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Macroeconomic Instabilities, Capital inflow and Manufacturing Sector Growth Nexus in Ethiopia: Evidence from ARDL Model

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Abstract

Currently, the world economy is experiencing frequent macroeconomic shocks due to both natural and anthropogenic factors, and the manufacturing sector is one of the main victims of these disturbances. The study examines the drivers of manufacturing sector growth in Ethiopia using a time series data set spanning from 1992 to 2022 and applying an ARDL model to analyze the data. The ARDL bounds test indicates the existence of a long-run relationship between manufacturing value added and the explanatory variables. Long-run ARDL estimates show that foreign direct investment (FDI), inflation, and exchange rate volatility have statistically significant long-run effects on manufacturing value added: FDI exerts a positive long-run impact, while inflation and exchange rate volatility exert negative long-run impacts. The error correction model (ECM) results further reveal that FDI, inflation, exchange rate, labor productivity, and export earnings are all statistically significant in determining manufacturing sector growth in the short run, and the error correction coefficient, estimated at -0.534, is highly significant and bears the expected negative sign, implying a very high speed of adjustment back to equilibrium. Based on these findings, the study recommends that the government revise and re-formulate fiscal and monetary policies to stabilize the macroeconomic and create a more conducive environment for attracting foreign direct investment to boost the manufacturing sector. **Keywords:** Manufacturing sector, ARDL, Capital inflow, macroeconomic instabilities

Citation: Bezabh GB, Ayalew HA, Walelign TW. *Macroeconomic Instabilities, Capital inflow and Manufacturing Sector Growth Nexus in Ethiopia: Evidence from ARDL Model*. JIST 2026. Vol 1(1): p 26–50. DOI: <https://doi.org/10.66777/w2q7r653>

1 Introduction

Currently, the issue of the drivers of manufacturing sector growth is receiving attention from researchers, policymakers, and practitioners. The world economy experiences frequent macroeconomic shocks due to natural and anthropogenic factors. The manufacturing sector is one victim of such macroeconomic disturbances. This is why researchers have focused on examining the drivers of manufacturing sector growth.

The manufacturing sector is an engine of economic growth and development [1]; however, growth and its contribution to the Ethiopian economy is in its infancy [2, 3]. The manufacturing sector contribution to GDP, employment creation, and foreign exchange earnings is very low [4]. According to the [5], Ethiopia's manufacturing sector faces serious challenges, such as macroeconomic pressure, security challenges, and exogenous shocks. The share of manufacturing as a percentage of GDP declined from 5.9 percent in 2019 to 4.4 percent in 2022, largely due to combined shocks [5].

According to [4], the main drivers of Ethiopia's manufacturing sector growth include political stability, foreign direct investment (FDI), and real exchange rate. Others reveal that lack of finance, inadequate infrastructure, access to markets, and technology-related factors affect the sustainability and growth of micro and small enterprises [6].

The Ethiopian economy in general is now facing severe macroeconomic shocks (especially exchange rate volatility, inflation, and export-earning deterioration) [7, 8, 9, 10], the majority of which are the result of policy reform measures, the COVID 19 pandemic, and internal conflicts and political unrest [11, 12, 13, 14]. Obviously, Ethiopia's manufacturing sector cannot escape these macroeconomic shocks. Studies show that the manufacturing sector is highly sensitive to inflation and exchange rate volatility [15]. To achieve structural transformation (from an agrarian economy to industrialization), the country needs to advance its manufacturing sector [16, 17].

The study is anchored in a multiple of theoretical

and empirical literature that explain the relationship among capital inflow, macroeconomic instabilities, and the performance of manufacturing sector. According to Lewis's structural transformation model, it is possible to achieve economic growth and development by transforming surplus and idle labor from the agrarian sector to the most productive industrial sector [18]. Studies by [19] reveal that the most productive and efficient way in which an economy can be transformed from a predominantly traditional to a modern sector is by increasing industrial capacity and technological innovation. The endogenous growth theory explain the relationship between foreign direct investment (FDI) and growth of manufacturing sector. According to this theory, FDI has spillover effects on the domestic manufacturing sector because it brings technological transfer, R&D, and managerial skill knowhow [20]. Several studies disclose that FDI has an effect on the growth of the manufacturing sector. Foreign direct investment plays a significant role in manufacturing capacity [4, 21, 22]. In addition, several studies reveal that export earnings drive growth in the manufacturing sector. According to [23, 24] export incentives play a positive role in improving the expansion of the manufacturing sector.

Moreover, macroeconomic stability is the key driver of the manufacturing sector expansion [25]. Macroeconomic shocks, such as inflation and exchange rate volatility, are among the challenges that hinder the growth of the manufacturing sector. According to [15, 26], inflation negatively affects the manufacturing sector growth. Another study by [27] revealed that increases in consumption tax, the real exchange rate, and economic liberalization were determinants of manufacturing sector performance. Besides a stable level of price, political stability is crucial for sustainable development of a country [28, 29]. However, Ethiopia has experienced frequent political unrest since 2016. In particular, the country was in a bloody civil war between 2020 and 2022 between the TPLF and EPRDF, which resulted in mass human and resource destruction [30]. Even now, the country is in civil war in the Amhara and Oromia regions. This civil war affected

the manufacturing, financial, and overall sectors of the economy in general [31].

According to the International Labor Organization [32], “labor productivity refers to the amount of output produced per unit of labor input.” It is one of the critical elements in the growth and development processes of a given country. Labor productivity is an important driver of the expansion of the manufacturing sector [33, 34].

Overall, previous studies predominantly focus on the cross-country effect of FDI on the manufacturing sector using panel data, ignoring the country-specific impact of capital inflows on the growth of the manufacturing sector. Moreover, there is insufficient literature on the effect of foreign direct investment and macroeconomic instabilities on the growth of the manufacturing sector in Ethiopia. Therefore, as part of an effort to achieve this transformation, we examined the main drivers of manufacturing sector growth in Ethiopia, focusing on macroeconomic instability, export performance, and FDI. A time series dataset spanning 1992 to 2022 was used to incorporate the effect of the COVID 19 pandemic and some policy reform measures taken by the current regime in the manufacturing sector. Specifically, this study focuses on (1) testing for the existence of a long-run equilibrium relationship between the growth of manufacturing value-added and its determinants, and (2) estimating the long-run and short-run effects of the determinants on manufacturing value-added (MVA).

2 Methods and materials

2.1 Data type and sources

The type of data employed for this study was a time-series dataset that covers the years–1992-2022, collected from World Development Indicators. The variables collected from the World Development Indicators include manufacturing value-added (MVA), foreign direct investment (FDI), political stability (PS), inflation (INF), exchange rate (ER), labor productivity (LP), and export earnings (EXP). Data were collected in tabular form using an Excel spreadsheet.

2.2 Method of data analysis

The ARDL model was used to examine the drivers of the manufacturing sector expansion. According to [35, 36], the autoregressive distributed lag (ARDL) approach is preferred over other approaches to co-integration because the short- and long-run relationships can be estimated simultaneously.

2.3 Specification of the ARDL Model

The model specification for the determinants of growth in the manufacturing industry is formulated as follows [35].

$$Y_{it} = \alpha + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + \beta_5 X_{5t} + \beta_6 X_{6t} + U_{it} \quad (1)$$

Y_{it} is the dependent variable (growth of manufacturing industry)

X_1, X_2, X_3, X_4, X_5 and X_6 are explanatory variables

$\alpha, \beta_1 \dots \beta_6$ are parameters and U_{it} is the error term (disturbance term).

$$MVA_t = \alpha + \beta_1 FDI_t + \beta_2 PS_t + \beta_3 INF_t + \beta_4 ER_t + \beta_5 LP_t + \beta_6 EXP_t + U_{it} \quad (2)$$

Where MVA_t is manufacturing value added at time t

FDI_t is foreign direct investment net inflow at time t

PS_t is political stability at time t

INF_t is annual inflation rate at time t

ER_t is exchange rate at time t

EXP_t is export of manufacturing goods

LP_t is labor productivity at time t

The equation for the short- and long-run relationships in the ARDL model is formulated as follows:

$$\begin{aligned}
 \Delta MVA_t = & \alpha + \sum_{i=1}^p \beta_1 \Delta MVA_{t-1} + \sum_{i=0}^p \beta_2 \Delta FDI_{t-1} \\
 & + \sum_{i=0}^p \beta_3 \Delta PS_{t-1} + \sum_{i=0}^p \beta_4 \Delta INF_{t-1} \\
 & + \sum_{i=0}^p \beta_5 \Delta ER_{t-1} + \sum_{i=0}^p \beta_6 \Delta LP_{t-1} \\
 & + \sum_{i=0}^p \beta_7 \Delta EXP_{t-1} + \beta_8 MVA_{t-1} + \beta_9 FDI_{t-1} \\
 & + \beta_{10} PS_{t-1} + \beta_{11} INF_{t-1} + \beta_{12} ER_{t-1} \\
 & + \beta_{13} LP_{t-1} + \beta_{14} EXP_{t-1} + \varepsilon ct + U_t
 \end{aligned}
 \tag{3}$$

In the equation above, Δ represents first differ-

ence. $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ and β_7 show the short-run dynamics of the model, and $\beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}$ and β_{14} indicate the long-run associations, where P denotes the number of lag lengths. In this regard, the null hypothesis that states

$$H_0: \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = \beta_{12} = \beta_{13} = \beta_{14} = 0$$

were tested against the alternative

$$H_a: \beta_8 \neq \beta_9 \neq \beta_{10} \neq \beta_{11} \neq \beta_{12} \neq \beta_{13} \neq \beta_{14} \neq 0$$

2.4 Definition and measurement of study of variables

Table 1 summarizes the definitions, measurements and sources of the data.

Table 1. Definitions of variables

Variables	Measurement(Definitions)	Expected sign	Data sources
Manufacturing value added(MVA _t)	Value added of manufacturing industry (% of GDP)	Dependent variable	World Bank (World development Indicators)
Foreign direct investment inflow(FDI _t)	Net inflow of foreign direct investment (% of GDP)	+ve	World Bank (World development Indicators)
Political instability (PSt)	violence/terrorism: measured in number of sources	-ve	World Bank (World development Indicators)
Inflation (INF _t)	Annual inflation rate, consumer price index (in %)	-ve	World Bank (World development Indicators)
Exchange rate fluctuation (ERT)	Official exchange rate measured per USD	-ve	World Bank (World development Indicators)
Labor productivity (LP _t)	Labor productivity is measured output per unit of labor	+ve	World Bank (World development Indicators)
Export of goods and services (EXP _t)	Amount of export of goods and services (as % of GDP).	+ve	World Bank (World development Indicators)

3 Results

3.1 Econometric Analysis

3.1.1 Stationarity Test

4.1. Econometric Analysis

4.1.1. Stationarity Test

Before conducting ARDL estimation, it is better to first check the stationarity of the dataset used in this study. Stationary time-series data are crucial for accurate modeling and forecasting in statistical analyses. Basically, stationarity means that a time series has a constant mean and variance over time. [37].

Testing stationarity enables us to select appropri-

ate time-series models. The most commonly used stationary test method is the Augmented Dickey Fuller (ADF). In this model, the null hypothesis, which states that time-series data are non-stationary, is tested against the alternative hypothesis, which states that the time series are stationary.

$$H_0: \text{Time series is non-stationary}$$

$$H_1: \text{Time series is stationary.}$$

Rejecting the null hypothesis and accepting the alternative means that the dataset is stationary, which implies that the mean and variance are constant over time and accurate forecasting can be made.

Table 2. ADF Test Result

Variable Name	At level	At 1st difference	Order of integration						
	Without trend	With trend	Without trend	With trend					
	5% C. values	T-statistic	5% c. values	T-statistic	5% c. values	T-statistic	5% c. values	T-statistic	
lnMVA	-2.986	-2.575	-3.580	-2.626	-2.989	-5.315	-3.584	-5.351	I(1)
FDI	-2.986	-2.724	-3.580	-2.788	-2.989	-6.374	-3.584	-6.302	I(1)
INF	-2.986	-2.934	-3.580	-4.018	-2.989	-7.083	-3.584	-7.009	I(0)
PS	-2.986	-1.900	-3.580	-2.531	-2.989	-9.124	-3.584	-9.332	I(1)
lnER	-2.986	-1.794	-3.580	-4.381	-2.989	-9.049	-3.584	-8.878	I(0)
lnLP	-2.986	-0.921	-3.580	-3.597	-2.989	-8.650	-3.584	-8.551	I(0)
lnEXP	-2.986	-0.291	-3.580	-2.363	-2.989	-6.297	-3.584	-6.468	I(1)

Source: own computation using Stata 15

3.1.2 Determination of the lag lengths of the variables

As indicated in Table 2, the variables are stationary with a mixed nature, which means that they are stationary at level and stationary at the first difference. In this case, the ARDL model is appropriate for estimating the parameters.

Various methods can be used to determine the lag lengths of variables. The most common method for determining the maximum lag length is the Akaike information criterion (AIC) [35]. The AIC is preferable to other methods because of its low complexity and balance for model fit. The lag length of each variable is indicated in Table 3 as follows:

Table 3. Determination of maximum Lag Length of the variables

Variable	Lag Length from AIC
lnMVA	2
FDI	2
PS	2
INF	1
lnER	1
lnLP	2
lnEXP	2

Source: own computation using Stata 15

3.1.3 ARDL Bounds Test for Co-integration

As it is shown in Table 3, the maximum lag length for lnMVA, FDI, PS, lnLP and lnEXP is 2 whereas for INF and lnER is 1.

4.1.3. ARDL Bounds Test for Co-integration

The bounds testing procedure is a powerful statistical tool in the estimation of level relationships

when the underlying property of the time series is entirely I(0), entirely I(1), or jointly co-integrated [35].

The result of the ARDL Bounds Test for the long-run co-integration test using Pesaran/Shin/Smith's (2001) ARDL bounds test is given in Table 4.

Table 4. The result of bounds co-integration Test

F-stat.	8.214	10%	5%	1%				
		Lower	upper	Lower	upper	Lower	upper	
		2.12	3.23	2.45	3.61	3.15	4.43	

Source: own computation using Stata 15

3.1.4 Long run and short run Results

Number of observations: 31

4.1.4. Long run and short run Results

R-squared = 0.9148

Log likelihood = 55.540823

Table 5. Long run Estimation Result

Variable	Coefficients	Stt. Error	t-statistic	P> t
dFDI	.0907907	.0289184	3.14	0.011**
dPS	-.0214952	.0390127	-0.55	0.594
INF	-.0135389	.006142	-2.20	0.052***
LnER	-.6509958	.2844405	-2.29	0.045**
dLnLP	.3186426	.5213353	0.61	0.555
dlnEXP	-.7283523	.4413146	-1.65	0.130

, *implies the variable is significant at 5% and 10% level of significance respectively. Source: own computation using Stata 15.

Interpretation: As it is indicated in Table 5, about 91% of the total variation in the manufacturing value added is explained by explanatory variables (FDI, inflation, exchange rate volatility, labor productivity, political instability, and export performance). The P-values show that FDI, inflation, and exchange rate volatility have a significant long-run impact on the growth of manufacturing value added. FDI has a positive and significant long-run impact on manufacturing value-added (% of GDP) at the 5 percent level of significance. Whereas Inflation and log of official exchange rate fluctuations have a negative and statistically significant long-run impact on the growth of manufacturing value added as % GDP

at 10% and 5% levels of significance, respectively.

dFDI: a 1 percent increase in the first difference of FDI results in a 0.09 percent increase in manufacturing value-added as a percentage of GDP.

Inflation: A one percent increase in inflation leads to a 0.0133 percent decline in manufacturing value added as a percentage of GDP.

lnER: A one percent depreciation in the country's official exchange rate results in a 0.65 percent reduction in the value of manufacturing value added.

Table 6: Short Run estimation result

Number of observations: 31

R-squared = 0.9148

Log likelihood = 55.540823

Table 6. Short Run estimation result

Variable	Coefficients	St. Error	t-statistic	P> t
LD(FDI)	.0405302	.0213738	1.90	0.087***
PS	-.0228032	.0162503	-1.40	0.191
D1(INF)	-.007119	.0016418	-4.34	0.001*
D1(LnER)	-.3164322	.1091468	-2.90	0.016**
LD(LnLP)	.5945569	.2242613	2.65	0.024**
LD(lnEXP)	.4214529	.1417455	2.97	0.014**
_cons	2.390377	.717108	3.33	0.008*
ECM term (-)	-.5342189	.1472377	-3.63	0.005*

*, **, *** implies the variable is significant at 1%, 5% and 10% level of significance respectively. Source: Author's computation using Stata 15.

As indicated in Table 6, all the variables except political stability are statistically significant and have a short-run effect on the log of manufacturing value-added (as % of GDP).

dFDI: The short-run dynamic results indicate

that the first difference in FDI has a positive and significant impact on manufacturing value-added in the short run. Other things being constant, a one percent increase in FDI as a percentage of GDP leads to a 4% increase in the log of manufacturing value added.

D1(INF): Inflation at first difference is statistically significant and has a negative short-run effect

on manufacturing value added. Other things being constant, a one percent increase in inflation leads to a 0.07 percent reduction in the log of manufacturing value-added as a percentage of GDP.

D1(LnER): The log of exchange rate fluctuation at the first difference is statistically significant and has a negative short-run effect on manufacturing value-added. Other things being constant, a one percent increase in the log of exchange rate fluctuation leads to a 3 percent reduction in the log of manufacturing value-added as a percentage of GDP in the short run.

LD(LnLP): Labor productivity measured as output per unit of labor is statistically significant at the 5% level of significance. Other things being

constant, a one percent increase in labor productivity results in 59% increase in manufacturing value added as a percentage of GDP in the short run.

LD(LnEXP): Export earnings measured as a percentage of GDP are statistically significant at 5% level of significance. Other things being constant, a one percent increase in export earnings results in a 42% increase in manufacturing value added as a percentage of GDP in the short run.

ECT: The error correction coefficient estimated at -0.534 is highly significant and has the correct negative sign. This implies that there is a very high speed of adjustment to the equilibrium.

3.1.5 The result of Diagnostic Tests

4.1.5. The result of Diagnostic Tests

Table 7. Diagnostic Test Results

Diagnostic Tests	Tests used	Result	Decision
Serial correlation	BG Test	P=0.059 (Chi2 value > 5% P value); accept null hypothesis	No serial correlation
Heteroscedasticity	BPG test	Chi 2= 0.2568 (which is well above the p-value of 0.05)	Accept the null hypothesis and conclude that no heteroscedasticity problem.
Normality	Jarque-Bera Test	chi2 =0.86 (which is well above the p-value of 0.05)	The data is normally distributed.

Source: own computation using Stata 15

As shown in Table 7, the serial correlation test using the BG Test showed that there was no serial correlation. This implies that the model is well-specified and that the residuals behave like white noise (i.e., random, uncorrelated errors).

4 Discussion

The assumption of normality was performed using the Jarque-Bera Test. As is clearly shown in Table 7, the Chi2 value of the Jarque-Bera test is 0.86, which is well above the 5% significance level. In this case, the null hypothesis, which states that residual terms are normally distributed, is accepted.

Discussion

The results reveal that foreign capital inflows (FDI) and macroeconomic instabilities (inflation, exchange rate fluctuation, labor productivity, and export performance) have a significant effect on the growth of manufacturing value-added in Ethiopia.

FDI boosts the Ethiopian manufacturing sector through technological transfer, sharing managerial skills, and creating a competitive environment for domestic producers. This result is similar to the findings of previous studies by [39, 40, 41, 42] on the relationship between the manufacturing sector and foreign direct investment in Nigeria. This similarity may be attributed to several reasons. First, both countries are located in the same region, and their levels of development and economic activity do not vary significantly. Moreover, Nigeria and Ethiopia are among the top three highest FDI recipient African countries [43]. Another study by [44, 45] also indicated that FDI has a positive effect on the growth of the manufacturing sector in countries. However, studies have also revealed the negative effect of FDI on the growth of the domestic manufacturing sector owing to its huge propensity to import production inputs from abroad [46, 47].

Therefore, this study provides evidence that capital inflow leads to the growth of the manufacturing sector.

This study revealed that macroeconomic instabilities are obstacles to the growth of the manufacturing sector. Both inflation and exchange rate volatility hinder the growth of Ethiopia's manufacturing sector. The findings indicate that inflation has led to a decrease in Ethiopia's manufacturing sector productivity because of the increased cost of inputs and a lack of demand for manufactured goods. In addition, inflation affects investors' decisions because they are uncertain about the future costs of inputs and product prices. This result supports the findings of [26, 48]. In contrast, some studies argue that inflation has a positive impact on the manufacturing sector's performance. [49]. This finding implies that the real impact of inflation on the growth of the manufacturing sector is inconclusive. In this study, we have attempted to add more literature on this topic. In the Ethiopian context, studies have examined the effect of inflation on economic growth [50, 51, 52]. However, there is a limited number of literature on the nexus between inflation and the growth of the manufacturing sector.

5 Conclusions

Labor productivity and export earnings have a significant and positive effect on the growth of Ethiopia's manufacturing sector. An increase in labor productivity is associated with the efficiency of input usage. This is possible through the specialization and division of labor [59]. Export earnings enhance the growth of the manufacturing sector because they enable firms to import machinery, technologies, and other capital goods.

6. Conclusions

This study examines the nexus between macroeconomic instability, FDI, export performance, and the growth of the manufacturing sector in Ethiopia. In addition, the long-run trends between the growth of the manufacturing sector and the explanatory variables were tested.

ARDL and ECM models were used to empirically investigate the drivers of growth in the manu-

facturing sector. Before conducting the ARDL and ECM estimations, common time-series diagnostic tests have been conducted, such as serial correlation, heteroscedasticity, and normality tests. The data fulfilled and passed all diagnostic tests. In addition, time-series unit root tests were conducted using the ADF test.

The ARDL bounds co-integration test revealed that there is a long-run relationship between manufacturing value added and its determinants. The results further suggest that both ARDL and ECM models are appropriate for estimating the long-run and short-run effects of explanatory variables on the growth of manufacturing value-added.

6 Policy Implications

The error correction coefficient (ECT) was found to be -0.534, which is highly significant and has the correct negative sign. This implies that there is a very high speed of adjustment to the equilibrium.

Policy Implications

Currently, the Ethiopian economy is experiencing macroeconomic shocks, internal instabilities, and a lack of capital inflows. As one sector of the economy, the manufacturing sector is affected by all these pressures. Therefore, the Government of Ethiopia (GoE) should attract foreign direct investment to boost manufacturing value-added through capital inflow, technology transfer, worker skill development, job creation, improved infrastructure, and increased competition. The government should have an open-door policy for foreign investors and create a conducive business environment, especially for security and bureaucracy. Policymakers should manage inflation and exchange rates by reformulating a country's fiscal and monetary policies. The government should prioritize and support the productivity of sectors (especially manufacturing firms) rather than invest in luxurious recreational projects. The continuous depreciation of the birr hurts the manufacturing sector. Therefore, it is appropriate to set the exchange rate to an optimal level.

Disclosure statement

Researchers recommend further studies on the sector-specific impacts of FDI in Ethiopia using time-series analysis.

Funding statement

The authors reported no potential conflict of interest.

Data Availability Statement

The data will be available for review from the corresponding author when requested.

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