

Feyisa, Bulo

Article

Sources of inflation in Ethiopia: a dynamic ARDL model

Cogent Economics & Finance

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Feyisa, Bulo (2024) : Sources of inflation in Ethiopia: a dynamic ARDL model, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 12, Iss. 1, pp. 1-13, <https://doi.org/10.1080/23322039.2024.2421702>

This Version is available at:

<https://hdl.handle.net/10419/321646>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Sources of inflation in Ethiopia: a dynamic ARDL model

Bulo Feyisa

To cite this article: Bulo Feyisa (2024) Sources of inflation in Ethiopia: a dynamic ARDL model, Cogent Economics & Finance, 12:1, 2421702, DOI: [10.1080/23322039.2024.2421702](https://doi.org/10.1080/23322039.2024.2421702)

To link to this article: <https://doi.org/10.1080/23322039.2024.2421702>



© 2024 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 10 Nov 2024.



Submit your article to this journal [↗](#)



Article views: 1551



View related articles [↗](#)



View Crossmark data [↗](#)

Sources of inflation in Ethiopia: a dynamic ARDL model

Bulo Feyisa

Department of Economics, Jinka University, Jinka Town, Ethiopia

ABSTRACT

Inflation has recently become a significant obstacle to the Ethiopian government's efforts to achieve economic progress. Consequently, there is an increasing need to identify the sources of inflation in the country. This study, therefore, analyzed the drivers of inflation in Ethiopia using annual data from 1990 to 2020 and employed an autoregressive distributed lag model for analysis. According to the results of the ADF test, all variables are stationary at first difference. Additionally, the bound test results indicated the existence of long-run co-integration between inflation and its determinants. The study found that money supply, exchange rate, and the gross domestic product of the service sector are significant inflation-augmenting variables, whereas the import volume index and budget deficit are inflation-reducing variables in both the short-run dynamic model and the long-run static model. The coefficient of adjustment, 90 percent, indicates that short-run deviations from the average value of the outcome variable would dissipate within one year. Therefore, the government of Ethiopia should promote agricultural and industrial productivity, implement conservative monetary and exchange policies, and increase imports to reduce the current surge of inflation in the country.

IMPACT STATEMENT

This research provides critical insights into the drivers of inflation in Ethiopia, offering policymakers a robust analysis of key economic factors influencing price stability. By identifying the money supply, exchange rate, and service sector GDP as primary inflation-augmenting variables and highlighting the counteracting roles of import volume and budget deficit, this study equips decision-makers with a focused understanding of the economic levers they can adjust to control inflation. The findings underscore the importance of adopting conservative monetary and exchange policies and promoting agricultural and industrial productivity, offering a roadmap to mitigate inflation's adverse effects and foster sustainable economic growth in Ethiopia.

ARTICLE HISTORY

Received 13 December 2022
Revised 27 June 2024
Accepted 22 October 2024

KEYWORDS

ADRL; CPI; Service GDP;
Broad Money Supply;
Official Exchange Rate

SUBJECTS

Economic Theory &
Philosophy; Econometrics;
Development Economics;
Finance; Industry &
Industrial Studies

1. Introduction

Inflation is a sustained rise in the general price level of goods and services but not only an increase in the price of a particular product (Patterson, 1999). Inflation reduces the real income of people mainly those fixed income earners and reallocates income from one group of people to the other group and hence creates income inequality and has serious economic and social effects. Despite its social and economic effects, inflation also hinders Foreign Direct Investment because it raises the cost of materials and inputs and thereby reduces production.

Ethiopia has experienced strong economic growth for the past two decades. However, inflation has become a major challenge. High, and volatile, inflation is a threat to good economic performance and has negative effects on many of the poor especially people who earn fixed wages. Economic growth took off in the past decades in Ethiopia, but alongside higher growth, there has been rapid inflation and large inflation volatility.

CONTACT Bulo Feyisa  feyisabulo16@gmail.com  P.o.Box, 164, Jinka, Ethiopia.

© 2024 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

Ethiopia's inflation rate remains insistently high, reaching 33.6 percent in February 2022. Food and non-food inflation stood at 41.9 percent and 22.9 percent respectively in February 2022 (NBE, 2022). The major factors driving food inflation are raises in the price of cooking oils and fats, non-alcoholic beverages, bread and cereals, fish, dairy, and meat products. Weak domestic market supply due to agricultural production constraints and steady devaluation of the local currency are among the major factors contributing to the staggeringly high inflation levels. Although the Ethiopian government took various policy actions including monetary, fiscal, and structural measures to control price escalations, the inflation levels remain in the double digits.

It is widely accepted that high inflation is a monetary phenomenon related to excess money supply. The main driving forces are that the government prints money to finance its deficit, it expands the money supply to stimulate aggregate demand, or expectations of higher inflation force the authorities to accommodate historical price increases. However, in many Sub-Saharan countries, it is challenging for monetary authorities to control inflation even if there is a political will, due to weak institutional frameworks, thin financial markets, and imperfect competition among banks (Durevall & Sjö, 2012).

The main aim of this paper is to examine the determinants of inflation and its scenario in Ethiopia from 1990 to 2020 obtained from the National Bank of Ethiopia and the World Bank. Moreover, the paper aimed to explore the trend of inflation, and examine both the short-run and long-run determinants of inflation in Ethiopia using an amalgamation of different theories of inflation as a theoretical framework and an autoregressive distributed lag model as an analytical model for the period 1990–2020. The remaining sections of this study are organized as follows. The second section presents a review of the literature. The third section deals with materials and methods. The fourth section presents the results and discussion while the last section presents the conclusion of the study.

2. Literature review

2.1. Theoretical review

There are various economic theories that explain the sources of inflation, and they include structural, cost-push, demand-pull, new political macroeconomics, and quantity theories of money. The structural theory of inflation was coined for the first time by Myrdal and Streeten. The structural theory of inflation predicts that the structural imbalance in economic, political, and social systems is attributed to the disproportionate response of output to an increase in investment spending and money supply. Proponents of this theory assume that savings in developing economies are inadequate to finance investment, and government uses deficit financing. Hence, agricultural output, resources, exchange rate, and infrastructural constraints are the primary contributors to inflation according to the structural theory of inflation. They also argue that an increase in money supply leads to a less proportionate increase in output, and this by itself will push the price up.

The quantity theory of money which was developed by Milton Friedman claims that inflation is primarily a monetary phenomenon. In other words, his theory assumes inflation is always and everywhere a monetary phenomenon and changes in general price level are solely caused by the changes in the monetary stock or money supply. That means a change in money supply proportionately changes the general price level. Besides, the proponents of this theory assume that the inflation rate which is caused by the rise in money supply is not followed by an increase in output. Following the quantity theory of money, the relationship between price and money supply is given by:

$$MV = PY \quad (1)$$

where M is the money supply, V is the velocity of money, P is the general price level and Y is the level of output. Advocates of monetary policy argue that the monetary policy is a more potent instrument of economic stabilization than the fiscal instrument, and money supply does not affect output in the short-run.

Cost-push inflation is caused by an increase in price level due to a rise in the level of wage, and other inputs of production. When prices of factors of production increase, employers also increase the price of their product. According to this theory, workers would buy only as much as before if the producers

adjusted the prices of their products following an increase in wages. Home currency depreciation affects domestic inflation via two channels: the direct and the indirect channels. On one hand, the depreciation of home currency directly affects the prices of imported goods and leads to a higher domestic price. On the other hand, the depreciation of home currency increases the prices of imported inputs which leads to a higher cost of production. In addition, the other cause of cost-push inflation is profit-push inflation or price-push inflation. Firms in imperfect competitive markets charge higher prices for their product to maximize their profit. For instance, firms in oligopoly or monopolistic markets have power over prices, and they may charge higher prices for their products to command higher profits.

The Keynesian macroeconomists argue that excess aggregate demand is the primary cause of domestic inflation. The upward pressure on prices due to excess aggregate demand is called demand-pull inflation. The aggregate demand consists of investment, consumption, and government expenditure. The demand-pull theory of inflation was coined for the first time by Maynard Keynes and he assumes that inflation occurs if aggregate demand exceeds aggregate supply. According to this theory of inflation, the solution to the rapid increase in the general price level is to use policies that cause a decrease in the components of aggregate demand.

However, the above theories of inflation have focused on the macroeconomic determinants of inflation. They overlooked the role of non-economic factors in influencing home inflation. However, the new political macroeconomics focuses on the non-economic determinants of domestic inflation. The new political macroeconomics theory provides a new outlook on the relationship between political instability, culture, and inflation. This theory attributes the cause of rapid inflation in an economy to the timing of elections, the performance of policymakers, and political instability. According to this theory, government officials use their power to increase government expenditure, especially at the end of their term. Several studies have been done regarding the non-monetary variables of inflation.

Hence, the analysis of the theoretical literature showed that money supply, economic growth, exchange rate fluctuation, government expenditure, and import are the potential sources of inflation. In other words, both the demand-side factors and the supply-side factors cause inflation in an economy. This study used the amalgamation of the above theories of inflation as a theoretical framework to examine the sources of the recent rapid rise in the inflation level in Ethiopia.

2.2. Empirical review

Various previous studies have examined the sources of inflation using different analytical models. A study conducted by Erdoğan (2020) on the determinants of inflation in European countries found that official exchange rates and domestic money supply are the primary sources of inflation. In the same vein, a study conducted by Demeke and Tenaw (2021) on sources of recent inflationary pressures and interlinkages between food and non-food prices in Ethiopia found that inflation expectation, money supply growth, world food price, real income, and food supply are the main determinants of food inflation while expected inflation, exchange rate, administered price, and world non-food price level are sources of non-food inflation.

Moreover, a study conducted by Al-Mutairi et al. (2020) on determinants of inflation in Kuwait using multiple linear regression found that inflation is positively associated with interest rate spreads, imports of goods and services, and money supply. The same study indicated that inflation is negatively and significantly associated with tax revenue and current account balance. Further, a study conducted by Okoye et al. (2021) on determinants of behavior of inflation rate in Nigeria using an autoregressive distributed lag model showed that external debt, exchange rate, fiscal deficits, money supply, and economic growth are the major determinants of inflation in Nigeria. However a study conducted by Kahssay (2017) on determinants of inflation in Ethiopia using an ordinary least square technique of estimation found that inflation is positively and significantly associated with domestic money supply and gross domestic product.

Moreover, broad money supply, foreign direct investment, and trade balance are positively and significantly associated according to a study conducted by Salma (2021) on macroeconomic determinants of inflation in Bangladesh. Besides, a study conducted by Salim et al. (2021) on determinants of Inflation in selected Asian countries using a static fixed effect model found that money supply and inflation are

negatively and significantly associated. Yet, a study conducted by Wudu Abate (2020) on determinants of inflation in Ethiopia found that money supply is positively and significantly associated with domestic inflation. The same author indicated that the output gap and public borrowing are also positively and significantly related to inflation in Ethiopia using the vector error correction model. Still, a study conducted by Olamide et al. (2022) on exchange rate volatility and inflation in developing countries showed that exchange rates are positively and significantly associated with inflation. However, a study conducted by Islam et al. (2017) on determinants of inflation in Malaysia found a negative and significant association between exchange rate and inflation.

2.3. Conceptual framework

Based on the theoretical and empirical review of the literature, some covariates of inflation are identified for this study and presented in the following diagram. As seen from Figure 1 below, the independent variables that have been used in order to examine inflation determinants in Ethiopia are import volume, exchange rate, money supply, budget deficit, and service GDP. From literature and previous studies money supply, exchange rate, budget deficit, and Service GDP are expected to affect inflation positively and significantly. However, import volume will reduce inflation.

3. Materials and methods

3.1. Sources of data and variables

To examine the sources of the recent mounting of the consumer price index in Ethiopia, this study used time series data for the period 1990–2020. Thus, 31 years of data on consumer price index (CPI_t), the official exchange rate (EXR_t), service GDP ($SGDP_t$), import volume index (M_t), broad money supply (Ms_t), and budget deficit (BD_t) were collected from the World Development Indicator and the National Bank of Ethiopia. Annual time series data on budget deficit (BD_t), service GDP ($SGDP_t$), the official exchange rate (EXR_t), broad money supply (Ms_t) and data on the consumer price index (CPI_t) were collected from the World Development Indicator database. However data on food inflation, non-food inflation, and general inflation were obtained from the National Bank of Ethiopia. The natural logarithms of all variables were used because log-linear specification produces more efficient estimates than simple specification.

3.2. Model specification

As presented in the literature section, several theories explain the sources of inflation in an economy. This study employed the amalgamation of various inflation theories such as structural, demand-pull, cost-push, and quantity theory of money as a theoretical framework to examine the drivers of recent inflation in Ethiopia. The quantity theory of money predicts that money supply is the primary contributor to domestic inflation while the demand-pull inflation theory blames government expenditure or budget deficit as the source of inflation. The structural theory of inflation assumes that a change in gross domestic product is the primary source of inflation. However the cost-push inflation theory predicts that the exchange rate directly and indirectly contributes to domestic inflation. By augmenting the quantity theory of money which is given in equation (1) with other variables, the following relationship between inflation and its determinants is specified:

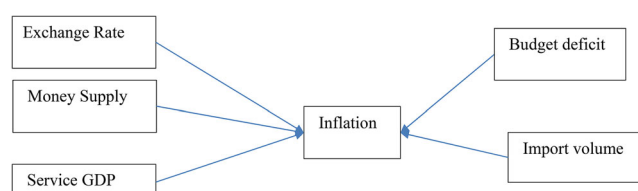


Figure 1. Conceptual framework of inflation. Source: Author compilation, 2022.

$$CPI_t = f(MS_t, SGDP_t, BD_t, EXR_t, M_t) \quad (2)$$

Where CPI_t is the consumer price index, $SGDP_t$ is the service gross domestic product, BD_t is the budget deficit, EXR_t is the official exchange rate, and M_t is the import volume index. Hence, to identify the determinants of recent inflation in Ethiopia, time-series data for the period 1990–2020 and an autoregressive distributed lag (ARDL) model were employed in this study. Thus, the general autoregressive distributed lag (ARDL) model which gives unbiased and consistent estimates even for a small sample is mathematically specified as follows;

$$\begin{aligned} \Delta LCPI_t = & c + \alpha_{1i} \sum_{i=1}^n \Delta LCPI_{t-i} + \alpha_{2i} \sum_{i=0}^n \Delta LEXR_{t-i} + \alpha_{3i} \sum_{i=0}^n \Delta LBD_{t-i} + \alpha_{4i} \sum_{i=0}^n \Delta LMS_{t-i} + \alpha_{5i} \sum_{i=0}^n \Delta LM_{t-i} \\ & + \alpha_{6i} \sum_{i=0}^n \Delta LSGDP_{t-i} + \delta (LCPI_{t-1} - \beta_1 LEXR_{t-1} - \beta_2 LBD_{t-1} - \beta_3 LMS_{t-1} - \beta_4 LM_{t-1} - \beta_5 LSGDP_{t-1}) + U_t \end{aligned} \quad (3)$$

where Δ is the difference operator, c is the constant term, $\alpha_{1i}, \alpha_{2i} \dots \alpha_{6i}$ are short-run coefficients, $\beta_1, \beta_2 \dots \beta_5$ are long-run coefficients of the model, $i = 0, 1, \dots, n$ are the number of lags, δ is the coefficient of adjustment, and $U_t \sim N(0, \delta^2)$ is the disturbance term of the model.

4. Results and discussion

4.1. Trend analysis

In this section, the trend of the variables is revealed. The trend is followed by various variables incorporated in the model with that of the trend of inflation rate. The aim of the trend is to serve as a base for the basic analysis which will be done based on the econometric results.

The consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. As shown on Figure 2 above, the consumer price index of Ethiopia increases at an increasing rate from 18.5 in 1990 to 362.6 index in 2020.

From Figure 3, general and non-food inflation lies below food inflation in 2019 in Ethiopia. The food inflation rate remains persistently high, reaching 23.2 in 2021. The major factors driving food inflation are shocks in the price of cooking oils and fats, non-alcoholic beverages, bread and cereals, fish, dairy, and meat products. Weak domestic market supply due to agricultural production constraints and steady devaluation of the local currency are among the major factors contributing to the shockingly high inflation levels in Ethiopia.

Figure 4 above reveals that trends of food inflation and official exchange rate move in the same direction starting from 2014 in Ethiopia. This indicates, that as the official exchange rate increases food inflation also increases. A higher exchange rate means depreciation in the currency of the country in terms of other country's currency and this in turn makes imports more expensive and exports are cheaper. Therefore, the price of imported goods will go up because they are more expensive to buy

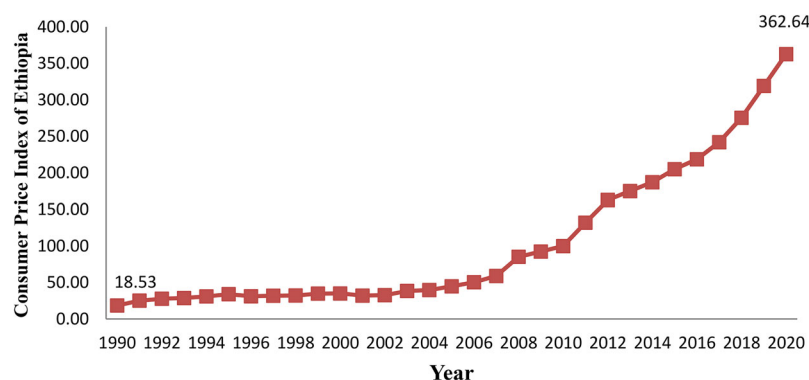


Figure 2. Trends of consumer price index in Ethiopia.

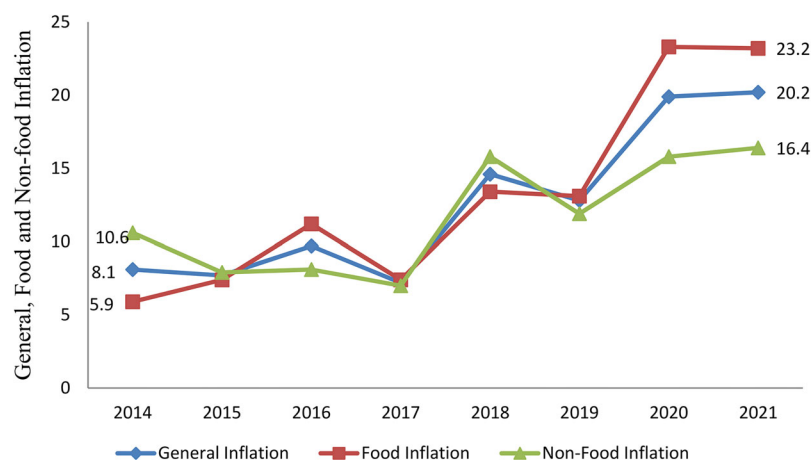


Figure 3. Trends of general, food and non-food inflation in Ethiopia.

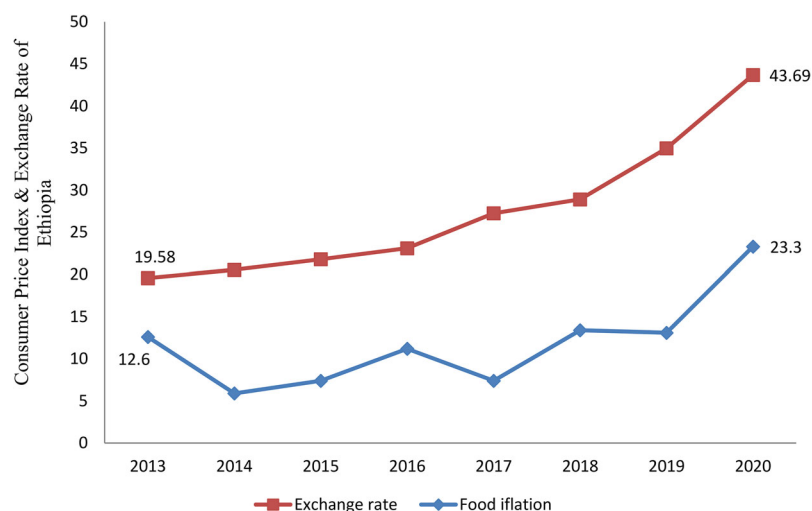


Figure 4. Trends of food price inflation and official exchange rate in Ethiopia.

from abroad and cheaper exports increase demand for Ethiopia exports. There is also a reduction in demand for imported goods, shifting consumption to domestic goods and there is an increase in domestic aggregate demand (AD), which may cause demand-pull inflation.

Figure 5 above reveals that, the contribution of the service and industrial sectors to GDP has increased from 36 percent in 1990 to 43 percent in 2003, overtaking the historically dominant contribution of the agricultural sector. In 2012 the agriculture and service sectors contributed about 44.3 percent and 38.5 percent to GDP respectively. However, in 2020, the share of agriculture in Ethiopia's gross domestic product was 35.45 percent, the industry contributed approximately 23.11 percent and the services sector contributed about 36.81 percent. However, the increasing share of the services sector in the GDP will have a negative effect on economic growth in the framework of the unbalanced growth model (Jalil et al., 2016). The unbalanced growth model postulates that the growth of the services sector may decrease the overall improvement in the productivity of an economy, which ultimately leads to a decrease in the economic growth of the economy.

As shown on Figure 6 above, Money supply, Gross domestic product and Government expenditure are consistently increasing from 1990 to 2020. However, Ethiopia's real gross domestic product (GDP) growth slowed down from 2018 to 2020 due to COVID-19 and money supply and government expenditure as well.

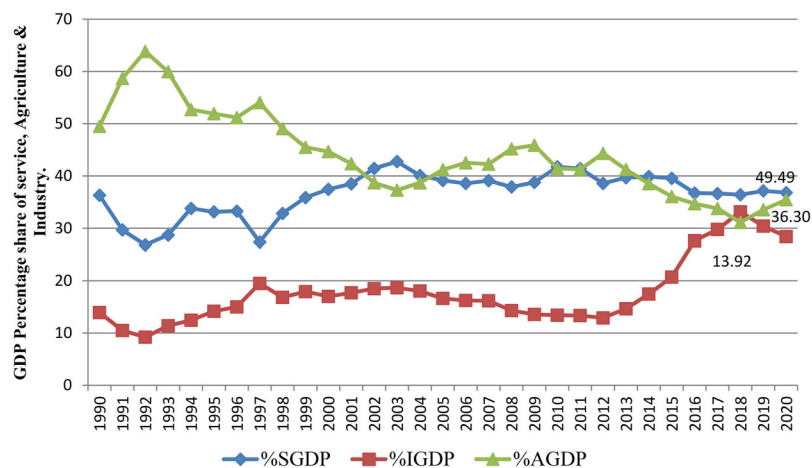


Figure 5. Trends of agriculture, industrial, and service percentage share of GDP.

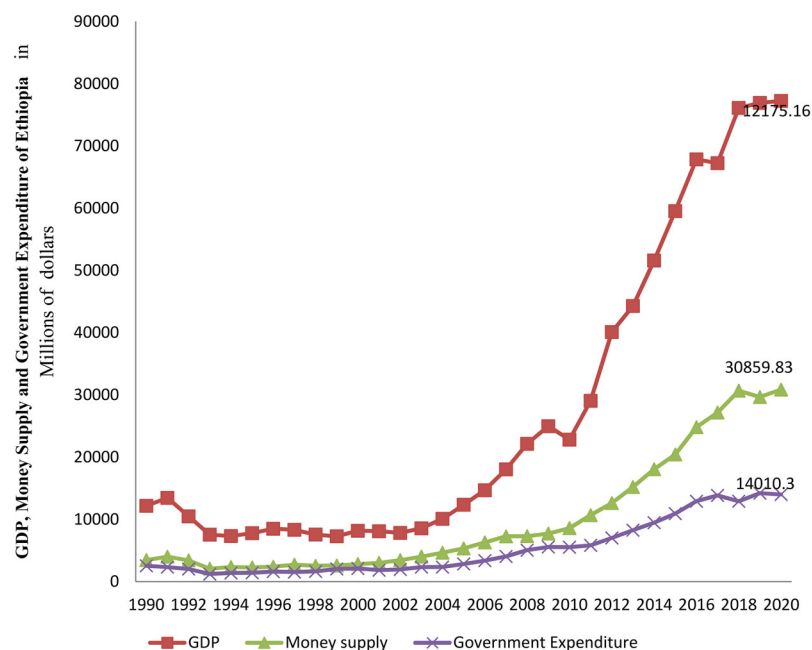


Figure 6. Trends of GDP, money supply and government expenditure of Ethiopia.

As shown on Figure 7, the gap between government revenue and government expenditure is negative in Ethiopia which implies there were budget deficit from 1990 to 2020. The large and consistent budget deficit could be due to monetary expansion, persistent inflation, and macroeconomic instability in the country. Thus the cautious fiscal policy as a tool for sustained economic growth and as a means of avoiding a source of macroeconomic imbalance is quite important for Ethiopia.

The difference between exports and imports is called the balance of trade. In Ethiopia, imports are greater than exports always greater than exports or there negative trade balance. This negative trade balance has persistently increased from 1990 to 2020. From Figure 8, recently the volume of goods and services Ethiopia imports from outside shows a decrement number mainly due to COVID-19. On the other hand even though exports are increasing (but at a decreasing rate) market access, low level of private investment, high transaction costs, infrastructural deficiencies, delays in service delivery, limited market knowledge, and shortage of skilled workforce are the main constraints and challenges of the sector in Ethiopia.

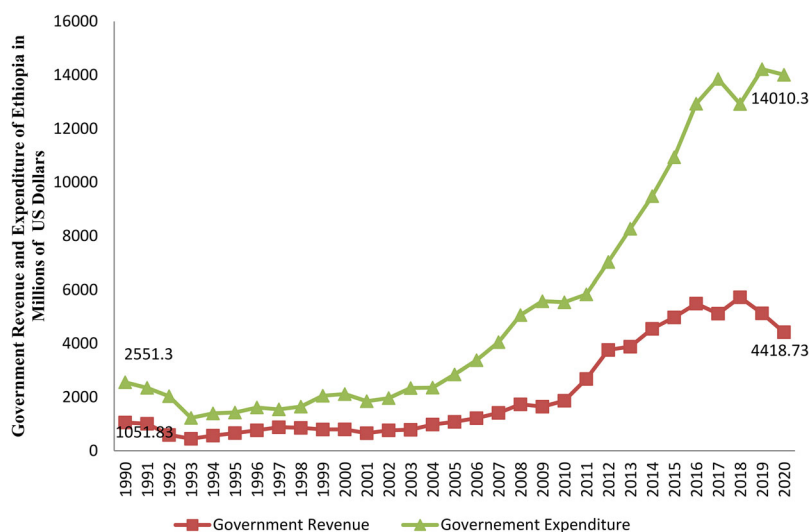


Figure 7. Trends of government revenue and expenditure of Ethiopia.

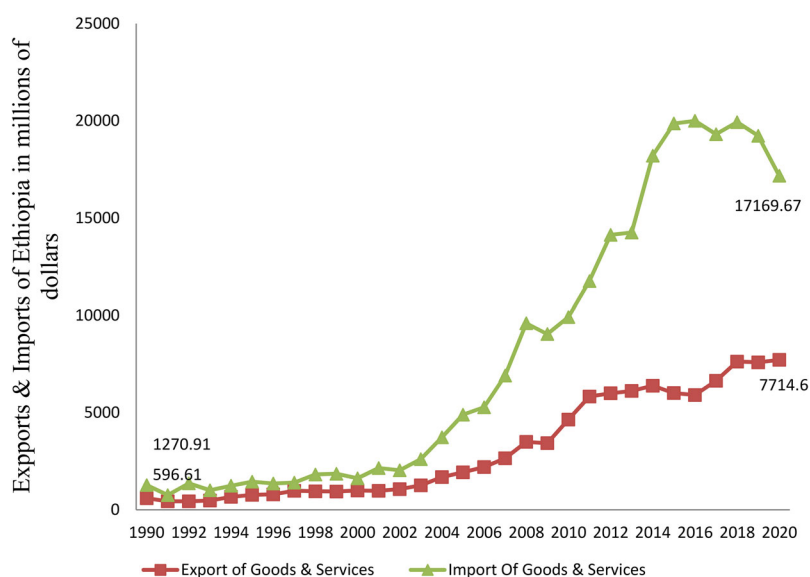


Figure 8. Trends of Ethiopian export and import of goods and services.

4.2. Econometrics result

To get rid of any spurious regression in the estimation of Equation (3), it is important to examine the time-series properties of the data that were employed in this study. To this end, the augmented dickey fuller (ADF) test was used to identify the non-stationarity of the variables in level. If the variables have unit roots at level, the ADF test is still used to check whether the variables are stationary at first difference or not. Table 1 shows the results of the ADF test on the time series data at a level and first difference. The results indicate that, at a 5 percent level of significance or lower, the null hypothesis of a unit root cannot be rejected for all tested variables.

However, the results in the same table show that all variables are integrated of order one at a 5 percent level of significance. In other words, at the first difference, all variables are stationary, and the null hypothesis of a unit root is rejected. Hence, the augmented dickey fuller (ADF) tests show that all variables in the model are non-stationary at the level and stationary at their first difference. In other words, in logarithmic form, all variables are integrated of order one or $I(1)$ variables.

In addition to the stationarity test, the co-integration test is also important if the variables have unit roots to check the existence of a long-run relationship between the inflation and all the covariates such

Table 1. Augmented Dicky Fuller (ADF) test of stationarity for variables in the model.

Logarithm of variables	At level		At first difference	
	Test statistics	Probability	Test statistics	Probability
Consumer price index, CPI	0.939	0.995	−4.267***	0.002
Money supply, MS	0.679	0.989	−3.857***	0.007
Budget deficit, BD	0.165	0.956	−3.281**	0.026
Off exchange rate, EXR	−1.414	0.562	−3.561**	0.013
Service GDP, SGDP	1.032	0.995	−3.350**	0.022
Import volume, M	−1.64	0.451	−12.51***	0.000

Source: Authors' computation, 2022.

Table 2. Bound test for existence of long-run relationship.

Test statistics	Value of test statistics	Number of covariates (k)
Fisher's F-statistics	7.995	5
Bounds of the critical value		
Level of significance (percent)	Lower bound	Upper bound
10	2.26	3.35
5	2.62	3.79
2.5	2.96	4.18
1	3.41	4.68

Source: Authors' computation using EViews 12, 2022.

as official exchange rate, service GDP, money supply, budget deficit, and import volume. The basic idea behind co-integration is that two or more variables may have a long-run relationship though they may drift apart in the short run. Though there are other tests of co-integration such as the Engle-Granger two-step co-integration test and Johansen co-integration, this study employed the bound test of co-integration. Table 2 indicates the results of the bound test for the existence of a possible long-run relationship between all covariates and the dependent variable.

Since the value of the test statistics (7.995) is greater than the upper bound critical values at all levels of significance, there exists a long-run relationship or co-integration between the inflation and all covariates such as broad money supply (MS_t), budget deficit (BD_t), official exchange rate (EXR_t), import volume (M_t), service gross domestic product ($SGDP_t$).

4.3. Long-run static model of inflation

As indicated in Table 3, money supply, official exchange rate, service gross domestic product, and import volume index are the major determinants of long-run inflation in Ethiopia. For instance, a one percent increase in money supply positively and significantly increases inflation by 0.352 percent, *ceteris paribus*. This supports the quantity theory of money which states that everywhere inflation is a monetary phenomenon. Besides, studies conducted by Bane (2018), Wudu Abate (2020), and Salma (2021) found that money supply and inflation are positively and significantly associated. However a study conducted by Salim et al. (2021) found a negative and significant association between money supply and inflation in selected Asian countries.

The coefficient of service gross domestic product is positive and statistically significant at a one percent level of significance as indicated in Table 3. As service gross domestic product increases by one percent, domestic inflation significantly increases by 0.815 percent, *ceteris paribus*. This suggests that service gross domestic product increases inflation by boosting aggregate demand for agricultural and industrial products. The service gross domestic product is the primary contributor to the total gross domestic product of Ethiopia in recent years. Previous studies used gross domestic product as the covariate, and they found mixed results. Studies conducted by Demeke and Tenaw (2021) and Olamide et al. (2022) obtained a negative and significant association whereas a study conducted by Kahssay (2017) found a positive and significant association between a gross domestic product and inflation in Ethiopia.

The coefficient of the official exchange rate is positive and statistically significant at one percent in influencing the domestic inflation in Ethiopia. This result supports the structural theory of inflation which states that structural imbalance is the primary source of inflation. As presented in Table 3, a one percent devaluation of Ethiopian currency, the domestic inflation increases by 0.429 percent, other things being

Table 3. Regression results of the long-run static model of inflation.

Logarithm of covariates	Coefficient	Std. Error	t-Statistic	P-value
Money supply, LMS_t	0.352	0.181	1.942	0.068
Budget deficit, LBD_t	-0.333	0.084	-3.944	0.001
Exchange rate, $LEXR_t$	0.429	0.068	6.318	0.000
Service GDP, $LSGDP_t$	0.815	0.135	6.033	0.000
Import volume, LM_t	-0.247	0.074	-3.342	0.004
Constant, C	-3.422	0.284	-12.055	0.000

Source: Authors' computation, 2022.

equal. There are mixed results in the literature regarding the link between exchange rates and inflation levels. Studies conducted by Okoye et al. (2021) and Olamide et al. (2022) indicated a positive and significant link between exchange rate and inflation while a study conducted by Islam et al. (2017) found a negative and significant association between exchange rate and inflation.

The coefficient of the money supply is 0.352, which implies a 1 percent increase in money supply will lead to the consumer price index rising by 0.352 percent on the average value. This is consistent with the quantity theory of money (QTM) and the Classical Monetary Theory which says "there is a close relationship between the amount of money and inflation and that the excessive increase in the amount of money is the main reason for the occurrence of the inflation" Batarseh (2021).

The relationship between budget deficit and inflation is not always obvious and it is different from country to country. The budget deficit may have a positive or negative effect on inflation. In this study the coefficient of budget deficit which is -0.333, means as the budget deficit increases by 1 percent Consumer price index will decrease by 0.333 percent other things remain constant and on average value. A budget deficit is a situation when total government expenditures exceed total government revenues. According to Alper et al. (2014), there are two possible channels through which higher deficits lead to higher inflation. Firstly, the government's borrowing requirements normally increase the net credit demands in the economy, driving up the interest rates and crowding out private investment. The resulting reduction in the growth rate of the economy will lead to a decrease in the amount of goods available for a given level of cash balances and hence the increase in the price level. Secondly, a deficit can also lead to higher inflation even when central banks do not monetize the debt when the private sector monetizes the deficits. This occurs when the high interest rates induce the financial sector to develop new interest-bearing assets that are almost as liquid as money and are risk-free. Thus, the government debt not monetized by the central bank is monetized by the private sector, and the inflationary effects of higher deficit policies prevail.

The positive coefficient of the real effective exchange rate (0.429) is interpreted as, if the exchange rate is increased by 1 percent, then the inflation rate will be increased by 0.429 percent and it is consistent with previous studies such as Laryea and Sumaila (2001), Durevall and Sjö (2012), Solomon (2016), and Wudu Abate (2020). Exchange rates, which give the price of a country's currency relative to foreign currencies, fluctuate based on global market dynamics. These fluctuations can affect domestic inflation rates that is when the Ethiopian birr depreciates, imported goods generally become more expensive, and the prices of domestically produced goods may also rise as domestic producers face weaker competition from abroad.

The coefficient of service GDP (0.815) implies as the service GDP increases by 1 percent the consumer price index also increases by 0.815 percent holding other things unchanged, on average which is consistent with the previous studies. Lastly, the relationship between inflation and import volume is negative, that is as the import volume rises by 1 percent consumer price index decreases by 0.247 percent.

4.4. Short-run dynamic model of inflation

The short-run model of inflation indicates that, the speed of adjustment to restore to the equilibrium in the dynamic model. It is a one-lagged period residual obtained from the estimated dynamic long-run model. The coefficient of adjustment indicates how quickly variables converge to equilibrium. Moreover, it should have a negative sign and be statistically significant at a standard significant level (i.e. p -value

Table 4. Regression results of the short-run dynamic model of inflation.

Covariates (logarithm of 1 st difference)	Coefficient	Std. Error	t-Statistic	P-value
Money supply, ΔLMS_t	0.813	0.320	2.539	0.021
Budget deficit, ΔLBD_t	-0.158	0.068	-2.331	0.032
Exchange rate, $\Delta LEXR_t$	1.747	0.422	4.135	0.001
Service GDP, $\Delta LSGDP_t$	1.041	0.190	5.482	0.000
Import volume, ΔLM_t	-0.099	0.054	-1.815	0.086
Coefficient of adjustment, ECT_{t-1}	-0.910	0.196	-4.641	0.000
Diagnostic tests				
Serial correlation	$F_{(3, 15)} = 0.839$, Probability > $F = 0.494$			
Heteroskedasticity	$F_{(11, 18)} = 0.903$, Probability > $F = 0.556$			
Ramsey RESET test	$F_{(3, 15)} = 2.169$, Probability > $F = 0.134$			
Normality test, Jarque-Bera = 5.55, Probability = 0.062				

Source: Author computation, 2022.

should be less than 0.05). The coefficient of adjustment is negative, less than one, and statistically significant as presented in Table 4. This suggests that the current deviation of inflation from long-run equilibrium or relationship will be corrected by 91 percent in the following period. In other words, the adjustment of price to its long-run equilibrium will almost take only one year.

As shown in Table 4 above money supply, real exchange rate and service GDP are the variables that affect inflation in the short run positively and significantly. However, budget deficit and import volume negatively and significantly affect inflation in the short run.

Furthermore, in checking for the existence of serial correlation the Brusch-Goodfry test is used. As it can be seen from the above table the P value is greater than the 5% significance level ($0.494 > 0.05$). So we accept the null for no serial correlation i.e. no serial correlation exists in the model at a 5% significance level. The test for heteroscedasticity investigates whether the variance of the errors in the model is constant or not. In the Brusch-Pagan-Godfry test for heteroscedasticity, the null hypothesis states that residuals are homoscedastic and independent of the regressors and that there is no problem of model misspecifications. As shown in the above table the P value is larger than the 5% significance level ($0.556 > 0.05$), we accept the null for homoscedasticity. Therefore the residuals are homoscedastic and independent of the regressors and no model misspecification problem. Finally, the Ramsey test is used to check whether there are omitted variables or not. Since the p -value ($0.134 > 0.05$) null hypothesis is accepted and there are no omitted variables in the model.

5. Conclusion

This study examined the sources of persistent inflation in Ethiopia using the amalgamation of structural, demand-pull, cost-push, and quantity theory of money as a theoretical framework, and the autoregressive distributed lag model as an analytical model. Time series data from 1990 to 2020 were obtained from the World Development Indicator and the National Bank of Ethiopia and used in this study to identify the drivers of recent inflation in Ethiopia. The estimation results of the ARDL model show that inflation in the country was positively and statistically significantly affected by money supply; official exchange rate; budget deficit; service GDP and import volume. Money supply, official exchange rate and service GDP are positively and significantly affect inflation in Ethiopia (consistent with the quantity theory of money (QTM) and the Classical Monetary Theory). Official exchange rate is another important variable in determining inflation both in the long run and short run. Exchange rates, which give the price of a country's currency relative to foreign currencies, fluctuate based on global market dynamics. These fluctuations can affect domestic inflation rates that is when the Ethiopian birr depreciates, imported goods generally become more expensive, and the prices of domestically produced goods may also rise as domestic producers face weaker competition from abroad. Therefore, it is advisable for the National Bank of Ethiopia to appreciate domestic currency in terms of the foreign exchange market.

Moreover, service GDP is also affecting inflation positively. The service sector has overtaken agriculture as a share of GDP in recent years which aggravates the inflationary pressure in the country. On the other hand, budget deficit affects inflation negatively that is when the imbalance between government revenue and expenditure increases by 1 percent inflation decreases by 0.33 percent. The negative and significant relationship between budget deficit and inflation is unexpected and this may be due to

strong budget deficit and money supply. Finally, import volume is negatively associated with inflation both in the long-run and short-run as expected.

Thus, the National Bank of Ethiopia is advised to apply a conservative monetary policy that is by decreasing the amount of money circulating throughout the economy, typically by selling government bonds, raising interest rates, and increasing the reserve requirements for banks. On the other hand, the National Bank of Ethiopia is advised to appreciate domestic currency in terms of the foreign exchange market. Moreover, the government must subsidize the industrial sector to reduce the impact of the non-producing sector (service sector). Finally, it is advisable, to reduce imports by imposing a tax rate on imports.

Disclosure statement

No potential conflict of interest was reported by the author(s).

About the author

Bulo Feyisa holds a Master's Degree in Economics from University of Gondar, Ethiopia and BA Degree in Economics at Addis Ababa University, Ethiopia. His research interests encompass a wide range of economic fields, including Macroeconomics, Environmental Economics, Econometrics Modeling, Environmental Valuation, and Energy Economics. He has published 3 research papers on these fields of studies.

References

- Al-Mutairi, A., Al-Abduljader, S., Naser, K., & Al-Mutairi, A. (2020). Determinants of inflation in Kuwait¹. *The Journal of Developing Areas*, 54(3), 20–34.
- Alper, C. E., Fund, I. M., & Ozmucur, S. (2014). Budget deficit, money supply and inflation: evidence from low and high frequency data for Turkey.
- Bane, J. (2018). Dynamics and determinants of inflation in Ethiopia. In A. Heshmati & H. Yoon, (Eds.), *Economic growth and development in Ethiopia. Perspectives on development in the Middle East and North Africa (MENA) Region*. Springer. https://doi.org/10.1007/978-981-10-8126-2_4
- Batareseh, A. (2021). The nature of the relationship between the money supply and inflation in the Jordanian economy (1980–2019). *Banks and Bank Systems*, 16(2), 38–46. [https://doi.org/10.21511/bbs.16\(2\).2021.04](https://doi.org/10.21511/bbs.16(2).2021.04)
- Demeke, H., & Tenaw, D. (2021). Sources of recent inflationary pressures and interlinkages between food and non-food prices in Ethiopia. *Heliyon*, 7(11), e08375. <https://doi.org/10.1016/j.heliyon.2021.e08375>
- Durevall, D., & Sjö, B. (2012). The dynamics of inflation in Ethiopia and Kenya. Working Paper Series N° 151. African Development Bank, Tunis, Tunisia.
- Erdoğan, S. (2020). Dynamics and determinants of inflation during the COVID-19 pandemic period in European countries: A spatial panel data analysis. *Düzce Tıp Fakültesi Dergisi*, 22, 61–67. <https://doi.org/10.18678/dtfd.794107>
- Islam, R., Bashawir, A., Ghani, A., Mahyudin, E., & Manickam, N. (2017). Determinants of factors that affecting inflation in Malaysia. *International Journal of Economics and Financial*, 7(2), 355–364.
- Jalil, A., Manan, S., & Saleemi, S. (2016). Estimating the growth effects of services sector: A cointegration analysis for Pakistan. *Journal of Economic Structures*, 5, 1–14. <https://doi.org/10.1186/s40008-016-0037-8>
- Kahssay, T. (2017). Determinants of inflation in Ethiopia: A time-series analysis. *Journal of Economics and Sustainable Development*, 8(19), 1–6.
- Laryea, S. A., & Sumaila, U. R. (2001). Determinants of inflation in Tanzania. *Working Paper - Chr. Michelsen Institute*, 12, 1–17.
- NBE (2022). National Bank of Ethiopia Independent Auditor's Report and Financial Statements 30 June 2022. Office of the Federal Auditor General Audit Service Corporation.
- Okoye, L. U., Olokoyo, F. O., Evbuomwan, G. O., Okoye, L. U., Olokoyo, F. O., Ezeji, F. N., & Okoh, J. I. (2021). Determinants of behavior of inflation rate in Nigeria. *Investment Management and Financial Innovations*, 16(2), 25–36. [https://doi.org/10.21511/imfi.16\(2\).2019.03](https://doi.org/10.21511/imfi.16(2).2019.03)
- Olamide, E., Ogujiuba, K., & Maredza, A. (2022). Exchange rate volatility, inflation and economic growth in developing countries: Panel data approach for SADC. *Economies*, 10(3), 67.
- Patterson, B. (1999). *The determination of interest rates*. WORKING PAPER. Economic Affairs Series. European Parliament L-2929, Luxembourg.
- Salim, N. J., Leng, N. K., Husnin, M., Yusof, M., Yahya, H., Salim, N. J., Leng, N. K., Husnin, M., & Yusof, M. (2021). Determinants of inflation in selected Asian countries. *International Journal of Academic Research in Business and Social Sciences*, 11(11), 2318–2326. <https://doi.org/10.6007/IJARBS/v11-i11/11278>

- Salma, U. (2021). Macroeconomic determinants of inflation in Bangladesh. *European Journal of Business and Management Research*, 6(5), 264–267. <https://doi.org/10.24018/ejbmr.2021.6.5.1116>
- Solomon, M. (2016). Determinants of price dynamics in Ethiopia 1. *Ethiopian Journal of Economics*, 22, 109–130.
- Wudu Abate, T. (2020). Macro-economic determinants of recent inflation in Ethiopia. *Journal of World Economic Research*, 9(2), 136. <https://doi.org/10.11648/j.jwer.20200902.17>