	-0.217902	0.064000	-3.404733	0.0018
D(LnEXR_NEG)	-1.621738	0.632623	-2.563515	0.0154
R-squared	0.644054	Akaike info criterion		-2.281403
Adjusted R-squared	0.540715	Hannan-Quinn criteria.		-2.129211
F-statistic	6.232441	Durbin-Watson stat		2.366146
Prob(F-statistic)	0.000054			
Selection Summary				
Added D(LnEXR_NEG(-2)) Added D(LnINT_NEG) Added D(LnEXR_POS(-1)) Added D(LnEXR_NEG)				

Source: Prepared by researchers using Eviews 10 program

Using the results of the coefficients from table 7, we move forward to perform the Wald test for both the long run and short run as follows.

Long-run Asymmetry: Wald Test

Concerning interest rate, we do have evidence of long-run asymmetry concerning LnINT, so there is a nonlinear relationship between LnINVS and LnINT. The results reported in table 8 bellow.

Wald Test

Table 8: Equation: STEPWISE

for Interest Rate			
Test Statistic	**Value**	**df**	**Probability**
t-statistic	**-3.763245**	**31**	**0.0007**
F-statistic	**14.16201**	**(1, 31)**	**0.0007**
Chi-square	**14.16201**	**1**	**0.0002**
Null Hypothesis	**C(3)/C(2)=C(4)/C(2)**		
Normalized Restriction (= 0)		**Value**	**Std. Err.**
C(3)/C(2) - C(4)/C(2)		**-2.010581**	**0.534268**
for Exchange Rate			
Test Statistic	**Value**	**df**	**Probability**
t-statistic	**-1.940310**	**31**	**0.0615**
F-statistic	**3.764801**	**(1, 31)**	**0.0615**
Chi-square	**3.764801**	**1**	**0.0523**
Null Hypothesis	**C(5)/C(2)=C(6)/C(2)**		
Normalized Restriction (= 0)		**Value**	**Std. Err.**
C(5)/C(2) - C(6)/C(2)		**-1.834578**	**0.945508**

Source: Prepared by researchers using Eviews 10 program

Concerning exchange rate (LnEXR), we do not have evidence of long-run asymmetry concerning LnEXR, so there is no asymmetric relationship between LnINVS and LnEXR.

Short -run Asymmetry: Wald Test

For the Interest rate, there is only one value for the negative chock as follows.

D(LnINT_NEG) = 1.092039, and it is statically significant (P-value = 0.0001.

As for the exchange rate, there is evidence of short-run asymmetry concerning LNEXR, so there is a linear relationship between LnINVS and LnEXR. . Results reported in table 9 below.

Wald Test

Table 9: Equation: STEPWISE

for Exchange Rate			
Test Statistic	Value	df	Probability
t-statistic	-3.532970	31	0.0013
F-statistic	12.48188	(1, 31)	0.0013
Chi-square	12.48188	1	0.0004
Null Hypothesis	C(7)+C(10)=C(9)		
Normalized Restriction (= 0)		Value	Std. Err.
C(7) - C(9) + C(10)		-3.668438	1.038344

Source: Prepared by researchers using Eviews 10 program

Dynamic Multiplier Graph and Diagnostic

a.For Interest Rate

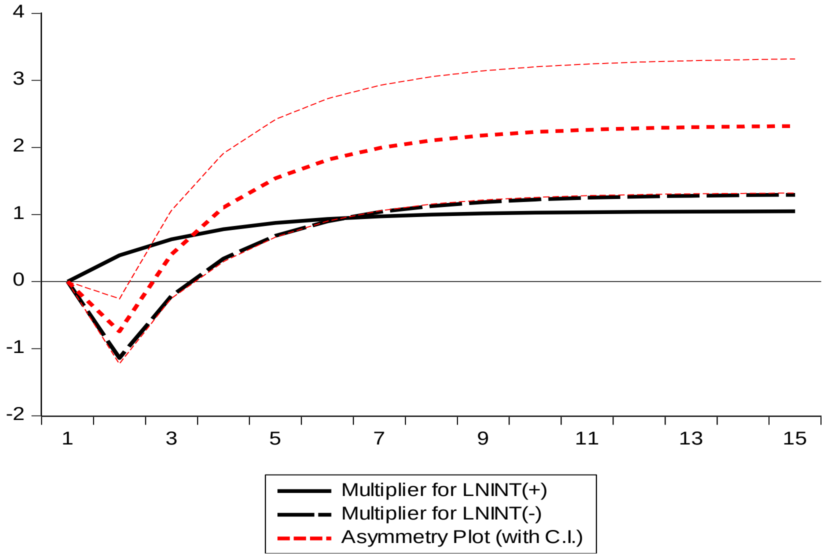

Figure 2

Source: EViews 10

1-The continuous black line shows how LnINVS adjusts in response to a positive change in LnINT, and the dashed black line shows the adjustment of the dependent variable LNINVS over the horizon due to a negative shock in LnINT.

2-The darted line is the asymmetric plot that shows the disparity between the dynamic multiplier of positive and negative changes in the regressor.

3-The asymmetry line lies within the upper and lower bands of the 95% confidence intervals. The zero line falls below the lower boundary of the 95% confidence intervals, indicating that their asymmetry is statically significant.

4- The dependent variable responds positively to a positive change and negatively to an adverse change in the regressor. Also, we can see the response of LnINVS. Getting positive or negative changes is a more noticeable further field in the long run than in the short run, where it is virtually operating simultaneously.

We can also see that magnitude of an increase due to a positive change is greater than the magnitude of decrease due to an adverse change in the long run, and that difference is suggestive of the perceived asymmetry already determined in the Wald Test.

b. For Exchange Rate

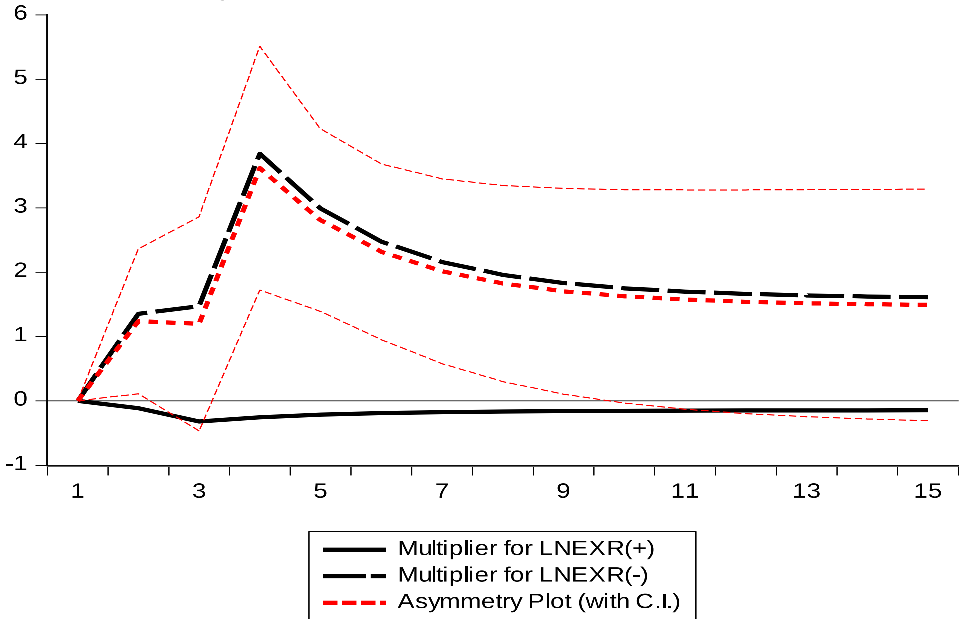

Figure 3

Source: EViews 10

1-The continuous dark line tells how LnINVS corrects due to a positive change in LnEXR, and the dashed black line shows the adjustment of the dependent variable LnINVS over the horizon to a negative shock in LnEXR.
2-The dashed line is the asymmetric plot, and it shows the difference between the dynamic multiplier of positive and negative changes in the regressor.
3-The asymmetry line lies within the upper and lower bands of the 95% confidence intervals. The zero line falls below the lower boundary of the 95% confidence intervals, indicating that their asymmetry is statically significant.
4-We can easily see that the dependent variable responds positively to a positive change and negatively to an adverse change in the regressor. Also, we can see the response of LnINVS.

Getting positive or negative changes is more evident in the long run than in the short run, where it is virtually operating simultaneously.

Furthermore, the scale of an increase resulting from a positive change is larger than the scale of decrease because of a negative change, and that variation is suggestive of the observed asymmetry already established in the Wald Test.

Furthermore, we ran CUSUM, and CUSUM SQUIRE tests to get a sense of stability.

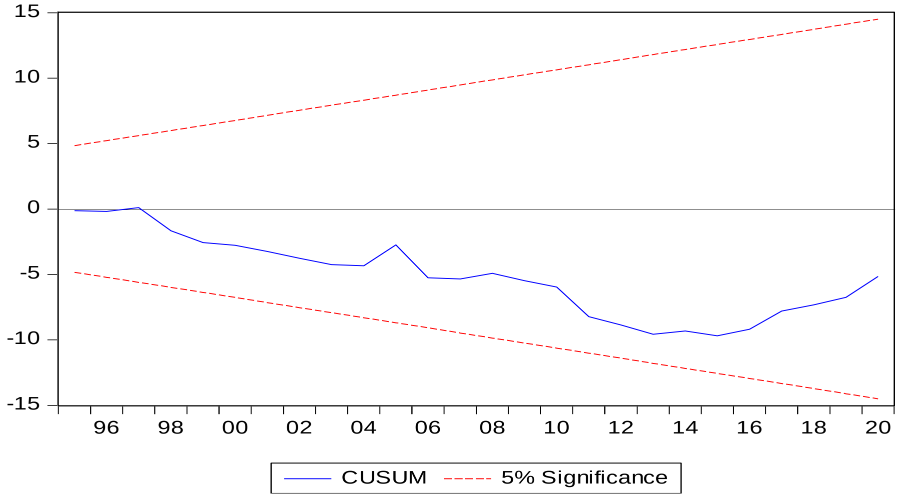

Figure 4

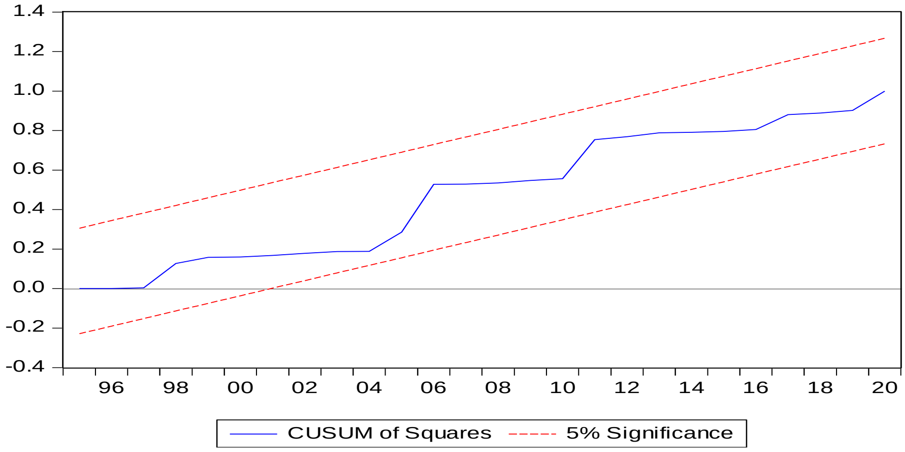

Figure 5

Source: EViews 10

We can see from Figures 4 and 5 that the blow line lays within the 5% boundary, either way, indicating stability.

Also, we can check for Heteroskedasticity as reported in table 10 below.

Table 10: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.587347	Prob. F(11,29)	0.8233
Obs*R-squared	7.470037	Prob. Chi-Square(11)	0.7598
Scaled explained SS	2.123005	Prob. Chi-Square(11)	0.9980

Source: Prepared by researchers using Eviews 10 program

The results of the P-vales are all above 5%, which tell us we cannot reject the null hypotheses of Homoscedasticity.

In addition, checking for normality, we use the Jarue Bera's statistic as shown in figure 6 below.

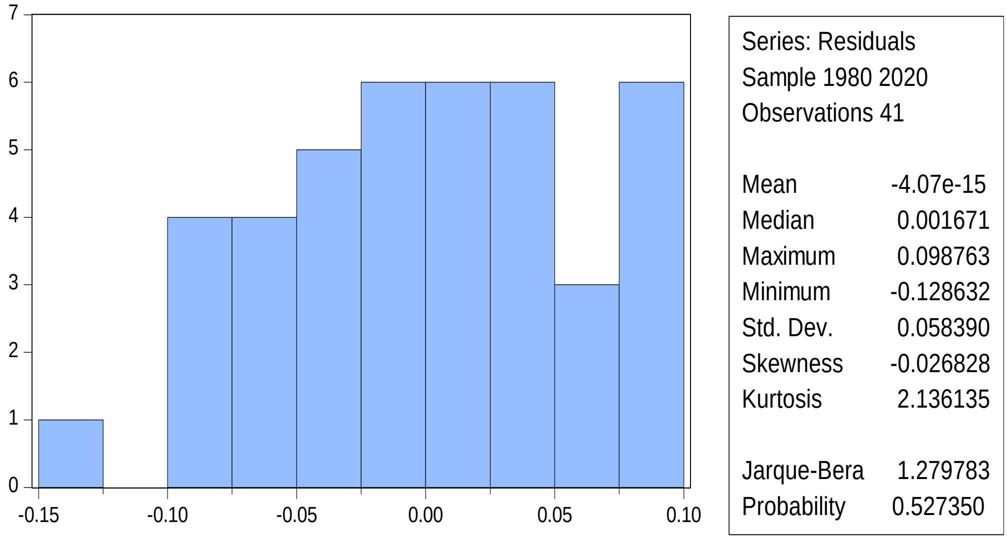

Figure6

Source: Prepared by researchers using Eviews 10 program

The results in figure 6 indicate that the p-value of Jarue Bera's statistic (0.527350) is above 5%, which indicate a normal distribution of the data.

4. Conclusion

Although most previous studies were primarily concerned with knowing the effect of interest rate and exchange rate on investment symmetrically, limited studies have investigated the unequal effect of both positive and negative interest rate changes on investment.

Therefore, the results of the current study showed, in the long run, that a positive change in interest has a positive causal effect on investment (coefficient = 0.254532) in the current period, while a negative change has a negative causal effect on investment (coefficient = -0.446993) in the last period.

The results from the levels equation indicate that in the long run, a positive change in LnINT has a positive influence (0.694220) on the dependent variable, while an adverse change in LnINT has a negative effect (-1.219143) on the dependent variable (domestic investment).

As for exchange rate, the results show that, for both, positive and negative shocks in LnEXR have negative impacts on the dependent variable. In other words, the increase in the exchange rate (the depreciation of the Egyptian pound) will lead to a decrease in investments by 5.71%. In addition, a depreciation in the exchange rate (the improvement in the value of the Egyptian pound) will lead to an increase in investments by 228.2%.

However, in the short term, the results showed that the negative interest rate change in the current period has positive causal effects on investment (coefficient = 1.161702) and statistical significance (probability value = 0.0001).

As for the effect of fluctuations in exchange rates on investment showed that responses were negatively and statistically significant to positive and negative changes in the exchange rate in the current period. In addition, the positive change of the past period is detrimental to the investment (coefficient = -0.214735) and is statistically significant (p = 0.003).

The previous results lead to the importance of the knowledge of fiscal and monetary policymakers of the effects of unequal shocks to interest rates and exchange rates on investment when designing fiscal and monetary policies.

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دراسة الأثار غير المتكافئة للفائدة وسعر الصرف على الاستثمار المحلي في مصر للفترة 1976-2020م: تطبيق نموذج التوزيع التلقائي للانحدار غير الخطي المتباطئ

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مستخلص البحث:

ركزت معظم الدراسات التي أجريت في العقود الماضية على تأثير أسعار الفائدة وأسعار الصرف على الاستثمار المحلي بافتراض أن المتغيرات المستقلة لها نفس التأثير على المتغير التابع، ولكن كانت هناك دراسات محدودة حققت في الآثار غير المتكافئة للتغيرات في أسعار الفائدة وأسعار الصرف، الإيجابية والسلبية، على الاستثمار المحلي. استخدمت هذه الدراسة نموذج التوزيع التلقائي للانحدار غير الخطي المتباطئ (NARDL) لتقييم الآثار غير المتكافئة لمتغيرات سعر الفائدة الحقيقي وسعر الصرف الحقيقي على الاستثمار المحلي في مصر للفترة 1976 - 2020. كشفت النتائج عن حدوث تأثيرات إيجابية وسلبية غير متساوية لكل من سعر الفائدة وسعر الصرف على الاستثمار على المدى الطويل والقصير. بالإضافة إلى ذلك، تم اختبار ثبات النموذج غير الخطي باستخدام اختبارات التقديرات المتكررة ووجد أن النموذج مستقر.

نوع البحث: ورقة بحثية

المصطلحات الرئيسة للبحث: تأثيرات عدم التناسق، الاستثمار المحلي، مصر، نموذج التوزيع التلقائي للانحدار غير الخطي المتباطئ، سعر الفائدة الحقيقي، سعر الصرف الحقيقي