Journal of Scientific Research & Reports

26(7): 18-26, 2020; Article no.JSRR.60027
ISSN: 2320-0227

Analysis of Inflation Rates in Ethiopia Using Vector Autoregressive Models

Gemechu Bekana Fufa[1*]

[1]*Department of Statistics, College of Natural and Computational Science, Wollega University, Nekemte, Ethiopia.*

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/JSRR/2020/v26i730282
Editor(s):
(1) Dr. Prinya Chindaprasirt, Khon Kaen University, Thailand.
Reviewers:
(1) Addzrull Hi-Fi Syam Bin Ahmad Jamil, Polytechnic Kota Kinabalu, Malaysia.
(2) Oluchukwu Chukwuemeka Asogwa, Alex Ekwueme Federal University Ndufu Alike Ikwo (AEFUNAI), Nigeria.
(3) Abdurakhman, Gadjah Mada University, Indonesia.
Complete Peer review History: http://www.sdiarticle4.com/review-history/60027

Original Research Article

Received 28 May 2020
Accepted 03 August 2020
Published 22 August 2020

ABSTRACT

This study aims to analyze the inflation rates by using Vector Autoregressive models. Vector Autoregressive (VAR) Models, Testing Stationary: Unit root test, Estimating the Order of the VAR, Cointegration Analysis (testing of cointegration), and Vector Error Correction (VEC) Models were used in this study for data analysis. Comparisons were made between food price index and nonfood price index using descriptive analysis. The findings of the study suggest that the percentage of food price index in higher than nonfood price index. The results also imply the existence of short-term adjustments and long – term dynamics in the CPI, FPI, and NFPI. Unit root test reveals that all the series are nonstationary at level and stationary at first difference. The result of Johansen test indicates the existence of one cointegration relation between the variables. The final result shows that a Vector Error Correction (VEC) model of lag two with one cointegration equation best fits the data. To contain inflation rates, therefore, the policy interventions aimed at tackling the current situation of inflation rates need to take into account the priorities of the government as the effect of policy instruments and means of solutions.

Keywords: Inflation; vector autoregressive; vector error correction model; Ethiopia; forecasting.

**Corresponding author: E-mail: gemechubekana@wollegauniversity.edu.et;*

1. INTRODUCTION

1.1 Background of the Study

Inflation can be defined as a sustained or continuous rise in the general price level or, alternatively, as a sustained or continuous fall in the value of money. Several things should be noted about the definition. First, inflation refers to the movement in the general level of price. It does not refer to changes in one price relative to other prices. These changes are common even when the overall level of price is stable. Second, the rise in the price level must be somewhat substantial and continue over a period longer than a day, week, or month. However, if the rise is a continuous drop instead, it is called deflation [1].

There are many measures of inflation, because there are many different price indices relating to different sectors of the economy. The two widely known indices for which inflation rates are reported in many countries are the Consumer Price Index (CPI), which measures the rate of change in the price of goods and services bought by the consumers and the GDP deflator, which measures prices of locally produced goods and services [2].

In Ethiopia raw inflation figures are reported monthly using the Consumer Price Index (CPI) by the Central Statistical Agency. The CPI is an estimation of the price changes for a typical basket of goods. In other words, the prices of everyday goods such as housing, food, education, clothing, etc., are compared from one month to the next and the difference represents the CPI. The CPI published by CSA composed of the weighted average of two sub-index-es that reflect the development of prices of goods production in certain sectors of economy, namely, food and nonfood prices [2].

1.2 Concepts and Measurements of Inflation and Computation

A price index is a weighted average of the prices of a number of goods and services. Inflation rates are calculated from different price indices.

I. The consumer price index (CPI)

Consumer Price Index (CPI) is the measures of changes in the prices of baskets of goods and services that households consume. Such changes affect the real purchasing power of consumers' income and their welfare. When the prices of different goods and services vary by different rates, a price index can only reflect their average movement. The types of inflation measurement provide different outcomes with their respective purpose.

II. Producer price index (PPI)

It measures the general price level at the producer stage. These are generally the prices charged by the producers at the level of their first commercial transaction. These are of course the wholesale prices charged at the first link of the distribution chain. These prices are easy to obtain and monitor. The construction and interpretation of this index is broadly the same as that of the consumer price index.

III. GDP-Deflator: It is the ratio of nominal and real gross domestic product

In the past, rises in prices in Ethiopia was associated with fall in output (mainly agricultural harvest) and years of high production were accompanied by fall in price. In 2000/01, for example, output grew by 8.3 percent (mainly due to a 9.6 percent increase in agricultural output) and consumer price index decreased by 5.2 percent (owing mainly to a 10.4 percent decrease in food price). In the following two years, there was a significant fall in agricultural production due to unfavorable weather condition [3,4].

There are different empirical studies on the possible sources of this inflationary situation in the country. The major sources of inflation discussed in the literature are the increase in money supply unwarranted by the level of output growth, the nature of investment in the country, the widening of the national deficit and ways of financing it, the inefficiency within government-controlled organizations, soaring of oil prices and others [5,6,7,8,9]. In contrast, the government argues that the inflation is due to rapid economic expansion that has happened in countries [10,11,12,13]. They also indicate that oil prices and increase in world food prices as the possible sources of inflation.

There are limited researches conducted on inflation and its correlates in Ethiopia. The implication is that the inflation situations of the country were not given attention. Besides this, most research paper focus on the national level focuses on the causes of inflation. Modelling and analysis of inflation at country level becomes sound enough to put an agenda on the inflationary process.

1.3 The Objectives of the Study

The main objective of this study is to Analysis the Inflation Rates in Ethiopia using Vector Autoregressive models. Specifically, this research aims:

- To analyze the food and Nonfood inflation using Vector Autoregressive models in Ethiopia.
- To compare food and nonfood inflation in Ethiopia.
- To study the relationship between consumer price index, food and nonfood price index.

2. MATERIALS AND METHODS

2.1 Methods of Data Collection

This study was conducted in Ethiopia. The study applied the secondary data type collected from different organizations and institutions (CSA, Ministry of Finance and Economic Development (MOFED), and National Bank of Ethiopia). The data was yearly time series data, that documented for more than 20 years.

2.2 Methods of Data Analysis

a) Vector Autoregressive (VAR) Models

The VAR model is one of the most systems of regression models, successful, flexible, and easy to use models for the analysis. The VAR model has proven to be especially useful for describing the dynamic behavior of economic and financial time series and for forecasting.

b) Stationary vector autoregression model

Let $Y_t = (y_{1t}, y_{2t}, \ldots, y_{nt})^T$ denote (nx1) random vector of time series variables. The basic p-lag vector autoregressive (VAR (p)) model has the form [14].

$$\mathbf{Y}_t = \mathbf{C} + \pi_1 \mathbf{Y}_{t1} + \ldots + \pi p \mathbf{Y}_{tp} + \epsilon t, \; t = 1, 2, \ldots, T \quad (1)$$

Where π is a fixed coefficient matrix, $\mathbf{C} = (c_1, c_2, \ldots, c_n)'$ is a fixed *nxn* vector of intercept terms allowing for the possibility of a non-zero mean $E(\mathbf{Y}_t)$.

Stationary Processes: A stochastic process $\mathbf{Y}_t$ is weakly stationary if its first and second moments are time invariant. In other words, a stochastic process is stationary if

- $E(\mathbf{Y}_t) = \mu$, constant for all value of t and $Cov(\mathbf{Y}_t, \mathbf{Y}_{t-j}) = \sum$, for all $t, j=0,1,2,\ldots$ where with $\mathbf{\Sigma}$ an (nxn) symmetric positive definite matrix.

Let c_i denote the i^{th} element of the vector **C** and let $\pi_{ij}^{(1)}$ denote the row i, column j element of the matrix π_1.Then the first row of the vector system in (2) specifies that:

$$Y_{1t} = C_1 + \pi_{11}^{(1)} Y_{1,t-1} + \pi_{12}^{(1)} Y_{2,t-1} \ldots + \pi_{1n}^{(1)} Y_{n,t-1} + \pi_{11}^{(2)} Y_{1,t-2} + \pi_{12}^{(2)} Y_{2,t-2} + \ldots + \pi_{1n}^{(p)} Y_{n,t-p} + \epsilon t, \; t = 1, 2, \ldots, T \quad (2)$$

Thus, a vector autoregression is a system in which each variable is regressed on a constant and *p* of its own lags as well as *p* lags of each of the other variables in the VAR. Note that each regression has the same explanatory variables.

c) Testing Stationarity: Unit root test

Before fitting a particular model to time series data, the series must be made stationary. Stationarity in a time series occurs when the mean remains constant and the autocovariances of the series depend on the lags separating the time points. Therefore, the stochastic process Yt is said to be stationary if:

i. $E(\mathbf{Y}_t) = \mu$, constant for all value of t and (3)

ii. $Cov(\mathbf{Y}_t, \mathbf{Y}_{t-j}) = \gamma_j$, for all $t, j=0,1,2,\ldots$ T (4)

Condition (3) means that all Y_t have the same finite mean vector $\boldsymbol{\mu}$ and (4) requires that the autocovariances of the process do not depend on t but just on the period j the two vectors Y_t and Y_{t-j} are apart. Therefore, a process is stationary if its first and second moments are time invariant.

The stationarity of the series is tested by using statistical tests such as Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller [15] and [16] and the Phillip-Perron (PP) due to Phillips [17]. In this study, **Augmented Dickey-Fuller (ADF)** test was used for test of stationarity.

Consider a simple AR (1) process:

$$Y_t = \theta Y_{t-1} + X_t' \delta + \varepsilon_t \quad (5)$$

Where X_t are optional exogenous regressors which may consist of constant or a constant and trend, θ and δ are parameters to be estimated, and ε_t is assumed to be white noise. If $|\theta| \geq 1$, Y_t is a non -stationary series and the variance of Y_t increases with time. If $|\theta| < 1$, Y_t is a stationary series.

Thus, the hypothesis of stationarity can be evaluated by testing whether θ is strictly less than one i.e. H0: $\theta = 1$ (unit root in θ (z) = 0) $\Rightarrow Y_t \sim$ I(1) H1 : $|\theta| < 1 \Rightarrow Y_t \sim$ I(0)

The standard Dickey-Fuller test is conducted by estimating equation (5) after subtracting Y_{t-1} from both side of the equation and obtain the following equation.

$$\Delta Y_t = \alpha Y_{t-1} + \varepsilon_t \tag{6}$$

$\varepsilon_t \sim N[0, \sigma^2]$,and $\mathrm{Cov}[\varepsilon_t, \varepsilon_s] = 0 \; \forall \, t \neq s$.

Where $\alpha = \theta - 1$ and $\Delta Y_t = Y_t - Y_{t-1}$. The null and alternative hypotheses may be re-expressed as H_0: α = 0 versus H_1: α < 0 and evaluated using the conventional t - ratio:

$$t_\alpha = \frac{\hat{\alpha}}{s.e(\hat{\alpha})} \tag{7}$$

Where $\hat{\alpha}$ is the estimate of α, and $s.e(\hat{\alpha})$ is the standard error of $\hat{\alpha}$.

Dickey and Fuller [15] show that under the null hypothesis of a unit root, this statistic does not follow the conventional Student's t-distribution and they derive asymptotic results and simulate critical values for various test and sample sizes.

d) Estimating the Order of the VAR

The lag length for the VAR model may be determined using model selection criteria. The general approach is to fit VAR models with orders m = 0, ... , p_{max} and choose the value of m which minimizes some model selection criteria [14]. The general form model selection criteria have the form

$$C(m) = \log|\hat{\textstyle\sum}_m| + C_T \cdot \varphi(m, K) \tag{8}$$

Where $\hat{\sum}_m$ is the residual covariance matrix estimator for a model of order *m, φ(m,k)* is a function of order *m* which penalizes large VAR orders and C_T is a sequence which may depend on the sample size and identifies the specific criterion. The term $\log|\hat{\sum}_m|$ is a nonincreasing function of order *m*.

The three most commonly used information criteria for selecting the lag order are the Akaike information criterion (AIC), Schwarz-Bayesian information criterion (SBIC), Hannan-Quin (HQ) information criteria:

$$\mathrm{AIC}(m) = \ln|\hat{\textstyle\sum}_m| + \frac{2}{T} mn^2 \tag{9}$$

$$\mathrm{SBIC}(m) = \ln|\hat{\textstyle\sum}_m| + \frac{lnT}{T} mn^2 \tag{10}$$

$$\mathrm{HQ}(m) = \ln|\hat{\textstyle\sum}_m| + \frac{2lnT}{T} mn^2 \tag{11}$$

In each case $\phi(m,n) = mn^2$ is the number of VAR parameters in a model with order *m* and *n* is number of variables. The AIC criterion asymptotically overestimates the order. On other hand, the HQ and SBIC criteria are both consistent, that is, the order estimated with these criteria converges to the true VAR order *p* under quite general conditions if the true order (p)is less than or equal to p_{max}.

e) Cointegration Analysis: using Johansen's methodology

The starting point in Johansen's procedure (1988), in determining the number of cointegrating vectors, is the VAR representation of Y_t. It is assumed a vector autoregressive model of order p and is expressed as follows:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + BX_t \tag{12}$$

where y_t is a k-vector of nonstationary I(1) variables(If a nonstationary series y_t must be differenced d times before it becomes stationary, then it is said to be integrated of order d. This would be written $y_t \sim$ I(d)), X_t is a d-vector of deterministic variables, and ε_t is a vector of innovations.

We may rewrite this VAR as

$$\Delta y_t = \pi y_{t-1} + \textstyle\sum_i^{p-1} r_t \Delta y_{t-i} + BX_t + \epsilon t \tag{13}$$

Granger's representation theorem asserts that if the coefficient matrix π has reduced rank r<k, then there exist k x r matrices α and β each with rank r such that π=αβ' and β'yt is I(0). Where r is the number of cointegrating relations (the cointegrating rank) and each column of is the cointegrating vector. Johansen [18] proposed two

tests for estimating the number of cointegrating vectors: The Trace statistics and Maximum Eigenvalue. Trace statistics investigate the null hypothesis of r-coin-te-grating relations against the alternative of n cointegrating relations, where n is the number of variables in the system for r = 0, 1, 2…n-1. Define $\hat{\lambda}_i$,i=1,2,…,k to be a complex modulus of eigenvalues of $\hat{\pi}$ and let them be ordered such that $\lambda_1 > \lambda_2 > ....> \lambda_n$. The statistic computed as:

$$\lambda_{trace}(r) = -T\sum_{i=r+t}^{n} \log[1 - \lambda_i] \quad (14)$$

The Maximum Eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of r+1 cointegrating relations for *r = 0, 1, 2…n -1*. This test statistic is computed as:

$$\lambda_{max}(r, r + 1) = -T\text{Log}(1 - \lambda_{r+1}) \quad (15)$$

where λ_{r+1} is the $(r+1)^{th}$ ordered eigenvalue of π, and T is the sample size. The critical values tabulated by [19] will be used for these tests.

f) Vector Error Correction (VEC) Models

A vector error correction (VEC) model is a restricted VAR designed for use with nonstationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The Vector Error Correction Model (VECM) from: [20].

$$\Delta y_t = \pi y_{t-1} + \sum_{i}^{p-1} \Gamma_t \Delta y_{t-i} + BX_t + \epsilon t \quad (16)$$

The above specification of VECM contains information on both the short and the long run adjustment to changes in y_t via estimating **Γ** and **π**, respectively. Matrix **π** can be decomposed as **π=αβ'**, where **α** is nxr matrix of speed of adjustment, and **β** is an n_{xr} matrix of parameters which determines the cointegrating relationships matrix of long- run coefficients such that $\beta' y_{tk}$ represents the multiple cointegration relationships. The columns of **β** are interpreted as long-run equilibrium relationships between variables.

3. RESULTS AND DISCUSSION

3.1 Descriptive Analysis

The descriptive statistics including the mean, the standard deviation, the coefficient of variation (CV), and Percentage values of the series. The result shows that there are 190 food price Index and 212 nonfood price Index from 402 general Index. The mean percentage to be 42.30% and 57.70% for the non-food price Index and food price Index, respectively.

3.2 VAR Model Analysis: Unit Root Test Results

The estimation begins with the testing of variables for unit roots to determine whether they can be considered as a stationary or nonstationary process. Table 2 presents the Augmented Dickey Fuller (ADF) tests of variables. The tests showed that all the variables were non-stationary at level. The Critical values for tests were found to be -2.88 and -3.44 at 5% significance level.

The analysis continued with the unit root test of the differenced series. Since the null hypothesis cannot be rejected, in order to determine the order of integration of the non-stationary time series, the same tests were applied to their differences. The order of integration is the number of unit roots that should be contained in the series so as to be stationary. After differencing, the tests showed that all variable were stationary at first difference. The Critical values for tests were found to be -2.88 and -3.44 at 5% significance level.

Table 1. Descriptive statistics for general index

Series	OBS	Mean	Stand. deviation	Percentage	CV
Food Price Index	190	44.32	35.54	57.70%	0.721
Non-food Price Index	212	41.14	39.42	42.30%	0.521
Consumer Price Index	402	45.23	38.15	100%	0.523

As we can see from table 1, the percentage of food index is higher than that of nonfood index. This shows the consumer price index is more affected by food price index

Table 2. ADF stationary test result level

Variables	Level with Intercept and no trend		Level with Intercept and trend		Decision
	ADF statistic	P-value	ADF statistic	P-value	
FPI	4.33	0.76	1.47	0.94	Nonstationary
NFPI	4.33	0.77	3.13	0.93	Nonstationary
CPI	4.46	0.96	3.31	0.94	Nonstationary
Crit.Value (5%)	***-2.88***		***-3.44***		

Where FPI -Food Price Index, NFPI - Nonfood Price Index and CPI - Consumer Price Index

Table 3. Unit root test results (after first difference)

Variables	Level with Intercept and no trend		Level with Intercept and trend		Decision
	ADF statistic	P-value	ADF statistic	P-value	
D_1(FPI)	- 5.42	0.003	- 1.58	0.001	Stationary
D_1(NFPI)	- 4.25	0.002	- 4.14	0.002	Stationary
D_1(CPI)	- 5.56	0.003	- 3.21	0.001	Stationary
Crit. Value (5%)	**-2.88**		**-3.44**		

The results in Table 3 indicate that the null hypothesis is rejected for the first differences of the all variable given that *p-values less than 5% level of significance* with intercept and trend in ADF test. This implies that the all variables are integrated of degree one (I (1)). Therefore, the ADF test shows that all series are non stationary in levels, and stationary in the first difference.

3.3 Estimating for Order of the VAR

As shown in Table 4, AIC, SC and HQ suggest appropriate lag length for the VAR model of four variables, GDP and three economic sectors output is two (2). The best fitting model is the one that minimize AIC or SC or HQ.

3.4 Cointegration Analysis

The results of Cointegration tests for FPI, NFPI and CPI are reported in, Table 5. The trace statistic indicates that at least one cointegrating vector (r ≥ 1) exists in the system at the 95 percent confidence level (estimated LR statistic, 42.59 > 29.79, 95 per cent critical value). In order to cross check for identifying the specific number of cointegrating vectors, the maximal eigenvalue statistic is further employed. This statistic confirms the existence of only one cointegrating relationship at the 95 per cent confidence level in this system (estimated LR statistic, 36.15 > 21.13, 95 per cent critical value).

From the Johansen cointegration test, it was determined that the rank of cointegration matrix to be equal to one. Consequently, the cointegrating vector is given by β = (1, -0.57211, -0.347224). The values correspond to the cointegrating coefficients of CPI (normalized to one), FPI, and NFPI, respectively. Thus, the vector above can be expressed as: $CPI_t = 0.58211FPI_t + 0.347224\ NFPI_t$.

3.5 Model Estimation

The result indicates that, the long run coefficients of consumer price index has a positive long run relationship with food price index and non-food price as expected in the theory. The long run equation is given as follows:

$$CPI_t = 8.08 + 0.58211FPI_t + 0.347224\ NFPI_t \quad (17)$$

Table 4. VAR lag order selection for GDP and three economic sectors

Lag	LogL	LR	FPE	AIC	SBIC	HQ
1	-510.25	177.23	185	38.53	38.95	38.59
2	-535.31	22.32	1.05	**37.93***	**38.01***	**38.05***
3	-553.12	3.28	1.12	38.5	38.55	38.9
4	-553.13	2.75	1.31	38.13	38.72	38.25

(indicates lag order selected by the criterion)*

Table 5. Johansen cointegration test results (by assumption: linear deterministic trend)

Number of cointegrating vector	Eigenvalue	Trace Test			Maximum Eigenvalue Test		
		Statistic	0.05 Crit. value	Prob.**	Statistic	0.05 Crit. value	Prob.**
None *	0.244378	42.58801	29.79707	0.001	36.14758	21.13162	0.0002
At most 1	0.037482	6.440438	15.49471	0.6434	4.928085	14.2646	0.7509
At most 2	0.011655	1.512353	3.841466	0.2188	1.512353	3.841466	0.2188

Normalized cointegrating coefficients (standard error in parentheses)

CPI	FPI	NFPI
1.000000	- 0.582110	- 0.347224
	(0.01644)	(0.02652)

** denotes rejection of the hypothesis at the 0.05 level*

***MacKinnon-Haug-Michelis (1999) p-values*

The value 0.582 suggests that a one unit increase in food price index induces, on average, an increase of about 0.58 units in consumer price index. Similarly, one unit increase in non-food price index leads to an increase of about 0.34 units in the CPI.

The first equation, i.e. the CPI equation((Eq(i) below), shows that the remaining long-term CPI gap closes by about 35 percent in each period, while the gaps in the FPI and NFPI equations close by about 29 and 43 percent, respectively(Eq(ii) and Eq(iii)). These results imply that FPI and CPI take longer to achieve equilibrium after a shock. Finally, using the error correction term as another independent variable in the unrestricted VAR model we can estimate the following Vector Error Correction Model.

3.5.1 Model of overall consumer price index:

$$\Delta CPI_t = 0.35*(CPI_{t-1} - 0.57*FPI_{t-1} - 0.35*NFPI_{t-1} - 8.08) - 1.89*\Delta CPI_{t-1} - 1.52*\Delta CPI_{t-2} + 1.54*\Delta FPI_{t-1} + 0.84*\Delta FPI_{t-2} + 0.61*\Delta NFPI_{t-1} + 0.31*\Delta NFPI_{t-2} + 1.05 \quad \text{Eq(i)}$$

3.5.2 Model of food price index

$$\Delta FPI_t = 0.29*(CPI_{t-1} - 0.57*FPI_{t-1} - 0.35*NFPI_{t-1} - 8.08) - 3.11*\Delta CPI_{t-1} - 1.46*\Delta CPI_{t-2} + 2.52*\Delta FPI_{t-1} + 0.78*\Delta FPI_{t-2} + 1.13*\Delta NFPI_{t-1} + 0.04*\Delta NFPI_{t-2} + 1.04 \quad \text{Eq(ii)}$$

3.5.3 Model of non-food price index

$$\Delta NFPI_t = 0.43*(CPI_{t-1} - 0.57*FPI_{t-1} - 0.35*NFPI_{t-1} - 8.08) + 0.68*\Delta CPI_{t-1} - 1.41*\Delta CPI_{t-2} - 0.28*\Delta FPI_{t-1} + 0.79*\Delta FPI_{t-2} - 0.49*\Delta NFPI_{t-1} + 0.59*\Delta NFPI_{t-2} + 1.06 \quad \text{Eq(iii)}$$

Where: 'Δ' stands for first difference (D), the value in the bracket is the error correction term and the coefficients of error correction term are called adjustment coefficients.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The results of the analysis showed that the non-food price index was higher than that of food price index. Reveals that the impact of variables on inflation were varies according to the variable status. The mean percentage of access of food and non-food productions (8.20%), money supply (8.20%), Tax (8.00%) and exchange rates (8.00%) were the highest percentages comparing to the other variables.

Over the time period considered, all the three series showed an increasing pattern, that is, there is the sign of non stationarity in each of the series. In order to examine the VAR model, the unit root tests (ADF tests), identification of the number of lags and cointegration analyses were conducted. Unit root tests indicate that all indices are non stationary at level and are stationary at first difference at 5% significant level. The Johansen cointegration test suggests that there is at least one cointegration vector, which describes the long run relationship between CPI, FPI and NFPI. The appropriate number of lag identified was two.

4.2 Recommendations

This study has tried to model and analysis of inflation in stated study area. Based on the results discussed above, the researchers would like to forward the following recommendations: -

- The policy interventions aimed at tackling the current situation of inflation need to take into account the priorities of the government as the effect of policy instruments highly depends on whether it is meant to temporarily deal with the inflationary problem or permanently reverse the inflation cycle.

- The access food and non-food items were directly related with inflation. Therefore, in order to control the inflation, increasing the products from the industry and increases the access of the items.
- Food Price index is the main determinants of inflation. Agricultural Products and Access of inputs for production were the main input for the increments of food items. Therefore, increasing the agricultural products will important for control the inflationary process.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Behera DK, Tiwari M. Growth and determinants of employment in Indian agriculture. Journal of Land and Rural Studies. 2014;2(1):43–55.
2. Central Statistical Agency (CSA). Report of the 2005. Federal Democratic Republic of Ethiopia, Addis Ababa. Central Statistical Authority (2001). Statistical Abstract; 2005.
3. Hilbe JM. Logistic regression models. Chapman & Hall, London; 2009.
4. MoFED. National Economic Accounts Directorate. Ministry of Finance and Economic Development, Addis Ababa; 2010.
5. Bahata YT, Willemse BJ, Grove B. The role of agriculture in welfare, income distribution and economic development of the Free State Province of South Africa: A CGE approach, Agrekon: Agricultural Economics Research, Policy and Practice in Southern Africa. 2014;53(1):46-74.
6. Geda A, Tafere K. The galloping inflation in Ethiopia: A cautionary tale for aspiring ‘Developmental States’ in Africa. Agricultural Economics Research, Policy and Practice in Southern Africa. 2015;53(1):46-74.
7. Gemechu B, Temesgen A, Temesgen D. Regression models to identify the determinants of inflation in Ethiopia: The case of Illu Abba Bor Zone, Ethiopia. International Journal of Multidisciplinary Research and Studies. 2019;1(2):2640-7272.
8. Sahoo K, Sethi N. Investigating the impact of agriculture and industrial sector on economic growth of India. OIDA International Journal of Sustainable Development. 2012;05(05):11-22.
9. John M, Worku S, Paulos Z. Impact of soaring food prices in Ethiopia. International Food Policy Research Institute (IFPRI). 2017;8(2).
10. Gemechu Bekana. Analyzing the share of agriculture and industrial sectors in the economic growth of Ethiopia: An ordinary least squares (OLS) application. International Journal of Information, Business and Management. 2018;10(4): 2076-9202.
11. Hair JF, Black W, Babin BJ, Anderson RE. Multivariate data analysis, 7th Edition, Prentice Hall; 2009. Hosmer DW, Lemeshow S. Applied Logistic Regression, 2nd Ed.; 2004.
12. Jema H, Fekadu G. Determinates of the recent soaring food inflation in Ethiopia. Universal Journal of Education and General Studies. 2017;12(1):00545–00552.
13. Khan MS, Senhadji AS. Threshold effects in the relationship between inflation and economic growth. IMF Staff Papers. 2013;48(1):1-21.
14. Lutkepohl H. Introduction to multiple time series analysis. Springer-Verlag, Berlin; 2005.
15. Dickey DA, Fuller WA. Distribution of estimators of autoregressive time series with a unit root. Journal of the American Statistical Association. 1979;74:427-31.
16. Dickey DA, Fuller WA. Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica. 1981;49(4):1057-72.
17. Philips PCB. Understanding spurious regression in econometrics. Journal of Economics. 1987;33:311-340.
18. Johansen P. Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control. 1988;12:231-254.

19. Johansen S, Juselius K. Identification of the long-run and the short-run structure. An application to the ISLM model. Journal of Econometrics; 1990.

20. Schultz TW. Transforming traditional agriculture. American Journal of Agricultural Economics. 1988;70(1):198-200.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/60027