Effects on Rate of Exchange on Export Earnings of Ethiopia: Insights from ARDL Model

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Abstract: This study investigates the short- and long-run effects of exchange rate fluctuations on Ethiopia's export earnings and overall economic performance from 1990 to 2025 using the Autoregressive Distributed Lag (ARDL) framework. Annual macroeconomic data, real GDP, export earnings, foreign exchange rate, inflation, foreign direct investment (FDI), and domestic consumption, were analyzed after confirming variable integration at order I(1). The bounds test results indicate a strong long-run co integrating relationship among the variables. Empirical findings show that exchange rate movements have a significant impact on real GDP in both the short- and long-run. FDI and inflation also have meaningful positive effects. Export earnings show a mixed pattern. There are negative short-run adjustments, followed by stability in the long run. The Granger causality tests reveal no directional causality between export earnings and real GDP. This suggests that structural constraints weaken the link between export performance and economic growth. However, export earnings are found to Granger-cause the exchange rate. This shows the exchange rate's sensitivity to changes in the external sector. Overall, the study highlights that a competitive and well-managed exchange rate is important for strong export competitiveness and economic growth. Policy measures should promote export diversification, value addition, and stable macroeconomic conditions. Attracting export-oriented FDI is also key to strengthening Ethiopia's long-term economic resilience.

Keywords: Export competitiveness, Real GDP, Short- and long run

JEL Codes: F31, F14, C22, O55

1.0. Introduction

Recent studies provide strong empirical support for the role of exchange rate dynamics in shaping Ethiopia's trade performance. Abegaz (2024) shows, using a nonlinear Autoregressive Distributive lag (ARDL)model, that all the changes in the real exchange rate, along with currency depreciation and appreciation, affect Ethiopia's trade balance in different ways., with depreciation modestly improving the long-term and short-term trade balance, whereas appreciation leads to much larger gains. Meanwhile, research by Kifle and Potts (ADB working paper) argues that a less valued a favorable real exchange rate helps boost Ethiopia's export supply and encourages more economic diversification. Belay and Sime (2022) have done more work that shows that the actual effective currency rate has had a big consequence on Ethiopia's growth of economic over the years. Finally, a 2023 study on exchange rate volatility uses GARCH and ARDL approaches to show that converts can inside the actual effective currency rate have big effects on, and sometimes non-linear, effect on export earnings underlining the importance of stable and well-managed exchange rate policy.

Exports account for 16 percent (%) of Ethiopia's GDP, while imports represent 42.4%. The country primarily exports traditional goods. Between 1990 and 2021, merchandise exports grew by an average of 7% annually, and manufacturing exports by 4%. In 2021, real merchandise exports reached 1.16 billion USD, with manufacturing exports at 92.3 million USD, representing 8% of merchandise exports. Export revenue was mainly driven by non-manufacturing goods. From 1990 to 2021, manufacturing exports comprised about 14.4% of total exports (Debel 2021).

Ethiopian exports remain small, undiversified, and primarily composed of unprocessed primary products. These exports are vulnerable to economic crises, declining demand and prices, and trade barriers. Manufacturing exports have grown slowly, with their part of over-all exports decreasing from 14% in 1990 to 4.6% in 2021 (Belayneh and Wondaferahu 2019). Despite currency devaluation, net exports have declined in recent years due to a sharp increase in imports. If this pattern persists, it may negatively impact Ethiopia's export sector and overall economic growth (Degefa 2015).

The Ethiopian Birr has been getting weaker since the early 1990s, when it switched to an exchange rate floating. Devaluation of the USD in 2017 further exemplifies these currency fluctuations (IMF, 2018). In 2015, the IMF thought that the Birr was worth 30% more than it really was. Persistent trade deficits have contributed to this situation and, in theory, are expected to further weaken the currency (Wondemu and Potts, 2016).

Aristotelous (2016) utilized a generalized model of gravity on panel data set concerning exports from Greece to 21 developed nations above the time of 1981 to 2005. The result shows that an actual admirationof the Greek currency values in a substantial decrease in Greek exports. Oh and Tumurbaatar (2016) similarly utilized trade of bilateral file to

examine market between Mongolia and its 59 primary trading collaborators from period of 1995-2008. In place of fixed effect or random effects models, pooled OLS is used for panel data analysis in this investigation. The findings suggest that a cherishing of the exchange rate is correlated with a reduction in export levels. Nguyen (2016) took a minimum different approach, using both static gravity model and dynamic gravity model to examine Vietnamese export flows. He found that a drop in the real exchange rate had a significant effect on trade between Vietnam and a foreign partner.

Samuel (2019) assessed the connections between real exchange rate and exports of Ethiopia, utilizing data on overall earnings of export and accepted key units. The findings indicate that the exchange rate influences export earnings in the long run, but not in the short run. The present study builds on existing research by examining short-run and long-term outcome of foreign direct investment (FDI) on export staging, while also assessing the associated influence of exchange rate volatility.

This research investigates the short run and long run challenges of rate of exchange fluctuations on convey revenues. This assesses how changes in the exchange rate influence Ethiopia's broader economy and analyzes recent trends in earnings of export in retaliation to these shifts. Objective is to elucidate the exchange rate impact policies on growth of economy and stability, with a particular focus on export performance.

2.0. Materials and Methods

This study relies exclusively on time-series quantitative macroeconomic data obtained from multiple official sources, including the National Bank of Ethiopia's annual reports, publications from Ministry of Finance and Economic Development (MoFED), and statistical bulletins issued by the Economic Association of Ethiopian. Thirty-three years of observations, spanning 1990 to 2025, including the two interior years, are used for the analysis of one explanatory variable and six other explanatory variables. Tables, charts, and other appropriate statistical tools were used to summarize the secondary data composed. To explain the factors affecting the nation's export earnings, the study employed diagnostic tests, including stationarity and autocorrelation tests, along with other suitable econometric techniques. The models were chosen for their simplicity and were expected to meet expectations for effectiveness, consistency, and objectivity.

Lagged model Auto-regressive Distributed (ARDL)

Model of Autoregressive Distributed Lag (ARDL) uses ordinary least squares and works well for both time series that aren't stationary and those that are mixed-order. It helps forecast and separate long-run relationships from short-run changes. The model also tracks how variables change over time, so it is useful for studying how one variable affects another by including lags.

Economic theory often points to a sustained relationship between the variables being studied. In the past, many econometricians did not pay enough attention to the changing patterns in most time series when building traditional regression models. These models usually presume the time series were followed a steady trend and that a long-run relationship was present. As a result, standard econometric models were built on the assumption that the variables' averages and variances stayed the same over time. These models were then used to study theory, make forecasts, and guide policy decisions.

Model Estimation

For the investigation of this study, we use Real GDP as an endogenous variable and six exogenous variables (EE, Fx, I, FDI, DC) having the following relationship in logarithm form, i.e., the data for all the variables transformed the data using natural logarithms to minimize the likelihood of heteroscedasticity.

$$\text{Ln RGDP} = \beta_0 + \beta_1 \text{lnEE} + \beta_2 \text{lnFx} + \beta_3 \text{lnI} + \beta_4 \text{lnFDI} + \beta_5 \text{DC} + \mu_i \quad \ldots\ldots (1)$$

Where, “RGDP” is the Actual Gross Domestic Product, “EE” is Export Earning, “Fx” is Foreign Exchange Rate,“I” is Inflation, “FDI” is foreign direct investment, and “DC” is domestic consumption. While μ_i refers to the error term, β_0 stands for an intercept, and β_1, to β_5 are the explanatory variable’s coefficients.

Here, one can easily observe that the functional Estimation is logarithmic, as it better expresses the change in the probability of export as a percentage change rather than a one-unit change in each explanatory variable.

This study employed the Lag model of Autoregressive Distributed (ARDL), in which the endogenous variable is specified as a purpose of the dawdle and current benefit of the independent variables and their respective lags. The ARDL strategy utilizes a broad to particular framework, enabling it to tackle various econometric problems, such as incorrectness and autocorrelation, and to formulate the most suitable interpretable model (Ghouse et al., 2018).

3.0. Results of Data Analysis

3.1. Descriptive Analysis

This investigation uses data from 1990 to 2025, covering thirty-three years, and was collected from several organizations. Information on export earnings, Actual Gross Domestic Product (RGDP), foreign exchange rate, export earning, foreign direct investment, inflation, and domestic consumption gathered from world bank. Descriptive statistics are used to summarize the dependent variable and exogenous variables.

The descriptive statistics demonstrate substantial variability and frequent skewness among the study variables, providing key insights into the macroeconomic data. For

example, Real GDP (RGDP) fro table 1 exhibits a mean of approximately 4.33×10^{10} million dollars (M$) and a median of 2.34×10^{10} M$, indicating a positive skew likely attributable to several high-value observations. The standard deviation 4.19×10^{10} M$ further suggests significant fluctuations in GDP during the sample period. Inflation (I) is strongly right-skewed with a value of 1.07 and displays a heavy-tailed distribution kurtosis value of 3.34, implying that large inflationary episodes occasionally elevate the mean above the median. Exchange rate shocks (Fx) exhibit even greater volatility and pronounced non-normality, with skewness of 2.84 and kurtosis of 10.77, indicating frequent extreme values that align with periods of sharp currency movements.

Table 1: Results of Descriptive analysis

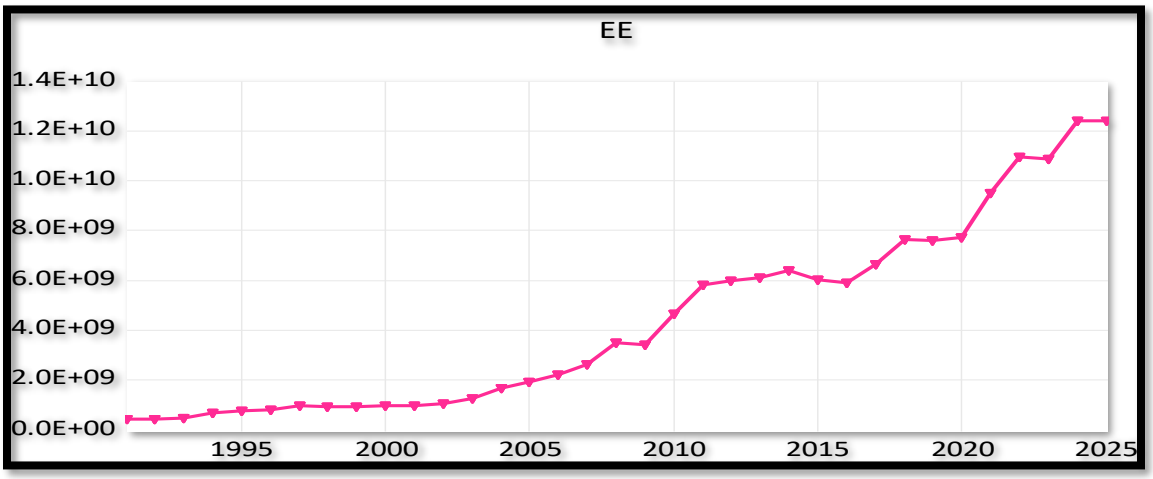
Variable	RGDP_IN_M$	I	FX	FDI_IN_$	EE	DC_IN_B$
Mean	4.33×10^{10}	13.13	22.3725	1.29×10^{10}	4.26×10^{9}	46.1525
Median	2.34×10^{10}	9.985	9.285	3.19×10^{8}	3.04×10^{9}	27.55
Maximum	1.27×10^{11}	44.36	140.28	4.26×10^{10}	1.24×10^{10}	160
Minimum	7.10×10^{9}	0	2.07	0	4.36×10^{8}	4.2
Std. Dev.	4.19×10^{10}	11.33	30.38066	1.55×10^{10}	3.76×10^{9}	41.45035
Skewness	0.853708	1.066	2.84342	0.867458	0.735628	1.215106
Kurtosis	2.193714	3.337	10.76992	2.054827	2.361703	3.574283
Jarque-Bera	5.348048	6.987	139.0615	5.854925	3.858027	9.353594
Prob. (JB)	0.068947	0.03	0	0.053533	0.145291	0.009309
Sum	1.56×10^{12}	472.7	805.41	4.63×10^{11}	1.53×10^{11}	1661.49
Sum of Squares	6.14×10^{22}	4496	32304.46	8.41×10^{19}	4.96×10^{20}	60134.6
Observations	36	36	36	36	36	36

Source: Estimated by the Author 2025

Foreign direct investment (FDI) also demonstrates considerable variation with mean value of 1.29×10^{10}; standard deviation value of 1.55×10^{10} and positive skewness, suggesting that foreign capital inflows are uneven and occasionally substantial. Export earnings (EE) are less skewed and has value of 0.74 but still exhibit notable variability value of standard deviation which is 3.76×10^{9}, reflecting cyclical patterns in export revenues. Domestic consumption (DC_IN_B$) is highly skewed with a value of 1.22 and exhibits elevated kurtosis value of 3.57, suggesting periods marked by significant credit changes. Collectively, these patterns particularly the heavy tails and non-normality observed in FX and credit markets highlight the prevalence of large shocks in the macroeconomic environment and underscore the necessity for robust econometric techniques, such as ARDL modeling, to effectively address these fluctuations and outliers.

Ethiopia participates in international trade; figure 1 shows that the trend in export earnings is roughly the same in the early years. After 2002, export earnings grew at a substantial rate; the overall trend is upward. The growth rate was very high in 2022 with export earning values of 11,613,000,000 birr and the lowest in 1991 with export earning values of 435,893,719 birr. The dissimilarity between the very best and very worst export earnings is 11,177,106,281 birrs, which is huge.

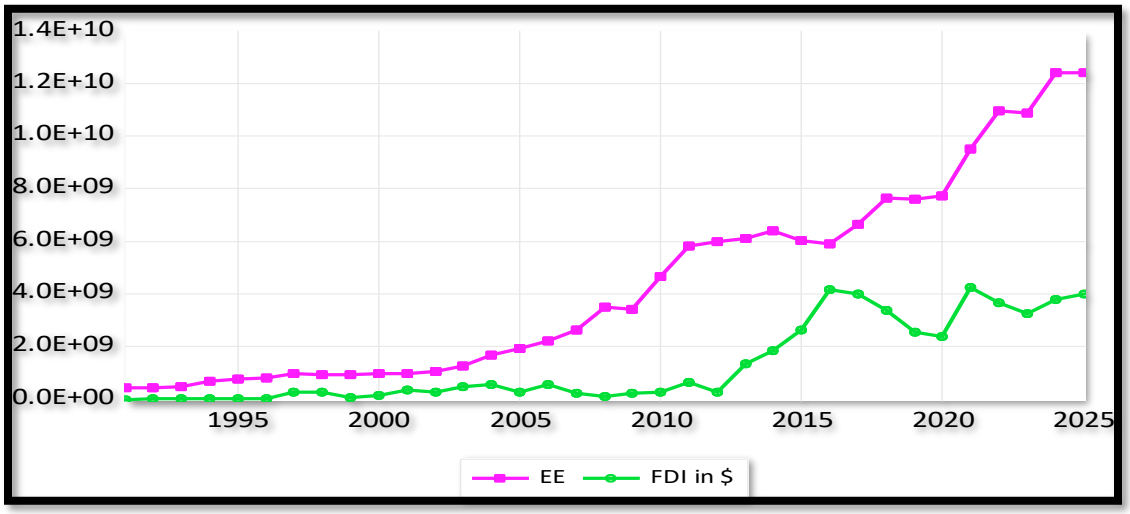
Figure 1: Trends in export earnings from 1990-2025



Source: Author analysis based on World Bank 2025

When export earnings exceed foreign direct investment (FDI), it means a country is earning more from exports than it is receiving from foreign companies investing in its economy. This can have both positive and negative implications for the country's economy. In the relationship figure 2 below, we can see that in 1992, export earnings were 437,485,314, while FDI was 0.00162.

Figure 2: Relationship between export earnings and FDI



Source: Author analysis based on World Bank

The country starts to revise its economic policy to attract foreign investment, which results in the continuous rise in the flow of FDI into the nation from its lowest stage in 1992 (0.00162) to 2.43 in 2022. Even though FDI increased from its lowest point, the gap between FDI and export earnings was large. This indicates that a nation's export revenue exceeds that from foreign firms investing in its economy.

Overall, the relationship between export earnings and FDI is complex and is contingent upon numerous factors, including a nation's economic policies, political stability, infrastructure, and human capital. While higher export earnings can be a positive sign for a country's economy, attracting foreign investment is also important to support long-term growth and development.

3.2. Unit Root Test

As discussed in the previous chapter, conducting a stationarity test is essential when applying an ARDL model. This procedure mitigates issues associated with changeable data and facilitates the identification of the amalgamation order of the variables, thereby reducing the risk of fraudulent regression. The investigation of the test result of Augmented Dickey-Fuller (ADF) are displayed below. If the value of critical exceeds thetest statistic of ADF, the null evidence of non-stationarity or unit root is declined. On the other hand, if the ADF test statistic is below the critical value, we retain the null hypothesis and must reshape the data by differencing.

Table 2: Test for Augmented Dickey Fuller (ADF)

Variables	Results	ADF result at levels I (0)		ADF evidence at first difference(I(1))		Order of Integration
		Interce pt	Trend and Interce pt	Interce pt	Trend & Interce pt	
lnEE	|ADF t-statics|	0.14	2.21	5.76	5.65	I (1)
	|Critical Value| @5%	2.95	3.54	2.95	3.55	
	P-Value	93.71%	46.99%	**0%**	**0.03%**	
LnFx	|ADF t-statics|	0.34	0.56	2.5	0.05	I (1)
	|Critical Value| @5%	2.95	3.54	2.95	3.56	
	P-Value	99.71%	97.5%	**1.23%**	**0.10%**	
LnI	|ADF t-statics|	2	2.59	5.95	5.85	I (1)
	|Critical Value| @5%	2.95	3.55	2.96	3.56	

	P-Value	28.52%	28.42%	**0%**	**0.02%**	
lnDC	|ADF t-statics|	0.3	1.48	5.86	6.35	I (1)
	|Critical Value| @5%	2.95	3.54	2.95	3.56	
	P-Value	97.5%	81.53%	**0%**	**0.01%**	
lnRGDP	|ADF t-statics|	0.16	3.88	3.41	3.72	I (1)
	|Critical Value| @5%	2.95	3.55	2.96	3.55	
	P-Value	96.62%	2.40%	**1.75%**	**3.45%**	
LnFDI	|ADF t-statics|	2.62	2.76	6.61	6.54	I (1)
	|Critical Value| @5%	2.95	3.55	2.96	3.56	
	P-Value	9.9%	94%	**0%**	**0%**	

Source: Author analysis based on World Bank

The table 2 above indicates that all variables, lnEE, lnRGDP, lnFx, lnI, lnFDI, and lnDC, are non-stationary at their real levels but stay the same after the first difference. This outcome suggests that there is an order one or two integration of these variables, denoted as I(1) and I(2). Specifically, lnRGDP, lnI, lnFDI, and lnDC achieve stationarity at the first difference, as their p-values are below 5% and their Augmented Dickey-Fuller test statistics exceed the results of critical at the 5 percent significance level. lnDC and lnEEare also stationary at the first difference, with p-values of 0% for the intercept and 0.01% for the trend and intercept, both below 5%.

3.3. Lag Selection Criteria

As theory suggests, the lowest AIC, HQ, or SBC suggests, or with few values of inaccuracy result corresponds good. Here, we use AIC to the model to select an appropriate number of lags. The results of selection lag criteria under the Vector Autoregressive (VAR) model from table 3 indicate that the second lag is the maximum lag for our model of ARDL. This is because the value of AIC at lag 2, which is 0.58, is lower than the AIC values at lag 1, which is 0.31.

Table 3Result of VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC.	SC	HQ
0	-101.4038	NA	0.000156	8.261832	8.552162	8.345436
1	37.85661	203.5345*	6.01E-08	0.318722	2.351032*	0.903954
2	85.57653	47.71992	4.06e-08*	-0.582810*	3.19148	0.504049*

Source: Author analysis

3.4. Model Estimation

Once a long-run association between the variables is identified, the ARDL model proceeds to estimate the long-run coefficients. In this stage of regression analysis, the results of the endogenous variables are predicted based on the independent variables. From figure 3; the regression graph results for the model ARDL are (1, 2, 1, 1, 2, 1), which is nominated by the (AIC) Akaike Information Criterion.

Based on ARDL model estimation, table 4 indicates that real GDP is strongly influenced by its own past values, with a substantial lagged effect. Foreign Exchange Rate has a significant favorable impact on real GDP. Export earnings initially exert a negative effect on GDP, reflecting short-term adjustment costs, but have an adverse effect in the long term. Inflation is favorably and significantly connected to real GDP in both the current and lagged periods. Overall, these findings highlight the complex, time-dependent relationships between macroeconomic variables and real GDP, underscoring the need for policies that account for both immediate and delayed effects.

Table 4: Result for the Estimation of ARDL Model

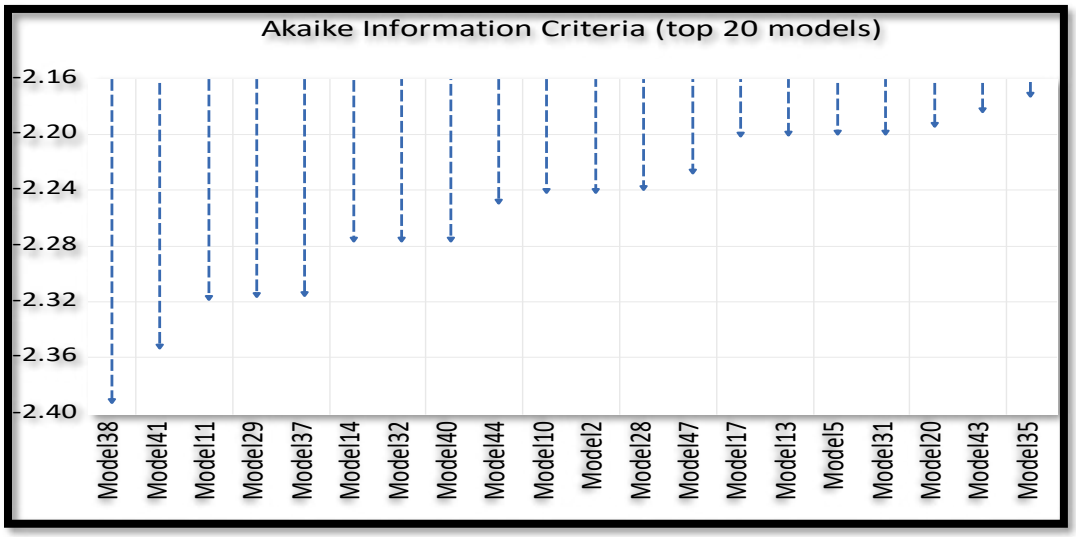
Variable	Coefficient	Std. Error	t-Statistic	Probability
LNRGDP_IN_M$ (–1)	0.891149	0.059381	15.00719	0.0000
FX	0.005975	0.002122	2.816064	0.0130
FX (–1)	–0.00120	0.001551	–0.770051	0.9396
FX (–2)	–0.023266	0.006462	–3.600453	0.0026
LNFDI_IN_$	0.052828	0.037261	1.417798	0.1767
LNFDI_IN_$ (–1)	0.054667	0.025821	2.117136	0.0514
LNEE (current)	–0.506357	0.175198	–2.890292	0.0125
LNEE (–1)	0.376028	0.167088	2.250481	0.0399
LNDC_IN_B$	–0.048849	0.049191	–0.99421	0.3344
LNDC_IN_B$ (–1)	0.014336	0.043433	0.33	0.7400
LNDC_IN_B$ (–2)	0.051511	0.059961	0.8598	0.4038
LNI	0.122597	0.029482	4.158311	0.0008
LNI (–1)	0.117447	0.026008	4.515742	0.0004
Constant (C)	2.778718	1.270479	2.187142	0.0450

Source: Estimated by the author

3.5. Model Selection Criteria

As theory predicts, the model from figure 3 with the smallest ARDL performs relatively better. Here, we chose ARDL (1, 2, 1, 1, 2, 1) because it is the smallest alternative that satisfies the theory.

Figure 3 Criteria for Selection Model



Source: Author analysis

3.6. Results for Granger Causality

Granger causality test used to determine whether previous result of one variable can predict future values of another, and whether current and future values depend on what happened before. From Table 5, the associated probability value for export earnings (EE) to Real GDP is 13.31%, which exceeds the 5% threshold. So, it is irregular to cancel the null hypothesis; instead, it is accepted, indicating that EE does not Granger-cause Real GDP. However, the corresponding probability value for Real GDP to EE is 6.39%, which is greater again than 0.05. Accordingly, the null hypothesis is accepted, which means that RGDP does not Granger-cause export earnings (EE).

Table 5 Results for the test of Granger causality

The Null Hypothesis	Obse.	F-Statistic	Probability
EE does not Granger Cause RGDP IN M$	34	2.16345	0.1331
RGDP IN M$ does not Granger Cause EE	34	3.02843	0.0639
FX does not Granger Cause RGDP IN M$	34	0.24466	0.7846
RGDP IN M$ does not Granger Cause FX	34	38.4184	7.00E-09
FX does not Granger Cause EE	34	1.78979	0.185
EE does not Granger Cause FX	34	9.06525	0.0009

Source: Author analysis

Probability value for Real GDP to foreign exchange rate is 0.13 percent, which is fewer than 5 percent. Consequently, we confidently set aside the null hypothesis and embrace the alternative hypothesis, which states that Real GDP does Granger-cause foreign exchange rate. Meanwhile, the associated probability value for Fx to Real GDP is 78.46%, which exceeds the 5 percent threshold. We conclude that the evidence supports the null hypothesis, indicating that Fx does not have a predictive effect on RGDP.

The probability value for the foreign export earnings to exchange rate is 0.09%, which is less than 5%. Thus, we reject the null hypothesis and accept the alternative hypothesis, which states that export earnings do Granger-cause foreign exchange rate. However, foreign exchange rate does not grander cause export earnings since probability value is 18.5%

Typically, switch in actual gross domestic product set the pace for shifts in the foreign exchange rate. The analysis of Ethiopian data from 1990 to 2025 found no directional causality between export earnings and real GDP; neither exports drive economic growth nor does GDP growth significantly influence exports. This is because of structural constraints, weak value addition, dependent on external shocks from the world market and policy barriers.

3.7. Long run Relationship

I. Long Run test

The study identifies the export earning as the most crucial variable influencing real gross domestic product (RGDP) in the employed model, revealing that a one-unit increase in the export earnings, holding other factors constant, results in a 0.006-unit rise in real GDP. Furthermore, from table 6 export earning is shown to have a statistically remarkable, favorable effect on real GDP, with a one-unit rise in export earning tends to a 0.51 percent rise in real GDP, ceteris paribus. Additionally, the long-run analysis indicates that the domestic consumption has a substantial advantageous impact on Ethiopia's real GDP; a 1 percent rise in domestic utilization will increase real GDP by 2.15 percent. As expected from table 6, the variable expected to explain real GDP in this model was domestic consumption. When domestic consumption increases by one-unit, real gross domestic product rise by 0.0215 units, all other factors constant.

This study reveals that the exchange rate level, our central focus, exerts a clear and meaningful boost on real GDP. When all else remains unchanged, a one-unit improvement in the exchange rate will bringa change in real GDP by 0.006 units. But, the second lag of foreign exchange has a negative influence on the net domestic product in real terms.

Table 6Results from ARDL Long Run and result of Bounds Test

Variables	Coefficient	Std. Error.	t-Statistic	Prob.
C	2.778718	1.270479	2.187142	0.0450
LNRGDP IN M$(-1)	-0.10885	0.059381	-1.8338	0.0867
FX(-1)	-0.01741	0.014729	-1.18284	0.2507
LNFDI IN $(-1)	-0.1071	0.022936	-4.67025	0.0002
LNEE(-1)	-0.130329	0.107191	1.216094	0.2380
LNDC IN BS(-1)	0.106998	0.049235	2.173302	0.0462
LNI(-1)	0.009409	0.06584	0.142934	0.8875
D(FX)	0.005975	0.002212	2.701678	0.0130
D(FX(-1))	0.023266	0.009221	2.524301	0.0194
D(LNFDI IN $)	0.052826	0.037251	1.417796	0.1707
D(LNEE)	-0.506357	0.167168	3.029621	0.0060
D(LNDC IN BS)	0.021514	0.002745	7.837644	0.0000
D(LNDC IN BS(-1))	0.005452	0.000519	10.50704	0.0000
D(LNI)	0.122597	0.029482	4.158311	0.0008

Source: Author analysis

If inflation increases by 1 percent, real GDP rises by 17.1447 %. Additionally, when domestic consumption grow by 1-unit, real GDP improves by 0.0215 units. In addition, a one-unit increase in one-year lag of Inflation will result in an increase 17.14 percent.

According to the long-run model, net inflows of foreign direct investment harm export earnings. This is because there are situations in which FDI may not lead to increased export earnings. For example, if foreign investors focus on producing goods and services for the domestic market rather than for export, it may not lead to increased export earnings. In addition, if foreign investors introduce technologies and management practices that do not align with the needs of the export market, this may not lead to increased export earnings.

Generally, Export earnings are closely linked to the six other explanatory variables over the long term. real GDP, exchange rate, export earning, domestic consumption, Inflation, and foreign direct investment).

II. Bound Test

A key method for uncovering co-integration and causality within the ARDL framework is the Bound Test for Co-integration. Introduced by Pesaran et al. in 2001, this versatile approach works no matter the integration order of the variables, whether they are I(0), I(1), or a mix of both. Table 7 reveals that the F-statistic of 13.14577 surpasses the upper bound at the 1% significance level. This finding confirms the existence of a long-term

relationship among the variables and allows us to reject the null hypothesis of no cointegration.

Table 7 ARDL Bound Approach to Co-integration

F-bound Test		The Null Hypothesis: No levels relationship		
Test Statistics	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic K	13.145775	10%	2.08	3
		5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Source: Author analysis

3.8. Short run

After specifying the long-run model and thoroughly understanding the direction of each expository variable on the endogenous variable, the subsequent step involves estimating the coefficients of short run. Just like in the long-run model, shifts in the foreign exchange rate over the short run spark a noticeable lift in actual gross domestic product. Each one-unit rise in the foreign exchange rate from table 8 nudges real GDP upward by 0.006 units. Whether looking at short-term or long-term models, foreign direct investment consistently brings positive effects since its probability is 1.14% of real gross domestic product. Greater openness to international trade leads to increased exports. Holding other factors constant, the short-run coefficient for FDI indicates that a 1-unit increase in FDI raises real gross domestic product by 0.053 units.

Table 8 ARDL short Run Result

Variable	Coefficient	Std. Error	t-Statistic	Probability
D(FX)	0.005975	0.000987	6.051508	0.0000
D(FX(–1))	0.023266	0.002174	10.70071	0.0000
D(LNFDI_IN_$)	0.052828	0.018339	2.880618	0.0114
D(LNEE)	–0.506357	0.11511	–4.398904	0.0005
D(LNDC_IN_B$)	–0.048849	0.030383	–1.607778	0.1287
D(LNDC_IN_B$(–1))	0.051511	0.035396	1.455272	0.1662
D(LNI)	0.122597	0.017127	7.158237	0.0000
Coint. Error (-1)	–0.108851	0.00959	–11.35027	0.0000

Source: Analysis of the Author

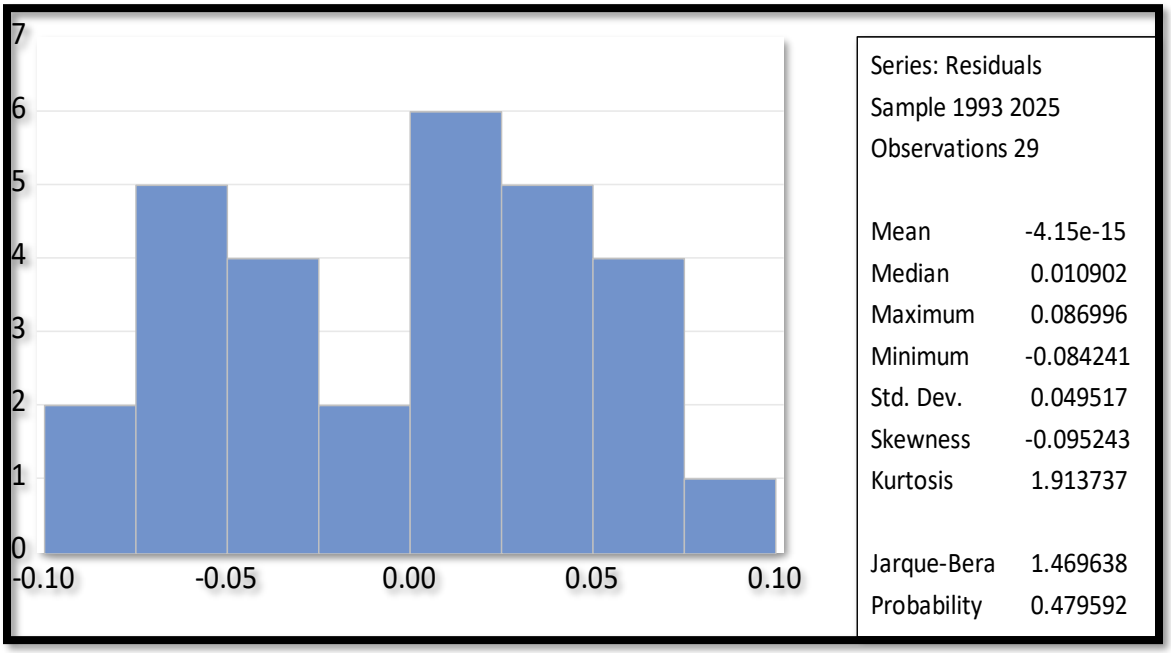
There is a direct relationship between the inflation rate and real gross domestic product; a 1% increase in inflation raises actual gross domestic product by 0% in the short run. The negative sign for the adjustment of speed, with a value of -0.10885, indicates that any drift from long-run equilibrium is steadily brought back on course.

3.9. Model Diagnostic

Diagnostic checks are essential, as residual issues may signal model inefficiency and result in biased parameter estimates.

I. Normality Test

Figure 4Results for Normality Test

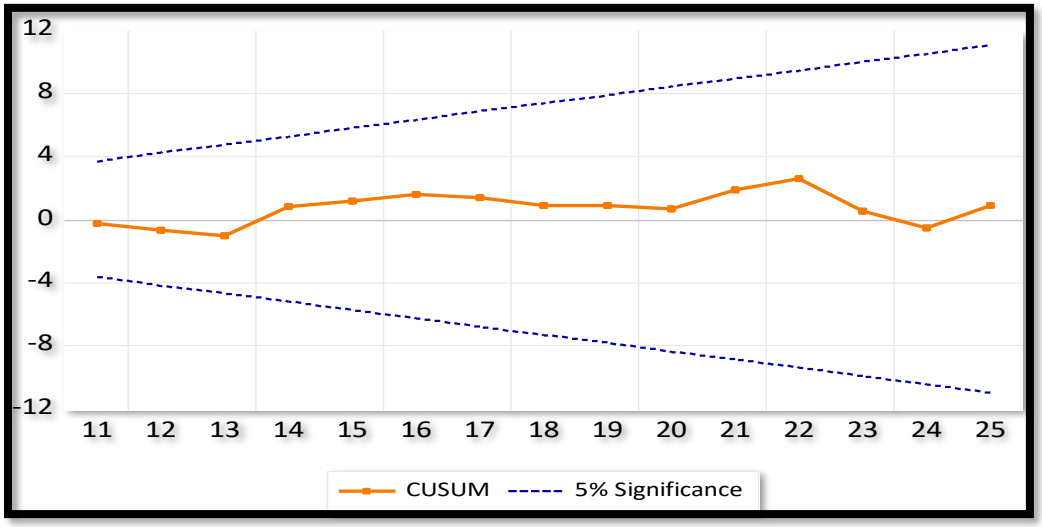


Source: Author analysis

According to statistical rules, data is considered not skewed distributed when Kurtosis is less than three, while skewness is almost zero, and the Jarque-Bera probability is above 0.5. As shown in the chart above, the skewness is way less than zero with -0.095 values, which is very good. Kurtosis is 1.91 which is below three, which is also good. Most importantly, the Jarque-Bera probability is 1.47, which was above 0.5 to confirm normality, further supports this. Therefore, the distribution of the data is normal.

II. Recursive Estimate

Figure 5 Recursive Estimate



Source: Author analysis

Beyond the usual checks for diagnostic, the CUSUM test from figure 5 was employed to assess potential structural breaks in the long-run relationship. The investigation was reassuring: the model showed no signs of instability. The cumulative sum of squares of the residuals remained within the critical lines, confirming parameter stability. As the model consistently remained within the 5 percent significance boundaries, its stability is clearly demonstrated.

4.0. Conclusion

This study examines how changes in exchange rates have affected Ethiopia's export earnings from 1990 to 2025, using the Lag model of Autoregressive Distributed (ARDL). The value indicates both short- and long-term links among the real exchange rate, export earnings, and other economic factors, including real GDP, inflation, foreign direct investment (FDI), and domestic consumption. The findings suggest that a stronger real exchange rate can boost export earnings and real GDP, while changes in FDI and inflation also play important but complex roles. The analysis further shows that export earnings and real GDP do not directly cause each other, suggesting that broader structural and policy factors influence Ethiopia's export sector.

In summary, the results show that a stable, competitive exchange rate is important for boosting exports and supporting economic development in Ethiopia. Policymakers should keep a close watch on global currency changes and use flexible exchange rate strategies to help exports stay competitive and the economy remain strong.

Based on these findings, Ethiopia should adopt a flexible, well-managed exchange rate policy to make its exports more competitive and support steady economic growth. Policymakers need to watch global currency trends and step in when needed to reduce exchange rate swings that could hurt export earnings. It is also important to broaden the range of exports by encouraging the value-added and manufacturing sectors, rather than relying solely on traditional primary goods. Bringing in more foreign investment to export-focused industries and keeping inflation under control will help improve export performance. Removing barriers like poor infrastructure, strict regulations, and weak institutions is also key. Finally, ongoing research and careful data analysis should guide policy choices so that exchange rate management supports Ethiopia's long-term goals.

Statements and Declarations

#Acknowledgement

I gratefully acknowledge Andhra University, Visakhapatnam, India, for providing invaluable academic support and a stimulating research environment throughout this study. I also extend special appreciation to my co-authors for their significant contributions, collaborative spirit, and unwavering commitment to the successful completion of this research. Their insights and teamwork have been instrumental in shaping the quality and depth of this work.

Funding

No funds were used to construct this manuscript.

Conflict of Interest

The author has no conflict of interest.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors haven't used any AI tools to write or prepare this research article.

Author Contributions

The corresponding author contributed to the conception and design of the study, data collection, statistical analysis, interpretation of results, and manuscript preparation. Co-author contributed to analysing, editing and validating of the results.

Ethics approval

The article hasn't included animal or human activity.

Data availability

The present investigation used datasets obtained from the World Bank.

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