Sources of recent inflationary pressures and interlinkages between food and non-food prices in Ethiopia

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**Abstract**

This study investigates the main sources of recent inflationary pressures from 1999Q1 to 2019Q4 using linear and non-linear Auto-Regressive Distributed Lag (ARDL) Models. It also examines the pass-through effects and causality between food and non-food prices using Dynamic Ordinary Least Square (DOLS) estimation and Toda-Yamamoto Granger Causality approach. The main findings of this study indicate that inflation expectation, money supply growth, world food price, real income, and food supply are found as the main short-run and long-run drivers of food inflation. While, non-food inflation appears to be mainly explained by expected inflation, exchange rate, administered price, and world non-food price level. The results further reveal that exchange rate, real income, world price, and food supply have asymmetric effects on the overall inflationary process. On the other hand, evidence of second-round effects between food and non-food prices is confirmed although a strong and long-lasting effect comes from food prices. The Granger causality test results also support a two-way causality between the two price groups. After all, this study suggests considering the specific behaviors and sources of food and non-food prices, as well as the transmission effects between them so as to effectively control the underlying inflationary shocks and maintain price stability in the economy.

1. Introduction

Compared to other developing countries, Ethiopia had relatively stable and low inflation before 2002/03. However, since 2003/04, the Ethiopian economy has deviated from its historical trends of stable price and the rate of inflation significantly increased from 7.3 percent in 2003/04 to 36.4 percent in 2008/09 and 34.1 percent in 2011/12 (National Bank of Ethiopia (NBE), 2020). Apparently, the inflationary process in Ethiopia has been dominated by food inflation over the last two decades. According to NBE (2020), the annualized food inflation was, on average, 16 percent during 2003/04-2018/19, while average non-food inflation was about 12 percent during the same period.

Ethiopia's rapid economic growth appears to have been accompanied by significant inflationary periods over the last one and half decades. Despite several market interventions and stabilization measures taken in the country (such as petrol subsidies, food imports and provision at subsidized prices to the domestic market, retail price regulations on several commodities, direction for restricting government borrowing (Gofere, 2013), and the recent introduction of new currency notes), the country has experienced a double-digit inflation rate. This indicates that rampant inflation has become one of the main macroeconomic challenges for the Ethiopian economy in recent decades.

The main determining factors of inflationary pressures have been investigated by various empirical studies across different countries. For instance, Adayleh (2018) in Jordan; Al-Jafari and Altaee (2019) in Iraq; Awan and Imran (2015) in Pakistan; Enu and Havi (2014) in Ghana; Hemmat et al. (2018) in Iran; Iya and Aminu (2014) in Nigeria; Lim and Odhiambo (2018) in South Africa; Makena (2020) in Zimbabwe; Naseem (2018) and Osman et al. (2019) in Saudi Arabia; Oppong et al. (2015) in Ghana; Ruzima and Veerachamy (2015) in Rwanda emphasized that money supply, exchange rate, government expenditure, interest rate, GDP growth, and import price are among the main determinants of inflationary process in developing countries. Nonetheless, these studies did not conduct a separate analysis of the main sources of food and non-food prices. The two major components of inflation may, however, have different trends, degrees of volatility and persistency, as well as follow different price-setting processes (see section 3.2). Thus, they are associated with different deriving forces (sources of fluctuation). The channels through which food and non-food inflation can affect the
economy, as well as their impact on the economy, are also quite different. For example, non-food inflation tends to have a more adverse impact on income inequality in both rural and urban areas as compared to food inflation (Walsh and Yu, 2012). Moreover, although the relationship between many macroeconomic variables is found non-linear (Shin et al., 2014), the asymmetric (nonlinear) relationship between inflation and its main drivers has been overlooked in the prevailing literature.

Similarly, a few empirical works have been done in the Ethiopian context (such as Altasseb, 2015; Bane, 2018; Bedada et al., 2020; Geda and Tafere, 2011; Gofere, 2013; Haji and Gelaw, 2012; Loening et al., 2009; Melaku, 2020; Nigusse et al., 2019). These studies have suggested different demand and supply-side factors behind the price spirals in Ethiopia. These studies with few exceptions (e.g., Geda and Tafere, 2011) examined the main drivers of general inflation (without taking food and non-food inflation separately). However, as mentioned above, the two types of inflation may give a different picture when compared to each other and overall inflation. For instance, food prices appear to be more volatile and less persistent and show a faster rise than non-food prices in recent years (Gofere, 2013; Tenaw and Demeke, 2020). Investigating the main sources of recent inflationary trends considering food and non-food inflation is crucial.

![Figure 1. Trends of Inflation rates in the ten years' average interval. Source: own computation from National Bank of Ethiopia (NBE) and Central Statistical Agency (CSA).](image1)

![Figure 2. Quarterly Inflation trends (2000/01Q1-2018/19Q4). Source: own computation from National Bank of Ethiopia (NBE) and Central Statistical Agency (CSA).](image2)

Table 1. Summary statistics of the variables (1999/2000Q1 to 2018/19Q4).

| Variables Description | Mean | Std. dev. | Min | Max |
|-----------------------|------|-----------|-----|-----|
| Food ($P_f$) Food price Index | 81.35 | 60.13 | 17.4 | 223.2 |
| Nonfood ($P_n$) Non-food price Index | 85.88 | 55.55 | 31.3 | 214.8 |
| GCPI ($P_t$) General consumer price Index | 83.2 | 58.04 | 23.4 | 219.4 |
| Inrate ($r$) Interest rate (%) | 7.23 | 1.18 | 5.46 | 9.87 |
| Money ($M^p$) Money supply growth (%) | 4.97 | 2.40 | 0.82 | 11.56 |
| RGDP (Y) Real GDP (in millions of ETB) | 2,44,045.6 | 127,315.8 | 93,442.11 | 513,118.7 |
| Fsupply ($S_f$) Food supply (in thousands of quintals) | 23,710.41 | 7,559.14 | 12,554.88 | 36,154.67 |
| Adminprice ($P_{adm}$) Administered price index | 83.998 | 49.81 | 28.08 | 183.54 |
| NEERI (E) Nominal Effective Exchange Rate Index | 64.62 | 23.48 | 35.6 | 103.85 |
| WFPi ($F_f$) World food price index | 82.47 | 16.10 | 58.85 | 111.27 |
| WNFPi ($F_n$) World non-food price index | 89.92 | 12.14 | 70.43 | 116.21 |
| WPI (F) World consumers price index | 85.97 | 14.19 | 64.29 | 113.59 |

Note: the total number of observations is 80.
prices independently will thus provide a full picture of inflation dynamics. In addition, the inflationary transmission mechanism and the asymmetric (non-linear relationship) dynamics have received no attention in the existing studies.

In general, given the inconclusive evidence regarding the main driving forces behind recent inflationary pressures and failure of government efforts to maintain price stability in Ethiopia, this study contributes to the current line of research by investigating the main short-run and long-run sources of inflationary pressures in Ethiopia using the Autoregressive Distributed Lag (ARDL) model. Second, it analyzes the short-run and long-run asymmetric relationship between general inflation and its determinants with the help of a non-linear ARDL (NARDL) model. Third, it assesses the pass-through (second-round) effects and causal links between food and non-food prices to understand the inflationary transmission mechanism and offer some insights for achieving price stability.

The remaining part of this study is structured as follows. The second section offers a general overview of the recent inflationary trends in Ethiopia. Section three provides the methodological aspects of this study. Section four is concerned with the findings and discussions. Finally, the concluding remarks are presented in the fifth chapter.

### 2. Overview of recent inflation in Ethiopia

#### 2.1. Trends of inflation rates in the ten years’ average interval

In the history of the Ethiopian Economy, inflation was not a major concern until 2002/03. Despite some drought and conflict-related inflationary episodes, there was generally a stable and low inflation trend before this period. As displayed in Figure 1, the average general inflation observed in the 1970s (about 11 percent) was higher than the 1980s and 1990s rate, and was largely driven by food price rises. The 1973/74 famine and conflicts in the country were the possible causes for the 1970s food inflationary pressures.

Overall inflation appeared to be very low and stable during the 1980–1999 period, with average rates of 4.5 percent in the 1980s and 7.7 percent in the 1990s. During this period, the major inflationary events occurred in 1985 and early 1990s following the 1984/85 severe drought and the widespread war that brought the Derg regime to an end. During the 2000–2019 period, however, food, non-food, and general inflation rates were significantly grown and reached their respective peaks in 2008/09 (with average rates of 44.2 percent, 23.5 percent, and 36.4 percent, respectively). This reveals that inflation has become a major economic issue in recent decades.

### Table 2. Unit root tests results.

| Variables   | ADF unit-root test | PP unit-root test | Order of integration |
|-------------|-------------------|------------------|---------------------|
|             | Intercept         | Intercept + trend | Intercept           | Intercept + trend | I(1) |
| In Food     | 0.159             | 3.002            | 0.274              | 2.961             | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In nonfood  | 0.076             | 4.351            | 1.080              | 3.211***          | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In GCPI     | 0.159             | 3.107            | 0.855              | 2.985             | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| Money       | 0.142             | 14.44            | -                  | -                 | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In irate    | 0.079             | 2.637            | -6.678*            | -8.009*           | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In NEERI    | 0.055             | 1.706            | -0.793             | 1.355             | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In admprice | 0.131             | 3.196***         | 0.131              | 3.206***          | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In RGDP     | 0.309             | 2.343***         | 0.43               | -2.211            | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In Fsupply  | 0.047             | 2.307            | -0.748             | -3.324***         | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In WPPI     | 0.068             | 2.06            | -0.159             | 1.925             | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In NIPPI    | 0.159             | 1.562            | 1.984              | -2.089            | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |
| In WPI      | 0.661             | 2.619            | 0.63               | -2.413            | I(1) |
|             | (0)               | (0)              | (0)                | (0)               |      |

Note: *, ** and *** denote statistically significant at 1%, 5% and 10% levels respectively.

a Indicates money is I(0) in PP test results. I(0) and I(1) represent stationarity at a level and first differences, respectively.

### Table 3. ARDL Bounds cointegration test results.

| Food Inflation   | Lower bound, I(0) | Upper bound, I(1) |
|------------------|-------------------|-------------------|
| F-Bounds test statistic | 3.41 @ 1%      | 4.68 @ 1%      |
| t-bounds test statistic | 2.62 @ 5%      | 3.79 @ 5%      |
| Non-food Inflation |                   |                   |
| F-Bounds test statistic | 3.045 @ 1%    | 4.05 @ 1%      |
| t-bounds test statistic | 2.04 @ 5%      | 3.24 @ 5%      |
| General Inflation  |                   |                   |
| F-Bounds test statistic | 32.99 @ 1%    | 4.26 @ 1%      |
| t-bounds test statistic | 2.32 @ 5%      | 3.5 @ 5%      |
Table 4. Linear ARDL model with Food Inflation Equation.

| Selected Model: ARDL (7, 8, 4, 1, 3, 2) | Dependent Variable: \( \Delta (\ln \text{food}) \) |
|------------------------------------------|-----------------------------------------------|
| **Short-run coefficients**                | **Std. error** | **P-value** |
| \( \Delta (\ln \text{food}) \)          | 0.404*         | 0.123       | 0.002       |
| \( \Delta (\ln \text{irate}) \)         | 0.053          | 0.129       | 0.684       |
| \( \Delta (\ln \text{RGDP}) \)          | –2.939*        | 0.984       | 0.005       |
| \( \Delta (\ln \text{Fsupply}) \)       | –0.471*        | 0.138       | 0.002       |
| \( \Delta (\ln \text{WPPI}) \)          | 5.733*         | 1.155       | 0.000       |
| \( @\text{quarter} = 2 \)               | –0.078*        | 0.017       | 0.000       |
| \( @\text{quarter} = 3 \)               | –0.071*        | 0.025       | 0.007       |
| \( @\text{quarter} = 4 \)               | 0.029          | 0.022       | 0.201       |
| Error correction term                    | –0.568         | 0.087       | 0.000       |
| **Long run coefficients**                |                |             |             |
| \( \ln \text{WFPI} \)                    | 6.888*         | 1.357       | 0.000       |

**Model Diagnostic tests**

- R\(^2\) (adj-R\(^2\)) = 0.9994 [0.999]
- F-statistic = 1873.36 [0.000]
- Breusch-Godfrey Serial Correlation LM Test (P-Value) = 0.273 [0.762]
- Heteroscedasticity Test: ARCH (P-Value) = 1.464 [0.192]
- Ramsey RESET Test (P-Value) = 3.599 [0.066]
- Normality: JB test [p-value] = 5.469 [0.065]

**Note:** *, **, and *** denote statistically significant at 1%, 5% and 10% levels respectively.

3. Data and sources of data

3.1. Types and sources of data

A quarterly time series data was used to conduct this study. The data was mainly extracted from annual and quarterly reports of the National Bank of Ethiopia (NBE), Ministry of Finance and Economic Development (MOFED), Central Statistical Authority (CSA), Ethiopian Economic Association (EEA), and Food and Agricultural Organization (FAO).

More specifically, the December 2011 based consumer price data (for food, non-food, general, and administered price) were taken from NBE and CSA. World price indices were obtained from FAO. Money growth, nominal effective exchange rate, real GDP, and interest rate are extracted from NBE. Food supply is taken as a sum of food imports (from NBE), food aid (from FAO), and cereal production (NBE and EEA). Since quarterly data for nominal effective exchange rate, real GDP, interest rate, food supply are not fully available, annual data is converted to quarterly data using quadratic-match sum conversion method (for GDP and food Supply) and quadratic-match average method (for interest rate and exchange rate). Table 1 present the summary statistics of the variables used in the study.

2.2. Quarterly movements in recent food, non-food and general inflation

Figure 2 presents the quarterly inflation rates in Ethiopia on annual basis (in year-on-year terms). Accordingly, inflationary movements have shown some ups and downs over the last two decades. For instance, the higher inflationary records (especially in food items) in the first quarter of 2000/01 were substantially decelerated and dropped into negative rates in the subsequent quarters, which may be due to good agricultural harvests and significant amounts in food aid inflows in Ethiopia. After 2002/03, however, food, non-food and general inflation were significantly grown and peaked in the first and third quarters of 2008/09. In particular, food inflation soared to 85.6 percent and 60.7 percent while non-food inflation rose to 25.9 percent and 28.3 percent during the same period. Moreover, compared to non-food inflation, food inflation was very high during major inflationary episodes mainly due to global food and oil price shocks (Bane, 2018). As a whole, the average quarterly food and non-food inflation rates during 2000/01–2018/19 were about 14 percent and 9 percent, respectively. And, general inflation was grown by about 11%, on average.

To sum up, as shown in Figure 2, an increase in general inflation was induced by a significant rise in food inflation in Ethiopia. In other words, the major inflationary situations in Ethiopia were highly correlated with the trends in food inflation since the country is of an agricultural-based economy. In addition, Figure 2 revealed that food and non-food inflation exhibit different trends and variability, emphasizing that they should be analyzed separately.

3.2. Price equations: food price, nonfood price, and overall price

Ethiopia is of a transitory and small open economy. Hence, following the empirical works of Geda and Tafere (2011); Lissovolik (2003) and Moser (1995), the overall price level (P) is taken as a weighted average of the price of tradable goods (P\(_1\)) and non-tradable goods (P\(_2\))\(^1\). Mathematically, the overall price level is expressed in log-linear form as:

\[ P = P_1 + P_2. \]

1. Tradable goods are those goods which area traded and potentially tradable in foreign market while non-tradable goods are those only sold in domestic markets.
Table 5. Linear ARDL model with non-food Inflation.

| Selected Model: ARDL (8, 6, 5, 5, 0, 6) | Dependent Variable: Δ (In nonfood) |
|-----------------------------------------|-------------------------------------|
| **Short-run coefficients**              | Std. error | P-value |
| Δ(Ln nonfood)                           | 0.161      | 0.13     | 0.226 |
| Δ (In irate)                            | 0.059      | 0.072    | 0.417 |
| Δ (In money)                            | −0.001     | 0.004    | 0.858 |
| Δ (In NEERI)                            | −0.215***  | 0.088    | 0.022 |
| Δ (In RGDP)                             | −0.178     | 0.348    | 0.612 |
| Δ (In admprice)                        | 0.068**    | 0.034    | 0.023 |
| Δ (ln money)                            | 0.761*     | 0.268    | 0.008 |
| @quarter = 2                           | −0.004     | 0.007    | 0.554 |
| @quarter = 3                           | −0.006     | 0.008    | 0.478 |
| @quarter = 4                           | −0.004     | 0.008    | 0.631 |
| Error correction term                  | −0.279**   | 0.032    | 0.000 |

| **Long run coefficients**              | |
|-----------------------------------------|---------|---------|
| Ln nonfood                              | 0.882*  | 0.197   | 0.000 |
| In irate                                | 0.56*   | 0.149   | 0.001 |
| Money                                   | −0.01   | 0.051   | 0.853 |
| Ln NEERI                                | −0.805* | 0.137   | 0.000 |
| ln RGDP                                 | −0.076  | 0.099   | 0.454 |
| ln admprice                             | 0.297** | 0.112   | 0.013 |
| ln WNFPI                                | 1.659***| 0.807   | 0.052 |

**Model Diagnostic tests**

R² [adj R²]                              | 0.9999 [0.9998] |
F-statistic [p-value]                     | 709.967 [0.000] |
Breush-Godfrey Serial Correlation LM Test [P-Value] | 2.474 [0.105] |
Heteroscedasticity Test: Breush-Pagan-Godfrey test [P-Value] | 0.57 [0.952] |
Ramsey RESET Test [P-Value]               | 0.448 [0.509] |
Normality: JB test [p-value]              | 0.239 [0.887] |

**Note:** *, ** and *** denote statistically significant at 1%, 5% and 10% levels respectively. The optimal lag length for the model is automatically selected using Akaike Information criteria (AIC). Heteroscedasticity and autocorrelation consistent (HAC) standard errors are considered in this estimation.

\[
\ln P_t = a \ln P_{t-1} + (1-a)\ln P_{t-2}
\]  

Where \( a \) represents the share of tradable goods, \( 0 < a < 1 \). Further, the price of tradable goods is exogenously determined by world market (that is, it depends on foreign prices and exchange rates at a given period, \( t \)). Tradable price is, therefore, expressed as a function of foreign prices (\( F \)) and nominal exchange rate (\( E \)), and after a logarithmic transformation:

\[
\ln P_t = \ln E + \ln F
\]  

The price of non-tradable goods (\( P_t \)) is determined by the money market equilibrium condition assuming, for simplicity, that the demand for non-tradable goods moves in line with the overall demand in the economy. Mathematically, given that \( M^e \) is stock of money supply, \( m^d \) is demand for real money balances and \( \beta \) is a scale factor representing the relationship between economy-wide demand and the demand for non-tradable goods.

\[
\ln P_t = \beta (\ln M^e - \ln m^d) + \varphi \ln P_{non}
\]  

Note that \( P_{non} \) represents administered price (the price of those goods like fuels, transport, electricity, water, and telephone—is exogenously adjusted by the government). The demand for real money balances is assumed to be an increasing function of real income (\( Y \)), and a decreasing function of inflationary expectations (\( P^e \)) and interest rate (\( r \)) (Moser, 1995). Accordingly, the demand for money function can be specified as:

\[
\ln M_t = \theta_1 \ln Y - \theta_2 \ln P + \theta_3 \ln r
\]  

Now, substituting Eq. (4) into (3), we obtain the non-tradable price equation:

\[
\ln P_t = \beta (\ln M^e - (\theta_1 \ln Y - \theta_2 \ln P + \theta_3 \ln r)) + \varphi \ln P_{non}
\]  

More specifically, the price of non-tradable goods can be split into food (\( P^f_2 \)) and non-food price (\( P^f_2 \)). That is, non-tradable inflation is a weighted sum of food inflation and non-food inflation, with the assumption that the price-setting processes for the two prices are different.

Food price is determined by the interaction of food supply and demand in a competitive market setup. Mathematically, based on Geda and Tafere (2011), the food supply and demand equations can be expressed in natural logarithm form, respectively as:

\[
\ln S_f = \ln Y_c + \ln M_f + \ln A
\]  

\[
\ln C_f = \ln C_f - (\mu_1 - \mu_3 \theta_1) \ln Y - \mu_2 \ln P^f_2 + \mu_3 (\ln M^e - \theta_2 \ln P^e + \theta_3 \ln r)
\]  

Where \( S_f \) is food supply, \( Y_c \) is the quantity of cereal production, \( M_f \) is the quantity of food imports, \( A \) is the quantity of food aid, \( C_f \) is real food consumption, and \( M^e \) is real money supply. Since food supply is exogenously determined (by weather conditions, international prices and institutional factors), food price movements may adjust any disequilibrium in the food market. Thus, equating (6) and (7), after rearranging terms, gives the food price (\( P^f_2 \) ) equation.

\[
\ln P^f_2 = \frac{1}{\mu_2} (\mu_1 - \mu_3 \theta_1) \ln Y + \mu_1 \ln M^e - \theta_2 \ln P^e + \theta_3 \ln r - \ln S_f + \ln F_t
\]  

Excess food supply, \( \tilde{S}_f \) is the sum of food imports, food aid, and marketed surplus (\( \ln Y_c - \ln C_f \)). Note that \( F_t \) is included to look at the effect of world food prices on domestic food prices.

Non-food price developments, on the other hand, may have been mainly driven by strong growth in demand following rapid growth in income (Geda and Tafere, 2011). Further, the Ethiopian manufacturing
Table 6. Linear ARDL model with General Inflation.

| Dependent Variable: ln NEERI | Selected Model: ARDL (2, 5, 4, 5, 5, 5, 5, 5) |
|-------------------------------|-----------------------------------------------|
| Δ(Ln NEERI)                  | 0.199**                                      |
| Δ (ln irate)                 | 0.38**                                       |
| Δ (ln money)                 | 0.002                                        |
| Δ (ln NEERI)                 | 0.378*                                       |
| Δ (ln RGDP)                  | 0.131                                        |
| Δ (ln admprice)              | 0.002                                        |
| Δ (ln Fu sleepy)             | 0.40*                                        |
| Δ (ln WPI)                   | 4.929*                                       |
| @quarter = 2                | 0.029*                                       |
| @quarter = 3                | 0.024**                                      |
| @quarter = 4                | 0.006                                        |
| Error correction term       | -0.575*                                      |

Model Diagnostic tests

|                           | Std. error | P-value |
|---------------------------|------------|---------|
| R2 (adj-R2)               | 0.9999     | 0.9997  |
| F-statistic [p-value]      | 5612.12    | 0.000   |
| Breusch-Godfrey Serial Correlation LM Test [P-Value] | 1.378 [0.271] |
| Heteroscedasticity Test: Breusch-Pagan-Godfrey test [P-Value] | 0.722 [0.84] |
| Ramsey RESET Test [P-Value] | 2.281 [0.137] |
| Normality: JB test [p-value] | 0.024 [0.877] |

Note: *, ** and *** denote statistically significant at 1%, 5% and 10% levels respectively. The optimal lag length for the model is automatically selected using Akaike Information criteria (AIC). Heteroscedasticity and autocorrelation consistent (HAC) standard errors are used in this estimation.

Finally, combining Eqs. (5), (8), and (11) and collecting like terms together yields the overall price level equation as:

\[ P^*_t = \alpha_k \ln M^* - \theta_2 \ln Y + \theta_2 \ln P^* + \theta_3 \ln r + \alpha_1 (\ln E + \ln F_t) \]  (11)

3.3. Autoregressive distributed lag (ARDL) model

ARDL model is a popular OLS-based dynamic econometric model applied to estimate the relationship between variables in a single-equation setup. It can be applicable in non-stationary time series as well as those with mixed order of integration. It also provides short-run and long-run estimates simultaneously (Nkoro and Uko, 2016; Pesaran et al., 2001). The conditional error-correction based ARDL (p, q) model can be specified as:

\[ \Delta Y_t = \alpha_0 - \theta_0 (Y_{t-1} - \beta_0 X_{t-1}) + \sum_{i=1}^{p-1} \delta_i \Delta Y_{t-i} + \sum_{i=0}^{q-1} \theta_i \Delta X_{t-i} + \epsilon_t \]  (13)

Where p and q are lag of dependent (\(Y_t\)) and independent variables (\(X_t\)). \(\Delta Y_t = Y_t - Y_{t-1}\), the speed of adjustment coefficient, \(\theta = 1 - \sum_{i=1}^{p} \delta_i\) and the long-run coefficients, \(\beta_i = \sum_{t=1}^{q} \theta_i\), \(\delta_i\) and \(\theta_i\) represent the short-run coefficients of lagged dependent and independent variables, respectively. Therefore, based on the theoretical framework discussed in section 3.2, the ARDL model specification for each price equation is expressed as follows:

**For Food inflation:**

\[ \Delta \ln P^*_t = \alpha_0 - \theta_0 (\ln (P^*_t + \ln Y + \beta_1 \ln P^* + \beta_2 \ln r + \alpha_1 (\ln E + \ln F_t)) \]  (11)

\[ + \beta_3 \ln (F_t)) + \sum_{i=1}^{p-1} \delta_i \Delta \ln P^*_t + \sum_{i=0}^{q-1} \theta_i \Delta \ln Y_{t-i} + \sum_{i=0}^{q-1} \theta_i \Delta \ln r_{t-i} + \epsilon_t \]  (14)

**For Non-Food inflation:**

\[ \Delta \ln P^*_t = \alpha_2 - \theta_2 (\ln (P^*_t + \ln Y + \beta_1 \ln P^* + \beta_2 \ln r + \alpha_1 (\ln E + \ln F_t)) + \sum_{i=1}^{p-1} \delta_i \Delta \ln P^*_t + \sum_{i=0}^{q-1} \theta_i \Delta \ln Y_{t-i} + \sum_{i=0}^{q-1} \theta_i \Delta \ln r_{t-i} + \sum_{i=0}^{q-1} \epsilon_t \]  (15)

**For General inflation:**

\[ \Delta \ln P_t = \alpha_3 - \theta_3 (\ln P_t + \ln Y + \gamma_1 \ln P^*_t + \gamma_2 \ln r + \gamma_3 \ln \epsilon_t + \gamma_4 \ln (P^*_t + \ln Y + \beta_1 \ln P^* + \beta_2 \ln r + \alpha_1 (\ln E + \ln F_t)) + \sum_{i=1}^{p-1} \delta_i \Delta \ln P^*_t + \sum_{i=0}^{q-1} \theta_i \Delta \ln Y_{t-i} + \sum_{i=0}^{q-1} \theta_i \Delta \ln r_{t-i} + \sum_{i=0}^{q-1} \theta_i \Delta \ln F_{t-i} + \sum_{i=0}^{q-1} \epsilon_t \]  (16)

and service sectors are highly dependent on imported inputs. Hence, the non-food price can be written in natural logarithm as:

\[ \ln P^*_t = \ln (1 + \delta) + \alpha_1 (\ln E + \ln F_t) \]  (9)

Where \(\delta\) is the markup factor, measuring the monopoly power of producers (artificial price hike by monopoly firms). The monopoly power is, however, assumed to be a function of excess demand (ED) in the goods market which, in turn, may be derived by excess supply in the money market.\(^2\) It is worth noting that the effect on inflation of budget deficit which results from expansionary fiscal policies is captured by excess demand in the goods market.

\[ \ln (1 + \delta) = \omega ED = \omega k \ln \left( \frac{M^*}{P} \right) - \ln m^d \]

\[ = \omega k \ln M^* - \theta_2 \ln Y + \theta_2 \ln P^* + \theta_3 \ln r \]  (10)

Where \(k\) measures the degree of interaction of the money market and the goods market (to what extent excess supply in the money market translates into excess demand in the goods market). Now, after substituting (10) into (9), we get the final non-food price equation (\(P^*_t\)) as:

\(^2\) In country where a good financial system does not exist like Ethiopia, there is strong substitution between money and goods than money and other financial assets (Geda and Tafere, 2011).
3.4. Non-linear ARDL (NARDL) regression model

The standard ARDL model is based on a linearity assumption and does not take into account the non-linear adjustment process. In many real situations, however, the nature of the relationship among different macroeconomic variables happens to be non-linear. Accordingly, Shin et al. (2014) developed a non-linear ARDL (NARDL) model as an asymmetrical extension of the linear ARDL model. This model addresses non-linearity (asymmetric dynamics) by using partial sum decompositions (partial sum processes of positive and negative changes) of regressors in the linear ARDL model. The partial sum processes in a variable $X_i$ are defined as:

$$X_i^+ = \sum_{t=1}^{t} \Delta X_i^+ = \sum_{t=1}^{t} \max(\Delta X_i, 0); \quad X_i^- = \sum_{t=1}^{t} \Delta X_i^- = \sum_{t=1}^{t} \min(\Delta X_i, 0)$$

(17)

Table 7. Non-linear ARDL model results.

| Selected Model: ARDL (6, 0, 0, 0, 0, 1, 1, 0, 1) | Dependent Variable: $\Delta \ln\text{GCPI}$ |
|---|---|
| **Short-run coefficients** | **Long run coefficients** |
| $\Delta (\ln\text{GCPI})$ | 0.243*** (0.022) | $\ln\text{GCPI}$ | 0.94* (0.000) |
| $\Delta (\ln\text{irate})$ | 0.001 (0.984) | $\ln\text{irate}$ | 0.005 (0.982) |
| $\Delta (\ln\text{admprice})$ | 0.071*** (0.059) | $\ln\text{admprice}$ | 0.234*** (0.012) |
| $\Delta (\text{money_pos})$ | 0.002 (0.624) | $\text{money_pos}$ | 0.008 (0.614) |
| $\Delta (\text{money_neg})$ | 0.001 (0.759) | $\text{money_neg}$ | 0.005 (0.788) |
| $\Delta (\ln\text{RGDP_pos})$ | $-0.644*$ (0.000) | $\ln\text{RGDP_pos}$ | $-2.124*$ (0.006) |
| $\Delta (\ln\text{RGDP_neg})$ | 1.156*** (0.081) | $\ln\text{RGDP_neg}$ | 3.815 (0.103) |
| $\Delta (\ln\text{NEERI_pos})$ | $-0.794*$ (0.000) | $\ln\text{NEERI_pos}$ | $-1.369*$ (0.000) |
| $\Delta (\ln\text{NEERI_neg})$ | 0.159 (0.226) | $\ln\text{NEERI_neg}$ | $-0.375*$ (0.018) |
| $\Delta (\ln\text{Fsupply_pos})$ | 0.216* (0.005) | $\ln\text{Fsupply_pos}$ | 0.046 (0.815) |
| $\Delta (\ln\text{Fsupply_neg})$ | $-0.083$ (0.270) | $\ln\text{Fsupply_neg}$ | 0.348** (0.043) |
| $\Delta (\ln\text{WPI_pos})$ | 3.349* (0.000) | $\ln\text{WPI_pos}$ | 11.05* (0.000) |
| $\Delta (\ln\text{WPI_neg})$ | 11.93* (0.000) | $\ln\text{WPI_neg}$ | 12.74 (0.124) |

**Error correction term** | $-0.303^*$ (0.000) |

**Bounds tests**

| F-statistic (p-value) | F-critical values at 1%: lower bound = 2.54; upper bound = 3.86 t-critical values at 1%: lower bound = -3.43; upper bound = 5.68 |
|---|---|
| 8.723, t-statistic = $-11.858$ |

**Model Diagnostic tests**

| $R^2$ [adj-$R^2$] | 0.9997 [0.9996] |
| F-statistic (p-value) | 8427.09 (0.000) |
| Breusch-Godfrey Serial Correlation LM Test (P-Value) | 0.165 (0.848) |
| Heteroscedasticity Test: Breusch-Pagan-Godfrey test (P-Value) | 1.098 (0.38) |
| Ramsey RESET Test (P-Value) | 0.059 (0.809) |
| Normality: JB test (p-value) | 0.026 (0.987) |

**Long run and Short-run asymmetry tests**

| Long run asymmetry | Short-run asymmetry |
|---|---|
| Money | 0.051 (0.822) | 1.208 (0.278) |
| ln RGDP | 3.972*** (0.052) | 0.541 (0.466) |
| ln NEERI | 20.60* (0.000) | 11.44* (0.002) |
| ln Fsupply | 4.338** (0.042) | 3.538*** (0.067) |
| ln WPI | 11.857* (0.001) | 13.82* (0.001) |

**Note:** Figures in brackets indicate P-values. *, ** and *** denote statistically significant at 1%, 5% and 10% levels respectively. The optimal lag length for the model is automatically selected using Akaike Information criteria (AIC). Heteroscedasticity and autocorrelation consistent (HAC) standard errors are considered in this estimation.
Where, \(X_t\) and \(X_{C0}\) are the partial sum processes of positive and negative changes around zero, respectively. They represent positive and negative shocks in \(X_t\). The first differenced series (\(\Delta X_t\)) is assumed to follow a normal distribution with a zero mean (Olufowose et al., 2017).

To estimate both the long run and short run asymmetries, the NARDL (p, q) model in error-correction form is given by:

\[
\Delta Y_t = \alpha_0 - \phi \left( Y_{t-1} - \beta_1 X_{C0,t} - \beta_2 X_t \right) + \sum_{i=1}^{d_{max}} \delta_i \Delta Y_{t-i} + \sum_{i=0}^{d_{max}} \theta_i \Delta X_{C0,t-i} + \epsilon_t
\]

(18)

Where the set of independent variables \((X_t)\) is decomposed as: \(X_t = X_{C0,t} + X_{i}^+ + X_{i}^-; \theta_i^+\) and \(\theta_i^-\) are the associated asymmetric long-run parameters (coefficients). \(\phi\) is the coefficient for the nonlinear error correction term.

The empirical estimation of the NARDL model consists of three steps. The first and the second steps are similar to the linear ARDL approach. The first step is to estimate Eq. (18) using OLS, and the second step is to test for the presence of asymmetric (nonlinear) cointegration among variables using F-bounds testing procedures. The F-bounds test assumes the null hypothesis of no cointegration (\(\phi = \beta_1^+ = \beta_1^- = 0\)) against the alternative of asymmetric cointegration. The third step is to check for the existence of short-run and long-run asymmetries using the standard Wald test, assuming the null of no asymmetry. For long run asymmetry, the null hypothesis is: \(\beta_1^- = \beta_1^+\). While the null of short-run asymmetry is:

\[
\sum_{i=0}^{d_{max}} \theta_i^+ = \sum_{i=0}^{d_{max}} \theta_i^-
\]

3.5. Interlinkages between food and non-food prices

3.5.1. Pass-through effects between food and non-food prices

The overall impact of food and nonfood prices on aggregate price does not merely depend on the share of each in the aggregate price index (Rangasamy, 2011). The pass-through (indirect) effects between the two components (the role of one inflation group on the aggregate inflationary pressure channeled through the other group) are also important. Therefore, analyzing the pass-through (second-round) effects between food and non-food prices is worthwhile to better understand the transmission mechanism in the inflationary process and provide better policy insights to achieve the goal of price stability.

In this study, following the works of Rangasamy (2011) and Thamea (2012), the pass-through effects are analyzed based on the gap models specified below. Put differently, Eq. (19) represents the pass-through effect from food to non-food prices while Eq. (20) embodies the pass-through effect from non-food to food prices.

\[
Nonfood_t - Nonfood_{t,k} = \alpha_1 + \beta_1 (Glnf_{t,k} - Nonfood_{t,k}) + \epsilon_{1t}
\]

(19)

\[
Food_t - Food_{t,k} = \alpha_2 + \beta_2 (Glnf_{t,k} - Food_{t,k}) + \epsilon_{2t}
\]

(20)

Where \(k\) is lags in quarters; \((Glnf_{t,k} - Nonfood_{t,k})\) is the gap between general and non-food prices, measuring the indirect impact of food price on non-food price. \((Glnf_{t,k} - Food_{t,k})\) is the gap between overall and non-food, signifying the impact of non-food on food price. Thus, significant and positive values of \(\beta_1\) and \(\beta_2\) in Eqs. (19) and (20) indicate that the changes in one influence the other—the existence of pass-through effects between the two price components.

Empirically, the Dynamic ordinary least squares (DOLS) estimation technique was used to estimate the pass-through (second-round) effects between food and non-food prices over the study period. DOLS is an asymptotically unbiased and fully efficient OLS-based approach that aids in the estimation of long-run cointegrating relationships (Stock and Watson, 1993).

3.5.2. Toda-Yamamoto Granger Causality testing approach

In this context, the Granger causality analysis helps to assess the direction of causal link between food and non-food prices. Accordingly, Toda and Yamamoto (1995) Granger causality was employed to ascertain whether food inflation Granger causes non-food inflation and so does the latter. The Toda-Yamamoto causality test is a modified version of Granger causality test that requires the estimation of the Vector Auto-regression (VAR) model and allows for a modified Wald (MWALD) test. The MWALD test for Toda-Yamamoto granger causality entails determining the maximum order of integration \((d_{max})\) of the variables and the optimal lag length \((k)\) of the VAR model. Once the appropriate \(d_{max}\) and \(k\) are identified, the adjusted VAR model of order \((k + d_{max})\) is run and the Toda-Yamamoto Causality test can be performed.

Following Alimi and Ofenyelu (2013), the VAR \((k + d_{max})\) model for food and non-food inflation can be given as:

\[
Food_t = \alpha_0 + \sum_{i=1}^{k+1} \alpha_i Food_{t-i} + \sum_{i=k+1}^{k+d_{max}} \alpha_i Food_{t-i} + \sum_{i=1}^{k+d_{max}} \delta_i Nonfood_{t-i}
\]

\[
Nonfood_t = \beta_0 + \sum_{i=1}^{k+1} \beta_i Nonfood_{t-i} + \sum_{i=k+1}^{k+d_{max}} \beta_i Nonfood_{t-i}
\]

(21)

(22)

Toda-Yamamoto Granger causality assumes the null hypothesis of no Granger causality (\(\alpha_i = 0\) for Eq. (21) and \(\beta_i = 0\) for Eq. (22)). That is, bi-directional causality between food and non-food inflation is detected if both \(\delta_1\) and \(\delta_2\) are statistically significant.

4. Empirical results and discussion

4.1. Unit root test results

To determine the existence of unit root in each of the time series, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were performed in this study. In both ADF and PP unit root tests, the null hypothesis is that data series are non-stationary (contain unit root).
against the alternative hypothesis of a stationary process. As shown in Table 2, the ADF test results indicate that all variables become stationary at their first difference (following I(1) process). The PP test reports similar results with the exception of money growth, which is stationary at level, I(0).

### 4.2. Cointegration test results

A cointegration test, after unit root tests, is carried out to test for the existence of a stable long-run relationship among variables of interest. For this purpose, the ARDL bounds cointegration test was applied, with a null hypothesis of no cointegration. The null hypothesis can be rejected if the F-statistic and t-statistic exceed the corresponding critical values for upper bound, I(1). As presented in Table 3, the ARDL bounds cointegration test results indicate that the variables are co-integrated in all three price equations as each F-bound and t-bound test statistics exceed their respective upper bound critical values at a 1% significant level. This implies the existence of a stable long-run relationship among variables in all three models.

### 4.3. Linear ARDL models

#### 4.3.1. ARDL model with food inflation equation

Table 4 presents the standard ARDL model results with food price as a dependent variable. Expected inflation (represented by the first period lag of food inflation) appears to be strongly significant and positive in explaining current food inflationary pressures in both the short-run and long-run. In effect, a one percent rise in food prices in the previous year causes the actual food prices to increase, on average, by 0.4 percent (in short run) and 0.84 percent (in long run). These results emphasize the importance of inflation inertia and persistent price-price spiral movement in Ethiopian food price dynamics. Food inflation is also positively influenced by money supply growth in both short-run (0.03 percent) and long-run (0.15 percent), indicating the significant role of monetary expansion for recent food price prices in Ethiopia. Similar results were found in Geda and Tafere (2011); Haji and Gelaw (2012). Table 4 further shows that world food price tends to have a significant positive impact on domestic food prices. Geda and Tafere (2011) and Loening et al. (2009) reported the same findings. This reflects that food price rises in the local market have coincided with food price hikes in the international market.

On the other hand, real income (real GDP) is negatively associated with the food inflationary process, implying that the negative pass-through effect of real income on excess money supply outweighs its positive effect as a component of food demand. In addition, as expected, the food supply reduces food prices and its short-run effect appears to be stronger. Seasonal dummies are also included in ARDL estimation to capture the seasonal nature of inflation. The results reveal that the coefficients for the second and third quarters are significant and negative (food prices appear to be decreasing by 0.08 and 0.07 percent in these quarters, respectively). These results may not be surprising as the second and third quarters coincide with the Ethiopian ‘Meher’ (the main harvesting season). A larger volume of agricultural production increases food supply in the market, which causes food prices to fall. This validates the negative effect of food supply on food inflation. Furthermore, the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUM square) tests depict the stability of the model parameters over the study period (see Figure 3).

#### 4.3.2. ARDL model with non-food inflation equation

The linear ARDL model results for the nonfood price equation are presented in Table 5. Inflation expectation tends to have a long-run significant impact on non-food inflation, indicating the importance of long-run inertia in non-food prices as well. Its impact is not, however, significant in short run, which can be roughly interpreted as a slower adjustment process in non-food prices towards the long-run equilibrium (that is, non-food prices react slowly to exogenous shocks). In contrast to food inflation, interest rate has a significant positive effect on non-food inflation in long-run, which can be explained by the fact that as interest rate increases, the cost of borrowing for producers also rises, causing prices to escalate in the market. The result is consistent with Geda and Tafere (2011): Administered prices are also found to have a strong influence on increasing non-food prices. A rise in world non-food prices is another important factor contributing to the recent nonfood inflationary process in Ethiopia. Since the country is heavily reliant on imports (particularly on crude oil imports, petroleum products, and manufactured goods), any price shocks in a foreign market will have a significant pass-through effect on non-food price spirals in the country. Furthermore, appreciation of exchange rate appears to reduce nonfood prices in Ethiopia, which is indicated by significant and negative coefficients of the nominal effective exchange rate in both short (responding by 0.21 percent) and long-run (0.81 percent).

Moreover, the speed adjustment coefficient is highly significant and negative, indicating that 28 percent of the deviation in non-food price from its equilibrium is corrected every quarter and that it roughly takes

### Table 8. Pass-through effect between food and non-food prices.

| From food to non-food inflation | From non-food to food inflation |
|--------------------------------|--------------------------------|
| Lag 1 | Lag 2 | Lag 3 | Lag 4 | Lag 1 | Lag 2 | Lag 3 | Lag 4 |
| Slope coefficient | 0.339* (0.003) | 0.802* (0.002) | 1.065* (0.000) | 1.110* (0.000) | -0.403* (0.003) | 0.205 (0.449) | 0.85* (0.003) | 1.204* (0.000) |
| Constant | 0.074* (0.000) | 0.167* (0.000) | 0.238* (0.000) | 0.319* (0.000) | 0.083* (0.000) | -0.029 (0.687) | -0.18** (0.025) | -0.23* (0.009) |
| R² [Adj. R²] | 0.419 (0.358) | 0.53 (0.47) | 0.552 (0.494) | 0.78 (0.737) | 0.842 (0.825) | 0.643 (0.617) | 0.739 (0.715) | 0.888 (0.873) |
| Hansen’s Parameter instability | 0.046 (>-0.2) | 0.038 (>-0.2) | 0.028 (>-0.2) | 0.043 (>-0.2) | 0.043 (>-0.2) | 0.021 (>-0.2) | 0.021 (>-0.2) | 0.043 (>-0.2) |

Note: The figures shown in brackets are p-values. * and ** indicate 1% and 5% significant levels. Automatic lags and lags are selected based on AIC. The null hypothesis of Hansen’s Parameter instability is that series are co-integrated and the results confirm the existence of cointegration (stable long-run relationship).

#### Table 9. Toda-Yamamoto causality test results.

| MWALD (Chi-Square) test | Granger causality |
|-------------------------|------------------|
| In food does not Granger cause In non-food | 184.48 (0.000) | Bi-directional Causality |
| In non-food does not Granger cause In food | 33.88 (0.000) | |
| VAR residual serial-correlation M test (at lag – 5) | 4,668 (0.323) | |
| VAR residual heteroscedasticity test | 65.996 (0.677) | |

Note: figures shown in brackets are p-values.
more than three quarters to fully return to the long-run equilibrium after a shock. Compared with food prices (which is about 57 percent), a slower speed of adjustment is observed in non-food prices. This suggests that non-food inflation has become more persistent than food inflation over the last two decades (that is, the shocks to food prices are relatively transitory than prices in nonfood components). In addition, the CUSUM and CUSUM square tests indicate the stability of parameters over the specified period (see Figure 4).

4.3.3. ARDL model with general inflation equation

As reported in Table 6, the general inflation also appears to be highly responsive to price expectations (inflation inertia) in both short-run and long-run, implying that exogenous shocks induce the price level to initially rise above the long-run equilibrium. On the other hand, the monetary expansion accelerates inflationary pressures in the long run only. This finding is supported by the argument that monetary transmission needs longer periods in counties with under-developed financial sectors, and thus may not have an immediate effect on price spirals (Geeda and Tafere, 2011). Similar results were found in Bedada et al. (2020). In contrast, interest rate has a significant price-reducing effect in the short run.

Real income and appreciation of exchange rate appear to have a negative effect on short-run and long-run price movements, but the short-run effect of real income is not significant. Gofere (2013) and Melaku (2020) also suggested quite similar findings in this regard. On the contrary, world price puts upward pressure on the price spirals in Ethiopia, which is quite consistent with the findings in Ademe (2015). Administered prices also significantly explain the price increases in the long run. Whereas, food supply happens to have a significant positive impact on general inflation in short-run. A possible explanation for this result is the role of increased food imports in meeting high domestic demand and its effect also increases over time. For example, for every 1 percent rise in food price, non-food price will increase by about 0.34 percent between the current and previous quarters. A 1 percent increase in food prices three or four quarters ago induces non-food prices to rise by 1.1 percent, implying a strong effect of food price shocks transmitted into non-food prices. To be precise, prices in non-food commodities seem to be highly dependent on food price movements. On the other hand, the second-round effect of non-food to food price appears to be significant after the third quarter lag. The coefficient ($\beta_2$ in Eq. (20)) is negative in the first quarter lag and insignificant in the second lag, indicating that non-food price shocks may not spread significantly to food inflation in the first two quarters. In the third and fourth lags, however, a 1 percent increase in non-food inflation leads to a 0.85 and 1.2 percent shock in food inflation, respectively.

In general, the results in Table 8 confirm evidence of transmission mechanism between food and non-food inflation (the shocks observed in one component feeds into the other) although the effects from food to non-food are stronger and more persistent. As a result, any attempt to control inflationary pressures need to take into account the price movements in both food and non-food sectors. As noted in Rangasamy (2011), understanding the bidirectional interlinkages between food and non-food price shocks is noticeably important for stabilizing prices in the economy as pass-through effects should be minimized to maintain price stability.

4.5.2. Toda-Yamamoto Granger Causality results

As shown in Table 9, the Toda-Yamamoto Granger causality test results indicate evidence of bi-directional (two-way) Granger causality between food and non-food prices. In other words, food prices Granger cause non-food counterparts and vice-versa. This implies that lagged values of food prices have significant predictive power when added to the equation of non-food price. The past values of non-food prices also have significant linear predictive power on the current values of food prices.

5. Conclusion

It is highly imperative to identify the main sources of price spirals and understand the possible interlinkages between prices in different sectors for policy measures to be effective in controlling inflationary pressures and maintaining price stability. To that end, this study investigates the main driving forces of recent inflationary situations in Ethiopia using quarterly data from 1999/2000 to 2018/2019. The study also examines the interlinkages between food and non-food prices to understand the transmission mechanism in the inflationary process.

The linear ARDL model was first employed to find out the main determining factors of food, non-food and general inflation. The findings confirm that inflationary sources differ between food and non-food sectors. Food inflationary rises, for example, are positively associated with inflation expectation, monetary growth, and international food price. In contrast, increases in real income and food supply appear to reduce food price spikes. On the other hand, expected inflation, exchange rate, administered price, and world non-food price are found to be the most important factors behind the recent non-food inflationary pressure. Second, the NARDL model was applied to check for the existence of an asymmetric (nonlinear) relationship between overall inflation and its drivers. The model results indicate that exchange rate, real GDP (in the long run), world price, and food supply have asymmetric effects on the general inflationary process. Regarding the interlinkages between food and non-food prices, the DOLS estimation results reveal evidence of a bidirectional pass-through (second-round) effect, with a stronger and long-lasting effect from food to non-food prices. The Toda-Yamamoto granger causality test also confirms the existence of a two-way causal linkage between food and non-food prices.
As a whole, the findings of this study suggest that both demand and supply-side factors play a significant role in explaining the recent inflationary experience in Ethiopia, implying that inflation is more than just a monetary phenomenon. Second, as the Ethiopian inflation appears to be party imported from outside (explained by international prices), policymakers should take global price movements into account while designing domestic price policies and implementing stabilization measures. Third, the presence of strong interlinkages between food and non-food prices indicates that any attempt to control inflationary movements should not be one-dimensional and needs to consider the spillover effects of one on another, and thus on the general inflationary pressure. Finally, the specific behaviors and sources of food and non-food prices, as well as the transmission effect between them should be considered to better understand the underlying inflationary dynamics and to effectively control inflationary shocks and pressures.

Declarations

Author contribution statement

Helen Demeke: Conceived and designed the experiments; analyzed and interpreted the data; wrote the paper.
Dagmawe Tenaw: Conceived and designed the experiments; analyzed and interpreted the data; wrote the paper.

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