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Determinants of Inflation in Ethiopia

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Abstract

Inflation, one of the basic indicators of macroeconomic stability, affects many other macroeconomic variables and it weakens the economy if it goes beyond a specified threshold level. The main objective of the study is finding out the determinants of inflation in Ethiopia. The paper uses secondary data collected from National Bank of Ethiopia and other sources. The ARDL model to co integration has been used to find out the short run and long run determinants of inflation. Findings showed that in the long run oil price, government expenditure and Broad money supply affect inflation positively at 5%, 1% and 1% respectively. However external debt and real GDP affect inflation negatively at 1% and 5% in the long run. But real exchange rate is found to be insignificant in the long run. While in the short run real exchange rate and government expenditure affect inflation positively at 5% and 1% respectively. On the other hand real GDP affects inflation negatively at 10% in the short run. But external debt, money supply and oil price are found to have insignificant effect on inflation in the short run. More over the error correction term estimated at -0.882 is significant at 1% significance level and has the recommended negative sign. Results confirm that both cost push and demand pull factors contribute to inflation in Ethiopia. The findings from this study reveal that inflation can be controlled by reducing money supply, government expenditure and oil price and by increasing external debt and real output.

Keywords: Auto regressive distributive lag (ARDL), Consumer price index (CPI), Cost push inflation, Demand pulls inflation, Quantity Theory of Money.

1. INTORDUCTION

To attain sustainable growth coupled with price stability remains to be the central objective of macroeconomic policies of most countries (Mwakanemel, *et.al*, 2013). Inflation, unemployment rate, balance of payment and output growth (Teshome, 2011) are the major indicators of macroeconomic stability.

Inflation is one of the basic indicators of macroeconomic stability; hence it is an indicator of the ability of the government to manage the economy. High levels of inflation are an indicative of a lack of sound governance by the monetary authority of a country. In addition, it is a sign of government that has lost control of its finances (Fischer, 1993). Studies reveal that inflation level is detrimental to economic growth (Seleteng, 2013). Hence it is important for policy makers to control the level of inflation in order to cope with its impacts on economic growth. Inflation has also an impact on other macroeconomic variables. For instance, Kalim (2010) confirmed that inflation significantly increases unemployment in the long term. Demilie and Samson (2013) argued that inflation reduces national saving; in which reduced national saving leads to reduced economic growth. But Inflation may not be always harmful; rather it may be harmful if it goes up beyond some acceptable level (Demilie and Samson, 2013).

Theoretically the determinants of inflation can be categorized into two broad parts: demand-pull and cost push inflation. Or some time inflation may arise due to both demand-pull and cost-push factors. Ethiopia's determinant of inflation is not out of these major sources of inflation (Teshome, 2011). But the challenge is to locate exactly which determinant of inflation dominates or takes the higher share.

In Ethiopia, during the command economic era, monetary variables were under direct control of the monetary authorities.

After the down fall of the Derg and the coming to power of Ethiopian People Revolutionary Democratic Front, attention was shifted from direct control of monetary variables towards market based policy instruments as the government leaves the economy to private sector (Chewaka, 2001); Which in turn offered the opportunities for price fluctuation.

Due to this and other factors, in Ethiopia in spite of good economic performance over the past decade inflation has spiraled out of control recently (Chewaka, 2001). Sharp increases in inflation could reduce economic growth and exacerbate poverty levels. The main driver of short-run inflation in Ethiopia is a surge in money supply, accounting for 40 percent (AFDB, 2011). This shows money supply determines inflation; indicating that controlling money supply is one of the tools to control inflation.

Ethiopia's inflation has significantly increased since the midst of 2004. This inflation inertia has the largest effect both in the short-run and in the long-run, as evident from the result; inflation itself explains more than 50% of inflation even three years after a shock (Loening *et.al*, 2008).

Inflation volatility is a much serious problem for Ethiopia. And the tangible reasons for this result could be; uncertain output production, uncertain price levels, the inertia effects of inflation volatility and flexibility in fiscal and monetary policies. High inflation would also increase of uncertainty about future inflation. Increased uncertainty could be harmful to economy since it could discourage economic activities. Inflation also results in reduction of exports. This is because a rise in domestic input prices makes the price of domestically produced products expensive in the international market (Abeba, 2014). Most importantly inflation redistributes income from wage earners and fixed income groups to profit recipients and from creditors to debtors. This in turn increases the number of poor hence resulting in more inequality (Jhingan, 1997).

The study tried to find out the factors that most determine inflation. There are similar researches made on the same area such as (Menj, 2016), which covered the time gap from 1997/98 to 2007/8 which is a shorter time lapse than this study. Therefore the research tried to include 31 years data; between 1986 and 2016 GC. The advantage from stretching the time period emanates from the fact that two economic systems, both the command and free market economic systems, have been implemented in Ethiopia. And this enables to observe what the inflation trend seems like within the two economic systems. More over the question how external debt affects inflation has not gained attention. Thus by analyzing the relationship between external debt and inflation in this paper fills the gap. More over most of the previous studies could not include gas oil price. Having this fact this study included gas oil price. Since gas oil price determines inflation (Biresew, 2013).

In addition to this most studies concerning inflation are not conducted to analyze the determinants of inflation rather on the impacts of inflation on other economic variables such as GDP in Ethiopia. This paper addresses the following question: What are the socio economic determinants of inflation in Ethiopia?

2. Material and Methods

The study focuses on the determinants of inflation in Ethiopia. This chapter outlines sources of data, method of data acquisition and analysis.

2.1. Data source

The study depends mainly on secondary data and the sources are annual reports of National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MoFED), African Development Bank (ADB), Ethiopian Economics Association (EEA), International Monetary Fund (IMF) and Central Statistical Authority (CSA). The time series data of selected macroeconomic variables between 1986 and 2016 were collected from their respective sources, so as to make the study fruitful in achieving its proposed objectives.

2.2. Method of analysis

In this study econometric method of data analysis has been used. To do this the econometric software Eviews version 9.0 has been used.

2.3. Model Specification

This section presents a model that attempts to capture the major macroeconomic factors affecting inflation in Ethiopia. Macroeconomic theory has identified various factors that influence the inflation from the Quantity, Keynesian, Classical and other theories. These factors include real output, government expenditure, corruption index, money supply, lending rate, exchange rate, gas oil price, external debt, budget deficit and others.

The study adopts a model used to analyze inflation in Ethiopia by Menji (2008) and in Tanzania in 2001 by Laryea and Sumalia to study the determinants of inflation. Based on the availability of data in Ethiopian context some variables are added and some are removed in case of this thesis. And the model is formulated as follows:

INF = F (XD, RER, M2, RGDPP, OP, G)……………………………………………………… (1)

Put in regression form the inflation function of equation (1) becomes:

$$INF = \beta_0 + \beta_1 gRER_t + \beta_2 gM2_t + \beta_3 gRGDPP_t + \beta_4 \, gOP_t + \beta_{5g} gG_t + \beta_6 sXD_t + U_i \dots\dots\dots\dots \quad (2)$$

It is to mean that, inflation (INF) is a function of external debt as a share of GDP (sXD), real exchange rate growth (gRER), money supply growth (gM2), real gross domestic per capita output growth (gRGDPP), growth in oil price (gOP) and government expenditure total growth (gG).

2.4. Co integration Analysis

Pesaran et al. (1999, 2001); Narayan (2004); have introduced a co integration technique known as the 'Autoregressive Distributed Lag (ARDL)' bound test. This co integration technique is the method used to analyze the short run and long run determinants of inflation in this study.

There are numbers of advantages of using ARDL model. First it can be used with a mixture of I (0) and I (1) data. Second it involves just a single-equation set-up, making it simple to implement and interpret. Third different variables can be assigned different lag-lengths as they enter the model. Fourth is the more statistically significant approach to determine the co integration relation in small samples as the case in this study (Pesaran *et.al*. 2001; Narayan, 2004), while the Johansen co-integration techniques require large data samples for validity. Finally in bound testing approach, the long run and short run parameters of the model in questions are determined simultaneously (Tsadkin, 2013).

The ARDL modeling of unrestricted error correction model using Ordinary Least Square (OLS) can be represent as follows Pesaran et.al. (2001).

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{\rho} \beta \, \Delta Y_{t-i} + \sum_{i=1}^{\rho} \alpha \, \Delta X_{t-i} + \delta_1 Y_{t-1} + \delta_2 X_{t-1} + U_t$$

Where Δ denotes for first difference operation, Y_t is for a vector of dependent variables, X_t is a vector of regressors, U_t is the residual term which is assumed to be white noise.

The ARDL approach to co integration enables to estimate of the error correction model (ECM) for the determinants of inflation.

$$\Delta \mathrm{INF_t} = \propto_0 + \sum_{i=1}^{\rho} \beta_0 \ \Delta INF_{t-i} + \sum_{i=1}^{\rho} \beta_1 \ \Delta gRGDPP_{t-i} + \sum_{i=1}^{\rho} \beta_2 \ \Delta gM2_{t-i} + \sum_{i=1}^{\rho} \beta_3 \ \Delta gG_{t-i} + \sum_{i=1}^{\rho} \beta_4 \ \Delta sXD_{t-i} + \sum_{i=1}^{\rho} \beta_5 \ \Delta gRER_{t-i} + \sum_{i=1}^{\rho} \beta_6 \ \Delta gOP_{t-i} + \emptyset_0 INF_{t-i} + \emptyset_1 gRGDPP_{t-i} + \emptyset_2 gM2_{t-i} + \emptyset_3 gG_{t-i} + \emptyset_4 sXD_{t-i} + \emptyset_5 gRER_{t-i} + \emptyset_6 gOP_{t-i}$$

All variables are as previously defined.

In order to know the existence of the long run relationship among the variables bound test or F test variables has been implemented. The null hypothesis for no co-integration in the long-run among the variables in equation is:-

$H_0: \emptyset_0 = \emptyset_1 = \emptyset_2 = \emptyset_3 = \emptyset_4 = \emptyset_5 = \emptyset_6 = 0 \ldots\ldots$ (Meaning no long run relationship among the variables) against the alternative one:

$$H_1: \emptyset_0 \neq \emptyset_1 \neq \emptyset_2 \neq \emptyset_3 \neq \emptyset_4 \neq \emptyset_5 \neq \emptyset_6 \neq 0$$

After checking the existence of long-run relationship (co integration) of the variables, the following long run ARDL ($P_1, P_2, P_3, P_4, P_5, P_6, P_7$) modeln will be estimated.

$$INF_t = \alpha + \sum_{i=1}^{P} \beta_0 INF_{t-i} + \sum_{i=0}^{p} \beta 1 gRER_{t-i} + \sum_{i=0}^{P} \beta_2 gRGDPP_{t-i} + \sum_{i=0}^{P} \beta_3 gM2_{t-i} + \sum_{i=0}^{P} \beta_4 sXD_{t-i} + \sum_{i=0}^{P} \beta_5 gOP_{t-i} + \sum_{i=0}^{P} \beta_6 gG_{t-i} + \ \varepsilon_t \ldots\ldots\ldots\ldots \quad (4)$$

Here all variables are as previously defined. Orders of the lags in the ARDL Model is selected by the Akaike Information criterion (AIC) before the selected model is estimated by ordinary least squares. We used the Akaike Information criterion (AIC) in lag selection because of its advantages for small sample size Tsadkan (2013) as it is the case in this study.

Determination of the optimal lag length is so crucial in ARDL model, because it helps us to address the issue of over parameterizations and to save the degree of freedom (Taban, 2010) as cited in Tsadkan (2013). For annual data, Pesaran and Shin (1999) recommended choosing a maximum of 2 lags. From this, the lag length that minimizes Akaike Information criterion (AIC) is selected.

2.5. Vector error correction model (VECM)

In the presence of co integration, short-run elasticity can also be derived by constructing an error correction model of the following form:

$$\Delta INF_t = \alpha + \sum_{i=1}^{P} \beta_0 \Delta INF_{t-i} + \sum_{i=0}^{P} \beta_1 \Delta gRER_{t-i} + \sum_{i=0}^{P} \beta_2 \Delta gG_{t-i} + \sum_{i=0}^{P} \beta_3 \Delta gM_{t-i} + \sum_{i=0}^{P} \beta_4 \Delta sXD_{t-i} + \sum_{i=0}^{P} \beta_5 \Delta gOP_{t-i} + \sum_{i=0}^{P} \beta_6 \Delta gRGDPP_{t-i} + \gamma ECT_{t-1} \dots\dots\dots\dots \quad \dots\dots \quad (5)$$

Where ECT_t is the error correction term, and can be defined as

$$\text{ECT}_t = \Delta INF_t - (\alpha_0 + \sum_{i=1}^{P} \beta_0 \Delta INF_{t-i} + \sum_{i=0}^{P} \beta_1 \Delta gRER_{t-i} + \sum_{i=0}^{P} \beta_2 \Delta gM_{t-i} + \sum_{i=0}^{P} \beta_3 \Delta sXD_{t-i} + \sum_{i=0}^{P} \beta_4 \Delta gOP_{t-i} + \sum_{i=0}^{P} \beta_5 \Delta gG_{t-i} + \sum_{i=0}^{P} \beta_6 \Delta gRGDPP_{t-i} \dots\dots\dots\dots (6).$$

Here Δ is the first difference operator; β 's are the coefficients relating to the short-run dynamics of the model's convergence to equilibrium, and γ measures the speed of adjustment.

2.6. Unit Root Test

It is fundamental to test for the statistical properties of variables when dealing with time series data. Time series data are rarely stationary in level forms. Regression involving non-stationary (I.e., variables that have no clear tendency to return to a constant value or linear trend) time series often lead to the problem of spurious regression. This occurs when the regression results reveal a high and significant relationship among variables when in fact, no relationship exist. That is a regression based on nonstationary time series explains the relationship during the study period only. This means that it is impossible to infer about the long run relationship of the variables. The other necessary condition for testing unit root test when we applying ARDL model is to check whether the variables enter in the regression are not order two (I.e. I(2)), which is a precondition in ARDL model. Therefore, it is necessary to test for time series variables before running any sort of regression analysis.

The decision is as follows; if the t value or t-statistic is more negative than the critical values, the null hypothesis (I.e. H0) is rejected and the conclusion is that the series is stationary. Conversely, if the t-statistic is less negative than the critical values, the null hypothesis is accepted and the conclusion is that the series is non-stationary.

Stationaryty can be tested using Augmented Dickey-Fuller (ADF) test, Phillips Perron (PP) test and Kwiatkowski- Phillips-Schmidt-Shin (KPSS) test. Thus, to ensure reliable result of test for stationaryty, the study employs Augmented Dickey-Fuller (ADF) test.

The testing procedure for the ADF unit root test is specified as follows:

$$\Delta Y_T = \alpha + \delta_t + \gamma Y_{t-1} + \sum_{i-1}^{\rho} \theta \Delta Y_{t-1} + \epsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where Y_t is a time series variable under consideration in this model at time t, t is a time trend variable; Δ denotes the first difference operator; ε_t is the error term; p is the optimal lag length of each variable chosen such that first-differenced terms make ε_t a white noise. The ADF test for the null hypothesis is there is a unit root (the variable is non stationary).

That is: H0: $\gamma = 0$; H1: $\gamma \neq 0$

2.7. Definition and measurement of variables

This section contains the definition of the variables included in the study and their expected signs based on empirics and theory.

Inflation (INF) – Inflation is the overall general upward price movement of goods and services in an economy. Inflation is measured by measuring the percentage change in the prices of a given basket goods over time as compared to the price in the base year. We can use the CPI to determine differences in price between two points in time and calculate inflation for that period. In Ethiopia the central Statistical Authority computes the CPI. It is a measure mostly used to measure inflation. The CPI measures the cost of buying a fixed basket of goods and services representative of the purchase of consumers. To get inflation, we take the more recent CPI, subtract the oldest CPI, and then divide by the oldest CPI. Since Inflation is considered as a percentage, so we take that number and multiply it by 100.

$$\text{INF} = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} * 100$$

Real Exchange Rate (RER) – Exchange rate is the amount of domestic currency needed to buy a unit of foreign currency. In international trade and foreign exchange, two types of exchange rates are used. The nominal exchange rate simply states how much of one currency can be traded for a unit of another currency.

Contrarily real exchange rate describes how many of a good or service in one country can be traded for one of that good or service in another country. For example, a real exchange rate might state how many Ethiopian bottles of wine can be exchanged for one US bottle of wine. Algebraically, the real exchange rate is the same as the nominal exchange rate (NER) times the domestic price of the item divided by the foreign price of the item.

$$\mathbf{RER= NER *} \frac{\boldsymbol{Domestic\ price\ of\ the\ item}}{\boldsymbol{Foreign\ price\ of\ the\ item}}$$

Thus an increase in exchange Rate leads to the decline in purchasing power of birr (higher amount of birr is needed to buy previously existing amount of Dollar) resulting in a rise in inflation rate. Thus exchange rate is expected to have a positive (+) sign.

Broad Money Supply (M2) - M2 is expected to have a **positive** sign. Because when the supply of M2 which is the sum of narrow money , saving deposit and time deposit, increases in the economy people will have to much money to pay for higher prices. And this increasing ability to pay for higher prices leads to inflation. More expansionary monetary policies can cause demand-pull inflation, which if combined with cost-push inflation can threaten macro and social stability.

Gas Oil Price- Since gas oil is a major component of import for most countries of the world any changes in the prices in the international market have a multiplier effect as it affects more than one sector. A change in fuel and energy prices may result to higher prices in the transport industry and a higher production cost to industry that rely on it as a source of power Kirimi, 2014. Thus it is expected to have a **positive (+) sign.**

Government Expenditure (G) – G is expected to have a **positive sign**. Because the more the government expenditure is the more money is injected in to the public, which leads to inflation. Total Government expenditure has two components. These are the capital expenditure and the recurrent expenditure. In this study total government expenditure is used, to analyze its effect on inflation.

External Debt (XD); Due to inadequate internal financial resources, countries borrow from external sources. External debt is that part of the total debt in a country that is owed to creditors outside the country. The debtors can be the government, corporations or private households.

According to Neyapti, (2003: 458-461), which examines the relationship between budget deficits and inflation rates, investigates the specific effect of external debt on inflation, and hypothesizes that the effect is not necessarily positive and is subject to the level of financial market development within the countries. In particular, this paper tests the validity of the idea that if the financial market is well developed, the debt may be less inflationary or even not inflationary at all. Having this evidence external debt is expected to have a **positive (+)** effect on inflation Ethiopia since the financial market is wick (Tiruneh, 2012).

Real Gross Domestic product (RGDP) –RGDP is the number reached by valuing all the productive activity within the country at a specific year's prices. When economic activity of two or more time periods is valued at the same year's prices, the resulting figure allows comparison of purchasing power over time, since the effects of inflation have been removed by maintaining constant prices. Real GDP is considered a more accurate measure of an economy's gross domestic product than nominal GDP because it takes into account inflation and changes in the economy's price level.

GDP causes inflation because, as production is being increased to meet increased demand increased production leads to a lower unemployment rate, further increasing demand. Because increased wages lead to higher demand as consumers spend more freely. This leads to higher GDP combined with inflation. Hence the expected sign of RGDP on inflation is **positive (+).**

3. Results AND Discussion

In this section the time series data collected from different sources is tested and analysed using Eviews 9 software. And the results are discussed.

3.1. The Unit Root Test Analysis

In order to determine the degree of integration, a unit root test has been carried out using the standard Augmented Dickey-Fuller (ADF) test. Moreover in applying ARDL model all the variables entered in the regression should not be integrated of order two.

Thus to check these conditions, unit root test is conducted before any sort of action taken. Even though the ARDL framework does not require per-testing variables to be done, the unit root test could convenience us whether or not the ARDL model should be used. The result in Table 5.1 shows that there is a mixture of I (0) and I (1) and none of them are integrated of order two, I(2).

Table 3.1: Unit root test (Augmented Dickey-Fuller test)

Augmented Dickey-Fuller test statistic(ADF Test)		
Variable	P VALUE	
	At level	At first difference
D(INF)	0.7362	0.0 1 6 6**
D(gRER)	0.999	0.0 0 8 5***
D(gOP)	0.000***	0.000***
D(sXD)	0.048*	0.0086***
D(gG)	0.162	0.000***
D(gM2)	0.0042***	0.000***
D(gRGDPP)	0.008***	0.0000***

***,**,* indicates 1,5,10 % significance level

As we can see form table 3.1 above, Inflation (INF) , Real Exchange Rate growth (gRER) and government expenditure growth (gG) are integrated of order one or stationary at first difference(I.e. I(1)). While, Gas Oil price index (gOP), share of external debt to GDP (sXD), Real per capita output growth (gRGDPP) and Broad Money Supply growth (gM2), are integrated of order zero; Or stationary at level (I (0)).

In the above table it is confirmed that all of the variable are integrated of either order 0 or order one. So it is possible to use them for the ARDL model since none of them are I (2).

3.2. Long Run ARDL Bounds Tests for Co-integration

In addition to the above diagnostic tests, the stability of long run estimates or the existence of long run relationship between the dependant and independent variables has been tested by applying the ARDL Bound test, by using a maximum of 2 automatic lag-length selection as recommended for yearly data and small sample size (Tsadkan, 2013).

This is done, firstly by estimating the long run equation of the model by using the ARDL estimation method with a maximum of 2 lags for both the dependant variable the regressers.

Table 3.2 Bound tests

F-Statistic 14.98924		
Significances	Lower bound[I0]	Upper Bound[I1]
10%	1.75	2.87
5%	2.04	3.24
2.25%	2.32	3.59
1%	2.66	4.05

The decision rule for the bound test is to reject the null hypotheses of no long run relationship exist if the f statistic is larger than the upper bound at 5% significance level, and to accept the null hypotheses if the F statistic is lower than the lower bound at 5% significance level and inconclusive about the existence of long run relationship if the F statistic lies between the lower and upper bounds.

As we can see from table 3.2 above the F statistic (14.98924) is larger than the upper bound even at 1% significance level so we reject the null and we accept the alternative hypotheses of long run relationship. In short there is long run relationship in the model.

3.3. Long Run ARDL Model Estimation

Hence the existence of long-run co-integration relationship among the variables is confirmed, the next step is running the appropriate ARDL model to find out the long run coefficients, as the reported in table 3.3 below.

Table 3.3 Estimated Long Run Coefficients using the ARDL Approach ARDL (1, 1, 1, 1, 1, 1, 2) selected based on Akaike Information Criterion.

Dependent variable is RCPI			
Regresser	Coefficient	t-statistic	Prob.
sXD	-0.02327	-4.54	0.0005
gM2	0.4717	2.98	0.0098
gRER	-0.05158	-0.4697	0.6458
gOP	0.2402	2.26	0.0400
gG	0.7310	4.10	0.0011
gGDPP	-1.06	-2.8	0.0144

As the long run estimated result shows in Table 3.3, External debt (sXD), represented as a percentage share of GDP has a negative effect on inflation in the long run. Accordingly a unitary increase in external debt to GDP ratio leads to an increase in inflation by 0.02327. which is opposite to its expected sign. In developing countries an increase in the ratio of external debt to GDP causes an increase in inflation (Marian, 2014). However in Ethiopia most public projects are financed by external debt, (IMF, 2012). Thus the impact of these projects for reducing transportation and communication and other production costs might have reduced the cost push inflation. Plus the output of these projects in the long run may calm down the demand pull inflation. Our result is also in conflict with the finding by Reinhart (2010) who found out a positive impact of external debt on inflation.

This difference could arise from the fact that his study includes war time debt, which is not productive in the long run. Other findings support our findings for instance Kannan and Singh (2007) found that deficits and debt have a negative impact on inflation during 1971 to 2006 in India.

According to Quantity theorist's inflation is always and everywhere a monetary phenomenon. In this study similarly to the Quantity theorists' idea, broad money supply, represented by money growth (gM2) has a positive impact on inflation in the long run at 1% significance level in the study area. Accordingly, a unitary rise in broad money supply results a raise in inflation by 0.4717, in the long run. Evidences show that in the long run, the consequential increase in the money supply causes inflation to move up wards (Sargent et.al, 1981). Other studies also confirmed a similar result (Menj, 2008, Kirimi, 2013 in Kenya, Hilegebrial, 2015, Sek, 2015, Layra, 2012, Biresaw, 2013 and Boafa, 2012 in Ghana). Moreover much evidences support that expansionary monetary policy can cause demand-pull inflation, which if combined with cost-push inflation can threaten macro and social stability.

Inflation, according to quantity theorists, is believed to be caused by excess money injected in to the economy. Because as money supply rises in a given economy aggregate demand becomes greater than aggregate supply and this results a rise in price to bring demand and supply to equilibrium. In which inflation rises since inflation is an increase average price level in a given economy. Moreover if the money supply grows too big relative to the size of an economy, the unit value of the currency diminishes; in other words, its purchasing power falls and prices rise.

Similarly at 1% level of significance, real government expenditure, which is represented by expenditure growth (gG), has also a positive effect on inflation in Ethiopia. In the long run a rise in real government expenditure by one unit leads to a 0.7310 rise in inflation. This result goes in line with the finding by (Sek, 2015). The rise in government expenditure results high amount of money to be injected in to the economy, which cause the population to be willing to pay for the good and service with high price than before. And finally this leads to a general rise in inflation.

According to Frisch (1977), the effects of international inflation on domestic inflation are through several channels for international inflation to be transmitted to domestic economies, including the liquidity effect, price effect and the demand effect. Imported inflation from oil price shock accelerates the growth of domestic inflation in Ethiopia. Accordingly a one percent increase in price of gas oil per barrel, put as a proxy by oil price growth (gOP), leads to a rise in inflation by 0.2402.

This result is similar to the theoretically expected sign and in line with results of other findings, Biresaw (2013) using a granger causality approach concluded that gas oil price Granger causes inflation. Since the government terminated subsidizing the gas oil sector 2007, oil price has contributed a significant impact for the Ethiopian inflation. For instance using OLS estimation technique Menj (2008) concluded Gas oil price has been found to be insignificant in influencing inflation. Since the study period was during the subsidization period.

On the other hand real gross domestic product per capita (gRGDPP), causes inflation in Ethiopia to fall in the long run. This might be due to the decline in demand pull inflation by the rise in output. Accordingly, a unitary (a Birr) increase in RGDPP as a proxy by real per capita output growth leads to a 1.06 decline in inflation in the long run. This finding is similar to other finding by Khan and (Qasim, 1996).

Finally, in contrary our priory expectation, real exchange rate (gRER) is found to have insignificant impact on inflation in Ethiopia in the study period. Romer, (1993) argues that the choice of the exchange-rate regime not an important determinant of inflation. According to Loungani (2001) in countries with fixed exchange rate inflation cannot be caused by exchange rate changes. And since Ethiopia follows controlled floating exchange rate regime since 1992 Reuters (2017) it is possible to absorb insignificant impact of exchange rate on inflation in the long run.

The weak correlation between the price and exchange rate might be due to Ethiopian governments pegged the Birr to U.S. exchange rate regime. Especially in the Derg regime it was fixed at 2.07. All these might have caused exchange rate not to have a significant influence on price in the long run.

But the empirical finding suggests that exchange rate has a significant negative relationship with price in the long run. This negative relationship is possible as explained by Ito and Sato (2008) that the interaction of exchange rate and domestic prices that varied from one country to another. Observing the heightening level of external debt, by the IMF redefinition, external debt caused exchange rate will then lead to inflation.

But based on the last debt sustainability analysis (DSA) prepared in august 2011 Ethiopia is at low risk of external debt and Ethiopia reached the completion point under the Heavily Indebted Poor Country (HIPC) Initiative in 2004, IMF (2012). Thus, in Ethiopia, debt caused exchange rate devaluation is not a risk to cause a significant rise in inflation.

3.4. Diagnostic Tests

In this study a number of diagnostic tests have been undertaken, to check the validity of the model. This includes Serial correlation test (Brush &Godfray LM test), and Heteroscedasticity test.

Table 3.4: Diagnostic test for the long run ARDL

Test	P Value
Serial correlation	0.883
Heteroscedasticity	0.6404

The above table shows the results of serial correlation and Heteroscedasticity tests. In checking for the existence of serial correlation the Brusch-Goodfry Lagrange multiplier (LM) test is used. The null hypotheses of LM test for serial correlation is the residuals are not serially correlated. If the P value is less than 0.05 we reject the null of no serial correlation and accept the alternative for the existence of serial correlation (Harris, 1995). However as it can be seen from the above table (Table 3.4) the P value is greater than the 5% significance level (0.883>0.05). So we accept the null for no serial correlation i.e. no serial correlation exists in the model at 5% significance level.

The test for heteroscedasticity investigates whether the variance of the errors in the model are constant or not. In Bruisch –Pagan-Godfry test for heteroscedasticity, the null hypotheses states that residuals are homoscedastic and independent of the regressors and that there is no problem of model misspecifications.

If the Bruisch –Pagan-Godfry test statistic is significant, i.e. P value is less than 0.05; the null hypotheses of homoscedasticity and no model misspecification will be rejected. As shown in the above table the P value is larger than 5% significance level (0.6404>0.05), we accept the null for homoscedasticity. Therefore the residuals are homoscedastic and independent of the regressers and no model misspecification problem.

3.5. Short Run Error Correction Model

The next step after the acceptance of long-run coefficients of the inflation equation is estimation of the short-run ECM model. As discussed in chapter three the error correction term (ECM), indicates the speed of adjustment to restore to the equilibrium in the dynamic model. It is a one lagged period residual obtained from the estimated dynamic long run model. The coefficient of the error correction term indicates how quickly variables converge to equilibrium. Moreover, it should have a negative sign and statistically significant at a standard significant level (i.e. p-value should be less than 0.05).

Table 3.5: The Short Run Error Correction Representation for the Selected ARDL (1, 1, 1, 1, 1, 1, 2) selected based Akaike Information Criterion.

Regresser	Coefficient	t-value	P-Value
D(sXD)	0.026	1.550	0.142
D(gM2)	-0.123	-0.94	0.362
D(gRER)	0.084	1.964	0.069
D(gOP)	0.056	0.956	0.350
D(gG)	0.393	3.458	0.000
D(gRGDPP)	-0.300	-1.867	0.082
ECT(-1)	-0.882	-7.800	0.000

As shown in table 3.5 above, the error correction coefficient estimated at -0.882 is significant at 1% significance level and has the recommended negative sign. According to Gebrehiwot (2016), the highly significant error correction term further confirms the existence of a stable long-run relationship.

Moreover, the coefficient of the error term (ECM-1) implies that the deviation from long run equilibrium level of inflation in the current period is corrected by 88.2 %, in the next period to bring back equilibrium when there is a shock to a steady state relationship. The negative values in speed of adjustment indicate the impact of shocks on inflation is declining over time.

As shown in table 3.5 above real exchange rate (gRER), government expenditure and real GDP per capita (gRGDPP), are the variables that affect inflation in the short run, significantly. Accordingly, a unitary increase in exchange rate of birr per US dollar leads to a 0.099 rise in inflation. The decline in purchasing value of birr due to devaluation against dollar might have caused this inflation. In addition; a rise in government expenditure causes a 0.393 rise in inflation per each unitary growth in government expenditure in the short run. The demand pull inflation due to the government injected money into the public might have caused this. Plus to that; as a government rises spending, it can temporarily boost overall demand and economic growth. If, however, this increase in demand exceeds an economy's production capacity, the resulting strain on resources creates "demand-pull" inflation. Policymakers must find the right balance between boosting growth when needed without over stimulating the economy and causing inflation.

Real gross domestic product per capita is the other variable that affects inflation in the short run. Accordingly each additional birr rise in real RGDPP causes inflation to decline by 0.30. The rise in real output reduces the demand pull inflation and this might be the cause behind this negative effect.

4. Conclusion

The main objective of this study was to analyze the determinants of inflation in Ethiopia during the specified period. To determine the long run and short run relationship among the variables, Autoregressive Distributed Lag (ARDL) model has been applied. Before applying the ARDL model, all the variables are tested for their time series properties (stationarity properties) using the ADF test. As a result, oil price, money supply and real GDPP are stationary at level, I (0). While inflation, real exchange rate and government expenditure are stationary at first difference. I.e. none of the variables used in this study are I (2).

Next to testing for the time series properties, the model stability test was done by applying the multicoloniarity and hetrosKedasticity tests. The results revealed that no evidence of serial correlation, no functional form problem (the model is correctly specified), the residual is normally distributed and no evidence of hetrosKedasticity problem.

In addition the study applied the methodological approach called ARDL model also known as bound test approach. As the test result indicated the bound test (F-statistic) value is found to be larger than the upper bound critical values at one percent significance level, indicating the existence of a long run relationship between Inflation rate (RCPI) and its determinants (external debt, broad money supply, real exchange rate, oil price and government expenditure) in long run during the study period.

Based on the empirical finding of this study among the determinants of inflation external debt affects inflation negatively in the long run. In the long run, a one percent increase in external debt causes inflation to decline by 0.023.

In Ethiopia most public projects are financed by external debt, (IMF, 2012). So that the impact of these projects reduces transportation, communication and other production costs and this in turn might have reduced the cost push inflation in the long run.

Gas oil price also affects inflation positively. In the long run a one percent rise in oil price per barrel is found to have a 0.24 positive effect on inflation.

Broad money supply is the other variable affecting inflation positively in the long run. A one percent increase in broad money supply causes inflation to increase by 0.47 in the long run.

Real exchange rate plays insignificant role in determining inflation in the long run. But in the short run a unitary increase in exchange rate causes inflation to increase by 0.084.

On the other hand government expenditure affects inflation positively both in the short run and in the long run. Thus, as government expenditure increases by one percent it leads to an increase in inflation by 0.71 and 0.39 in the long run and in the short run respectively.

Contrarily RGDPP affects inflation negatively both in the short run and in the long run. Accordingly a one percent rise in real gross domestic product per capita (RGDPP), causes a 1.06

and 0.3 falls in inflation in the long run and in the short run respectively. This might be due to the decline in demand pull inflation by the rise in output.

References

Biresaw, T. T. (2013). Determinant and impacts of dynamic inflation in Ethiopia (Master's thesis, Norwegian University of Life Sciences, Ås).

Chewaka, J. E. (2014). Comment: Legal Aspects of Stock Market Development in Ethiopia: Comments on Challenges and Prospects. Mizan Law Review, 8(2), 439-454.

Demilie Basha Hailu, Samson Abay, (2013). A journal on, Inflation and Gross Domestic Savings nexus in Ethiopia, Department of Economics, Adigrat University, Adigrat, Ethiopia.

Harris, R. I. (1995). Using cointegration analysis in econometric modelling.

IMF, (2012). Staff report for the 2012 article iv consultation—debt sustainability analysis, the federal democratic republic of Ethiopia

Loening, J., & Takada, H. (2008). Inflationary expectations in Ethiopia: some preliminary results.

Marian, A. (2014). The impact of public debt on economic growth and iflation. Department of Enterprise's Information Systems, Faculty of Economics, Slovac university. Working paper v.62, n.6. http://dx.doi.org/10.11118/actaun201462061545

Menji, S. (2008).Determinants of Recent Inflation in Ethiopia.

Narayan, P. (2004). Reformulating critical values for the bounds F-statistics approach to cointegration: an application to the tourism demand model for Fiji (Vol. 2). Australia: Monash University.

Pesaran M.H., Shin Y. and R.J. Smith (2001), "Bound Testing Approach to the Analysis of Level Relationships", Journal of Applied econometrics, Vol.16, pp 289-326

Pesaran, M. and Shin, Y. (1999), "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis" in S. Strom, Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch centennial Symposium, Cambridge University Press, Cambridge.

Reinhart, C. M., &Rogoff, K. S. (2010). Growth in a Time of Debt. American Economic Review, 100(2), 573-78.

Seleteng, M. (2013).Inflation and economic growth nexus in the Southern African Development Community: a panel data investigation (Doctoral dissertation, University of Pretoria).

Taban, S. (2010). An examination of the government spending and economic growth nexus for Turkey using the bound test approach. International Research Journal of Finance and Economics, 48, 184-193.

Teshome A. (PhD), (2011). Sources of inflation and economic growth in Ethiopia: descriptive analysis, assistance professor at Ethiopia Civil Service University: e-mail address: feysaduu@yahoo.com.

Tsadkan, A. (2013). The nexus between public spending and economic growth in Ethiopia: Empirical investigation. Unpublished Master Thesis.