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Oil Price Pass-Through on Food and Non-Food Inflation in Ethiopia

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Abstract

This study sought to investigate the inflationary impact of international oil price on inflation in Ethiopia. It mainly focused on the impact of fluctuations in international oil prices on food and non-food inflation, to estimate the degree of international oil price pass through into inflation and lastly to draw policy implications for controlling domestic inflation. The study was based on the Cost Push Inflation theory. The study tested for cointegration and employed VECM for food CPI and OLS for non-food CPI. The study found a negative and significant relations for changes in food CPI and changes in lag (2) and (3). Further, the study established a positive and significant relationship between change in food CPI and change in oil prices lag (1) and (2). In addition, oil prices positively and significantly affect non-food CPI from the study findings. The study observed the existence of partial pass- through effect of oil prices on food and non-food CPI. Based on the findings, fluctuations in international oil prices have a direct and significant impact on food and non-food CPI in Ethiopia in the short run. This implies that there is need for the Ethiopian government to formulate policies aimed at controlling inflation for both food and non-food CPI since it has a direct impact on people. Majority of the existing studies have focused on only food but leaving out non-food CPI. This study filled the gap by identifying the magnitude of the oil prices pass-through to domestic price for both food and non-food CPI.

Keywords: *Oil Price, Food and Non-Food Inflation & Ethiopia.*

1.1 Background

Inflation which is an integral part of the macroeconomic policies is core in stabilization of the economy. Refined petroleum formed 19%,11%,21%,12% and 10% of Ethiopia's total imports in 2012, 2013, 2014,2015 & 2016 respectively (OEC, 2016). Fluctuations in the world oil prices may influence prices of petroleum products and therefore the prices of other goods and services into Ethiopia. Such effects may be transmitted to the inflation and therein have a trickle-down effect to other key macroeconomic sectors like; consumption levels, savings, investments and trade balance.

As an oil importing country, Ethiopia cannot influence on international oil price changes. However, policymakers in Ethiopia can have an influence various domestic taxes such as excise taxes and sales taxes of oil products, to cushion the economy against international oil price fluctuations. To understand how to address the effect of oil price fluctuations it is important to investigate how oil prices fluctuations pass through to domestic inflation in Ethiopia.

Price stability is preferred by firms and house holders (Federico, 2001). Firms prefer stability in prices to ensure stable costs of production. This aids investment decisions, households benefit due to stable real incomes and consumption patterns. Inflation defined as persistent rise in general price levels can exist in the form of demand pull, cost-push or structural forms (Ross *et al.*, 2001). Demand pull inflation occurs when aggregate demand exceeds the value of output at full employment. In monetary terms, it occurs when excess money balances are spent on goods and services. Cost-push inflation arise when rise in production costs (independent of changes in demand) push up the general levels of prices. Structural inflation occurs when an increase in price levels is made persistent by other dynamics of the economy (Ross *et al*., 2001).

Cost push inflation may occur if high crude oil prices raise costs of production (Pau *et al.*, 2007). Oil products are not only used as final consumer goods but also used as inputs for economic activities. Therefore, change in price of oil can pass through to the prices of other products directly and indirectly. Since energy constitutes a large share of final consumption of goods, then the direct effects involves movement of the consumer prices upwards while indirect effects pertains to an increase in the producer prices which may on the other side pass to consumers through purchase of final produced goods. The size of the effect is determined by the ability of the firms to transmit the production cost to the consumers as well as flexibility in the market.

1.2 Statement of the Problem

Oil price fluctuation can affect domestic markets of importing country may in two phases lead to a rise in price of other commodities (Bhattacharya & Indranil , 2001). Initially, sellers hoard goods in anticipation of a future price increase of the same products. In addition, the rise in price of petroleum and its products increase the cost of production and the impact is felt at the completion of an average production cycle. In order for a country to cushion itself against these external shocks of oil prices, it has to understand the magnitude of the effect, and therein be able to know the magnitude of the response domestically. Transmission of the global prices of oil occur fast to the economy relatively to the global maize prices in East Africa (Dillon & Barren, 2015). Shocks due to oil prices and subsidies on oil prices on the Ethiopian economy leads to the depreciation of the Ethiopian Birr and this led to increased level of exports (Ayalew *et al*., 2012).

Ethiopia is a small oil importer relative to world oil import. It is prone to shocks that arise due changes in world oil prices. Therefore, one policy concern is the degree of pass-through of oil price change into domestic prices. The shocks can affect domestic commodities directly through direct purchases or indirectly through industries. It being small implies it can only use domestic tools like domestic taxes to caution itself against the external shocks. To address the issue, a good analysis of the impact of the external shocks is warranted, in order to have positive results of the domestic policies.

Previous studies carried out Ethiopia have majorly focused on the food sector and ignored the non-food. They mainly focused on annual and monthly time series data with main inclination in the food sectors (Ahmed, 2007 Habtamu, 2013; Durevall *et al*., 2010). Further, a recent study done focused on annully by (AS, 2015) only established the existence of long run relationship between domestic inflationin Ethiopia and world oil price but whithout specification of the magnitude of the pass-through. Simialiarly, Fekadu (2005) found that although oil price increase did not significantly have an effect on general inflation in the short term ,it plays an important role on the core inflation.Since there is no study carried out focusing on non food and quarterly time seris data, this study seeks to seeks to fill that gap by focusing on quarterly time series .This captured both the short and long run periods' effects. This study fills this gap by identifying the magnitude of the oil prices pass-through to domestic price. The magnitude is important for policymakers especially those in the central bank of Ethiopia. The study also included the non-food inflation in order to give out a concise effect of oil prices on inflation in the country.

1.3 Research Questions

The principal research question of this study was whether international oil price fluctuations has significant impact on goods prices in Ethiopia. The specific questions guiding the study were:

i. What is the impact of fluctuations in international oil prices on food and non-food inflation in Ethiopia?
ii. What is the extent of oil prices pass-through into inflation in Ethiopia?

1.4 Objectives of Study

The main objective of this study was to investigate the inflationary impact of international oil price on inflation in Ethiopia. The Specific objectives were:

i. To analyze the impact of fluctuations in international oil prices on food and non-food inflation.
ii. To estimate the degree of international oil price pass through into inflation.
iii. To draw policy implications for controlling domestic inflation.

2.1 Literature Review

2.2 Theoretical Framework

2.2.1 Cost Push theory

This theory is becoming significant prior and after the World War II and the argument is that prices are pilled by increase in the cost of production. Increase in the price of goods and services is due to the increase in the cost of labour and raw materials used in the production process. According to Totonchil (2011) increase in production cost leads to increase the price levels of goods and services. This generates supply-side led inflation. One source of increase in the production cost is

increase in wage costs not accompanied with increase in productivity. Consequently, firms may raise the prices charged on their goods and offering of services

2.2.2 Inflation Transmission Channels

Production side Transmission channels

Theoretically, there exist a variety of channels in which the impact of oil price increase is transmitted into the economy. Production costs tend to increase due to the increase in the price of oil and hence potential output decrease and this associated with the reduction in the aggregate output and consequently rise in price levels. Oil price instability leads to decrease in economic activities in the economy because continued increase in the oil price volatility will consequently (Hou, Keane, Kennan & te Velde, 2015).

This is because oil price change cause the postponement of the investment decisions. When oil becomes expensive, the cost of production for the industries which depend heavily on oil for their operations. This discourages investments in the industries while encouraging the growth of the non-oil industries. Moreover, this reduces output and increase unemployment due to reduced capacity utilization (Tang et al, 2010). Rise in the cost of oil translates to the rise in the in the cost of the factors of production. This is because energy is because many production processes depends on oil for running of machines and transportation of their goods s to the market. The inputs are reduced and hence low out level. Output level creates shortage and hence inflation in the economy (Rasche & Tatom, 1977).

Whenever oil prices increase, workers anticipate for high prices and wages because of the reduced purchasing power of their incomes. Since labour is an input in the production, firms increase prices due to increase in the wages. Consequently, there is increase in the inflation in the economy.

Consumer side transmission channels

Oil being a factor of production is important in the economy given its use in the transportation as a fuel. Increase in the production cost is transferred to the finished product and this leads to the increase in inflation (Abel & Bernanke, 2001; Brown and Yucel ,2002)

Oil price increase cause a corresponding increase in the demand for money to buy oil products because the money available to them is not sufficient hence they have to look for loans. Due to increase in demand for money, there is rise in the interest rate. The implication would be the decrease in the investments and hence decrease in economic activity if appropriate monetary action is not taken (Brown and Yucel, 2002).

Exchange rate transmission channels

Oil price rise can also be transmitted through the exchange rate which later cause inflation in the economy (Hanson *et al.,* 1993). When the price of oil increase lead to the devaluation of the currency by the oil importers and this translates into inflation in the economy. The exporters of oil will reap from this because oil price increase leads to the appreciation of their currency and hence imports of oil is economical to the exporters but uneconomical to the oil importers. It therefore this makes the products of the oil exporters less competitive internationally.

Terms of trade transmission channels

From the international trade openness perspective, oil prices affect the trade terms in the oil importer. Consequently, wealth is transferred from the nations that import oil to the oil producers. This diminishes the purchasing power of the firms and households in the economy of the importer. This leads to eh change in the labour and capital structure due to the decrease in the production. Further, increase in the oil prices is detrimental to consumption and investments because oil price increase reduces consumer disposable incomes and increase production cost (Dohner, 1981).

2.3 Empirical Review

According to Chou and Tseng (2011) international prices of oil were found to significantly have pass-through effects on inflation in Taiwan in the long term. However, the short-term pass-through effect was insignificant.This study used Augmented Philips curve and ARDL model for the period 1982M1-2010M12 to estimate the effects of the global oil prices in the short run and long run. The study employed regression and recursive regression to compare pass-through effects on inflation rates but did not show variation with the global oil.

Using monthly data from 2003/3 to 2013/3 Abounoori *et al*. (2014) undertook a study to find out the effect of oil price pass-through on domestic Inflation in Iran.Increase in oil prices has long and short run passthrough effects on domestic inflation by dynamic ECM.Rise in oil price cause an increase inflation in the economy of Iran.

The study by Gregario, Landerretche and Neilson (2007) on oil prices and inflation established that oil price shocks were not strong on the twelve nations factored into the study. This was associated with the decrease in the oil intensity of economies around the world,increased demand for the oil and a more favorable inflation environment.This study employed augmented Phillis curve framework and a rolling vector autoregressions for a subsample of countries for which we have sufficient data.This study covered the period between 1970s and 1980s.

Using ECM , Shahbaz and Jawaid (2018) established a long run relationship between global oil prices and inflation rate in Pakistan for the time period1981-2011.The study findings indicated that short-run relationship between consumer prices and prices of oil did not exist.Positive shocks significantly and positively affected inflation in Pakistan.In their investigation of the oil prices on consumer index and economic activity in US , Cunado and Gracia (2005) noted that oil prices significantly affect both economic activity and price indexes in the short run but does not have any effect in the long run. Furthermore, the effect was found to be significant when the prices were measured in the local currency.

After South Africa had relied on the inflation targeting framework aimed at lowering and stablizing inflation from 2000 , there was no clear cut on how the application of monetary policy to stablize the the price with the volatile prices as a result of imported oil and exchange rates. This formed the basis of the study by Tshepo(2014) using Granger causality apporach analyzed the effects of passthrough prices of oil on South African inflation covering for the period 1990-2014. The study also found a causality running from oil price to inflation.The OLS results showed that increase

in the oil price increase cause inflation.This study proposed price control measures to mitigate domestic inflation in the country.

Studies conducted on developed economies (U.S and European economies) have shown a declining oil price effects on the economy over years due to the shifting of dependence of oil for energy to other forms of energy. However, this has not been the case for other economies like Turkey, whose effects have been increasing over time. Ethiopia is not among the most developed economies and would be worthy understanding oil price effects on inflation over the years. The dynamics of oil prices shocks to different economies, seem to have varying outcomes, based on the; different economies (developed and developing; oil supplying economies and oil demanding economies), Ethiopia falling on the developing and oil demanding economies. Dillon Barren and (2015) noted that global oil prices are transmitted fast to the economy relatively to the global maize prices in East Africa using monthly time series data for the period 2000-2012 and ECM was used in the analysis. In Ethiopia, Ayalew *et al*. (2012) established that oil shocks and subsidized oil prices on the Ethiopian economy depreciated the Ethiopian Birr and this led to increased level of exports.

According to Ibrahim and Said (2011) in Malaysia in the examination of the consumer prices and oil prices pass-through, oil price is cointegrated with food price indexes and consumer prices in the long run using ECM for the annual data for the period 1971-2009. Short run results showed that inflation, rent, fuel, and power price and transportation were significantly affected by prices oil. The study by the AFDB (2012) on the inflation dynamics considering Kenya, Uganda, Tanzania and Ethiopia established that inflation in Kenya and Tanzania was mainly determined by the prices of oil. In Uganda and Ethiopia increased money supply in their economies caused inflation in the short run. The study recommended appropriate monetary and fiscal policies in controlling inflation in their economies.

In Kenya, using a similar approach of Augmented Philips Curve (APC) Kiptui (2009) concluded that inflation in Kenya was affected by oil prices in the long run and short run. The short-run inflation which he refers to as incomplete oil price pass through effect was 0.5% while the long run pass through which he referred to as the complete pass-through was 10%. He also noted that inflation in Kenya is mainly affected by the aggregated demand conditions majorly revealed from the large output gap.

In Botswana, Lerato (2014) using a similar Augmented Philips Curve (APC) approach, particularly augmenting it with world oil prices and Southern Africa Inflation to account for spill-overs of inflation to Botswana domestic market, showed that oil prices globally affect inflation in Botswana, but the pass-through had been declining over the years due to an improvement in the monetary policy in the country over the years since 1980s.

In Nigeria, Adenuga *et al*. (2012) showed that in Nigeria, oil prices have very significant effects on inflation. It is however notable that Nigeria that is one of the major oil exporting countries in Africa, and thus heavily depends on this product for revenue. The Study finds that there is a short run pass-through effect of 0.04 and 0.06 in the long run, but it also finds out that exchange rates pass-through is much larger than the oil prices pass-through, and consequently reached to a conclusion that oil-prices pass-through was incomplete.

The East African study by Dillon and Barret (2015) on the global oil prices and food prices domestically found out that global oil prices are channeled fast to the local maize prices as compared to the global prices of maize. Transportation cost drives the prices of grains. This study also found out that elasticities of domestic maize prices in relation to the global oil prices to be greater or equal relative to maize prices globally for the markets that are far from the entry ports. ECM was employed in the study for the monthly time series data for the period 2000-2012.

Ademe (2015) on the study to investigate interaction between Ethiopia and inflation the rest of the world using time series from 1981 to 2012. This was done by investigating the effect of world oil price increment on Ethiopian inflation. The VECM results showed that inflation was cointegrated with increase in the global oil price. This implied that price of oil is an important factor of the inflation level in Ethiopia and this explained its relationship with the world.

Working paper in economics on the dynamics of inflation and food prices in Ethiopia by Durevall *et al*. (2010), found that inflation is an important aspect in relation to the agriculture and the sector of food in Ethiopia with a strong impact coming from the international food crisis. The study was conducted for the period 2000-2009, the years which spanned the period when the world faced international food crisis. The study employed Error correction model (ECM) for analysis. An important insight from the paper is that inflation of the country is affected by the external sector in the long run, specifically it found that local food prices respond more to changes in the international prices of food because of the prominence of the local market for the agricultural goods in the country. They conclude also that local food supply market shocks strongly affect consumer price index in the short run.

Studies done for Ethiopia have majorly focused on the food sector and ignored the non-food sector, particularly that of Durevall *et al.* (2010). Similarly, he carried out similar study in 2012 in Kenya and Ethiopia focusing on food sector. However, Durevall and Habtamu (2013, 2013) carried out a study in cooperating food and non-food sectors using monthly data. In conclusion, these studies mainly focused on annual and monthly time series data with main inclination in the food sectors (Ahmed, 2007; Habtamu, 2013). Further, a recent study done by (AS, 2015) only identified that there is a long run relationship between Ethiopia's inflation and world oil price but did not specify the magnitude of the pass-through. Fekadu (2005) found that the rise of oil price affect inflation however the effect was insignificant on the overall inflation in the short period. This study fills this gap by identifying the magnitude of the oil prices pass-through to domestic price. The magnitude is important for policymakers especially those in the central bank of Ethiopia. The study will also include the non-food inflation in order to give out a concise effect of oil prices on inflation in the country. Therefore is necessary to understand the effect that shocks caused by oil prices have on the domestic inflation of goods in Ethiopia. Therefore, this study fills this gap, by not only conducting a quarterly time series to take into account short and long run effects of oil prices on inflation in the country.

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3.1 Research Methodology

This study was based on the cost-push inflation theory.

The relationship between inflation and oil prices was summarized as:

$$Y = f(\boldsymbol{P}, X) \quad \ldots\ldots (1)$$

Where Y is the general price level, P is a vector of variables explaining price of raw materials. in this study representing the price of oil, X is a vector which captures control variables (Exchange rate and money supply) that explain inflation.

The relationship in equation (1) is operationalized by expressing it in the form of a Cobb-Douglas function as:

$$Y = AP^{\beta_1} ER^{\beta_2} \mathrm{MS}^{\beta_3} \quad \ldots\ldots (2)$$

Where A is constant and $\beta_1, \beta_2, \beta_3$ are elasticity. Log-linearizing equation (2) we have:

$$Ln\, Y = LnA + \beta_1 LnP + \beta_2 Ln\, ER + \beta_3 LnMS \quad \ldots\ldots (3)$$

Econometric Model Specification

The model specification to be estimated in this study can be obtained from operationalizing equation (3) in the form of:

$$LnCPI = \beta_0 + \beta_1 LnOILP + \beta_2 LnER + \beta_3 LnMS + \varepsilon \quad \ldots. (4)$$

Where:

Ln CPI = natural Logarithm of consumer price index

Ln OILP = natural logarithm of oil price

Ln EXC = natural logarithm of exchange rate

Ln MON = natural logarithm of money supply

ε = error term

β_0 and $\beta_1, \beta_2\, \beta_3$ = Elasticities of explanatory variables

The oil prices pass through is given by the parameters β_1. If $\beta_1 = 1$ there is full oil price pass through. If $\beta_1 < 1$ there is partial pass through.

Estimation Procedure

Unit Root Test

The first step involved in time series modelling, is testing fore unit root tests in the series. A stationary series has a constant variance, mean and auto-covariance over time (Gujarati, 2004). Time series data are usually faced with the problem of non-stationarity which is characterized by lack of independence across observations. Using such data series in regression analysis may result to spurious/meaningless regression results (Gujarati, 2004, 2011). In the event that the data series are non-stationarity, differencing can be applied to make them stationary.

ADF test is carried out based on the following equation (Dickey and Fuller, 1981)

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta Y_{t-i} + \varepsilon_t \quad \text{..... (5)}$$

Where Y_t is the particular variable to be tested β is the coefficient for trend, α is a constant, ε_t is the error term,γ is the coefficient for the lag of Y variable,ΔY is the first difference and k is the optimal number of lags to deal with serial correlation. The hypotheses of the ADF test (Unit root) are:

H_0: Series is non-stationary

H_1: Series is stationary

The rejection of the H_0 happens when the ADF test statistic is greater than Critical values.

Lag selections

The study carried out a lag length analysis using for main criteria. These include the Hannan-Quinn, Schwarz Bayesian and Akaike information criteria as well as Sequential Modified Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC). According to Gujarati (2004, 2011) one uses the optimal through the rule of thumb.

Cointegration and ECM

Two variables are co-integrated if they have a long-term or equilibrium relationship between them (Thomas, 1997). If the time series have a unit root (non-stationary) they may be co-integrated. To test for co-integration, Johansen Cointegration test can be used.

The hypotheses for Johansen test of cointegration are (Johansen, 1988**)**:

H_0: There is no cointegration (None*)

H_1: There is cointegarion as n level.

Rejection of the null hypothesis of no co-integration then an ECM is estimated. Optimal lag for cointegration test was determined using information criteria described in 3.3.2.

Granger theorem notes that cointegration between two or more variables implies the existence of the error correction term (Engle and Granger, 1987). This is captured by the error correction model captures in the short run dynamics of the model. This term has information about the adjustment towards long run relationship between the variables.

The ECM is estimated as follows:

$$\Delta LnCPI = \lambda_0 + \lambda_1 \Delta OILP + \lambda_2 \Delta EXCR + \lambda_3 \Delta MON + \delta\left(Ln\widehat{CPI_t} - Ln\widehat{CPI_{t-1}}\right) + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The study used quarterly time series data that spans from 2004 Q1 to - 2016 Q4 giving 52 observations for study period. Inflation values are the changes in for food and non-food products, retail oil prices of petroleum in Addis Ababa (Birr per liter), money supply in millions of Birr, exchange rates are based on a Birr per unit of USD Currency. All the data was obtained from National bank of Ethiopia (NBE), Ethiopian National Bank statistics (ENBS) Ethiopia Petroleum Enterprise (EPE) and Central Statistic of Ethiopia (CSA), and the Ministry of Finance and Economic Development (MoFED).

4.1 Results and Findings

4.2 Correlation Analysis

Table 1 shows the association of the variables in the model for food CPI. The results reveal that food CPI and oil prices were positively and significantly associated (r=0.9592*). The results also reveal that food CPI and money supply have a positive significant association (r=0.9879*). Further, results indicate that food CPI and exchange rate have a positive and significant association (r=0.9756*).

Table 1: Correlation Results for food CPI model

	lncpif	lnoilp	lnms	lnexr
lncpif	1.000			
lnoilp	0.9592*	1.000		
lnms	0.9879*	0.9330*	1.000	
lnexr	0.9756*	0.9509*	0.9712*	1.000

Source: Author's Computation

Table 2 presents the correlation coefficients of variables in the model non-food CPI. The results reveal that non-food CPI and oil prices have a positive and significant association (r=0.9569*). The results also reveal that non-food CPI and money supply have a positive and significant association (r=0.9776*). Further, results indicate that non-food CPI and exchange rate have a positive and significant association (r=0.9638*).

Table 2: Correlation results for non-food CPI model

	lncpinf	lnoilp	lnms	lnexr
lncpinf	1.000			
lnoilp	0.9569*	1.000		
lnms	0.9776*	0.9330*	1.000	
lnexr	0.9638*	0.9509*	0.9712*	1.000

Source: Author's Computation

4.3 Time series properties of the variables

The ADF test results show that all the variables were non- stationary at level at 5% significance level with the t-statistics values being less than absolute 1.96 as presented in table 3. However, after first differencing, all the study variables attained stationarity at 5% level of significance with the t-statistics values being more than absolute 1.96.

Table 3: Unit Root Test

		At Level			At 1st Difference		
Variable	# lags	Test Statistics	Stationarity	P-value	Test Statistics	P-value	Stationarity
lncpi	4	-1.667	Non-Stationary	0.765	-4.207	0.001	Stationary
lncpinf	2	-1.608	Non-Stationary	0.7891	-4.830	0.000	Stationary
lnoilp	1	-0.261	Non-Stationary	0.990	-6.423	0.000	Stationary
lnms	3	-1.900	Non-Stationary	0.414	-7.052	0.000	Stationary
lnexr	3	-1.730	Non-Stationary	0.737	-7.325	0.000	Stationary

Source: Author's Computation

4.4 Food CPI model

4.4.1 Johansen co integration test results food

In testing for co integration two methods are usually used; two step Engle granger and Johansen cointegration tests are employed. This study used Johansen co integration test since it's more accurate and superior to Engel granger test of cointegration (Gujarati, 2004, 2011). Decision is taken by choosing the least value from the of information criteria (Gujarati, 2004, 2011). This study used AIC to select the model since it gives the lowest value of information. Table Appendix 1 and 2 indicated the AIC lag values to be 1, 2, 3 and 4 for food and non-food. As per the AIC values, 4 is the lowest lag value selected.

The results in Table 4 indicate that the null hypothesis of no cointegration for the model linking food CPI to oil prices, money supply and exchange rate was rejected at 5% level of significance. The trace statistic for the existence of at most 1 cointergrating equation was larger than the set critical value at 5%. This implies that the variables are cointegrated of rank 1.

Table 4: Johansen Cointegration test: Food CPI model

Maximum Rank	Eigenvalue	Trace Statistic	5% Critical Value
0	.	67.3428	47.21
1	0.54508	29.5362*	29.68
2	0.22759	17.1406	15.41
3	0.18912	7.078	3.76
4	0.1371		

Source: Author's Computation

4.4.2 Vector Error Correction Model

When the cointegration is found to exist between among the stationary variables then VECM is applied. In this study, the model that relates food CPI to the independent variables; oil prices, exchange rate and supply of money in the economy were found to be cointegrated, then the VECM was specified to relate short-run and the long-run relationships.

Results as presented in table 5 indicate the short run relationship between CPI food and its determinants. ECT showed the rate of adjustment towards a long run equilibrium. The value ECT is negative and statistically insignificant. The negative sign indicates a return to the equilibrium. The speed of adjustment in this context is slow at 0.01018% indicating that it may take a long time to return to the equilibrium.

Further, the results indicate a negative and significant relationship between change in food CPI and change in food CPI lagged twice (p=0.000) and thrice (p=0.039). This means that a 1% increase in CPI lagged twice and thrice cause a reduction in food CPI by 0.44% and 0.32% respectively. Ibrahim and Said (2011) also found that changes has a significant effect on inflation, food, rent, fuel and price of electricity as well as in communication and transportation.

In addition, the results indicate a positive and significant relationship between changes in food CPI and change in oil prices lagged once (p=0.014) and twice (p=0.008) respectively This means that a 1% increase in oil prices (ETB) lagged once and twice leads to an increase in food CPI by 0.14% and 0.13% respectively. Since the β_1 coefficients of lag 1 and 2 are 0.14 and 0.13 respectively are less than 1, then it implies that there exists partial pass through effect of oil prices to food CPI. These findings are similar to the results of the study by Shahbaz and Jawaid (2018) who established that positve shock on the price of the international oil has a positive significant effect on inflation in Pakistan.Moreover, Abounouri et al.(2014) using monthly data in Iran established a short run pass through oil on inflation .

However, the study results indicate a negative and insignificant relationship between change in money supply and oil price change. This is consistent with the study of Durevall (2012) who found that an increase in supply of money in the economy was insignificant in determining the level of inflation in both Kenya and Ethiopia. The results contradict the findings by AFDB (2012) that increased money supply in the economy caused inflation in the short run in Uganda and Ethiopia.

Lastly the study found out that exchange rate and change in food CPI are negative and insignificant related. Similarly, Ayalew et al. (2012) who established that oil price shocks depreciated the Ethiopian Birr and this resulted to increase in exports. Further, it was also established that depreciation leads to the increase in the tradable agricultural output and decline in both service and manufacturing sectors.

Table 5: Error Correction Model

	Variable	Coef.	Std. Err.	z	P>|z|
Δlncpif					
	ECT	-0.01018	0.012576	-0.81	0.418
	Δlncpif				
	LD.	-0.14465	0.157133	-0.92	0.357
	L2D.	-0.44007	0.117278	-3.75	0.000
	L3D.	-0.31647	0.153136	-2.07	0.039
	Δlnoilp				
	LD.	0.141467	0.057416	2.46	0.014
	L2D.	0.132659	0.050291	2.64	0.008
	L3D.	-0.08207	0.055353	-1.48	0.138
	Δlnms				
	LD.	-0.42327	0.44481	-0.95	0.341
	L2D.	-0.0636	0.312411	-0.2	0.839
	L3D.	-0.06887	0.210605	-0.33	0.744
	Δlnexr				
	LD.	-0.19949	0.217782	-0.92	0.36
	L2D.	-0.13639	0.256606	-0.53	0.595
	L3D.	0.096951	0.176967	0.55	0.584
	_cons	0.000302	0.004144	0.07	0.942

Source: Author's Computation

4.5 Non-food CPI model

4.5.1 Johansen cointegration test results

The results in Table 6 indicate that the null hypothesis no cointegration for the model linking non-food CPI to oil prices, money supply and exchange rate and we failed to reject the null hypothesis at 5% significance level. The implication is that there is no cointegration between the variables.

Table 6: Johansen co Integration ln CPI Non-Food

Maximum Rank	eigenvalue	Trace Statistic	5% Critical Value
0	.	64.696	47.21
1	0.51465	29.9974	29.68
2	0.24918	16.2409	15.41
3	0.2022	5.3977	3.76
4	0.10636		

Source: Author's Computation

4.5.2 Short run results

In this case, OLS was used to establish the short-run relationship between the study variables. Table 7 presents the results of the regression model with non-food CPI as the dependent variable. The R square of 0.1632 implies that 16.32% variation in the non-food CPI is explained by oil prices change, money supply and exchange rate explain 16.32% of the total variations in non-food CPI.

The results show that the relationship between changes in oil price and non-food CPI (p=0.013) to be positive and significant. The coefficient value of 0.12 means that 1% upward change in oil prices (ETB) cause non-food CPI to increase by 0.12%. These findings agreed with the study of Cunado and Gracia (2005), on the impact of prices of oil on consumer index and economic activity in US and arrived to a conclusion that that oil prices significantly affected on both economic activity and price indexes in the short run.

Further, the study findings indicate that money supply and non-food were insignificantly and negative related CPI. The findings are inconsistent with that of Durevall et al. (2013) who found that increased money supply for non-food led to increased inflation. The findings also contradict the findings of AFDB (2012) who found that increased money supply in the economy caused inflation in the short run.in Uganda and Ethiopia.

However, results reveal positive and insignificant relationship between changes in exchange rates and CPI non-food. This was in line with the findings by Ayalew et al. (2012) who established that oil price shocks depreciated the Ethiopian Birr (ETB) and this resulted to increase in exports. Further, it was also established that depreciation leads to the increase in the tradable agricultural output and decline in both service and manufacturing sectors.

Since the coefficients of oil price is 0.12 then it implies that there exists partial pass through effect of oil prices to non-food CPI.

Table 7: Regression Results

Δlncpinf	**Coef.**	**Std. Err.**	**t**	**P>|t|**
Δlnoilp	0.115265	0.044538	2.59	0.013
Δlnms	-0.22979	0.328516	-0.7	0.488
Δlnexr	0.343622	0.257559	1.33	0.189
_cons	0.265601	0.092722	2.86	0.006
R-squared	0.1632			
Adj R-squared	0.1098			
F Statistics	3.05			
Prob > F	0.0374			
Durbin Watson	2.76			
Jarque-Bera test	chi2=29.577, Prob > chi2=0.00025			

Source: Author's Computation

The Durbin Watson value is more than 2. Consequently, the null hypothesis of no auto- correction is not rejected. Jarque-Bera test revealed that the data was not normally distributed since the p value was 0.00025<0.05. Therefore, the null hypothesis of normal distribution is rejected.

5.1 Conclusions

It was concluded that fluctuations in international oil prices directly and significantly affect food and non-food inflation in Ethiopia in the short run based on the study findings. Further, the research concluded that international oil prices have a partial pass-through effect on food and non-food inflations in Ethiopia.

6.1 Recommendations

This study recommends that there is need for the Ethiopian government to formulate policies aimed at controlling inflation for both food and non-food. In particular, the government should be concerned about the food inflation, since it has a direct impact on people. The government has no control over fluctuations of the international oil prices, as such; it should focus on other causes of inflation such as money supply. The government should therefore, adopt appropriate monetary policies such as reduction in money supply in the economy. This will help in reducing inflation for both food and non-food items. The government of Ethiopia should also develop a suitable exchange rate policy that will ensure acceptable levels of exchange rate are maintained. This will control for inflationary tendencies. For example, the government should consider adopting a devaluation policy.

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Appendix 1: Lag Length Selection for lnCPI food

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	72.1262				6.90E-07	-2.8386	-2.7797	-2.6827
1	357.399	570.55	16	0	9.20E-12	-14.058	-13.764	-13.2786*
2	372.892	30.986	16	0.014	9.60E-12	-14.037	-13.507	-12.634
3	414.427	83.07	16	0	3.40E-12	-15.101	-14.335	-13.074
4	448.616	68.378*	16	0	1.7e-12*	-15.859*	-14.8572*	-13.208

Appendix 2: Lag Length Selection for CPI Non-Food

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	48.1895				1.90E-06	-1.84123	-1.7823	-1.68529
1	335.662	574.95	16	0	2.30E-11	-13.1526	-12.858	-12.3729*
2	352.526	33.727	16	0.006	2.20E-11	-13.1886	-12.6582	-11.7852
3	397.561	90.07	16	0	6.90E-12	-14.3984	-13.6323	-12.3712
4	428.521	61.921*	16	0	4.0e-12*	-15.0217*	-14.02*	-12.3709