

# The Effect Of Monetary Policy On Inflation In Ethiopia

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## Abstract

Inflation is one of the macroeconomic variables that practitioners usually focus on because it hurts the life of poor in particular and social welfare in general. It has been identified in the literatures that supply side bottlenecks, excessive aggregate demand and structural factors are the major source of inflation although the relative importance of each factor in explaining it varies from country to country. The objective of this study is to examine the effect of monetary policy variables on inflation proxed by consumer price index in Ethiopia. The result from Auto Regressive Distributive Lag indicates that expected inflation, real gross domestic product, money supply and real interest rate are the major determinants of inflation both in the long and the short run. Moreover, government expenditure, domestic credit and remittance inflow are also the main determinants of inflation in the short run. This study implies that government should design and follow policies that stabilize expectation of economic agents, ensure positive real interest rate, control money supply and promote domestic production. The movement of exchange rate, growth of money supply, government expenditure and remittance inflow should be in a way that it does not bring inflation. Furthermore, facilitating access to credit is also essential to promote real output and stabilize inflation. Finally, monetary authority that sets clear inflation target and committed to it is indispensable.

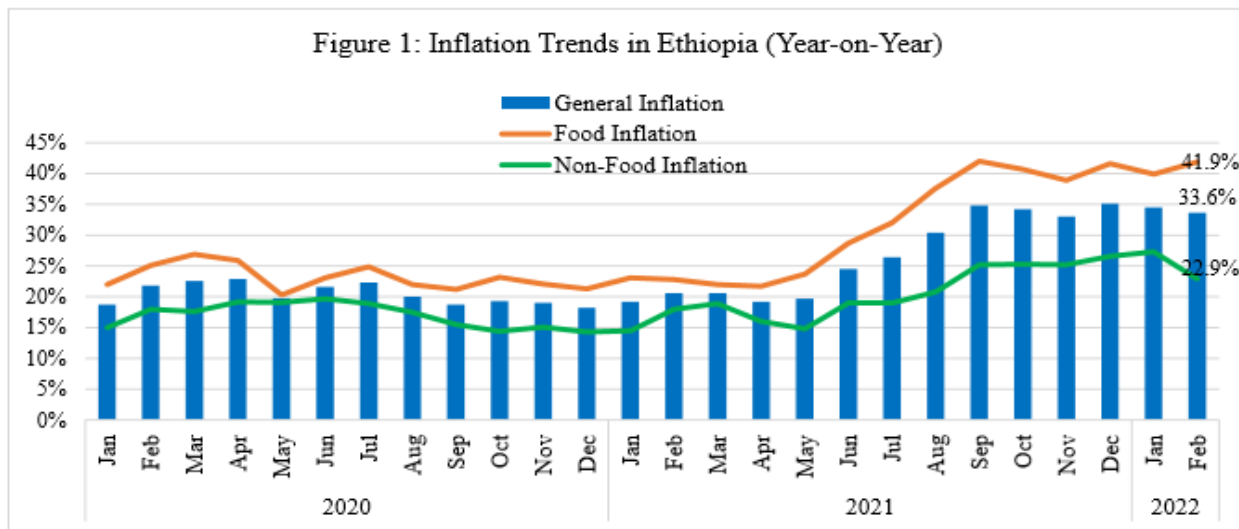
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## I. Introduction

Stable inflation is among the primary objectives of policy makers. Inflation erodes real income, affects relative price, causes income inequality, creates uncertainty and results in poor performances of business (Loening et al, 2008; Furrakh, 2011 and Paul, 2019). It also distorts money market, drives down the returns to deposits, discourages saving and hence the processes of capital accumulation and economic growth (Vikesh and Subrina, 2004; Boariu and Bilan, 2007). Historically inflation was not a

problem in Ethiopia and it had been held, on average, below nine percent a year and sharply jumped to twenty one percent in 1990/91 (Gashaw, 2014). Consumer price index was 8.53 on average during 1972-1991, increased to 23.62 during 1992-2004 and reached an average of 79.05 over the period of 2005-2016 (WB, 2016). The headline inflation hit 26.4 percent during the month of august, 2021 and consumer price index reached more than three hundred in the same year (NBE, 2021). Inflation is persistently high reaching 33.6 percent in February 2022 and Food inflation stood at 41.9 percent while non-food

inflation hit 22.9 percent in the same month (USDA, 2020).



Source: United State Development Agency (USDA), 2022

In response to the current rising inflation, a number of policy actions are undertaken by National Bank of Ethiopia to decrease the quantity of money in circulation indirectly using policy tools like reserve requirement, open market operation, discount rate and intervention in the foreign exchange market. To this end, the reserve requirement is increased from 5% to 10% and the interest rate levied on commercial banks on loans from the central bank is raised by 13% percentage points to 16%. Banks are obliged to deposit 50% of their foreign currency from export and remittances. The policy also raised bank customers maximum foreign currency amount in their diaspora account from the previously 31.5% to 40%. Development Bank of Ethiopia is allowed to sell bonds to banks, insurance and pension institutions to increase its revenue (NBE, 2021).

A number of empirical studies have been conducted on inflation in Ethiopia. Most of those studies vary in terms of variable selection, sample size, data type and methodology used. However, the variables used are roughly similar. Some of

them used quarterly data and error correction model (Loening et al, 2008). Geda and Tafere(2008) constructed vector autoregressive model of inflation in Ethiopia using quarterly data and employing a synthesis of monetarist and structuralist model of inflation. Others examined quarterly data by using Engle-Granger and Johansen Co-integration (Abis, 2013; Tsegay et al, 2015 and Fistum et al, 2016). Anteneh (2014) and Demissew (2015) used Structural Vector autoregressive model. Bane (2018) studied the dynamics and determinants of inflation using annual data and ARDL model. There are also studies by (Robera, 2019; Hagos and Nigussie, 2020; Tadesse, 2020; Melaku, 2020 and Girma, 2020). However, nobody has focused on the effect of monetary policy on inflation in Ethiopia. This study focuses on the effect of monetary policy variables such as domestic credit, money supply, interest rate and exchange rate on inflation in Ethiopia. It also uses annual data of relatively larger sample size and Autoregressive distributive lag model which is relatively better approach for co-integration.

## **2. Monetary Policy In Ethiopia**

### **2.1. Evolution of Monetary Policy in Ethiopia**

The practice of monetary policy in Ethiopia dates back to 1963 when the National Bank of Ethiopia was given administrative autonomy and juridical personality by proclamation 206 of 1963. During military government from 1974-1992, there was fixed exchange rate, direct control of credit and discrimination in foreign currency allocation. Interest rate was fixed so as to restrict the private sector participation in the economy. There was discrimination in interest rate setting and allocation of foreign exchange and credit. The interest rate was deliberately set at a very low level and different sectors did face different interest rates depending on the degree of socialization. The private sector was charged the highest rate in all kind of loans and highly discouraged (Erchafo, 2001). Banking sector was totally dominated by government banks and private sector was prohibited from entering into the financial sector and National Bank of Ethiopia had been conducting its monetary policy by directly controlling monetary variables and prices (Taye, 2015).

Following the fail of Derg in 1991, the new government established different reforms in financial sector. National Bank of Ethiopia devalued its currency to 5 Birr/US\$ at the beginning and subsequently introduced an auction-based exchange rate system. New monetary and banking law, which allowed private banks participation only for nationals, was promulgated in 1994. Discrimination of interest rate between sectors is abandoned and ceiling on lending interest rate is liberalized while the minimum deposit rate is still under control of the National Bank of Ethiopia (Geda, 2001). Inter-bank foreign exchange and money markets were introduced because foreign exchange supply by National Bank of Ethiopia through the auction system was not sufficient to satisfy the

demands by Banks. Inter-bank money market was also established to facilitate borrowing and lending of funds between banks, micro finance institutions and non-bank financial institutions at market determined interest rate (Geda, 2001). Different financial markets such as Treasury bill market have evolved over time after the reform period of 1992 (Taye, 2015). Government uses Treasury bills as a monetary policy instrument to manage reserve money balance and as a means of mobilizing resource. Currently, there are various treasury bills of different maturity length (NBE, 2020).

### **2.2. Conduct of Money Policy in Ethiopia**

National Bank of Ethiopia is responsible for the conduct of monetary policy in the country. According to proclamation No. 591/2008, the purpose of undertaking monetary policy is to maintain stable inflation and exchange so as to foster a healthy financial system and create conducive environment for rapid economic development. To attain its objectives, NBE currently operates with the reserve money as operating target and broad money as an intermediate target. It prepares a financial program and sets annual targets for reserve money and broad money consistent with real, fiscal and external sector targets before the start of any fiscal year (Muluneh, 2018).

The National Bank of Ethiopia uses both direct and indirect monetary policy instruments. Direct Instruments includes Credit Ceiling and interest rate. Credit ceiling is practiced as it was a case in 2017/18. NBE also controls the minimum interest rate on saving and time deposits, which currently is 7 percent per annum. On the other hand, indirect instruments are Reserve requirement, treasury bills and intervention in the foreign exchange market. By selling or buying foreign currency, NBE influences money supply and inflation (NBE, 2021).

### 3. Theories of Inflation

Keeping inflation close to the desired target is among the primary goals of monetary policy (Paul, 2019). A number of theories have been developed over time to explain the issue of inflation and its determinants. The classical economists directly link inflation to growth in money supply. They focused on the long run and concluded that change in money supply results changes in only price level (Boariu and Bilan, 2007). But the modern version of quantity theory of money recognizes that money has real effect in the short run (Totonchi, 2011). Keynes proposed that money has indirect effect on inflation through its influence on interest rate, investment and aggregate demand (Ireland, 2014). Increase in money supply raises the supply of loanable funds through the banking system causing interest rates to fall which in turn boosts aggregate demand and economic growth. But, the increase in aggregate demand triggered by low interest rate is inflationary once economy is at full employment level (Kim, 2020).

Monetarist believe that fiscal policy is ineffective for stabilizing inflation because of its crowding out effect and little influence on aggregate spending (Gramlich, 1971). They take in to account broad variety of wealth when discussing the transmission channels of monetary policy and acknowledged the possibility that monetary policy might have short-run effects on interest rates, employment and economic growth, but believed that these effects arose exclusively from the public's misperception of the impact of policy changes on the price level. Expansionary monetary policy may encourage employment due to worker's misperception and raises production in the short run. However, output returns back to its original level as soon as households and firms realize that real wages have not changed. Monetarists believed that the economy would be better off if the monetary authority supplied

money according to a fixed and publicly announced formula (Apere and Karimo, 2014).

#### 3.1. Theoretical review on determinants of Inflation

It is commonly classified as demand pull inflation, cost push inflation and structural inflation based on its sources. Cost-push inflation is the outcome of large increases in cost of production such as wage, raw material and imported inputs like petrol while structural inflation is attributed to inelastic food supply, infrastructural inadequacies that pose problems for distribution of output, foreign exchange shortage caused by low export receipts, limited tax base, population growth and immigration (London, 1989; Totonchi, 2011). Demand pull inflation, on the other hand, is inflation that arises when aggregate demand in an economy goes faster than aggregate supply. The demand side factors include increase in the money stock, change in money demand, fall in tax rate and increase in government purchases (Romer, 1996; Lim and Papi, 1997).

Keynesian and classical economists attribute inflation to high aggregate demand in a situation of unchanging aggregate supply. However, they disagree on the sources of such demand. Classical economists argue that money has direct effect on aggregate demand and inflation but for Keynesians, inflation is indirectly the outcome of change in interest rate, investment and aggregate demand (Boariu and Bilan, 2007). Keynes' theory links inflation to the level of actual output and natural rate of unemployment. When output is above the potential and unemployment is below the natural rate, inflation increases as suppliers increase their prices. The supplier's decision is related to the price/ wage spiral caused by workers trying to keep their wages up with price. However, the exact level of potential output and natural rate of unemployment is generally unknown and tends to change over

time (Vikesh and Subrina, 2004). In the classical theory and monetarist perspective money supply drives inflation. Deficit financing through monetization and consequent raise in money supply causes inflation (Boariu and Bilan, 2007). The continuous increase in money supply and resulting increase in demand causes output to rise above the natural level and inflationary situation (Solomon and wet, 2004).

Inflation is also affected by supply side problems or cost of production and such type is called cost-push inflation. Cost-push inflation is due to increases in cost of production which could be caused by the labor union that presses employers to grant wage increases. This may raise the cost of production and push employers to raise prices of their products. An increase in prices induces unions to demand still higher wages and cost-push inflation may be further aggravated by upward adjustment of wages to compensate for rise in cost of living. The wage-push inflation in a few sectors of the economy may soon lead to rise in prices in the entire economy because in many cases, products of some sectors are used as inputs for the production of commodities in another sector. Further, an increase in the price of imported raw materials may lead to cost-push inflation (Totonchi, 2011; Gordon, 2019). Oligopolistic and monopolist firms raise the price of their products to offset the rise in labor and cost of production to earn higher profits. Infrastructural inadequacies that pose problems for distribution of output, a low export receipt that leads to foreign exchange shortages, exchange rate depreciation, lack of financial resource and limited tax base could also cause less developed countries to resort to deficit financing through the central banks that lead to inflationary pressures (Totonchi, 2011).

Expectation is also another variable that affects inflation. Expectations determine inflation because they are fundamental to the behavior of economic agents and all economic activities as

economic agent's expectations of the future value of economic variables influence their demand and supply decisions (Snowdon and Vane, 2005). Keynes expectation is exogenous and driven by what he called animal spirit yet for new classical it is endogenously determined. In adaptive expectation peoples make same forecasting error over time basing their forecasting only on past information. However, in the rational expectation, people do not consistently make the same forecasting error. Economic agents are rational and they base their expectation on both past and current relevant information. The economic model of rational expectation predicts that correctly anticipated monetary shocks have proportional effects on prices and no effect on real variables (Nagel and Parker, 2003). Economic agents understand the nature of relationship among economic variables and rationally react to publically announced policy change (Heijdra, 2002).

### **3.2. Empirical review on determinants of inflation**

A number of Empirical researches have been conducted on inflation in different countries at different period of time. The work of (Harvey and Cushing, 2014) found that structural factors dominate monetary growth in the inflation dynamics in Ghana. Another study by (Apere and Karimo, 2014), on inflation in Nigeria showed that in the short-run the level of production is more important in controlling inflation, but it is monetary policy variables that matter in the long-run. The research by (Sharif et al, 2015) on monetary policy and its inflationary pressure in Pakistan found that money supply and interest rate are important policy variable to control inflation in the long run. Study by (Kantur & Özcan, 2021) reveals that interest rate affects inflation through the cost channel in Turkey. But labor share of income, price of imported inputs and consumption goods are the dominant factors in contributing to inflation. A research conducted

by (Ikpesu, 2021) on the effect of bank credit on inflation and growth in thirty five sub Saharan African economies indicates that banking sector credit affects inflation positively. Similarly, Barredo-Zuriarrain (2022) found that credit to the oil company fueled aggregate demand and inflation in Venezuela. Rivera and Tullao (2020) stated that the usual argument that remittances contribute to economic instability needs further investigations. However, Study by (Dilanchiev et al, 2021) revealed that inflation is positively associated with remittance in the long run in Georgia. Joshi (2022) also found that remittances have a positive impact on inflation whereas the impact of real gross domestic product is negative.

There are also some empirical literatures on determinants of inflation in case of Ethiopia. Study conducted by (Loening et al, 2008) on inflation in Ethiopia using error correction model, found that increased money supply and nominal exchange rate significantly affect inflation in the short run. Furthermore, Inflation in Ethiopia was found strongly affected by past inflation. Similarly, a study by (Geda and Tafere, 2008) found that the most important forces behind food inflation in the long run are a sharp rise in food demand triggered by an alarming rise in money supply, inflation expectation and international food price hike while the long run determinants are money supply, interest rate and inflation expectation. In the short run, wages, international prices, exchange rates and constraints in food supply are found to be prime sources of inflation. Yohannes et al, (2010) also studied inflation dynamics and food price in Ethiopia using monthly data and the result from single error correction model indicates that international food and goods prices determine the long run evolution of domestic price. In the long run, agricultural supply shock is found important determinant of food inflation and but money supply growth affected short-run non-food price inflation. Anteneh (2014) modeled the effects of

shocks to Ethiopian monetary policy on price and output using structural Vector auto regression approach obtained that output and price are more responsive to shocks to reserve money than Treasury bill rate both in the short term and long term horizon. The study by (Tsegay and Raho, 2015) using Johansen co-integration and Vector error correction model indicated that domestic source of budget deficit finance and money supply growths are the main determinants of long run inflation in Ethiopia while inflation inertia and exchange rate are important in the short run.

The research by (Demissew, 2015) using SVAR, shows that monetary policy innovations have both real and nominal effects on economic parameter depending on the policy variable selected. The work by (Fistum et al, 2016) using Johansen co-integration approach and error correction technique, found long run bidirectional causality between money supply and inflation and unidirectional causality from economic growth to inflation. Similarly, the study by (Bane, 2018) shows that the major determinants of dynamics of inflation in Ethiopia are both monetary sector and structural factors. Money supply and real interest rate are important determinants from monetary sectors while shocks to the real sectors are important structural factors. Tadesse (2020) studied macroeconomic determinants of recent inflation in Ethiopia using annual data from 1985 to 2018 and found that real interest rate and real effective exchange rate are significant in determining inflation both in the short run and long run but money supply determines inflation only in the long run. Similar Study by (Melaku,2020) using ARDL approach show that oil price, government expenditure, external debt and money supply are important in explaining inflation in Ethiopia. Rohera (2021) conducted study on determinants of inflation in Ethiopia using Vector Error Correction Model and found that money supply affects inflation only in the short run.

In general, literatures confirmed that Inflation is the outcome of factors related to aggregate demand, aggregate supply, Structure of the economy (institutions, market conditions, dependency on import) and inflation expectation. Variables like money supply, interest rate, exchange rate, government expenditure, world price index and expectation are the main determinants of inflation.

#### 4. Methodology of the study

##### 4.1. Data Source and Description of Variables

This study uses annual data ranging from 1980 to 2021 which is collected from both domestic and international organizations. Data of exchange rate, domestic credit, interest rate and money supply are obtained from National bank of Ethiopia. Real Gross domestic product and government expenditure is from ministry of finance and economic cooperation. The data of consumer price index and remittance received is taken from World Bank data of World development indicators. The variables such as exchange rate, domestic credit, remittance, interest rate, government expenditure and money supply are categorized under policy variable since the government can influence them either directly or indirectly. Consumer price index is the ultimate objective variable. Real gross domestic product, government expenditure, domestic credit and money supply are measured in millions of either ETB or USD. Exchange rate is the

amount of domestic currency per unit of foreign currency.

##### 4.2. Method of Data Analysis

This study uses the vector autoregressive distributed lag model developed by (Pesaran et al, 2001). The autoregressive distributive approach has the advantage that it does not require all variables to be integrated of order one unlike the Johansen Co-integration framework and is applicable regardless of order of integration as long as the order of integration of variables in the data set are less than two. i.e. the model can be used if variables in the data set are integrated of order one, zero or mixed. It also automatically selects appropriate lag to be included in the model and hence reduce the possibility of residual correlation. By including lags of dependent variable, it helps us to study the effect of past experience of the variable on its own current value. Similarly, by including lags of independent variables it enables researchers to see the lags between policy action and the effect on the target variable (Pesaran et al, 2001). Autoregressive distributed lag model has also advantages over other competing approaches for co-integration as it takes a sufficient number of lags to capture the data generating process in general to specific framework and helps to derive the error correction model through a simple liner transformation, which integrates short run adjustments with long run equilibrium without losing long run information (Nkoro and Uko, 2016). The ARDL model can be specified as:

$$Z_t = \alpha + \sum_{i=1}^p \varphi_i Z_{t-i} + \sum_{j=1}^n \sum_{i=0}^{m_j} \beta_{j,i} Y_{j,t-i} + u_t \dots \dots \dots (4.1)$$

Where, P= number of lags of the dependent variable Z which is consumer price index, m= number of lags of explanatory variable Y which includes money supply, government expenditure, real gross domestic product, domestic credit,

exchange rate, real interest rate and remittance inflow. Thus, there is j to n number of explanatory variables and for each individual explanatory variable there is a lag that ranges from 0 to  $m_j$ ,  $\beta_{j,i}$  is coefficient of each explanatory

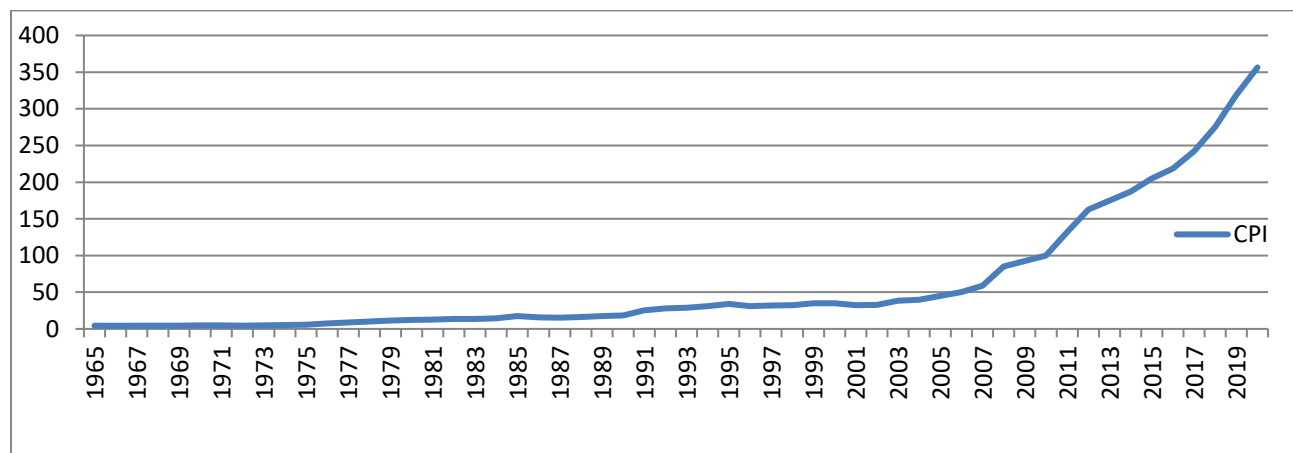
variables at different lag length,  $\alpha$  is constant term.  $u_t$  is residual or error term which captures the measurement errors and the effect of excluded relevant explanatory variables,  $\varphi_i$  is coefficient of lags of dependent variable at lag  $i$  when  $i$  ranges from 1 to  $p$

## 5. Results and Discussion

### 5.1. Trend of Consumer Price Index and Other Variables

Economists usually derive inflation from consumer price index and gross domestic product deflator. Consumer price index turns the prices of many goods and services into a single index measuring overall level of prices while GDP deflator is the ratio of nominal gross domestic product to real gross domestic product. Consumer price index is usually used to measure inflation in Ethiopia and it was historically very low in the country. Consumer price index has never been above 50 percent until about 2007. However, it started to increase sharply since then and reached more than three hundred after 2019.

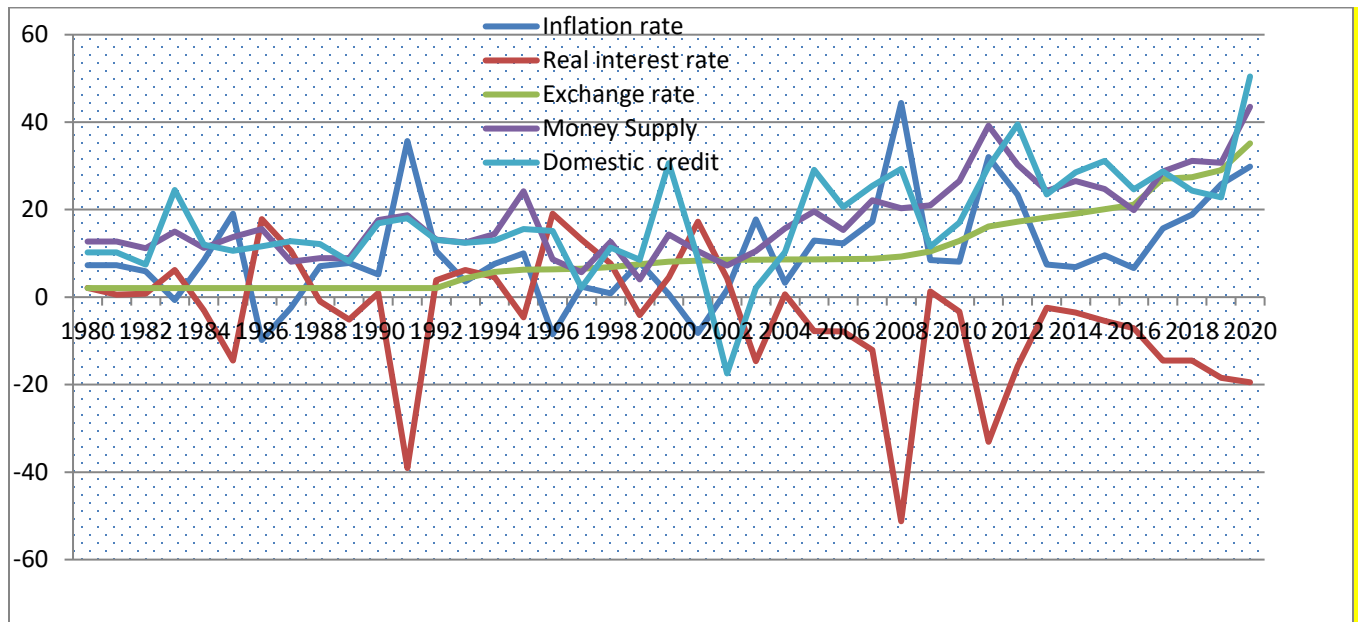
**Figure 2: Trends of Consumer Price Index in Ethiopia (1965-2021)**



**Source: Author’s Computation (2022)**

This sharp increase is correspondent to the trend of real interest rate, domestic credit, exchange rate, money supply and remittance inflow despite of sum fluctuations.



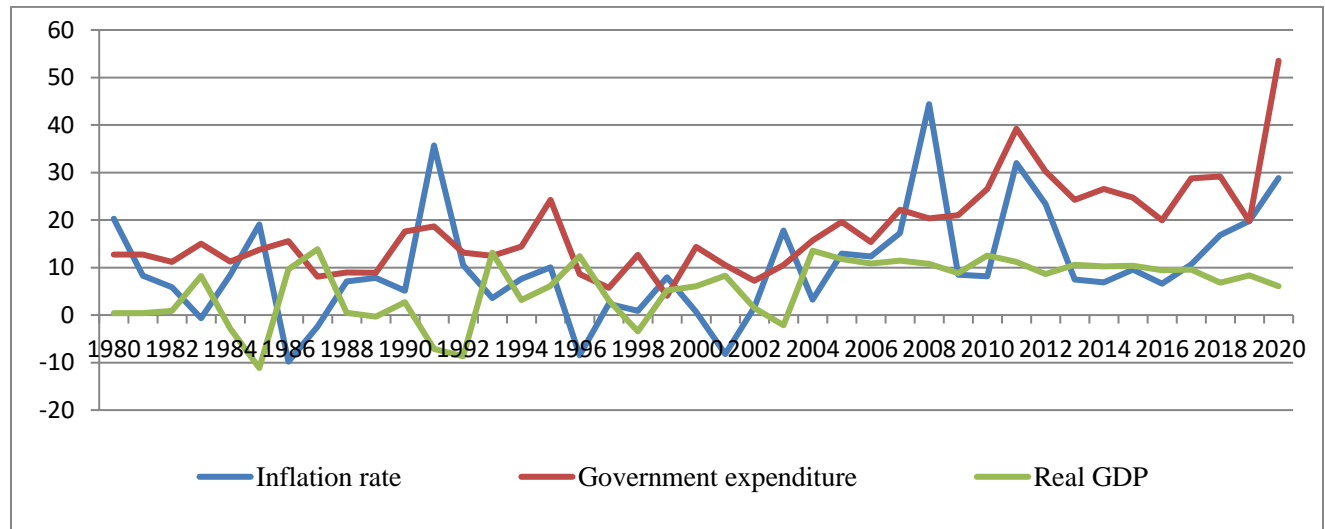
**Figure 3: Trend of Inflation and Policy Variables (1980-2020)**

**Source: Author's Computation (2022)**

As indicated in the above Figure, real interest rate in Ethiopia is always negative especially since 2002. Exchange rate, inflation rate, money supply and domestic credit are also increasing during the period. However, all other variables are fluctuating except exchange rate which is

relatively stable probably due to the fact that the country is pursuing managed floating exchange rate. Inflation rate also follows similar trends with government expenditure and real gross domestic product.

**Figure 4: Inflation rate, government expenditure and real GDP (1980-2020)**



**Source: Author’s Computation (2022)**

Growth rate of Real GDP in Ethiopia is roughly fluctuating and fluctuates around zero until 2002. It is swinging around 10 percent since then. However, the growth of government expenditure is most often greatest and it is sharply increasing since 2018 which is most probably due to political instability and the rise in expenditure to finance the war in the North. However, real GDP is following the downward truck since then.

As discussed earlier, the auto regressive distributive lag model is applicable as long as the order of integration of the variables is either zero or one. The Augmented Dickey Fuller Test is conducted and the test result shows that all variables are stationary after they are first differenced except real gross domestic product and interest rate. Real gross domestic product is stationary at level and while real interest rate is stationary at both level and first difference. Since, all the variables contains a set of I (0) and I (1), the ARDL co-integration approach can be used to analyze the short run and long run relationship among variables.

**5.2. Autoregressive Distributive Lag (ARDL) Model**

**5.2.1. Tests for Stationarity**

Data is tested for unit root using Augmented Dickey-Fuller and Phillip-Perron tests so as to avoid the problem of spurious regression. Both tests the null hypothesis of a no unit roots against alternative hypothesis of unit root. If the calculated statistics is greater than the critical values, we cannot reject the claim of the null hypothesis and hence the variable is stationary.

**5.2.2. Lag length selection**

As indicated in the following table, Log likelihood ratio, final prediction error and Akaike information criterion selected two lag lengths. Hannan-Quinn information criterion and Schwarz criteria selected one lag length.

**Table 1: Optimum lag length selection**

Lag	Log	LR	FPE	AIC	SC	HQ
0	-363.2272	NA	1.157364	17.17336	17.41911	17.26398
1	-84.87920	466.0710	1.50e-05	5.901358	7.621600*	6.535730*
2	-42.89134	58.58771*	1.25e-05*	5.622853*	8.817588	6.800973
3	-11.12498	35.46012	2.01e-05	5.819767	10.48899	7.541634

\* indicates lag order selected by the criterion

Most of the information criterion recommends two lag lengths and hence the regression is made with two lags. However, the autoregressive distributive lag model automatically selects the optimum number of lags of each variable to be included once the maximum lag length is selected using lag selection criteria. Thus, the coefficient matrices of ARDL model are not symmetry unlike the unrestricted vector autoregressive models.

### 5.2.3. Long run model

In the long run, the coefficient of consumer price index at one year lag is 1.067775 and significant at 1 percent. Similarly, the coefficients of exchange rate, money supply, government

expenditure, real gross domestic product, real interest rate, domestic credit and remittance inflow are 0.006178, 0.175222, 0.029511, -0.250148, -0.002797, -0.056730 and 0.004585 respectively. However, government expenditure, domestic credit, exchange rate and remittance inflow are insignificant in the long run. Positive long run effect of money supply on inflation is found in line with the theoretical hypothesis of classical economists and empirical findings by Geda and Tafere (2008) and Teshome et al (2016). The increase in real output leads to decline in price because it boosts aggregate supply but increase in real interest rate results to decrease in inflation probably through its effect on demand for real balance and private consumption.

**Table 2: Estimated Long run model**

Dependent Variable: CPI

Selected Model: ARDL(1, 1, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CPI(-1)	1.067775	0.037087	28.79083	0.0000
RGDP	-0.250148	0.081862	-3.055740	0.0047
RGDP(-1)	0.030825	0.063666	0.484166	0.6318
GEXP	0.029511	0.024211	1.218913	0.2324
M2	0.175222	0.085626	2.046366	0.0496
DC	-0.056730	0.056130	-1.010685	0.3202
EXR	0.006178	0.021913	0.281914	0.7799

RIR	-0.002797	0.000164	-17.05544	0.0000
REMI	0.004585	0.007233	0.633856	0.5310
C	0.744733	0.371643	2.003894	0.0542
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R-squared	0.999610	Mean dependent var	1.685229	
Adjusted R-squared	0.999493	S.D. dependent var	0.443374	
S.E. of regression	0.009979	Akaike info criterion	-6.164300	
Sum squared resid	0.002988	Schwarz criterion	-5.742080	
Log likelihood	133.2860	Hannan-Quinn criter.	-6.011639	
F-statistic	8550.609	Durbin-Watson stat	2.009195	
Prob(F-statistic)	0.000000			

\*Note: p-values and any subsequent tests do not account for model selection

The effect of price inertia, nominal exchange rate and real interest rate found in this study is in line with the findings of Loening et al (2008) for Ethiopia.

**5.2.4. ARDL bound Test for Co-integration**

To investigate the existence of long run relationship, auto regressive distributive lag

bound test of (Pesran et al, 2001) procedure is used. It tests the null hypothesis of no co-integration against alternative hypothesis which claims the presence of long run relationship among variables. If the calculated F-statistics is greater than the critical upper bound values, we reject the claim and the variables are co-integrated.

**Table 3: ARDL Bound Test**

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	8.854211	8
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Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	1.66	2.79
5%	1.91	3.11
2.5%	2.15	3.4
1%	2.45	3.79

As indicated in table 5.4, the calculate F-statistics is greater than the critical upper bound values and

hence there is a long run relationship among the variables.

### 5.2.5. Short run error correction model

The error correction term says fifty eight percent of any deviation from the long run equilibrium can be corrected within one year using the variables in the model. In the short run model, all coefficients have expected sign and statistically significant except exchange rate. The short run coefficients of expected inflation, real gross domestic product, government expenditure, money supply, domestic credit, exchange rate, remittance inflow and real interest rate are 0.627689, -0.167474, 0.018217, 0.028320, -0.047578, -0.002670, 0.007260 and -0.002831 respectively. All coefficients are significant with expected sign in line with economic theories and empirical findings except exchange rate which is insignificant.

Moreover, price inertia and real gross domestic product are the major determinates of inflation in the short run as they respectively explain 62 and 16 percent of variation in consumer price index in the short run. Exchange rate, government expenditure, money supply and remittance

inflows positively affect inflation. The positive effect of government expenditure on inflation is also consistent with Keynesian demand pull theory but it is insignificant. However, increase in domestic credit leads to decrease in consumer price index. This might be through its positive effect on domestic production and real output.

Remittance inflow is inflationary in the short run probably it increases personal income and private consumption. The effect of interest rate is in line with what economic theory say. When real interest rate increases the demand for real money balance decline and then inflation fall and vice versa. The coefficient of exchange rate shows the existence of imported inflation which could be through directly its effect on the price of imported goods especially in developing countries that depends on imported food items for consumption and capital goods for their infant industries or remittance inflow and resulting aggregate demand. Therefore, the imperial result shows that devaluation is inflationary in Ethiopia although it could be incentive for our exporters.

**Table 4: Estimated short run model**

Dependent Variable: DCPI

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DCPI(-1)	0.627689	0.078750	7.970672	0.0000
RGDP	-0.167474	0.017583	-9.524760	0.0000
RGDP(-1)	0.168540	0.017573	9.590834	0.0000
DGEXP	0.018217	0.007303	2.494298	0.0193
DM2	0.028320	0.016393	1.727524	0.0959
DDC	-0.047578	0.015970	-2.979147	0.0062
DEXR	-0.002670	0.009251	-0.288571	0.7752
DEXR(-1)	0.026336	0.007655	3.440562	0.0020
DREMI	0.007260	0.002422	2.997179	0.0059
RIR	-0.002831	3.62E-05	-78.26366	0.0000
RIR(-1)	0.001638	0.000229	7.146944	0.0000
ECT	1.132715	0.049920	22.69038	0.0000
ECT(-1)	-0.580648	0.088561	-6.556469	0.0000

R-squared	0.997690	Mean dependent var	0.037368
Adjusted R-squared	0.996623	S.D. dependent var	0.042089
S.E. of regression	0.002446	Akaike info criterion	-8.927671
Sum squared resid	0.000156	Schwarz criterion	-8.373150
Log likelihood	187.0896	Hannan-Quinn criter.	-8.728713
Durbin-Watson stat	1.473301		

\*Note: p-values and any subsequent tests do not account for model selection

The coefficient of error correction term is negative and significant indicating that there is long run relationship. The Durbin-Watson statistics which is around two indicates that there is no autocorrelation problem and the F-statistics reveals that the included variables are jointly significant. The R square also indicates that the model has strong explanatory power.

## 6. Conclusions and Policy implications

### 6.1. Conclusions

Maintaining stable inflation is among the primary objectives of monetary authorities because high and unstable inflation creates uncertainty, erode purchasing power of income and hurts the life of poor and social welfare in general. It has been identified in the vast of economic literature that supply side bottlenecks, excessive aggregate demand, political and structural factors are the major source of inflation. In empirical literatures on inflation variables such as interest rate, money supply, exchange rate, import, remittance inflow, credit, government expenditure, budget deficit, unemployment, world price and real gross domestic product are most commonly used. However, the relative importance of each factor in explaining inflation varies from country to country and across time. This study is aimed at analyzing the effect of monetary policy variables, which monetary policy could relatively influence, such as money supply, domestic credit, interest rate and exchange rate on inflation in Ethiopia.

For this purpose, the annual data of forty one year from 1980 to 2021 is analyzed using autoregressive distributive lag model.

The estimated result of the model show that Price inertia, real gross domestic product, money supply and real interest rate are the main determinants of inflation in the long run while price inertia, real gross domestic product, government expenditure, money supply, domestic credit, remittance inflow and real interest rate are important variables that explain short run fluctuation of inflation in Ethiopia. The magnitude of elasticity coefficient in both short and long run model indicates that inflation in Ethiopia is mainly explained by past inflation or price inertia and real gross domestic product. This significant positive effect of Price inertia or expectation may be linked to incomplete information and uncertainty.

Inflationary effect of devaluation in the long run may be justified in two ways. First it may causes import expensive and hence imported inflation. Second, devaluation could also increase remittance inflow which in turn leads to the rise in domestic aggregate demand and inflation. Increase in interest rate also reduces inflation through its effect on the demand for real balance. Real interest rate and nominal exchange have expected sign and significant yet the response of inflation to change in those variables is very low. These inelastic coefficients may be due to the fact that exchange rate in Ethiopia is not fully flexible and interest rate is not actively used monetary

policy tool. This Study concludes that expected inflation, money supply, government expenditure, real gross domestic product, domestic credit, remittance inflow, exchange rate and interest rate are the major sources of inflation in Ethiopia.

## 6.2 Policy Implications

This study implies that the joint action of fiscal and monetary policy is needed to monitor inflation. Aggregate demand management is essential and government expenditure should take place in a way that it is not inflationary. Transparent and credible government policy is essential to stabilize expectation of economic agents and inflation. Thus, government should design and follow policies that stabilize expectation of economic agents, ensure positive real interest rate and promote domestic production. Special focus on promoting domestic production and real economic growth is indispensable so as to increase domestic supply and reduce imported inflation.

The stable political and favorable economic environment should be created for domestic and foreign investors to this end. Financial and technical support like credit for entrepreneurs and private investors is also crucial to promote domestic production and stabilize inflation. Interest rate should also increase so as to reduce the demand for real balance and inflation. Devaluation should take place only when there is opportunity to benefit from it otherwise it is inflationary. Government should also ensure that remittance inflow is used for productive investment that boost real production and that it does not lead to increase in domestic money supply to extent it rise inflation. The growth of money supply should be in a way that it promotes economic growth and does not lead to inflation. Government should also set clear inflation target and be committed to achieve it using appropriate policy.

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