The Effect of Some Economic Factors on inflation in Ethiopia

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By

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DECLARATION

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged

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This is to certify that the thesis prepared by Antehun Eshetu, entitled: **The Effect of some economic factors on inflation in Ethiopia** and submitted in partial fulfillment of the requirements for the Degree of Master of Science complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

This research looks at the effect of some economic factors on inflation in Ethiopia.The study was conducted with the target of searching for the relationships that exist between selected economic variables and inflation. Thus, this study employed analysis together with Econometric analysis like Johnson co-integration, Vector Error correction model (VECM), Granger causality tests, impulse response and forecast error variance decomposition to analysis future and short-run relationship between variables. We have estimated economic variables by using annual statistic data for the amount starting from 1975 to 2019. The empirical results show that real rate of exchange and cash in hand were the variables that are found to own a protracted run significant and positive relationship with the inflation and government expenditure and also the long term significant and negative relationship with the inflation. In short run the lagged coefficient of real charge per unit, cash in hand and government expenditure incorporates a positive effect on inflation. The error correction term the adjustment coefficient found during this study indicates that a couple of 12% of the variation within the inflation from its equilibrium level is corrected within a year. The pairwise Granger causality test result suggest that the existence of strong and significant correlation between a uni- directional causation runs from real GDP to inflation, funds to inflation, government expenditure to inflation and inflation to real exchange rate per unit. .

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Acronyms

ADF	Augmented Dickey Fuller Test
AIC	Akaike information
CPI	Consumer Price index
CSA	Central Statistical Agency
DF	Dickey Fuller
ECM	Error Correction Modeling
ECT	Error correction term
EEPRI	Ethiopia Economic Policy Research Institute
FMOLS	Fully Modified Ordinary Least Square
FPE	Final Prediction Error
GDP	Gross Domestic Product
HQ	Hannan-Quinn information
IMF	International Monetary Fund
LCPI	Log of Consumer price index
LGEX	Log of Government Expenditure
LREXR	Log of Real Exchange rate
LRGDP	Log of Real Gross Domestic Product
LM	Lagrange multiplier
LMS	Log Money supply
LR	Likelihood Ratio
MoFEC	Ministry of Finance and Economic Corporate
MS	Money Supply
NBE	National Bank of Ethiopia
OLS	Ordinary Least Square
REXR	Real Exchange Rate
RGDP	Real Growth Domestic Product
SAPS	Structural adjustment policy
SIC	Schwarz information criterion
USD	United States Dollar
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
VMA	Vector Moving Average

1 Introduction

1.1 Background of the study

High economic process at a stable inflation is one in every of the most important objectives in most of economies worldwide. Stabilizing indicator plays a critical role in determining growth of an economy; so, monetary authorities in many countries implement monetary policies to regulate and maintain inflation at a desirable level. Too high inflation has an adverse effect on the economy but there are empirical evidences to point that a moderate inflation also decreases economic process (Temple, 2000). However, high inflation isn't only stemmed from instruments of monetary policy (money supply, rate, rate, inflation) but also comes from instruments of economic policy (government revenue and expenditure, fiscal deficit, public debt).

Ethiopia may be a country with a population of 114 million (in 2019/20) where 79 percent of the population lives in rural areas. The country includes a total area of 1.1 million sq.km of which 15.1 percent is arable land and 0.45 percent is irrigated land. The population density (person per sq.km) is near 115:1 sq.km. The age dependency ration is around 95.9 percent. The population has been growing at a mean rate of two.7 percent per annum for the past 9 years. This high rate of growth of the population in line with the age structure is undermining the economic progress made. Additionally it also creates pressure on the present resources. The lifetime at birth is around 65.9 for males and 69.8 for females. The overall fertility is around 4.3 births per women (Karabag,S.F,2020)

The gross domestic product of Ethiopia is around 94 billion US dollars in 2019. The real GDP per capital has been 570 US dollar. The general performance of the Ethiopian Economy has been satisfactory during recent years. This could be revealed by the upper rate of growth of real GDP. The expansion rate of real GDP has been 9% in 2019. Additionally the expansion rate of real GDP has also been positive within the last 10 years. The consecutive growth of the economy is thanks to suitable climatic conditions in terms of timely and adequate rainfall, some efforts and support for farmers within the kind of extension packages and a rise in tillage. Because of the relative performance of the agricultural sector, more emphasis on the agricultural sector by the govt and increased urban population, per capita income growth in rural areas has been beyond that of urban areas (Abreha,K.G. 2019)

Inflation has been low in Ethiopia within the overdue to varied reasons. During the Derg regime the value control by the govt has kept prices stable. The govt was also ra-

tioning goods at fixed prices to the general public which successively has contributed to the lower inflation attained during the Derg regime. Additionally the lower and pegged rate has also helped to lower the impact of international price hikes on Ethiopia; in fact it also makes imports cheaper. During the sooner years of this regime inflation has been low despite the massive inflow of cash by the IMF and other donors. This happened because the displacement of former government soldiers and layoffs of workers because of the structural adjustment policy (SAPS) followed by the country had depressed demand. This depression of demand has counteracted the inflationary impact of increased demand because of the inflow of aid. But in recent years inflation has been high in Ethiopia (IMF, 2008)

There is still no argument on the causes of the high inflation experienced in recent years. The govt. state supply bottlenecks, market structure, increased income within the rural sector and international price developments especially of petroleum to be the reason for inflation. IMF and most economists argue that inflation is caused because of increased demand caused by expansion in funds, increased remittances. Additionally deficit is additionally thought to be an explanation for inflation. Briefly the govt. attributes inflation to produce factors while international organizations and most economists attribute inflation to demand factors (Ababa,Addis 2005/06).

1.2 Statement of the Problem

Inflation is bad not because people hate it but because it affects people adversely. Inflation reduces the income of individuals, especially those with fixed incomes, reduce their living standard and reduces saving. The reduction in saving is thanks to the will of more cash to shop for goods and services. This ends up in lower investment and capital formation. Inflation also hinders foreign direct investment because rising cost of materials and inputs makes foreign investment less profitable. Uncertainty about prices and increase in production costs also reduce production. Inflation also causes misallocation of resources (Abegaz, B. 2018).

Inflation also ends up in reduction of exports. This is often because rise in domestic input prices makes the worth of domestically produced products expensive within the international market. Additionally inflation also ends up in increased imports. This can be because the inflation leads to higher price of domestically produced products which successively ends up in increased demand for imports. The rise in imports and also the decline in exports caused by inflation successively lead to adverse balance of payments within the country. Most importantly inflation redistributes income from wage earners and stuck income groups to profit recipients and from creditors to debtors. This successively increases the amount of poor and on the opposite hand increases the amount of the rich and hence leading to more in equality. (Jhingan, 1997) it's clear that the currently high rate of inflation in Ethiopia will retard the expansion of the country achieved in recently years. The present inflation incorporates a dampening effect on the present development of the export sector. This can be because inflation makes Ethiopian products dearer within the international market which successively makes them less competitive.

Inflation in Ethiopia is additionally hampering Ethiopia from reducing poverty and hunger. The living standard of urban dweller has been adversely suffering from inflation in Ethiopia. Inflation also redistributes wealth there by increasing the amount of poor people within the country. whether or not it's, said by the govt that farmers have the benefit of rising food prices, something that needs empirical investigation, rise in food prices are causing many to be unable to feed themselves. Most significantly inflation in Ethiopia may misallocate resources from productive to unproductive sectors. Thus, this paper tries to address this data gap in analyzing the effect some economic factors on inflation using statistic data from 1975 to 2019.

1.3 The Objective of the study

General objective

To analyze the effect of some economic factors on inflation in Ethiopia.

Specific objective

- To examine the long run and short run relationship between inflation and selected economic variables
- To identify the causality between some selected economic factors on inflation.
- To investigate the trends of inflation and selected economic variables over time

1.4 Significance of the study

The results of this study attempts to point out the effect of some economic factors on the inflation, with particular concentrate on Ethiopia. Most significantly the study is anticipated to lift the interest of students to figure on inflation. It also provides an understanding of the link between some economic factors and Inflation, which might help economic analysts to assess the economic performance of the country and make informed decisions. Finally the study is helpful to other researchers of upper institutions for his or her further study on the area of economic development.

1.5 Scope of the study

The scope of this study confined to the investigation of the suitability of inflation as a policy instrument within the Ethiopian economy for the amount of 1975-2019.

1.6 Limitation of the study

Limitation of the study has aroused from the matter of inconsistency of information prepared by different institutions. Even data from the identical institution different figures for the identical years. Generally, this study faced with the matter of inadequate materials for assessment and difficulty to access to relevant data for thorough analysis, limited time, inconsistent data and a few weaknesses of the model.

1.7 Organization of the Study

This study has five chapters. The primary chapter contains the introductory part including statement of the matter, objective, scope and limitation. The second chapter presents

both theoretical and empirical literature review while the third chapter presents methodology and econometric analysis including model specification, estimation techniques. The fourth chapter analysis and interprets the econometric results. Finally, chapter five gave conclusion and policy recommendation.

2 Literature Review

This part reviews theoretical and empirical literature are attempted. Firstly, theoretical literature was reviewed and so relevant empirical literature highlighting variables and study approach used other studies were reviewed to spot the gap.

2.1 Theoretical Literature review

Inflation could be a highly controversial term which has undergone modification since it had been first defined by the neo-classical economists. Neo-classicals defined inflation as a galloping rise in prices caused by excessive increase within the quantity of cash. For Keynesians true inflation happens when cash in hand increases beyond financial condition level (Jhingan, 1997). Though various economists define inflation in numerous ways there's an agreement that inflation could be a sustained increase within the general price index.

Even though inflation could be a sustained rise in prices it should be of assorted magnitudes. When the increase in prices is incredibly slow Like that of a snail or creeper, it's called creeping inflation. Creeping inflation happens when prices increase but 3 percent once a year. Such a rise is thought to be safe and essential for economic process. When prices rise at a rate greater than 3 but but 10 percent every year, it's called walking inflation. Walking inflation may be a alarum for the govt. to manage inflation before it becomes running inflation. An annual increase in prices at rate of 10 to twenty percent is termed running inflation. When rate of inflation goes above 20 percent it's called hyperinflation (Jhingan, 1997).

2.1.1 Inflation Targeting- Recent Concept

Inflation targeting may be a monetary policy within which a financial organisation attempts to stay inflation during a declared firing range typically by adjusting interest rates. it's been introduced in New Zealand in 1990, has been very successful, and as of 2007 had been adopted by quite 20 industrialized and non-industrialized countries. it's characterized by (a) an announced numerical inflation target, (b) an implementation of monetary policy that provides a serious role to an inflation forecast and has been called inflation-forecast targeting, (c) and a high degree of transparency and accountability.

Svenson (2007) Inflation is sometimes measured because the change in prices for goods, called the buyer index number (CPI). Inflation targeting assumes that this figure accurately represents growth of cash supply. Thus central banks or the responsible authority fixes the target supported the change in consumer price level. The success of inflation targeting rests on four conditions.

Carare, et al (2002) the primary condition may be a mandate in support of an inflation objective and an accountability for achieving this objective to pursue inflation target. this needs setting inflation targeting as a primary objective, an authority (most of the time the central bank) with sufficient discretion to line monetary instruments PRN. additionally accountability and transparency also are necessary. This ends up in inflation target to be explicit to the general public including the monetary instruments. Second, macroeconomic stability which has absence of fiscal dominance and external stability is very important for the success of inflation targeting. Third, a sufficiently and well developed financial set-up is very important condition for inflation targeting. Finally effective monetary policy instruments were forwarded to the success of inflation targeting.

Criticisms say that since inflation is measured by consumer price level (CPI), inflation targeting ends up in misleading policy measures when price rises thanks to external factors. this is often because the rise in CPI, hence increased inflation, makes central banks to boost rate which successively inhibits investment and growth. additionally, inflation targeting gives much weight to inflation stabilization than to the soundness of the important economy. Despite these shortcomings, so far, since its inception within the early 1990s, inflation targeting has been a substantial success, as measured by the soundness of inflation and also the stability of the important economy. There is no evidence that inflation targeting has been detrimental to growth, productivity, employment, or other measures of economic performance. The success is both absolute and relative to alternative monetary-policy strategies, like exchange-rate targeting or money-growth targeting. No country has up to now abandoned inflation targeting after adopting it, or maybe expressed any regrets. For both industrial and non-industrial countries, inflation targeting has proved to be a most flexible and resilient monetary-policy regime, and has succeeded in surviving variety of huge shocks and disturbances. As of 2007, long lists of non-industrial countries were asking the International money for assistance in introducing inflation targeting Svenson (2007).

2.1.2 Empirical Literature review

In this part, a review of empirical works on inflation are going to be done. The section is split in to 3. The primary section, other countries experience, a review of literature on some European and Asian countries are going to be made. Within the second part literatures an African countries are going to be reviewed. Finally, within the third section, a review of literature of Ethiopian inflation are made.

A. Other counties experience

Ghosh et al (1996) in their analysis of the influence of the assorted charge per unit regimes

on inflation and growth used data comprising all IMF members from 1960-90. The paper draws on material originally contained in IMF working paper 95/121. The researchers classified charge per unit regimes in to pegged, intermediate (i.e. floating rates, but within a predetermined range), and floating. The results from the sample show that countries with pegged exchange rates had a median annual inflation of 8% compared with 14% for intermediate regimes, and 16% for floating regimes. The researchers state that the difference comes from two separate effects. the primary is disciple, countries with pegged exchange rates have lower rate of growth in funds. The second effect is confidence. because of high confidence of the general public in pegged regimes, for a given rate of growth of cash supply there'll be higher demand for money which successively results in low in inflation. The results from the sample accustomed analyze effect of charge per unit on growth show that growth was fastest under the intermediate regimes over aging over 2% a year, while it absolutely was 1.4% for pegged and 1.7% under floating rates.

Bailliu and Fujii (2004) empirically investigated charge per unit pass-through and therefore the inflation environment in industrialized countries. They used a panel data set of elven industrialized countries over the amount 1977 to 2001 and that they found evidence to support the Taylor hypothesis (2000) that ERPT declines with a shift to a low-inflation environment caused by a change within the monetary policy regime. More specifically, the results suggest that pass-through to import, producer, and consumer price inflation declined following the inflation stabilization that occurred in many industrialized countries within the early 1990s, but not following an identical episode that occurred within the 1980s.

B. African experience

Barung (1997) has tried to check the determinants of inflation in Uganda. Barung (1997) used miscalculation Correction Model to identity the role played by monetary base, real exchange rates and provide shocks in explaining inflationary pressure in Uganda. The results from the model show that monetary expansion is that the main source of the variations in prices within the short term. Supply shocks have also been found to be significant in explaining the variations within the index number. The rate has been found to possess negative sign also in significant. The negative sign of the charge per unit comes from the financing of huge volume of imports through import support grants which can have offset the inflationary impact of the important deviation.

Sowa and kwakye (1993) analyzed the sources of inflationary pressure in Ghana using on annual data from 1962 up to 1989. The researchers used an econometric model, OLS technique which states index number as a function of cash supply, output, and charge per unit and price expectations. The results from the model show that provide constraint and monetary constraint are found to possess inflationary impacts, but the study found

that offer effects are stronger than monetary effects. Rate devaluations have also found to own inflationary impacts.

Acute, et al (2001) used annual data form 1974 to 2000 to spot the determinants of inflation in Swaziland. The study employed econometric technique of Co-integration and Error Correction Modeling (ECM). The results show that the impact of cash supply on inflation was found to be insignificant, suggesting that money supply growth in Swaziland doesn't accord with normal behavioral expectations towards inflation. rate of interest is additionally found to be insignificant in explain inflation. Exchange rates and wage rates are found to possess significant long term influence on the amount of costs in Swaziland.

C. Ethiopian Experience

Getachew (1996) is his study of inflation in Ethiopia used two models. Within the first model monetarist?s model has been used using monthly data from July 1990/91 to February. Within the second model, an extended run model, an assessment of annual data from 1972/73 up to 1990/91. The results from the primary model show that within the short run money stock has been found to be significant determinant of inflation in Ethiopia. The long term model shows that within the long term inflation in Ethiopia is set by supply factors. Getachew (1996) recommends that within the short run controlling pecuniary resource is very important to manage inflation while within the future he suggested in removing the bottlenecks of the provision side of the economy.

Yohannes (2000) during this study of inflation in Ethiopia used quarterly data from 1967/68 to 1998/99. Yohannes used three econometrics models monetarists, demand and provide side model and structuralism model. Results from the primary model show that money supply could be a explanation for inflation within the short run. The results from the second model show that inflation inertia and actual world inflation affect Ethiopian inflation within the short run. within the last model structural variables are found to elucidate both short run and long term inflation in Ethiopia while inflation inertia, finances and world inflation explain inflation only within the short run.

Mehari and Wondafrash (2008) investigated the impact of cash supply on inflation in Ethiopia. The researchers used quarterly data from the primary quarter of 1996/97 until the second quarter of 2006/07. Mehari and Wondafrash (2008) used independent models for the narrow funds and broad funds. The result from their work reveals that cash supply incorporates a direct impact on inflation. The impact of narrow cash in hand which incorporates currency outside banks and net demand deposits was found to be greater than that of broad monetary resource which incorporates narrow pecuniary resource and quasi money. From the studies reviewed on Ethiopia; within the short run funds, inflation inertia and actual world inflation are found to affect inflation while within the long term Ethiopian inflation is attributed to structural factors, mainly to the bottle necks of the

agricultural sector, and to monetary factors.

3 Data and Methodology

Research methodology could be thanks to systematically solve the research problem. It is science of studying how research is finished scientifically. This chapter gives the methodology that employed to conduct the study. Here the info source and variable used, estimation method, model stability and residual assay and model specification for the study are briefly discussed under this chapter.

3.1 Data Source and Variable

In this paper secondary statistic data wont to empirically assess the effect of some economic factors on inflation, for the amount of 1975-2019. The info were collected from National bank of Ethiopia (NBE), Central Statistical Agency (CSA) and Ministry of Finance and Economic Corporate (MoFEC). The variables are included within the study are Inflation (CPI), Real Growth Domestic Product (RGDP), Real exchange rate (EXR), Money supply (MS) and Government expenditure (GEX). The consumer price level (CPI) is additionally included as proxy measure for Inflation.To analyze the data Eviews-9 Software used.

3.2 Method of Data Analysis

3.2.1 Descriptive Analysis

The study applies quantitative method of information analysis using statistic data. The descriptive method is employed to assess the trends of inflation with time.

3.2.2 Stationary test

Stationary series is defined jointly with a continuing mean, constant variance and constant auto covariance for every given lag and therefore the value of the covariance between the two time periods depends only on the space or lag between the 2 time periods, not on the time at which the covariance is calculated (Gujarati, 2003). Otherwise it is nonstationary statistic variable. A non-stationary statistic which needs to be differenced d times to form it stationary is claimed to be integrated of order d. The order of integration refers to the amount of unit roots within the series, or the amount of difference operations it takes to create a variable stationary.

Brooks (2008) shows that if the variable quantity could be a function of non-stationary variables, the regression will produce spurious results (a nonsense regression). Although

the trending variables are completely unrelated, it's likely that significant t-ratios obtained. Thus, to avoid the matter of spurious regression it's necessary to check for stationary of your time series variables before running any style of multivariate analysis. There are several tests for Stationarity including a visible plot of the info, unit root tests and people that directly test for Stationarity of these tests augmented Dickey-Fuller employed in this paper.

Dickey-Fuller and the Augmented Dickey-Fuller Tests

Presence of unit roots of the variables are often examined by Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF), which is that the most often, used unit root tests. The DF test estimates the subsequent equation:-

$$\Delta Y_t = \delta + \beta_t + \alpha Y_{t-1} + \epsilon_t \qquad (3.1)$$

Where,δ and β_t are intercept and trend respectively, Y_{t-1} is the relevant time series at the time of t-1, Δ is a first difference operator, t is a linear trend or time and ϵ_t is the error term. DF test does not take into account the possible autocorrelation in the error term (ϵ_t). The ADF test corrects this shortfall for high-order serial correlation by adding a lagged differenced term on the right-hand side in the DF equation (3.1). ADF employs the following equation:-

$$\Delta Y_t = \delta + \beta_t + \alpha Y_{t-1} + \sum_{i=2}^{m} \Delta Y_{t-i} + \epsilon_t \qquad (3.2)$$

Where,δ and β_t are intercept and trend respectively, Y_{t-1} is the relevant time series at the time of t-1, Δ is a first difference operator, t is a linear trend or time and ϵ_t is the error term.

Both DF and ADF may also be estimated with a relentless and trend term. The hypothesis used to test unit root for all the above tests was stated as follows H0= there's unit root (non stationary)

H1= there's no unit root (stationary)

In both tests, if the calculated statistic is a smaller amount (in absolute terms) than the MacKinnon (1991, 1996) critical values the null hypothesis is accepted and there's a unit root within the series. In other words, it means the statistic isn't stationary. The alternative is true when the calculated statistic is larger than the MacKinnon critical value.

3.3 Method of estimation

Estimation Method needs knowledge about the theoretical relationship among variables of interest and their expected sign (Lutkepohl, 2005). In line with theoretical and Empirical framework discussed within the literature review section, the subsequent techniques are applied, Johansen cointegration technique, vector error correction model (VECM), Granger causality and variance decomposition to capture both short-run and long-run effects of inflation on selected economic factors the needs of this study the functional relationship between the variables is specified below:

CPI=f(RGDP, REXR, MS and GEX)

Where

CPI=Consumer Price index (inflation)

RGDP= Real Growth Domestic Product

REXR=Real Exchange Rate

MS= Money Supply

GEX=Government Expenditure

3.3.1 Lag Length Selection Criteria

Prior to cointegration test the most lag length k was chosen for the VAR model, since choosing appropriate lag length is extremely important because to small value of K invalidate the tests and to large reduce the ability of the test. To pick out the lag length we use information criteria Akaike information Criterion (AIC), Schwarz criterion (SIC), sequential modified LR test statistic (LR), Hannan-Quinn information criterion (HQ) and Final Prediction Error (FPE) (Ozcicek, O., and Douglas Mcmillin, W. 1999).

3.3.2 Model Stability and Residual Diagnostic Test

To check the verifiability of the estimated future model, some residual diagnostic assay is undertaken. Diagnostics test is a very important concept in model selection. The vector error corrected(VEC) model should pass diagnostics tests like serial correlation test, hetroschadasticity test and normality test so as to mention the right model is chosen on the premise of selection criteria if doesn't passe the above diagnostics test then other action is required.

Serial Correlation test: In statistic analysis the chosen model should satisfy the assumption of no serial correlation unless adding lags or variables to get rid of serial correlation. To test the existence of serial correlation within the VEC model LM test was

considered. The null hypothesis stated here is that the residuals don't seem to be serially correlated against there is serial correlation on the choice hypothesis. To mention the model well done the null hypothesis mustn't be rejected (Andrei, D. M., and Andrei, L. C. 2015).

Heteroskedasticity test: The opposite assay is heteroskedasticity test which is used to test the homoscedasticity of residuals within the model. The null hypothesis stated that the residuals are homoscedastic against the choice the residuals are heteroskedastic.

Normality test: The chosen model should be normally distributed so as to mention the model is sweet. To check normality Jarque bera test was considered and also the null hypothesis stated that the residuals are normally distributed against the residuals aren't normally distributed.

Stability test: To check the steadiness of reduced VEC model test of Roots of Characteristic Polynomial considered. If the moduli of the Eigen values are but one, then the VAR(p) process is stable.

3.3.3 Co-integration Tests

Co-integration Tests One possible means of avoiding spurious regression is that the application of co-integration techniques which permit the estimation of non-spurious regressions with non-stationary data. The economic interpretation of co integration is that if two (or more) series are linked to make an equilibrium relationship spanning the long-run, then although the series themselves may contain stochastic trends (i.e., non-stationary) they'll nevertheless move closely together overtime and therefore the difference between them are going to be stable (i.e. stationary) (Enders,1995). Therefore, it's important to look at co integration as a technique to estimate the equilibrium or long-run parameters during a relationship with unit root variables. So as to see whether or not a long-run equilibrium relationship exists among the unit root variables in an exceedingly given model, we want to check empirically that the series within the model are co integrated. thus far there are two major procedures to check for the existence of co integration, namely, the Engle-Granger two step procedures and the Johanson Maximum Likelihood Estimation procedure.

In the Engle-Granger two-step procedure, variables entering the co integrating vector are tested or integration of the identical order; of course order of one-I(1). the primary step is to estimate the future static model of the I(1) variables and acquire residual. If this residual, which is that the linear combination of the variables or the disequilibrium, is stationary, then the variables are said to be co integrated. The second step during

this procedure is to estimate the error correction term (ECT) during which the primary difference of the variable quantity is regressed on the primary difference of explanatory variables with their appropriate lags, and also the first leg of the residual obtained within the commencement. Although the Engle and Granger (1987) procedure is definitely implemented, it's several important defects. within the first place, the strategy has no systematic procedure for the separate estimation of multiple co integrating vectors. the strategy only allows for one co integration equation.

The Johanson (1988) Maximum Likelihood Estimation procedure avoids the utilization of two step Engle-Granger procedure and might estimate and test for the presence of multiple co integrating vectors. Johanson procedure also allows testing restricted versions of co integrating vector(s) and speed of adjustment parameters for the aim of testing a theory by drawing statistical inferences concerning the magnitudes of the estimated coefficients. During this procedure, the existence of co-integration relationship is tested using vector error correction mechanism (VECM) and arbitrary selection of endogenous and exogenous variables is avoided. as a result of its apparent superiority to it of the Engle-Granger methodology, during this study the Johanson Maximum Likelihood Procedure applied for empirical analysis.

3.4 Model Specification

3.4.1 Procedures for selecting a representative model for the study

The representative model for this thesis would path through the owing procedures. Depending on the behavior of the information obtained, the subsequent flowchart provides how the used models for the thesis have selected.

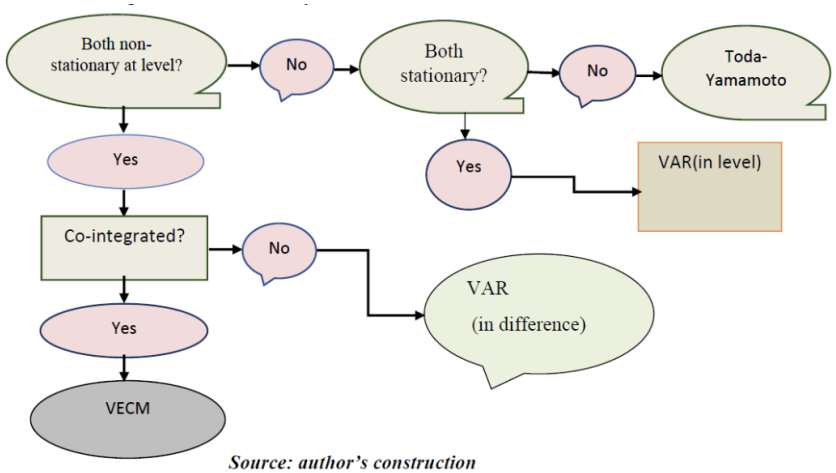

Figure 1: Flowchart of the model selection

3.4.2 Vector Auto Regressive (VAR) Model

The VAR model is established supported the statistical properties of knowledge. Within the VAR model, each endogenous variable within the system is taken into account because the lagged value of all endogenous variables within the system; thus the univariate autoregressive model is generalized to the Vector autoregressive model consisting of multivariate statistic variables. In 1980, Christopher Sims introduced VAR model into economic field and promoted the widespread application in dynamic analysis of national economy.
The VAR model established as follows:

$$Y_t = \theta + \sum_{i=1}^{k} \beta_i X_{t-i} + \epsilon_{ti} \qquad (3.3)$$

Where Y_t is (n x 1) vector of endogenous dependent variable, θ is (n x 1) vector of constants, β_i is (n x n) matrix of coefficients, X_{t-i} is (n x 1) the lags of endogenous explanatory variables and ϵ_{ti} is (n x 1) vector of white noise, innovations or shocks (Enders,Walter, 2008).

3.4.3 Vector Error Correction Model (VECM)

The VAR model may be a general framework wont to describe the dynamic interrelationship among stationary variables. If the statistic isn't stationary the VAR specified above has to be modified to permit consistent estimators of the relation among the variables. In order to capture both short run and future relations within the models the study Vector Error Correction Model (VECM), a special case of the VAR for the variables in their first differences. VECM also takes co-integration among the variables into consideration. If there is an extended run relation among the variables, a blunder correction model are often formulated to show the future interaction between variables (Verbeek, 2008).
VECM shows the achievement of future and therefore the rate of change within the short run to realize equilibrium. It is useful in determining short term dynamics between variables by restricting the long-run behavior of variables. Therefore, the vector error correction model is perfectly suited to winding up analysis in this paper. The vector error correction model is little steps from the VAR model; we alter VAR equations into their respective first difierence and also the lag of error correction term. The VECM for this thesis is just derived as:

$$\Delta Y_t = \theta + \sum_{i=1}^{k-1} \beta_i \Delta X_{t-i} + \Omega \text{ECTt-k} + \epsilon_{ti} \qquad (3.4)$$

Where,Y_t is a vector of endogenous dependent variable, k-1= shows that the lag length is reduced by 1, θ is constant, Δ is a difference of explanatory variables, β_i=Coefficients

of the model adjustment to long-run equilibrium. Ω=speed of adjustment parameter, ECT=error correction term, ϵ_{ti} =residual and often called white noise, stochastic error terms, Impulses innovations or shock.

Using the long-run model, the study then proceeded to construct miscalculation correction term (ECT) which is employed along with the stationary variables in co-integrating relationships which integrates short run and future dynamics of the model. The coefficient of error correction term (ECT) which represents the speed of adjustment to the future equilibrium should be negative and significant if the disequilibrium is to be corrected within the subsequent period and long-run restored. If insignificant, then correction term is otherwise ignoring. An easy error correction term is defined by:

$$\text{ECT}=\Delta Y_t\text{-}\sum_{i=1}^{k}\Psi_i X_{t-i} \tag{3.5}$$

Where, ECT=Error correction term, Y_t is a vector of endogenous dependent variable, ψ is the coefficients relating to the short run dynamics and X_{t-i} is (n x 1) the lags of endogenous explanatory variables

3.5 Granger causality

Granger causality may be a thanks to investigate causality between two variables in an exceedingly statistic. The method could be a probabilistic account of causality; it uses empirical data sets to seek out patterns of correlation. Causality is closely associated with the concept of cause-and-effect, although it's not precisely the same. A variable X is causal to variable Y if X is that the reason for Y or Y is that the reason behind X. However, with Granger causality, you're not testing a real cause-and-effect relationship; what you wish to understand is that if a specific variable comes before another within the statistic. In other words, if you discover Granger causality in your data there's not a causal link within the true sense of the word (for example, sales of Easter baskets Granger-cause Easter!). Note: When econometricians say cause what they mean is Granger-cause although a more appropriate word could be precedence (Goldstein, M., and Khan, M. S. 1985).

3.6 Impulse Response and Variance Decomposition

Once the determinants of the some economic factors on inflation are identified in an exceedingly wellspecified model, the interesting issues that remain are how the inflation reacts to shocks in any of these determinants. The detail discussion of this subject

concerns with which shock is comparatively the foremost important and the way long, on average, it'll view the inflation to revive its equilibrium following such shock. to indicate which of the variables within the model have statistically significant influences on the longer term values of every of the variables within the system, the standard block F-tests and an examination of causality in an exceedingly VAR can be used. But these tests won't reveal whether changes in a very value of a given variable have a negative or positive influence on the opposite variables within the system or how long it would deem the effect to figure through the system (Brooks, 2002). to produce such information impulse response and forecast error variance decomposition analyses for a VEC process with cointegrated variables are used.

3.6.1 Impulse Response Analysis

The responsiveness of the variable quantity within the VAR to shocks to every of the opposite variables traced out with impulse response analysis. Within the context of this paper it shows that the sign of the chosen economic factor shocks on the inflation. A shock to a variable during a VAR not only directly affects that variable, but also transmitted to all or any other endogenous variables within the system through the dynamic structure of the VAR. For each variable from the equations separately, a unit or just one occasion shock is applied to the forecast error and therefore the effects upon the VAR system over time are observed. The impulse response analysis is applied on the VECM and, on condition that the system is stable, the shock should gradually slack off (Brooks, 2002). During this study the Cholesky orthogonalisation approach is employed for performing impulse response analysis. This approach is preferred because, unlike other approaches, it incorporates small sample degrees of freedom adjustments.

3.6.2 Variance Decomposition Analysis

Variance decomposition analysis measures the proportion of forecast error variance in an exceedingly variable that's explained by impulses in it self and therefore the other variables. It provides the proportion of the movements within the dependent variables that are because of their own shocks versus shocks to the opposite variables (Brooks, 2002). In other words Variance decompositions performed on the VECM provide some information on the relative importance of shocks to the chosen economic factors on inflation in explaining variations within the inflation. within the variance decompositions the identical factorization technique and knowledge utilized in estimating impulse responses is applied.

4 Results and Discussions

In the preceding chapter methods of analyzing the long-run and short run relationships between some economic factors on inflation are discussed. Econometric techniques that are discussed within the previous chapter are employed during this chapter and also the results are discussed well. The initial a part of this chapter deals with descriptive Analysis of the information. This could be wont to evaluate the legion inflation can easily be understood within the style of graphs. within the next sub-sections of the chapter unit root tests are performed using the Augmented Dickey Fuller (ADF) test. The results of those stationarity tests will then result in the testing of long-run relationships between the variables understudy. The long-run relationship is captured using the Johansen co-integration tests. The Vector error correction method follows to capture the short-run dynamics within the relationship between inflation and a few economic factors. The last a part of the chapter deals with the residual and diagnostic tests, granger causality, impulse and variance decomposition tests are allotted using Econometric Views (E-Views) version 9.0 statistical software.

4.1 Descriptive Analysis

As a preliminary to the descriptive analysis of knowledge trend is discussed during this section. The trends of Inflation and selected economic factors from 1975 to 2019 follows as.

Trends of inflation and selected variables

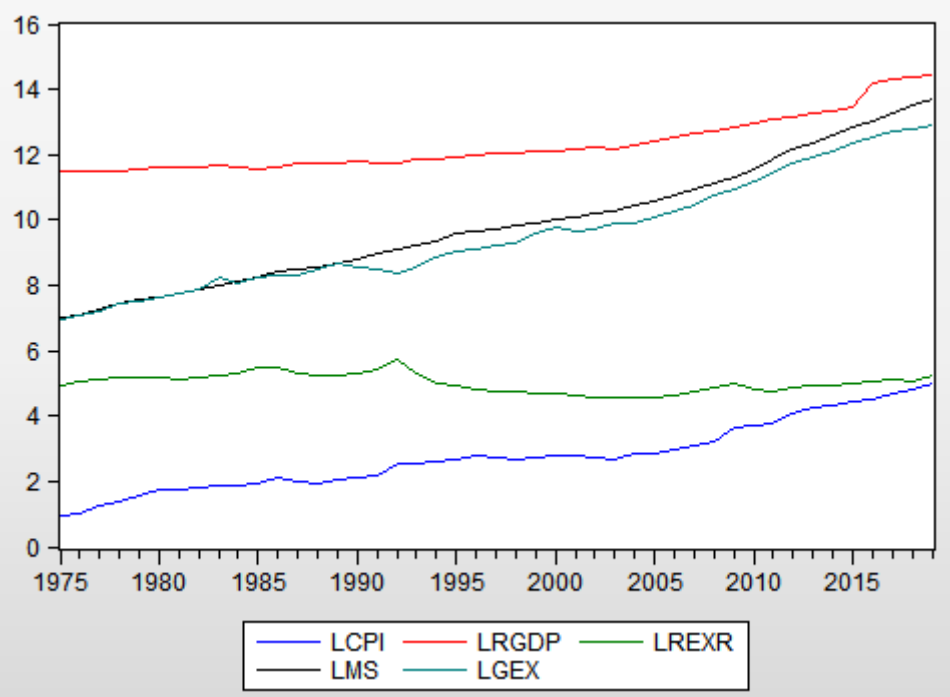

Figure 2: Trends of inflation and selected variables from 1975 to 2019

From above figure 2, we are able to see that the inflation in Ethiopia isn't stable. It slowly rose since 1975 up to 1991. It moderately raised from 1992 to 2008. In 2009, inflation was rising up and doesn't come down thereafter. Since the country depends on rain fed agriculture as a main source of income, the drought diminished output growth which successively contains a significant influence on the increment of inflation. In 1991/92 and 2016/17 there was a political transition in country which also affected progress of the economy. Again, in 2018/19 Ethiopian inflation highly surged.

4.2 Econometric Estimation

4.2.1 Unit Root Test

The first step in statistic econometric analysis is to hold out unit root test on the variables of interest. The test examines whether the information series is stationary or not. To conduct the test, the traditional Augmented Dickey Fuller (ADF) test was employed

with and without a trend.

Table 1: The results of unit root test

At Level				
		Intercept		**Trend and Intercept**
Variable	t-statistics	Probability	t-statistics	Probability
LCPI	0.776365	0.9925	-0.680050	0.9684
RGDP	4.182394	1.0000	2.824870	1.0000
LREXR	-1.434539	0.5568	-1.699778	0.7342
LMS	2.260045	0.9999	0.635578	0.9994
LGEX	1.537466	0.9992	-0.578799	0.9754
At First Difference				
		Intercept		**Trend and Intercept**
	t-statistics	Probability	t-statistics	Probability
LCPI	-5.776321	0.0000*	5.810152	0.0001*
RGDP	-5.456137	0.0000*	-6.719367	0.0000*
LREXR	-5.307869	0.00001*	4.962861	0.0012*
LMS	-1.273623	0.6327	4.242909	0.0086*
LGEX	-5.662629	0.0000*	-5.974180	0.0001*

Source: Computed by authors using E views 9 software

*Note: * indicates rejection of the null hypothesis of a non-stationary at 1% levels of significance (test critical -3.592462 at 1%, -2.931404 at 5%, and -2.603944 at 10%).*

As table 1 results clearly show that the Augmented Dickey-Fuller (ADF) test statistic Inflation(CPI), Real gross domestic product, Real rate of exchange, funds Government expenditure are non- stationary at level. When the test is applied to first differences of all variables stationary CPI, RGDP, REXR and GEX with intercept and with trend and intercept While MS with trend and intercept are stationary at 1% level of significance, since all variables are integrated of order one, we are able to apply VECM

4.2.2 Lag Length Selection Criteria

The first issue of the VAR model is to work out lag intervals for endogenous. The larger the lag intervals for endogenous is that the more it can entirely reflect the dynamic nature of the model. But during this case, more parameters are needed to be estimated to constantly reduce model degree of freedom. This can be a contradiction within the selection of proper lag intervals for endogenous. There are many methods that may determine optimal lag period for the VAR model. In comprehensive consideration of choosing lag intervals for endogenous, this paper adopted lag length criteria as shown in table 2 below.

Table 2: Lag length selection results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-24.93734	NA	2.96e-06	1.460358	1.669330	1.536454
1	224.6143	426.0638	5.24e-11*	-9.493380	-8.239546*	-9.036803*
2	250.5629	37.97360*	5.29e-11	-9.539654*	-7.240960	-8.702596
3	268.1772	21.48083	8.83e-11	-9.179375	-5.835820	-7.961837
4	288.4276	19.75652	1.53e-10	-8.947689	-4.559273	-7.349670

** indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level)*

As table 2 above shows the lag length 2 was selected lag length selection criteria of Akaike information criterion (AIC). It is found that the optimal lag order for the VAR model is 2 (2).

4.2.3 Cointegration test

The Johansen co-integration test conducted under the belief of trend and intercept within the equation. Whether trend is included within the model or not it's identified by unit root test or by graph. Most of the time the trace and maximum Eigen values statistics might yield conflicting results. To accommodate this problem Johansen (1990) recommend a sing on one among them to spot the amount of co-integration vectors. But Khan (1999) shows that the trace tests are more robust than the most Eigen value statistic in testing for co-integration. The table 3 below shows the results of trace statistics for co-integration tests.

Table 3: Johansen-Juselius Cointegration Rank Test (Trace)

Null	Alternative	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**	Hypothesized No.
r=0	$r \geq 0$	0.546232	71.95653	69.81889	0.0334*	None *
$r \leq 1$	$r \geq 1$	0.352923	38.76939	47.85613	0.2695	At most 1
$r \leq 2$	$r \geq 2$	0.320800	20.48724	29.79707	0.3904	At most 2
$r \leq 3$	$r \geq 3$	0.090395	4.239994	15.49471	0.8832	At most 3
$r \leq 4$	$r \geq 4$	0.006188	0.260713	3.841466	0.6096	At most 4

Source: Computed by authors using E views 9 software

** Denotes rejection of the null hypothesis at 5% significance level*

As it seen from table 3 Johansens cointegration rank the Trace test statistics indicates that one co-integrating equation at 5% significance level. In other words, it accepts the choice hypothesis of getting one co-integrating vector. Since the test statistic (71.95) is bigger than the 95% critical value (69.81) of the trace statistics test, it's possible to reject the null hypothesis one co-integrating vector. It implies that there exists a protracted run relationship among the variables, then the paper estimate the model by VECM estimation method.

4.2.4 Vector error correction model (VECM)

A vector error correction model could be a restricted VAR model that has co-integration restrictions built in to the specification. It?s designed to be used with non-stationary series that are known to be co-integrated. The vector error correction specification restricts the longrun behavior of the endogenous variables to converge to their co-integrating relationships while allowing a good range of short-run dynamics. The error correction term corrects the deviation from long-run equilibrium gradually through a series of partial short run adjustments (Engle, R. F., and Granger, C. W. 1987).

4.2.5 The Estimation of Long-Run results

After confirming the existence of long-run co-integration relationship among the variables, the subsequent step is running the acceptable VEC model to find out the long term coefficients.

Table 4: Long run β Coefficients

Variable	Coefficients	Standard Error	t-statistics
LCPI	1.0000	.	.
LRGDP	-0.1132	0.3407	-0.3322
LREXR	-0.8762	0.2693	-3.2533*
LMS	-2.2730	0.3834	-5.9279*
LGEX	1.9849	0.4705	4.2186*
C	6.5214	.	.

Source: Computed by authors using E views 9 software

** Denotes significance at 5 percent level*

If the model contains cointegration relationship among the variables, then we are able to proceed to VECM and therefore the long run equation is:

LCPI=6.5214 + 0.11LRGDP + 0.87LREXR + 2.27LMS - 1.98LGEX

From the result real rate, cash in hand and Government expenditure are the most determinants of inflation thanks to their significance coeficient, while the important gross domestic product is insignificant during this model.

As it seen from given in table 4, a rise in one mathematical notation within the real exchangen rate (REXR) raises the speed of inflation by 0.87% point. this is often because the country is essentially import dependent and hence a rise within the real exchange rate (REXR) of Ethiopian currency (birr) to foreign currencies directly increases local price though international price remains unchanged. However, this result's statistically significant because the probability value of the t-statistic is over 0.05.

Moreover,the coeficients of long run relationship in table 4 show that future effect of cash supply on inflation is positive and statistically significant at 1 percent level. Money supply level will increase by 1% if inflation increases by 2.27%, hence the direction of relation is positive.

Again, the coefficient of government expenditure within the long term is 1.98. This value is important at 5% meaning that government expenditure as a variable incorporates a significant impact on inflation within the long term. Since the coefficient is negative, it indicates that one-hundredth an increase within the government expenditure will mini-

mize inflation by 1.98 percent to within the long term.

4.2.6 The Estimation of Short run results

Having already obtained the long-run and estimated the coefficients, the following step are going to be estimation of coefficients of the short-run dynamics that have important policy implications. Hence, a slip correction term are estimated which contains the short term interactions and also the speeds of adjustment towards long term.

Table 5: Short run coefficients

Variable	Coefficients	Standard Error	t-statistics
ECT(-1)	-0.119315	0.04421	-2.69878*
D(LCPI(-1)	-0.409702	0.16344	-2.50677*
D(LRGDP(-1)	-0.034442	0.12619	-0.27295
D(LREXR)(-1)	0.461608	0.13277	3.47683*
D(LMS(-1)	0.826537	0.25539	3.23638*
D(LGEX(-1)	0.427249	0.14137	3.02226*
C	-0.052761	0.03841	-1.37361

Source: Computed by authors using E views 9 software

** Denotes significance at 5 percent level*

As table 5 shows that the coefficient of the error correction term is critical at five percent level of significance with expected sign and reasonable magnitude (ECT =-0.119). The coefficient of the error correction term is negative and fewer than one. This result ensures that Inflation convergences to its future equilibrium. However, the speed of adjustment of the inflation to its own future equilibrium is moderate as shown by the adjustment coefficient. once a year just over approximately 12 percent of the disequilibrium in inflation is adjusted.

The result from this study as is shown above in table 5 shows that the short-run impact of the lagged change in real rate of exchange (REXR) on the lagged change of inflation is analogous sign to the long-run relationship. within the short-run a 1 percentage lagged change within the REXR results in 0.46% of variations within the inflation level. This result's statistically significant at 5% levels.

Moreover, The lagged value of cash supply affect inflation positively within the short run. The coefficient of 1 period lagged change in monetary resource is positive and significant at common fraction level. More clearly, a final year increases in pecuniary resource by

one-hundredth will result in a 0.82% increases within the current period inflation.
Again, Short-run estimation result shows that the lagged coefficient of inflation (CPI) is statistically significant for the lagged periods within the short-run dynamic associations. The estimation reveals that the lag values of inflation are significant. Again, government expenditure exhibits a big short run relationship with inflation. a 1 percent the lagged coefficient of state expenditure ends up in 0.42 percent increase within the current period inflation. This result further affirms the strong association between inflation (CPI) and government expenditure in Ethiopia. the subsequent step after estimating the Vector error correction model is to test for the adequacy of the model by performing diagnostic tests.

4.3 VECM residual diagnostic test

Up to the present point, we've just revealed that variables are integrated of order one. Therefore, an appropriate model could be a Vector Error Correction model. However, one step which should be taken before the discussion of the VECM (short run and long term model) is checking the robustness of our model. Hence checking for normality of residuals, stability, Heteroscedasticity, serial correlation and portmanteaus about the residual of the Vector error correction (VEC) Model is of interest.

Stability test

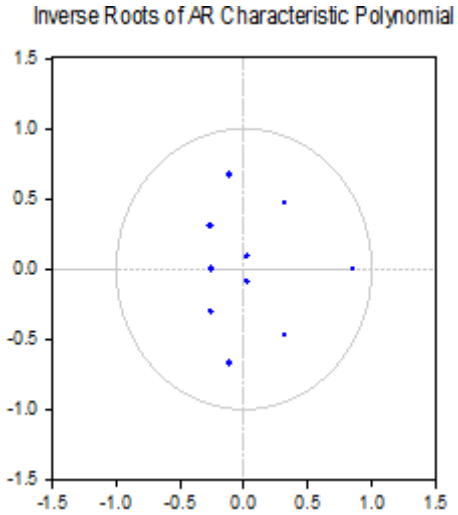

Figure 3: Inverse roots of VECM Stability test

From the above figure 3 show that the foundation of the VEC proved the steadiness of the model given all the points gave the impression to be within the most circle and no unit root lies outside the unit circle and there's no structural break within the series.

Table 6: Diagnostic test results

Diagnosis	Test	Null hypothesis	$\chi 2$ -stat	Prob.
Autocorrelation	Lagrange-multiplier	No serial correlation	31.7678	0.1648
Normality	Jarque-Bera test	Residuals are normal	957.7819	0.0000
Hetroskedasticity	white	Homoskedasticity	170.7688	0.2417
portmanteaus	adjQ-test	No autocorrelation	392.4965	0.4550

As shown from the above table 6 the results of the diagnostic tests shows that every one models are correctly specified and therefore the parameters are correctly estimated. The Model doesn't suffer from serial correlation, Heteroscedasticity, normality and portmanteaus. Thus, normality test implies that reject the null hypothesis for the Jaque-Berra normality test which says that the residuals are normally distributed Supported as (Akinbode,S.O.and Adekunle, C.p. 2017). Therefore, the whole diagnostic tests of the residual and as observed all test are pass the model will be needed.

4.4 Granger causality

Granger causality test is taken into account a useful technique for determining whether just the once series is nice for forecasting the opposite. The concept of granger causality test is explored when the coefficients of the lagged of the opposite variables isn't zero. As table 7 presents from the pair wise Granger-causality tests which were obtained with two lag for every variable.

Table 7: Pair-wise Granger Causality Test results

Pair wise Hypothesis	Obs	F-Statistic	Prob.
LRGDP does not Granger Cause LCPI	43	4.56293	0.0167*
LCPI does not Granger Cause LRGDP		1.55682	0.2240
LREER does not Granger Cause LCPI	43	2.37353	0.1068
LCPI does not Granger Cause LREXR		5.13829	0.0106*
LMS does not Granger Cause LCPI	43	9.92818	0.0003*
LCPI does not Granger Cause LMS		0.72504	0.4909
LGEX does not Granger Cause LCPI	43	4.84825	0.0133*
LCPI does not Granger Cause LGEX		00.55618	0.5780
LREXR does not Granger Cause LRGDP	43	0.25818	0.7738
LRGDP does not Granger Cause LREXR		0.21733	0.8057
LMS does not Granger Cause LRGDPI	43	1.50364	0.2352
LRGDP does not Granger Cause LMS		1.57734	0.2197
LGEX does not Granger Cause LRGDP	43	2.01676	0.1471
LRGDP does not Granger Cause LGEX		0.11400	0.8926
LMS does not Granger Cause LREXR	43	1.24707	0.2988
LREXR does not Granger Cause LMS		0.08374	0.9198
LGEX does not Granger Cause LREXR	43	0.03646	0.9642
LREXR does not Granger Cause LGEX		0.81855	0.4487
LGEX does not Granger Cause LMS	43	2.70113	0.0800
LMS does not Granger Cause LGEX		1.89698	0.1640

Source:Authors Estimation using e-view 9 Software.

Note:H0: No Causality Vs H1: Causality

(*) denotes rejection of the null hypothesis at 5% significant level

As shown from table 7 the important gross domestic product doesn't granger causes inflation is rejected at 5 percent level of significance. However, the reverse isn't rejected indicating that's real gross domestic product which causes inflation and not the opposite way round. This suggests that real gross domestic product significantly suggest something about short run behavior of inflation while inflation doesn't predict anything about the short run properties of real gross domestic product in Ethiopia.

As result presented in table 7 reveals that the null hypothesis cash in hand doesn't granger because inflation is rejected at 5 percent level but inflation doesn't granger cause cash in hand. Therefore this result indicates that causality running from cash in hand to inflation. The implication of the result's that money supply growth has valuable information in forecasting the values of inflation within the short run.

It is shown from the ends up in table 7 that the statements that government expenditure doesn't granger cause inflation (CPI) are rejected at 5 percent level of significance. However, the reverse isn't rejected indicating that's inflation (CPI) which causes government

expenditure. Therefore, we are able to conclude that there exists unidirectional causality between inflation (CPI) and every one explanatory variables.

4.5 Impulse Response Analysis

An impulse response traces the effect of 1 variable shock or innovation on itself and other endogenous variables. In analyzing the impulse response reduced form VEC must be represented by Vector Moving Average which is a vital feature of Sims'(1980) methodology. That is this value of endogenous variables could be a function of past and present value of the innovations. The impulse response function derived from VMA traces the trail of the response for the ith variable over time following an innovation from the jth variable, while holding all other reduced form innovations constant(Enders,1995).

Table 8: Accumulated impulse response results on lnCPI

Period	LCPI	LRGDP	LREXR	LMS	LGEX
1	0.091311	0.00000	0.00000	0.00000	0.00000
2	0.192145	-0.002149	0.039735	0.0561600	0.022921
3	0.283453	0.004597	0.079223	0.134468	0.022286
4	0.380396	0.018296	0.113409	0.213062	0.027123
5	0.480650	0.034706	0.146777	0.295763	0.044793
6	0.581433	0.053773	0.1779286	0.381822	0.068445
7	0.683519	0.075041	0.207040	0.469426	0.096473
8	0.786729	0.097666	0.235313	0.558670	0.127739
9	0.890547	0.121220	0.263203	0.649404	0.160519
10	0.994799	0.145420	0.290904	0.741179	0.193980
Average	0.48065	-0.00215	0.1796376	0.30049075	0.082459

Source:Authors Estimation using e-view 9 Software

As table 8 above presented the impulse response of inflation for every explanatory variables shock in value. The result shows that a 1 variance shock to real GDP, Real rate, pecuniary resource and Government Expenditure on inflation for ten periods included. a 1 variance shock to real exchange rate, Money supply and government expenditure on the average increase inflation by 0.179, 0.300 and 0.082 units for the given ten periods respectively while one variance shock to real gross domestic product decreases inflation on the average by 0.0021 units for given ten periods.

4.6 Variance Decomposition Analysis

Variance decomposition analysis provides the simplest way of determining the relative importance of shocks to every of the some economic factors of the inflation in explaining variations within the inflation. The subsequent table shows the proportion of the forecast error variance decomposition within the inflation.

Table 9: Variance decomposition of the inflation (CPI)

Period	S.E.	LCPI	LRGDP	LREXR	LMS	LGEX
1	0.091311	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.154169	77.857615	0.019439	6.642716	13.26983	2.210398
3	0.199606	67.37109	0.125848	7.876463	23.30698	1.319617
4	0.238322	63.80649	0.418665	7.582807	27.22515	0.966882

Source:Authors Estimation using e-view 9 Software

As shown from table 9 reports only the variance decomposition within the inflation and analysis the relative importance of every of its determinants in influencing its movements, because the interest is to understand the movements of the inflation following shocks to itself or its selected economic factors.

In the first period of play all of the variance within the inflation is explained by its own shocks. For the second period a head forecast error variance the inflation itself explains about 77 percent of its variation, while all its determinants explain only the remaining 23 percent. Out of this 23 percent the money supply explain about 13 percent, real rate of exchange about 7 percent and government expenditure 2 percent, while the remaining variables real gross domestic product don't significantly contribute to the variation within the inflation.

In the third period the inflation explains about 67 percent of its own variation, while its determinant explain the remaining 37 percent. Out of this 37 percent the money supply explain about 23 percent, real rate of exchange about 9 percent, government expenditure 1 percent, while the remaining variable real gross domestic product don't significantly contribute to the variation within the inflation.

5 Conclusions and Recommendation

In this chapter the summary of the findings additionally as recommendations are forwarded which can be relevant to the policy makers and academicians as an input for his or her policy and further research work on the area.

5.1 Conclusions

The central focus of this study is to spot the effect of some economic factors on inflation, specifically by using the framework of VAR and vector error correction mechanism using annual data covering the amount from 1975 to 2019. All the variables are tested for unit roots by Augmented Ducky Fuller test and therefore the test result revealed the variables are stationary at their first difference The results of co-integration test, using Johansen Maximum likelihood approach, indicates the existence of long term relationships between the variables in line with previous research in other countries. This implies that some economic factors on inflation move together within the long-run.

The empirical result shows that the coefficient of real charge per unit and monetary resource includes a positive significant effect on inflation in long term while government expenditure incorporates a negative effect on inflation. Similarly, in brief run the lagged coefficient of real exchange rate, pecuniary resource and government expenditure incorporates a positive effect on inflation. In general real charge per unit and monetary resource contains a positive and significant effect on inflation Ethiopia.

Short-run estimation result shows that the important economic interpretation within the error correction term is that the coefficient of the lagged error correction term (ECT). It reveals that in an exceedingly case of shock and disequilibrium, the model converges to its equilibrium position in the long-run. From the estimation result, it's revealed that 12% of the disequilibrium is adjusted in annually. From the causality relationship results obtained between selected economic factors and inflation regarded that causes inflation and also the reverse causation not holds true in Ethiopian selected economic variables there exists uni-directional causation between inflation and selected economic variables in Ethiopia. This means that real gross domestic product funds and government expenditure are causes and significantly suggest something about short run behavior of inflation while inflation doesn't predict anything about the short run and also inflation which causes real exchange rate per unit.

The impulse response analysis provided evidence that the real gross domestic product have a major impact on the inflation within the short run. Shocks to those variables have persistent effects on the inflation. The analysis of variance decomposition provided evidence that the real exchange rate; money supply and government expenditure are the

variables significantly explains the variation within the inflation.

5.2 Recommendation

Based on the findings of the study the subsequent policy implications are suggested:

- Balancing economic process target in line with a monetary policy target may have a vital role to spice up economic process and control the amount of inflation.
- Encouraging and expanding domestic import substituting industries to cut back the effect of imported inflation.
- Though real exchange rate, money supply and government expenditure has been found to be in positive and significant making a close study of the effect of those variables on inflation should be done. Therefore further study on the effect of those variables on inflation must be done.

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Appendix A

Figure A1: At level intercept of Consumer price index

Null Hypothesis: LCPI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.776365	0.9925
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Table A2:At level intercept and Trend of Consumer price index

Null Hypothesis: LCPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.680050	0.9684
Test critical values:	1% level	-4.180911	
	5% level	-3.515523	
	10% level	-3.188259	

*MacKinnon (1996) one-sided p-values.

Table A3:At level intercept and Trend of Consumer price index

Null Hypothesis: LRGDP has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		4.182394	1.0000
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

*MacKinnon (1996) one-sided p-values.

Table A4:At level intercept and trend Real ofgross domestic product

Null Hypothesis: LRGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.824870	1.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

*MacKinnon (1996) one-sided p-values.

Table A5:At level interceptof Real Exchange Rate

Null Hypothesis: LREXR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.434539	0.5568
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Table A6:At level intercept and trend of Real Exchange rate

Null Hypothesis: LREXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.699778	0.7342
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Table A7:At level intercept of Money supply

Null Hypothesis: LMS has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.260045	0.9999
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Table A8:At level intercept and trend of money supply

Null Hypothesis: LMS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.635578	0.9994
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Table A9:At level intercept of Government Expenditure

Null Hypothesis: LGEX has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.537466	0.9992
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Table A10:At level intercept and trend of government Expenditure

Null Hypothesis: LGEX has a unit root Exogenous: Constant, Linear Trend Lag Length: 0 (Automatic - based on AIC, maxlag=4)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.578799	0.9754
Test critical values:	1% level	-4.180911	
	5% level	-3.515523	
	10% level	-3.188259	
*MacKinnon (1996) one-sided p-values.			

Table A11:At First difference intercept of Consumer price index

Null Hypothesis: D(LCPI) has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on AIC, maxlag=4)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.776321	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	
*MacKinnon (1996) one-sided p-values.			

Table A12:At First difference intercept ad trend of Consumer price index

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.810152	0.0001
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Table A13:At First difference intercept of Real gross domestic product

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.456137	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Table A14:At First difference intercept and trend of Real gross domestic product

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.719367	0.0000
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Table A15:At First difference intercept of Real exchange rate

Null Hypothesis: D(LREXR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.307869	0.0001
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Table A16:At First difference intercept and trend of Real exchange rate

Null Hypothesis: D(LREXR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.962861	0.0012
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

*MacKinnon (1996) one-sided p-values.

Table A17:At First difference intercept of money supply

Null Hypothesis: D(LMS) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.273623	0.6327
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Table A18:At First difference intercept and trend of money supply

Null Hypothesis: D(LMS) has a unit root Exogenous: Constant, Linear Trend Lag Length: 0 (Automatic - based on AIC, maxlag=4)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.242909	0.0086
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	
*MacKinnon (1996) one-sided p-values.			

Table A19:At First difference intercept of Government Expenditure

Null Hypothesis: D(LGEX) has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on AIC, maxlag=4)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.662629	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	
*MacKinnon (1996) one-sided p-values.			

Table A20:At First difference intercept and trend of Government Expenditure

Null Hypothesis: D(LGEX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.974180	0.0001
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

*MacKinnon (1996) one-sided p-values.

Table A21:VAR Lag Order Selection Criteria

Endogenous variables: LCPI LRGDP LREXR
LMS LGEX
Exogenous variables: C
Date: 03/15/20 Time: 17:51
Sample: 1975 2019
Included observations: 41

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-24.93734	NA	2.96e-06	1.460358	1.669330	1.536454
1	224.6143	426.0638	5.24e-11*	-9.493380	-8.239546*	-9.036803*
2	250.5629	37.97360*	5.29e-11	-9.539654*	-7.240960	-8.702596
3	268.1772	21.48083	8.83e-11	-9.179375	-5.835820	-7.961837
4	288.4276	19.75652	1.53e-10	-8.947689	-4.559273	-7.349670

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table A22:VAR estimation before lag selection

Vector Autoregression Estimates
Date: 03/15/20 Time: 17:53
Sample (adjusted): 1977 2019
Included observations: 43 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LCPI	LRGDP	LREXR	LMS	LGEX
LCPI(-1)	0.368953	0.025644	-0.844992	0.000592	0.134349
	(0.17069)	(0.22690)	(0.18817)	(0.09477)	(0.25356)
	[2.16150]	[0.11302]	[-4.49062]	[0.00624]	[0.52985]
LCPI(-2)	0.173515	-0.009731	0.603769	-0.152508	-0.079695
	(0.18098)	(0.24057)	(0.19950)	(0.10048)	(0.26884)
	[0.95878]	[-0.04045]	[3.02636]	[-1.51785]	[-0.29644]
LRGDP(-1)	-0.000182	0.854869	0.014784	0.033963	0.111377
	(0.13375)	(0.17779)	(0.14744)	(0.07426)	(0.19868)
	[-0.00136]	[4.80825]	[0.10027]	[0.45736]	[0.56057]
LRGDP(-2)	0.120275	0.025551	0.115733	-0.000424	-0.010891
	(0.14308)	(0.19020)	(0.15773)	(0.07944)	(0.21255)
	[0.84059]	[0.13434]	[0.73373]	[-0.00533]	[-0.05124]
LREXR(-1)	0.378845	0.183385	1.190273	-0.056168	-0.203960
	(0.15045)	(0.19999)	(0.16585)	(0.08353)	(0.22349)
	[2.51809]	[0.91697]	[7.17669]	[-0.67244]	[-0.91261]
LREXR(-2)	-0.217069	-0.116464	-0.260715	0.111747	0.095653
	(0.15961)	(0.21216)	(0.17595)	(0.08861)	(0.23709)
	[-1.36003]	[-0.54894]	[-1.48179]	[1.26107]	[0.40344]
LMS(-1)	1.050500	0.010681	0.866184	1.155013	0.397412
	(0.32792)	(0.43590)	(0.36149)	(0.18206)	(0.48712)
	[3.20354]	[0.02450]	[2.39615]	[6.34418]	[0.81584]
LMS(-2)	-0.690644	0.012882	-0.970915	-0.128897	-0.252815
	(0.31912)	(0.42420)	(0.35179)	(0.17717)	(0.47405)
	[-2.16423]	[0.03037]	[-2.75994]	[-0.72752]	[-0.53331]

LMS(-2)	-0.690644	0.012882	-0.970915	-0.128897	-0.252815
	(0.31912)	(0.42420)	(0.35179)	(0.17717)	(0.47405)
	[-2.16423]	[0.03037]	[-2.75994]	[-0.72752]	[-0.53331]
LGEX(-1)	0.207974	0.195925	-0.005991	0.150989	0.885432
	(0.12508)	(0.16626)	(0.13788)	(0.06944)	(0.18580)
	[1.66274]	[1.17839]	[-0.04345]	[2.17428]	[4.76543]
LGEX(-2)	-0.383375	-0.137899	0.195622	-0.084038	-0.122853
	(0.13485)	(0.17925)	(0.14865)	(0.07487)	(0.20031)
	[-2.84304]	[-0.76931]	[1.31597]	[-1.12251]	[-0.61330]
C	-2.945087	0.354918	-1.415896	-1.059189	0.071328
	(0.87287)	(1.16029)	(0.96224)	(0.48461)	(1.29664)
	[-3.37401]	[0.30589]	[-1.47146]	[-2.18563]	[0.05501]
R-squared	0.994468	0.986308	0.920457	0.999493	0.995631
Adj. R-squared	0.992740	0.982029	0.895599	0.999334	0.994266
Sum sq. resids	0.231423	0.408923	0.281235	0.071334	0.510677
S.E. equation	0.085041	0.113044	0.093748	0.047214	0.126328
F-statistic	575.2824	230.5080	37.02969	6305.403	729.3014
Log likelihood	51.31683	39.07736	47.12558	76.61958	34.29982
Akaike AIC	-1.875201	-1.305924	-1.680259	-3.052073	-1.083712
Schwarz SC	-1.424662	-0.855384	-1.229720	-2.601534	-0.633173
Mean dependent	2.841703	12.34522	5.017473	10.01866	9.675154
S.D. dependent	0.998043	0.843253	0.290141	1.829853	1.668314

Table A23:Cointegration test

Date: 03/15/20 Time: 17:58
Sample (adjusted): 1978 2019
Included observations: 42 after adjustments
Trend assumption: Linear deterministic trend
Series: LCPI LRGDP LREER LMS LTGE
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.546232	71.95653	69.81889	0.0334
At most 1	0.352923	38.76939	47.85613	0.2695
At most 2	0.320800	20.48724	29.79707	0.3904
At most 3	0.090395	4.239994	15.49471	0.8832
At most 4	0.006188	0.260713	3.841466	0.6096

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.546232	33.18714	33.87687	0.0603
At most 1	0.352923	18.28215	27.58434	0.4718
At most 2	0.320800	16.24724	21.13162	0.2107
At most 3	0.090395	3.979281	14.26460	0.8615
At most 4	0.006188	0.260713	3.841466	0.6096

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A24:Vector Error Correction Model

Vector Error Correction Estimates
Date: 03/15/20 Time: 18:03
Sample (adjusted): 1977 2019
Included observations: 43 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LCPI(-1)	1.000000
LRGDP(-1)	-0.113209 (0.34072) [-0.33226]
LREXR(-1)	-0.876227 (0.26933) [-3.25337]
LMS(-1)	-2.273021 (0.38344) [-5.92792]
LTGE(-1)	1.984956 (0.47052) [4.21860]
C	6.521447

Error Correction:	D(LCPI)	D(LRGDP)	D(LREXR)	D(LMS)	D(LGEX)
CointEq1	-0.119315	0.019021	0.077562	0.015859	-0.036674
	(0.04421)	(0.05664)	(0.04971)	(0.02438)	(0.06062)
	[-2.69878]	[0.33582]	[1.56015]	[0.65061]	[-0.60495]
D(LCPI(-1))	-0.409702	-0.011152	-0.827710	0.033551	0.102988
	(0.16344)	(0.20939)	(0.18378)	(0.09011)	(0.22411)
	[-2.50677]	[-0.05326]	[-4.50372]	[0.37232]	[0.45954]
D(LRGDP(-1))	-0.034442	0.052568	-0.078602	0.099986	0.100109
	(0.12619)	(0.16166)	(0.14190)	(0.06957)	(0.17303)
	[-0.27295]	[0.32517]	[-0.55394]	[1.43710]	[0.57856]
D(LREXR(-1))	0.461608	0.108215	0.482087	0.013345	-0.222645
	(0.13277)	(0.17009)	(0.14929)	(0.07320)	(0.18205)
	[3.47683]	[0.63621]	[3.22910]	[0.18231]	[-1.22296]
D(LMS(-1))	0.826537	0.495829	0.868562	0.428012	0.340793
	(0.25539)	(0.32719)	(0.28718)	(0.14081)	(0.35020)
	[3.23638]	[1.51542]	[3.02444]	[3.03962]	[0.97314]
D(LGEX(-1))	0.427249	0.124728	-0.146042	0.094503	0.085936
	(0.14137)	(0.18111)	(0.15897)	(0.07794)	(0.19385)
	[3.02226]	[0.68868]	[-0.91870]	[1.21245]	[0.44332]
C	-0.052761	-0.025959	-0.028728	0.066944	0.058126
	(0.03841)	(0.04921)	(0.04319)	(0.02118)	(0.05267)
	[-1.37361]	[-0.52752]	[-0.66511]	[3.16103]	[1.10361]
R-squared	0.453761	0.165424	0.460576	0.463929	0.111555
Adj. R-squared	0.362721	0.026328	0.370672	0.374584	-0.036519
Sum sq. resids	0.300158	0.492654	0.379539	0.091247	0.564378
S.E. equation	0.091311	0.116982	0.102678	0.050345	0.125208
F-statistic	4.984208	1.189277	5.122980	5.192548	0.753370
Log likelihood	45.72554	35.07233	40.68061	71.32639	32.15013
Akaike AIC	-1.801188	-1.305690	-1.566540	-2.991925	-1.169773
Schwarz SC	-1.514481	-1.018983	-1.279833	-2.705218	-0.883066
Mean dependent	0.092084	0.068436	0.004171	0.153877	0.136182
S.D. dependent	0.114382	0.118553	0.129431	0.063661	0.122983

Table A25:Roots of Characteristic Polynomial

Endogenous variables: LCPI LRGDP REXR LMS LGEX
Exogenous variables:
Lag specification: 1 2
Date: 03/16/20 Time: 03:28

Root	Modulus
0.985745	0.985745
-0.047971 - 0.598812i	0.600730
-0.047971 + 0.598812i	0.600730
0.334070 - 0.452779i	0.562682
0.334070 + 0.452779i	0.562682
-0.252772 - 0.268400i	0.368690
-0.252772 + 0.268400i	0.368690
-0.259716	0.259716
0.035470 - 0.125544i	0.130459
0.035470 + 0.125544i	0.130459

No root lies outside the unit circle.
VEC satisfies the stability condition.