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Research Article

The Inflation Dynamics across Regimes and Its Effect on Poverty in Ethiopia: VAR and ARDL Approach

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ABSTRACT

The purpose of this paper was to examine the inflation dynamics across regimes and its effect on poverty in Ethiopia for the past 55 years (that is, from 1966 to 2021). The result showed that a 1% increase in broad money supply, real GDP, government expenditure, external debt, gas oil price and corruption index will increase INF significantly in the long run. result of the short-run model revealed that broad money supply, real gross domestic product, interest rate, government expenditure, budget deficit, external debt, gas oil price and corruption index were found to be significant variables in explaining the variation of inflation in the short-run. The analysis of inflation trend across regimes indicated that in comparison, the highest inflation was registered in 2008 during the EPRDF regime. Unlike the others, during the Prosperity Party (PP) regime, inflation keeps increasing. The result also shows there is Pair-wise causality between inflation and poverty. That is, inflation rate Granger cause poverty and also poverty Granger cause inflation rate.

Keywords: Inflation, Poverty, Ethiopia, VAR, ARDL

1.1. Introduction

In recent decades, inflation has become a burning issue in Ethiopia since 2005. Before 2005, high annual average inflation was recorded only during 1984/85 which is 18 percent because of drought, 21 percent in 1991/92 at the peak of war with Eritrea, and again 16 percent during the 2003 drought. However, after 2005 the rate of inflation continuously remained to be double digit. Specially, currently, the rate of inflation has become a head ache for most Ethiopians (NBE, 2015). The rise in inflation rates in Ethiopia hampers large number of urban households and increase poverty and hunger in all corners of the country. The living standard of urban dweller has been adversely affected by inflation in Ethiopia (World Bank, 2021).

The living standard of urban dweller may be adversely affected by inflation and with the recent increase in inflation, it was estimated that more than 15 million people of Ethiopia may be affected by famine in the country that was already the victim of drought and Coved-19 related economic stagnation (World Bank, 2021). The recent double digit increase in inflation may have its own contribution to the spiking poverty levels both in urban and local areas of the country.

Observing the above statistics and the rise in inflation in Ethiopia, it is plausible to study the determinants of inflation across regimes and its possible impact on poverty in Ethiopia. The research will attempt to explore the impact of inflation on poor, whether inflation makes poor people poorer.

Nonetheless, few studies, if any, attempt to identify the relative importance of the factors driving inflation and its impact on poverty. For example Global Agricultural Information Network, GAIN (2022) pointed out some of the major factors of food and nonfood inflation and its impact on poverty. Similarly, few studies from abroad like Talukdar (2012) who studied the effect of inflation on poverty in developing countries only focused on the effect of food and nonfood inflation on poverty. Cardoso (1992) focused on the nature of inflation tax and the extent of impact on those individuals below the poverty line. Ravallion (1998) examined only the effect of food prices and real wage and its impact on poverty in India.

However, as far as the knowledge of the researcher, there are no studies which try to characterize the rate of inflation across regimes and its effect on poverty. Different regimes have different political and economic policies; hence, the rate of inflation and its associated factors are expected to vary from regime to regime. Besides, this study used data from

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1966/67 to 2021/22 which might add more information to the currently existing situation related to inflation. Therefore, this study examined the dynamics of inflation across regimes and its effect on poverty, with comparative analysis. This research was found out answers to the following basic questions.

1. What kind of trend do inflation has across regimes?
2. What are the major factors that determine the rate of inflation?
3. What is the effect of inflation on poverty?

1.2. Objectives of the Study

The general objective of this research was to characterize the feature of inflation across regimes in Ethiopia as well as to show its effect on poverty Specific objectives

1. To make trend analysis of inflation across regimes.
2. To identify the major factors that determines inflation.
3. To analyze the effect of inflation on poverty.

1.3. Conceptual Framework

Considering the inflation dynamics in Ethiopia, the conceptual framework of inflation dynamics across regimes and its impact on poverty can be illustrated as follows.

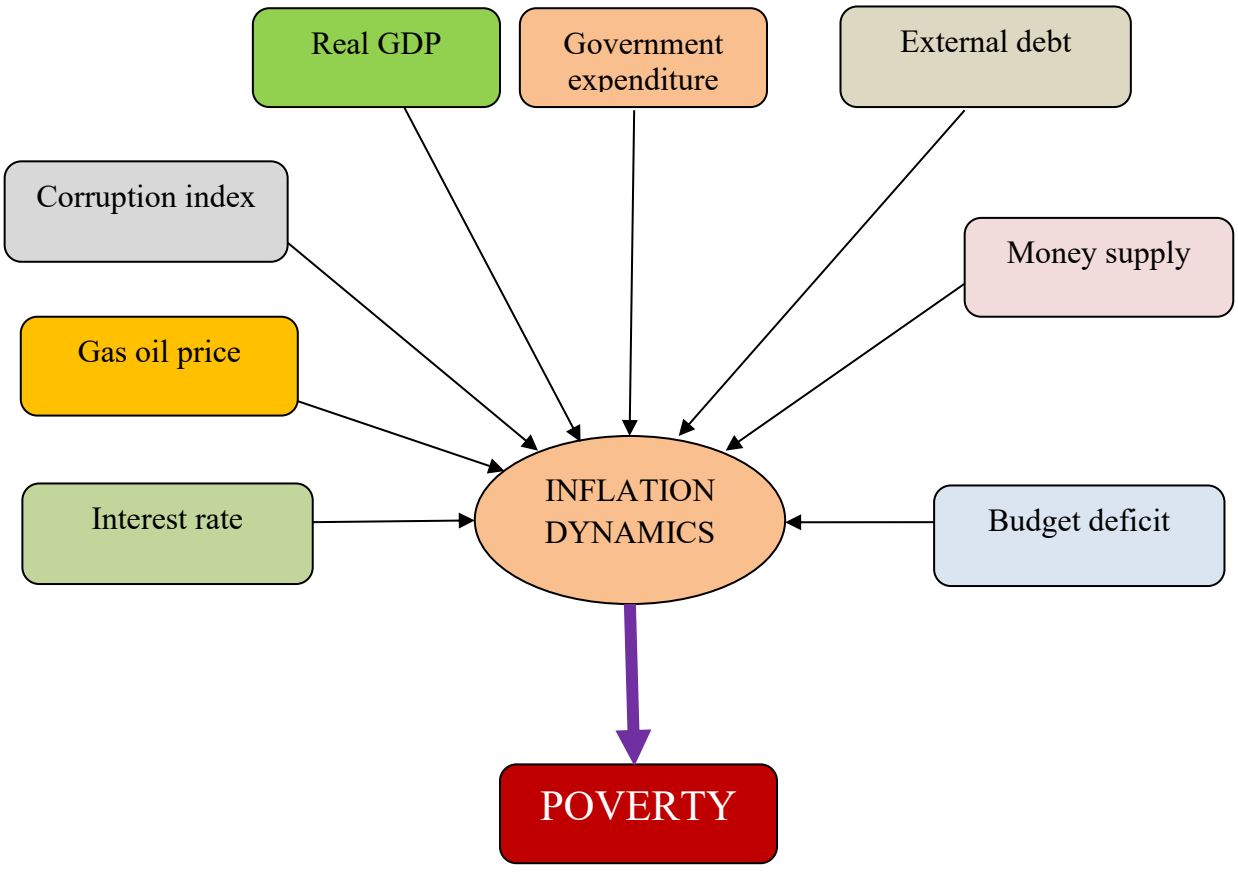

Figure 1: Conceptual framework of inflation dynamics

2 Methodology

2.1. Methods of Data Analysis

After the required secondary data were collected, the researcher used both descriptive and econometric analysis to determine inflation dynamic and its impact on poverty in Ethiopia. The descriptive analysis involved percentage to

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determine trend analysis inflation rate. The econometrics analysis involves all the relevant time series econometrics models. These included Autoregressive Distributed Lag (ARDL) model (to identify factors affecting inflation rate across time) and Vector Autoregressive (VAR) model for showing the effect of inflation on poverty. These models are presented in detail in the following sections. Before estimation of these model relevant time series tests (unit root and co-integration tests) tests was carried out to secure the validity of estimation results.

2.2 Model specification

i. The ARDL Model

[1]The ARDL co-integration technique is used in determining the long run relationship between series with different order of integration (Pesaran and Shin, 1999 and Pesaran et al, 2001). The re-parameterized result gives the short run dynamics and long run relationship of the considered variables.

$$\Delta INF_t = \alpha_0 + \sum_{i=1}^{\rho} \beta_0 \Delta INF_{t-i} + \sum_{i=1}^{\rho} \beta_1 \Delta RGDP_{t-i} + \sum_{i=1}^{\rho} \beta_2 \Delta BM2_{t-i} + \sum_{i=1}^{\rho} \beta_4 \Delta BD_{t-i} + \sum_{i=1}^{\rho} \beta_3 \Delta GXP_{t-i} + \sum_{i=1}^{\rho} \beta_5 \Delta GOP_{t-i} + \sum_{i=1}^{\rho} \beta_6 \Delta XD_{t-i} + \sum_{i=1}^{\rho} \beta_7 \Delta IR_{t-i} +$$

$$\sum_{i=1}^{\rho} \beta_8 \Delta CI_{t-i} + \emptyset_0 INF_{t-i} + \emptyset_1 RGDP_{t-i} + \emptyset_2 BM2_{t-i} + \emptyset_3 GXP_{t-i} +$$

$$\emptyset_4 BD_{t-i} + \emptyset_5 GOP_{t-i} + \emptyset_6 XD_{t-i} + \emptyset_7 IR_{t-i} + \emptyset_8 CI_{t-i} \quad (2.1)$$

Where INF = inflation, RGDP = real gross domestic product, BM2 = broad money supply, GXP = government expenditure, BD = budget deficit, GOP = gas oil price, XD = external debt, IR = interest rate and CI = corruption index.

ii VAR model for measuring the effect of inflation on poverty

The model was based on the neo-classical theory of poverty using Vector Auto Regressive (VAR) that was adapted from the work of Granville and Mallick (2006) and restricted to incorporate the effect of inflation on poverty incidence in Ethiopia.

$$POV_t = \alpha_0 + \sum_{j=1}^{m} \alpha_{1j} POV_{i-j} + \sum_{j=1}^{m} \alpha_{2j} INF_{i-j} + U_{1t} \quad (2.2)$$

$$INF_t = \beta_0 + \sum_{j=1}^{m} \beta_{1j} POV_{i-j} + \sum_{j=1}^{m} \beta_{2j} INF_{i-j} + U_{2t} \quad (2.3)$$

Where: POV represents poverty level and INF stands for inflation rate.

α_0, & β_0 are constant parameters,

$\alpha_{1j}, \alpha_{1j}, \beta_{1j}$ & β_{2j} are coefficients to be estimated,

U_{1t} & U_{2t} are the Gaussian white noise that are independently and identically distributed random variable.

Table 1: Description of the variables

Dependent variable	Description		Type	
Rate of inflation	Rate of inflation measured by the percentage change in consumer price index		Continuous variable	
Poverty	The level of poverty measured in term of percentage of real total consumption expenditure per adult equivalence		Continuous variable	
Explanatory variables	Description	Type	Hypothetical relationship with dependent variable	Reference
real GDP	Real output of the economy	continuous	Negative	

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government expenditure	Government spending for the economy	continuous	Positive	
corruption index	Level of corruption measured using index	continuous	Positive	
Broad money supply	Money supply measured in broad money	continuous	Positive	
Interest rate	Rate of interest declared by NBE	continuous	Negative	
gas oil price	Price of fuel imported from abroad	continuous	Positive	
external debt	Foreign debt received from abroad	continuous	Positive	
budget deficit	The extent of excess of expenditure over the revenue generated	continuous	Negative	

3 Results and Discussions

3.1 Trend of inflation across regimes

Examination of the historical development of inflation across regimes in Ethiopia over the past six decades has gone through diverse phases. These phases are associated to the underplaying changes in outgoing and incoming regimes' economic policies and reaction in economic agents. According to the World Bank (2021), before 2003, except in the years of supply shocks and war, Ethiopia was characterized as a low inflation country with a single digit inflation rate level. For instance, from 1966 – 1973 the final eight years of the Emperor regime, the inflation averaged 1.8%. Nevertheless, during those periods, the highest inflation was recorded as 10.1% in 1970 by the time when the power of the Emperor regime was about to slip away by the military coup behind the scene. From 1974-1991 during the military regime known as DERG, the inflation averaged 7.5%. In this period, the highest inflation of 35.7% was registered in 1991, the year which marks the end of the civil war and the incumbents the Ethiopian People's Revolutionary Democratic Front took power.

From 1992-2017 during the Ethiopian People's Revolutionary Democratic Front (EPRDF) regime, the average inflation until 2003 was 9.4%, from 2004 to 2014, however, inflation started to rise rapidly and average inflation in this period rose to 17.7% with the highest inflation rate of 44.4% registered in 2008. As it was indicated by Durevall *et al.* (2013), factors attributed to this high inflation during this period include accommodating monetary policy, agricultural supply shock and imported inflation due to the rise in international prices. From 2018 to 2021 during the Prosperity Party (PP) administration, inflation rate rose even further and it averaged 19.2%. In this period also, the highest inflation of 26.8% was registered in 2021.

The following Table and the figures illustrated below it show the average inflation rate across regimes and the years in which inflation reached its highest level during each regime. The analysis was made using data indicated in Appendix D.

Table 2: Average inflation across regimes in Ethiopia

Year	Average inflation rate (In %)	Highest (In %)
From 1966-1973	1.82	10.122 in 1970
From 1974-1991	7.54	35.7 in 1991
From 1992-2017	9.35	44.4 in 2008
From 2018-2021	19.2	26.83 in 2021

Source: Author's own calculation

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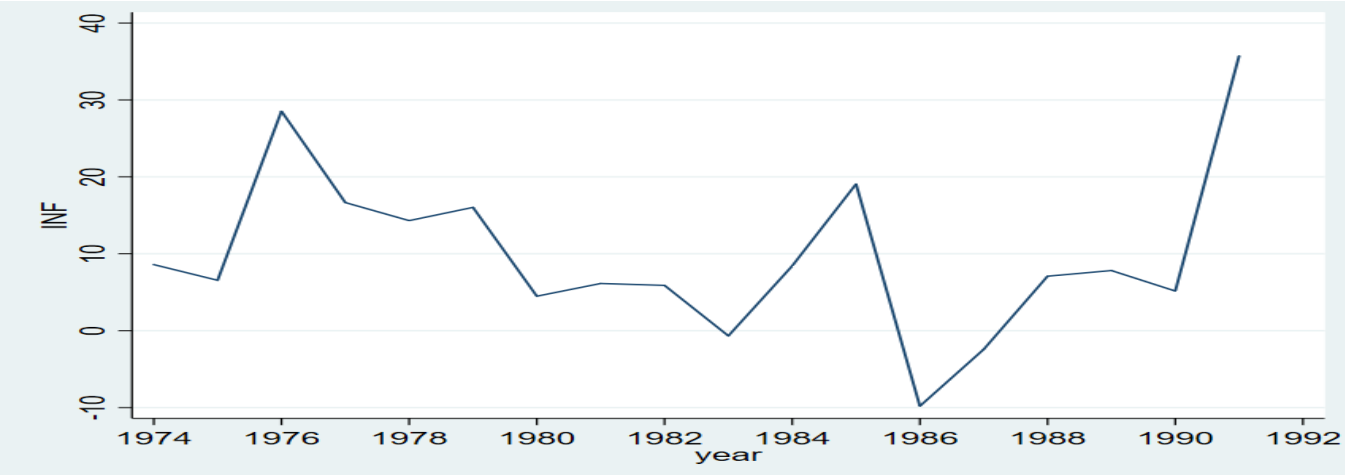

Figure 1: Graphical analysis of inflation rate from 1974 to 1991

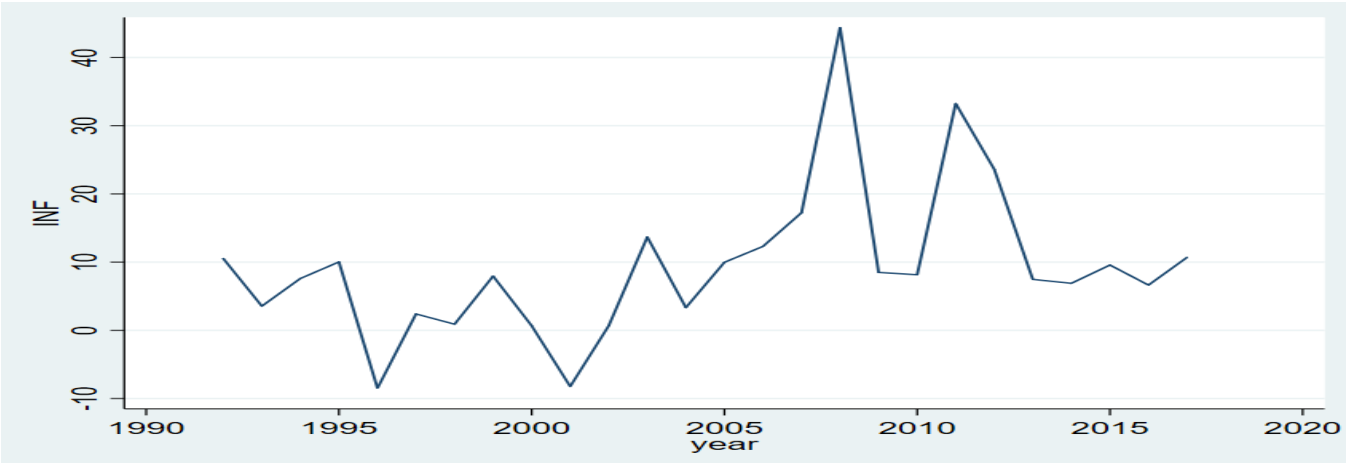

Figure 2: Graphical analysis of inflation rate from 1990- 2000

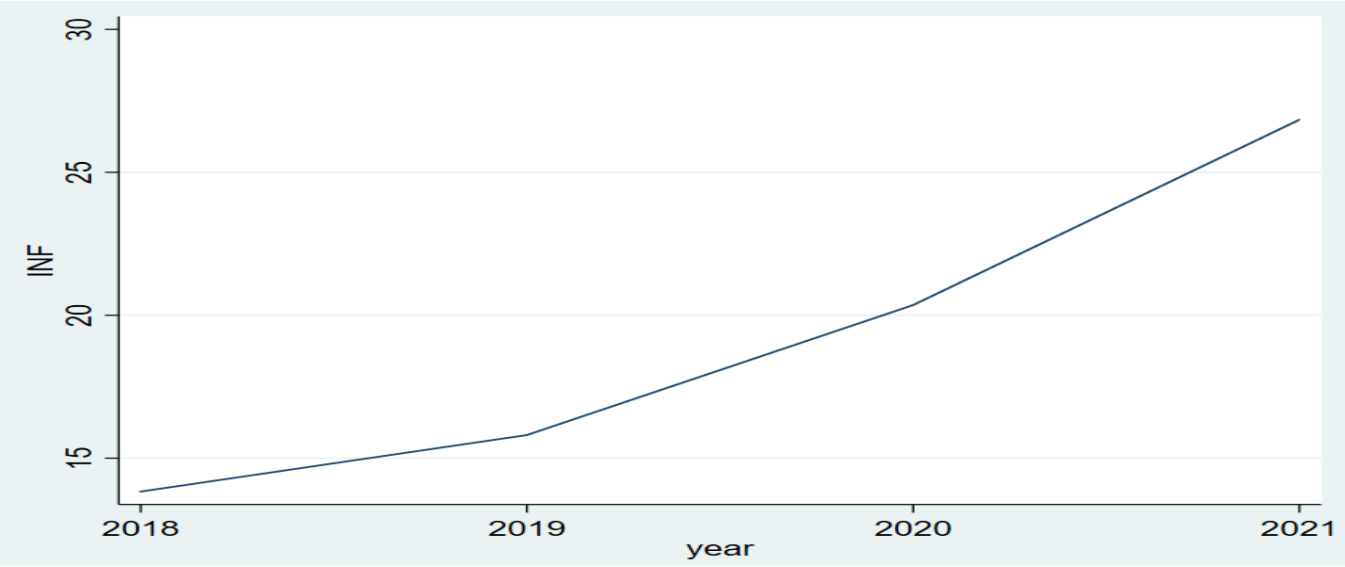

Figure 2: Graphical analysis of inflation rate from **2018- 2021**

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3.2 Econometrics analysis

i. The Long-run Model determinants of Inflation (INF) measured by CPI

Table 3: Long-run results

Dependent variable: Inflation (INF) measured by CPI				
Method: ARDL				
Sample (adjusted): 1968 to 2021				
Variables	Coefficient	Standard error	t-statistic	P>/t/
C	-2.80659	7.485851	-3.74	0.000
ln(BM2)	0.320579	0.279670	2.41	0.007
ln(RGDP)	0.096629	0.308962	0.31	0.016
ln(GXP)	0.552042	0.260602	2.12	0.039
ln(BD)	0.018479	0.472132	1.31	0.211
ln(GOP)	0.266147	0.070066	3.80	0.000
ln(XD)	0.117538	0.092325	1.27	0.009
ln(IR)	-0.019977	0.874749	-0.88	0.608
ln(CI)	0.290939	0.139947	2.08	0.043
R-Squared	0.9198			
Adjusted R^2	0.8514			
F-statistic	13.1545			
Prob(F-statistic)	0.02229			
Akaike info criterion	6.613798			
Durbin-Watson stat	2.342			

Source: Author's computation using E-view

As it can be seen from the above results, the R-squared was calculated to be 0.9198. This means that 91.98 % of the variation in inflation measured in terms of consumer price index was explained by the independent variables. This implies that the model explains 91.98 % of the variation in the dependent variable, which is in this case INF measured by CPI. Moreover, the analysis of the F-test shows that all the independent variables jointly explain the dependent variable (INF) remarkably. Thus, over-all significance of the model is good. Further, the analysis of the Durbin-Watson value was 2.342. This Durbin-Watson value also shows the absence of auto correlation in the model. In general, the R^2, the adjusted R^2, the F value and the Durbin-Watson value indicated that the model is strong. The value of the constant term, -2.81, which is also significant shows that even if all the explanatory variables included in the model are zero, INF will have a value of -2.81 units.

As it was stated by quantity theorists, inflation is always and everywhere a monetary phenomenon. An increase in broad money supply by one percent, ceteris paribus (other things being equal), will increase INF by 0.32 percent on average in the long-run. As it is shown from the estimation result, broad money supply is a significant factor affecting inflation. This result according to macroeconomic phenomenon of classical economists given in quantity theory of money, the increase in money supply leads to higher price levels. Due to higher money supply, more funds will be available to invest in the economy. Consequently, investment will take place. As investment increases, more jobs will be created and hence more employment will be generated. As a result, aggregate demand will increase, and finally there will be increase in consumer price index. This is true since the increase in aggregate demand affects price level through demand side.

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However, the monetarist proposition of one to one relationship between inflation and money supply do not work in Ethiopia.

In contrast to our prior expectation, real gross domestic product (RGDP) was found to be directly related with INF since its coefficient was positive 0.1. As it is clearly shown in the table indicated above, a 1 percent increase in gross domestic product will lead to an increase in inflation (INF) by 0.1 percent on the average in the long run. In other word, RGDP is inducing consumer price index. This positive relationship between RGDP and inflation may be due to the economic situation in the country. To support the economy to grow fast enough; the national bank of Ethiopia lowers interest rates to make borrowing more attractive. The logic behind this is that it will encourage spending, which will lead to a rise in RGDP. The drawback of this move is that it will also prompt inflation.

Similarly, the GXP was found to have a positive relation with INF. The result revealed that 1 percent increase in GXP will increase INF by 0.55 percent on average in the long run. This means that an increase in government expenditure can significantly affect inflation rate in the long run. On the other hand, BD was found to have a positive relationship with inflation but it has insignificant impact on inflation in the long run in Ethiopia. That is, a 1% rise in budget deficit results in a 0.02% increase in INF measured by consumer price index, provided that other variables are constant. The positive relation of the BD in determining inflation in the country maybe due to the fact that the existence of an excess expenditure across regimes. Gas oil price (GOP) was found to have a significant impact on inflation across regimes in Ethiopia. A 1% rise in gas oil price, holding other variables constant, results in a 0.27% rise of INF. This means that GOP is directly related to INF. This is due to the rise in price gas oil will lead to a price push on other goods and services, particularly those goods and services that are directly affected by the price rise of gas oil.

External debt (XD) was also found to have significant impact on INF. That is, an increase in external debt by 1 %, ceteris paribus, results in a 0.12% increase in the consumer price index (in this case, INF). On the other hand, interest rate (IR) was found to have an insignificant impact on inflation although a 1% rise in interest rate reduce inflation by 0.02 percent, this result indicated that it has insignificant influence on inflation (measured by CPI). However, corruption index (CI) was found to have a positive relation with inflation. That is, a 1% rise in CI leads to an increase in INF by 0.29% and found to be a significant impact on inflation.

ii. *The Short-Run Error Correction Model (ECM)* Short run model factors effect of INF measured by CPI

Table 4: **Short run model factors effect of INF measured by CPI**

Dependent variable: INF measured by CPI				
Variables	Coefficient	Standard error	t-Statistic	P>/t/
ECM(-1)	-0.247578	0.121016	-2.31	0.025
DlnBM2	0.3917135	0.119172	2.01	0.013
Dln(RGDP)	0.108435	0.027768	0.28	0.031
Dln(GXP)	0.583704	0.260602	2.12	0.018
Dln(BD)	0.181531	0.103122	1.55	0.026
Dln(GOP)	0.385262	0.031065	1.97	0.001
Dln(XD)	0.215974	0.060321	1.09	0.014
Dln(IR)	-0.229853	0.356752	-0.74	0.712
Dln(CI)	0.340718	0.031945	1.79	0.050
C	-0.171226	0.024331	-0.81	0.421
R-squared	0.6511			
Adjusted R^2	0.5704			
F-statistic	8.2716			
Prob(F-statistic)	0.0000			

Where *D* = Difference

Based on the above table, R^2 and adjusted R^2 for the short-run model are 65% and 57% respectively showing that 65% and after adjustment 57% of the variation in INF measured by consumer price index is explained by the variation in the explanatory variables in the short-run. Further, the result of the short-run model revealed that broad money supply, real

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gross domestic product, government expenditure, budget deficit, external debt, gas oil price and corruption index are significant variables in explaining the variation of inflation in the short-run whereas interest rate is insignificant variables.

The lagged ECM coefficient indicates that 24.8% of the disequilibrium in INF in one period is corrected in the next period. In other words, it indicates the speed of adjustment of about 24.8% from the actual price level in the short-run to the long-run equilibrium level. Moreover, it shows 24.8 percent of the discrepancy between the actual and the long-run or equilibrium value of INF is corrected each year or it takes more than three years to adjust the disequilibrium of inflation measured by consumer price index. The long run result indicated above supported the findings of GIAN (2022).

iii The Effect of Inflation on Poverty

Table 5: Vector Auto regression Estimates

	POV	INF
POV(-1)	0.766602	0.698018
POV(-2)	0.896098	1.278814
POV(-3)	0.453296	0.521494
POV(-4)	-0.112516	-0.001112
INF(-1)	-0.056560	0.361885
INF(-2)	0.071079	0.033470
INF(-3)	-0.039553	0.347344
INF(-4)	-0.032267	-0.085545
C	6.542083	3.683306
R-squared	0.806401	0.759176
Adj. R-squared	0.651778	0.689953
Sum sq. resids	1392.767	3746.732
S.E. equation	5.691216	9.334522
F-statistic at (8, 47)	12.93227	13.01264
Log likelihood	-159.2677	-184.9971
Akaike AIC	6.471835	7.461426
Schwarz SC	6.809550	7.799142
Mean dependent	23.65385	9.826538
S.D. dependent	9.644433	10.70710
Determinant resid covariance (dof adj.)		2736.769
Determinant resid covariance		1871.408
Log likelihood		-343.4652
Akaike information criterion		13.90251
Schwarz criterion		14.57794
Number of coefficients		18

Source: Author's computation using E-view

From model the Table, a unit changes in the first lag of poverty, Inflation rate will lead to 0.766602 and -0.056560 changes in POV. A unit change in the second lag of Poverty; Inflation rate will lead to 0.896098 and 0.453296 changes in POV. A unit change in the third lag of poverty, inflation rate 0.071079 and -0.039553. A unit change in the fourth lag of poverty, inflation rate -0.039553 and -0.032267. The R^2 is given as 0.806401 indicating that 80.6% variation in Poverty incidence is explained by the independent variables. F-statistics is given as 12.93227 which is greater than the critical value of 3.56 at (8, 47) indicating that the equation is significant.

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Similarly, a unit change in the first lag of poverty, inflation rate will lead to 0.698018 and 0.361885 changes in INF. A unit change in the second lag of Poverty; inflation rate will lead to -0.278814 and 0.033470 changes in INF respectively. A unit change in the third lag of poverty, inflation rate -0.421494 and 0.347344. A unit change in the fourth lag of poverty, inflation rate -0.001112 and -0.085545. The R^2 is given as 0.759176 indicating that 75.9% variation in inflation rate incidence is explained by the independent variables. F-statistics is given as 13.012635 which is greater than the critical value of 3.56 at (8, 47) indicating that the equation is significant.

4 Conclusions

Based on the findings of this study, it was concluded that: The trend analysis of inflation across regimes revealed that during the final eight years of the Emperor rule, there was a fluctuation in inflation level in those periods. However, the highest inflation level of 10.12 was registered in 1970. Similarly, during the Military regime known as DERG, there was similar fluctuation in inflation with slightly different level as the regime before it. But, the highest inflation of 35.7 was recorded in 1991 by the time when the civil war reached its pick. Furthermore, inflation reached its maximum level of 44.35 in 2008 during the EPRDF regime due to the 2007 – 2008 financial crises which started in the United States of America and latter engulfed the globe, and then resulted in global recession. The first four years of the Prosperity Party (PP) regime, the trend of inflation shows each year the rate of inflation was increasing and the highest inflation of 26.84 was registered in 2021.

From the analysis made by means of co-integration and error correction methods using yearly data for a period of 55 years, the results of the analysis revealed that in the long run broad money supply, government expenditure, external debt, gas oil price, corruption index, and real gross domestic product are contributed to the rising inflation whereas interest rate has negative relation with inflation but it has insignificant influence on inflation while budget deficit has positive relation with inflation but it showed insignificant impact on inflation.

In the short run, the coefficient of error correction term is -0.248 suggesting 24.8 percent annual adjustment towards long run equilibrium. Government expenditure has more positive effect on inflation than broad money supply (BM2), gas oil price (GOP), external dept (XD), RGDP BD and CI in the short run. The government expenditure coefficient is 0.58, implying a one percent increase in government expenditure trigger 0.58% increase in inflation. Nevertheless, the IR coefficient is –0.23, implying a one percent increase in interest rate resulted in a 0.23% decrease in inflation in the short run. Unlike the long run its insignificant effect on inflation, interest rate has a significant impact on inflation in the short run. This means that the rising of interest rate will lead inflation to decline in the short run. On the basis of the findings of the study, it can be concluding that inflation dynamics in Ethiopia is determined by demand side factors as well as supply side factors but the impact of government expenditure, broad money supply, gas oil price and corruption are critical.

Finally, regarding the impact of inflation on poverty, the econometrics analyses revealed that a unit changes in the first lag of poverty, Inflation rate will lead to 0.766602 and -0.056560 changes in POV. A unit change in the second lag of Poverty; inflation rate will lead to 0.896098 and 0.453296 changes in POV. A unit change in the third lag of poverty, inflation rate 0.071079 and -0.039553. A unit change in the fourth lag of poverty, inflation rate -0.039553 and -0.032267. The R^2 is given as 0.806401 indicating that 80.6% variation in Poverty incidence is explained by the independent variables. F-statistics is given as 12.93227, which is greater than the critical value of 3.56 at (8, 47). The findings further confirmed that there is Pair-wise causality between inflation and poverty indicating that inflation rate Granger cause poverty and also poverty Granger cause inflation rate. This means, inflation rate has a statistically significant impact on poverty level in Ethiopia. The implication of this is that an increase in inflation rate will lead to higher poverty level. It has a negative effect on poverty.

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