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The Galloping Inflation in Ethiopia: A Cautionary Tale for Aspiring 'Developmental States' in Africa

Alemayehu Geda (Addis Ababa University and IAES)
Kibrom Tafere (PhD Candidate, Cornel University and IAES)

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Institute of African Economic Studies.
P.o.Box. 100616
Addis Ababa, Ethiopia
Phone: 251-11-553-7181
Fax: 251-11-553-7181
Email: info@iaesafrica.com
Web: http://www.iaesafrica.com/

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Abstract

This study aims at understanding the forces behind the current inflationary experience in Ethiopia. To this end a synthesis monetarist and structuralist model of inflation is developed. The model is estimated using vector autoregressive (VAR) formulation for the period 1994/95 to 2007/08 using quarterly data. The determinants of inflation are found to differ for food and non-food sectors and in the short and long run as well. The most important forces behind food inflation in the long run are a sharp rise in food demand triggered by an alarming rise in money supply/credit expansion, inflation expectation and international food price hike. The long run determinants of non-food inflation, on the other hand, are money supply, interest rate and inflation expectations. In the short run model, wages, international prices, exchange rates and constraints in food supply are found to be prime sources of inflation. We also found an evidence of cost marking-up as another possible cause of inflation in the short run. This suggests the presence of strong monopoly power or marketing mal-function in price formation. To contain inflation, therefore, the government needs to exercise conservative fiscal and monetary policies. Inflation expectations need to be tackled by credible government policies to change public opinion and tackling marketing mal-function. It is important to consider targeting of macroeconomic variables and adhere to announced targets. The latter requires having sustainable domestic debt, minimizing deficit financing by being less ambitious as a 'developmental state' that is heavily engaging in the economy. Food import is also an important short run solution.

Key Word: Inflation, Macro Policy, Monetary and Fiscal Policy, Africa.

Corresponding Author: Alemayehu Geda at AG112526@gmail.com or AG@iaesafrica.com

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I. Introduction

Ethiopia's growth in the last decade, and in particular in the second half of the decade, has been appreciated by international observers, including the continental economic institutions such as the Economic Commission for Africa (ECA, 2007) and also '*The Economist' magazine in its July 2008 issue*. The government has began to openly argue that its success is fundamentally related to its rejection of the 'neo-liberal' economic policy which is usually referred as the 'Washington Consensus' or Structural Adjustment Policies (SAPs). The government also attributes this growth success to its embrace of the idea of a 'developmental state', the latter usually referring to a policy of public sector intervention in the economy both through policy and active investment. Unfortunately this 'success' is being accompanied by an alarming level of inflation. The official headline inflation for the month of August, 2008 stands at about 33% with food inflation being about 49%. In fact our own estimation puts this rate well above this figure. This is a huge macroeconomic shock given the price history of the country where inflation for the last five decades and until the year 2003, was below 5% per annum. What is more alarming is that the poor is the major victim of this recent inflationary phenomenon (Abebe, 2007).

It seems that the failure of World Bank and IMF sponsored macro policies such as SAPs in much of Africa seems to create a macro policy vacuum in the continent. We note the continuation of this 'Washington Consensus' based macro policy engagements of the International Financial Institutions (IFIs) with African countries through 'the poverty reduction strategy program (PRSPs); as well as through the UN's 'Millennium Development Goals (MDGs)'. In terms of macro policy, however, these latter two policy frameworks are the continuation of the SAPs because the essential ingredients of the macro policy prescriptions remained unchanged in the World Bank and IMF supported PRSPs and the UN's MDGs (see McKinley 2003 however). In this policy vacuum there is a danger of recklessly dropping some important policies in the IFI's macro policy framework. One such policy is prudent fiscal and monetary policy which is central to macroeconomic stability in the context of which growth and poverty reduction policies need to be framed. Lack of sensible alternative macro policy framework for poverty reduction[1] that could replace the SAPs could tempt governments (especially those that aspire to be 'developmental states') to engage in large public and private sector spending which is invariably financed by monetization. This leads to inflationary situation and exchange rate volatility which are anti-growth and poverty reduction. In this article we unraveled such phenomenon in Ethiopia. The issue deserves the attention of not only the government of Ethiopia but also other governments of Africa as well as international and regional institutions responsible for development and poverty reduction policies.

[1] The UNDP's Bureau for Development Policy under the directorship of Terry McKinley has been attempting to develop such alternative macro policy framework in Asian countries. It has also attempted to do the same in Africa making Zambia its pilot country (see McKinley 2003; Chisala *et al* 2006).

The rest of this study is organized as follows. In the next section we will briefly offer the macroeconomic environment in the last decade with the aim of contextualizing the current galloping inflation in the country. In section three we have modeled the possible source of inflation in Ethiopia. In the same section we have also estimated the model to offer a robust empirical basis for our argument. Section four will conclude the paper.

II. The Recent Macroeconomic Environment

In Ethiopia, inflation was not generally an issue before the year 2002/03. Before this period the government exercised tight fiscal and monetary policies which were institutional inheritance from previous regimes (see Alemayehu 2008). However, in the post 2002/03 period inflation began to appear as a major problem following the government's move towards less conservative monetary and fiscal policy and state activism as a developmental state in the economy breaking the institutional legacy of fiscal and monetary policy conservatism. During the same period, the economy is reported to have recorded a fast growth, export receipts have increased substantially and domestic tax revenue has increased. Government expenditure has also grown considerably. There has also been fast increase in money supply mainly as a result of growth in fiscal deficits. Studying the linkage between price developments and various macroeconomic variables will, therefore, enable us to understand the causes of the current inflation in Ethiopia.

The Ethiopian economy has been characterized by erratic nature of output growth as the economy has been highly dependent on vagaries of nature and external shocks (see Alemayehu 2008). Since agriculture accounted for over 50 percent of GDP for most of the recent past, whenever weather conditions turned to be unfavorable, agricultural production contracted and GDP followed suit. With this systematic relationship between GDP (output) and rainfall there followed a systematic price trend. Prices followed the inverse of output growth trend. During years of good rainfall as output rises prices often dropped considerably. Even within any particular year prices have been lower during harvest periods.

This co-movement appeared to have reversed in the post 2002/03 period. From 2003/04 onwards, output is on average reported to have grown by 11.8 percent per annum. Despite this reported significant increase in output (especially in agriculture) prices continued to rise. Thus, during the same period the general price level has recorded an average annual rise of 12 percent. The 2007/08 budget year alone witnessed prices jump by 18.4 percent, the food inflation being 49 percent in August 2008 (NBE, 2006/07; MOFED, 2007/08; CSA, 2008). This co-movement that contradicts the hither too pattern of negative co-movement in price and output growth has puzzled many and led many more to suspect the credibility of the stories of fast economic growth (and hence the official data) over the past five years.

Food expenditures constitute a lion's share of household expenditures. In 2006, for example, the share of food expenditures in total expenditures was 57 percent. Thus, the effect of rise in food price on general CPI and social welfare is significant. During the 1997/98-2006/07 period, the average annual rate of food price inflation was 7.4 percent, while non-food inflation stood at 4 percent. Over the 2002/03-2006/07 period, food

inflation more than doubled (at 15.2 percent) and non-food inflation averaged 6.4 percent. Two different forces may have played role in the fast increase of food prices: first a decline in supply of output by farmers following the improvement in access to credit and market information which has reduced the need to take whatever 'surplus' output they have to the market place immediately after harvesting. Second, the fall in supply of cereals as some donors shifted away from food aid in kind to cash aid may have led to a decrease in supply of food[2] (see also Mulat *et. al*. 2007). The fast increase in non-food prices could be attributed to strong demand resulting from huge public and private investments, fast growth in domestic credit, which is invariably informed by the government posture of a 'developmental state', and upward revisions in administered prices, especially of fuel. Since the onset of inflation in 2002/03, the gap between CPI and Food Index has widened owing to higher food inflation than non-food inflation (see Table 2.1).

Among food items, cereals and meat registered the highest increase in price with the price of cereals and meat soaring by 20 and 15 percent per annum in the last five years (see Table 2.1). The sharp rise in food price, especially the price of cereals, has placed an enormous pressure on consumers, especially the poor and workers in the formal sector, whose wage is fixed in nominal terms.

Table 2.1: Inflation rates during the 1997/98-2006/07 period.

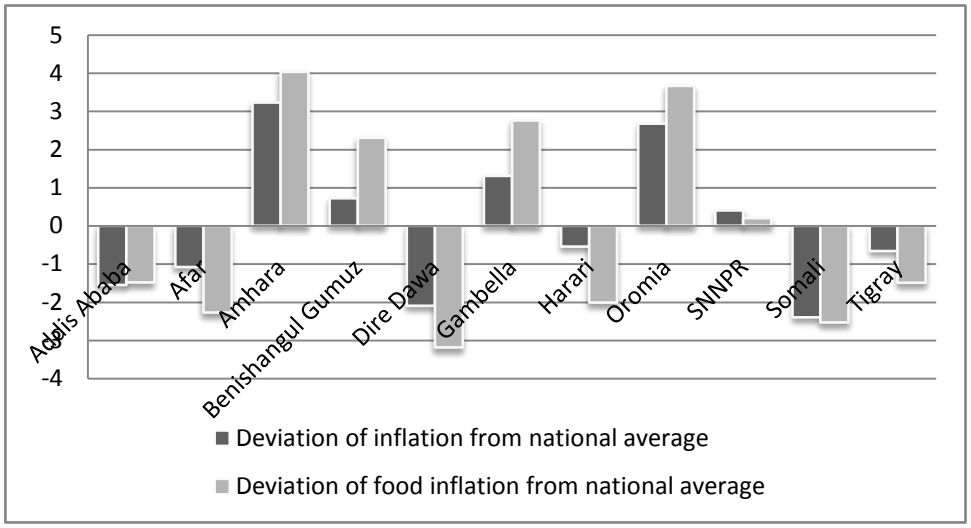
Item	Average annual Inflation (%) (1997/98-2006/07)	Average annual Inflation (%) (2002/03-2006/07)	Inflation (%) (August 2008)
CPI	6.2	12.1	33
Food Price Index	7.4	15.4	49
Cereals Index	10.2	20.5	
Meat Index	11.3	15.2	
Non-Food Price Index	4.0	6.4	

Source: NBE (2006/07) and own computation.

The soaring inflation of the 2002/03-2006/07 period has hit every corner of the country. However, the magnitude of the rise in prices varies across regions. What are called 'Amhara' and 'Oromiya' regions saw the highest average annual increase in price of 13.7 percent and 13.1 percent respectively; while Somali and Dire Dawa regions have the lowest inflation at 8.1 and 8.4 percent, significantly less than the national average of 10.5 percent for the period (see Figure 2.2 below).

[2] For example, the amount of food aid (grains) has fallen from over 14 million quintals to just over 2.8 million quintals between 2002/03 and 2006/07 (Disaster Preparedness and Prevention Authority, DPPA, 2008).

Figure 2.2: Inflation by region (2002/03-2006/07)



Source: NBE (2006/07) and own computation.

The relatively lower inflation in areas not very known for agricultural production (especially crop production) could be attributed to increase in supply to these areas due to improved infrastructure (road network, information communication technologies etc). Mulat *et al* (2007)[3] also offer supporting evidence to this argument. They indicate that there has been a tendency for prices to converge recently. Smaller markets are growing into independent big markets attracting supplies from adjacent districts and regions. The regional distribution of food inflation took the same pattern as the general inflation with the so called 'Amhara' (17.2 percent) and 'Oromiya' (16.8 percent) regions suffering the highest increase. Dire Dawa and Somali region recorded the lowest inflation, both hardly major food producing areas. Thus, in understanding inflation it is interesting to see condition of food supply.

The marketed surplus (supply) of food depends mainly on three factors: domestic marketed surplus which is the difference of total grain production and on farm consumption, food aid and the net of commercial food exports and imports. In relation to food aid what matters to the domestic price of food is not the food aid that comes into the country. Rather it is the distributed amount of food aid which has a direct effect on food prices. Between 2003/04 and 2007/08 the amount of food aid domestically distributed by NGOs and DPPA in constant 2000 prices has on average fallen by over 35 percent per annum, while food import has remained reasonably stable over the same period. Thus, this decline in food aid might have an impact on current inflation. However this effect may not be strong since the share of food aid in total food supply distributed, according to DPPA's data, is about 5% for the last 10 years.

[3] Mulat Demeke, Atlaw Alemu, Bilisuma Bushie, Saba Yifredew and Tadele Ferede, 2007, "Exploring Demand and Supply Factors Behind the New Developments in Grain Prices in Ethiopia: Key Issues and Hypothesis," a paper done for DFID-Ethiopia.

Another important dimension of the current inflation is the huge investment in the last decade which is not warranted by the level of domestic saving and food suppy. The average gross domestic saving and gross investment as percentages of GDP for the 1997/98-2006/07 period stand at 6.6 and 24 percent respectively, leading to a wider saving gap. In the last five years of the period under consideration, average domestic saving has fallen to 4.2 percent of GDP but average investment has increased to 23.9 percent of GDP (MoFED, 2007/08). This significant internal gap has its equivalent external gap (or balance of payment deficit) counterpart. Such gap has implication to inflation depending on the nature of financing this deficit. During the 1997/98-2006/07 period, private saving has been significantly higher than private investment. It has registered continuous and fast growth, except in 2001/02 and 2003/04, averaging 20 percent per annum. As opposed to developments in the private sector, fiscal deficit (the difference between government investment and government saving), grew by 16.3 percent per annum over the same period (MoFED, 2007/08). This government deficit has led to a widening national deficit, despite the surplus of private saving over private investment.

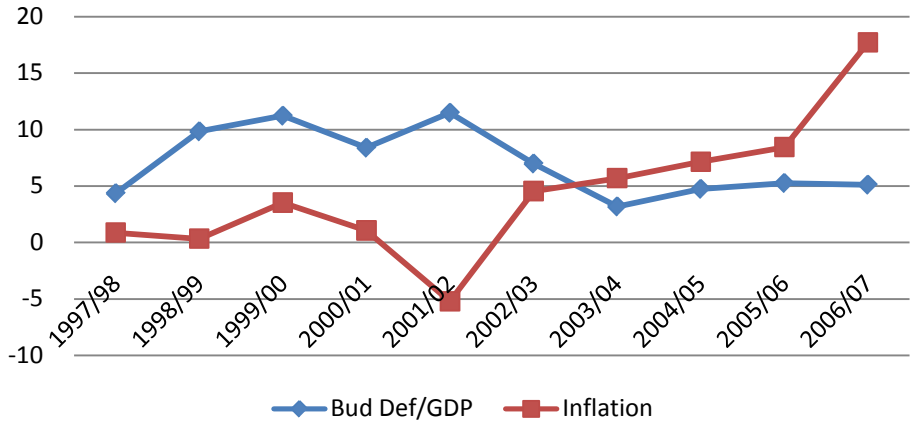
On average, during the 1997/98-2006/07 period, 61.7 percent of the total government spending has been on current expenditure the rest being on capital expenditure. This large size of current expenditure may have impeded growth by reducing the resources available for capital expenditure. Defense expenditure, poverty targeted expenditure (which includes education, health and agriculture) and expenditure on interest payment constitute the most important components of current expenditure with 27.9, 30.7 and 9.1 percent respectively. Over 55 percent of the interest obligation has been on domestic borrowing. Over the ten years period, current expenditure has grown steadily at a rate of 12 percent per annum.

Though its share in government expenditure for the 1997/98-2006/07 period was, on average, less than that of current expenditure, capital expenditure has grown at a higher rate (21 percent per annum). The share of capital expenditure has overtaken that of current expenditure in 2006/07 reaching 52 percent. Growth in capital expenditure is often considered as a welcome development. Yet capital projects do not go into operation within the period in which expenditures are made and usually have long gestation period to bear fruit. Thus, at least for some time to come the money injected into the economy for financing such projects might lead to inflationary pressure. The magnitude of such inflationary pressure, however, depends on the source of finance used and the food supply elasticity in the country.

The government has financed its capital expenditure from three sources. About 66 percent of capital expenditures were financed from central treasury while the rest from external assistance (15 percent) and external loans (19 percent) (MoFED, 2007/08). The lion's share of the means of capital expenditure financing coming from central treasury indicates that domestic money creation might have played significant role in the current inflationary process. Between 2002/03 and 2006/07, the National Bank of Ethiopia's (NBE) direct advance to the government has almost quadrupled while there has been no major change in central government deposit with NBE or the foreign assets of the NBE (NBE, 2006/07), despite statutory limits to this.

In general in the last 10 years, government deficit as percentage of GDP has averaged about 10 percent. To finance this budget deficit, the government resorted to external and domestic borrowing as well as privatization of public enterprises. For the 1997/98-2006/07 period external borrowing and domestic borrowing each accounted for around half of the total deficit with the balance slightly swinging towards domestic borrowing, while a very small share (4 percent) is taken up by receipts from privatization proceeds. In the post 2002/03 period, the means of financing the budget deficit has, shifted from external to domestic bank and non-bank sources, especially following the 2005 election where donors protested over the election by reducing the amount of aid and latter changing modality of its delivery from budget support to provision of basic services (PBS). This has led to the monetization of the deficits. The use of domestic means of deficit financing as percentage of budget deficit has grown from 34.4 percent in 2002/03 to 63.8 percent in 2006/07. The budget deficit and the means of financing it thereof might have played a major role in the current inflationary process. As can be seen from Figure 2.3, before 2002/03, budget deficits (including grants) were not associated with inflation mainly due to the conservative monetary policy stance of the government. After 2002/03 however, any given level of budget deficit appear to have been associated with ever growing inflation. Domestic borrowing reached over Birr 6 billion (the net stock of government debt being 42.3 billion birr which doubled since 2002/03) in 2006/07, with over 70 percent coming from the banking system (see NBE, 2006/07; MoFED, 2007/08).

Figure 2.3: Trends of Inflation and Budget deficit



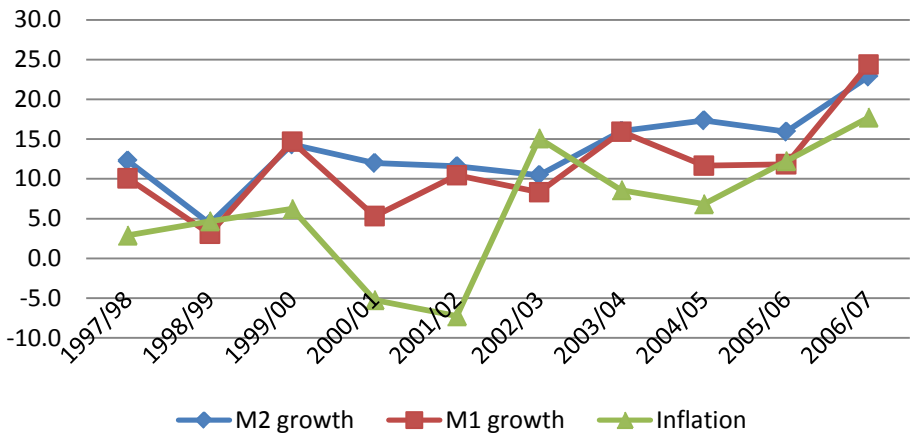
Source: NBE (2006/07)

The large budget deficit noted above and the resulting monetization of the deficit has a direct bearing on the recent rise in money supply. Between 2002/03 and 2006/07 money supply (M2)[4] given in official sources has on average grown by over 15.9 percent. GDP has grown by 9 percent over the same period (NBE, 2006/07 and MoFED, 2007/08). An

[4] Official data for M2 doesn't include credit by microfinance institutions as well as credit by the Development Bank of Ethiopia (DBE). In computing money supply (M2) growth we have included the credit by microfinance institutions and DBE.

important point worth mentioning in relation to money supply growth is the role of credit by microfinance institutions. Over the 2002/03 -2006/07 period, the outstanding credit by microfinance institutions has grown on average by over 48 percent annually, from Birr 527.5 million in 2002/03 to Birr 2.7 billion in 2006/07 (NBE, 2006/07). Similarly the credit by Development Bank of Ethiopia (DBE) is quite significant. The outstanding credit by DBE in the third quarter of 2007/08 stands at Birr 6.2 billion. Excluding the whole of credit by microfinance institutions and DBE from the money supply, thus, may lead to a completely wrong conclusion about the role of money supply in the current inflationary trend in the country. (When this is taken onboard money supply growth between 2002/03 and 2006/07 by a staggering 24 percent). Be that as it may, assuming money is held only for transactions purposes and the velocity of money is roughly constant, the growth rate of money supply (the 15.9 percent) should be equal to the growth rate of real GDP to leave the price level intact. Before 2002/03 velocity of money on average was falling; after 2002/03, this trend has been reversed and it has continuously grown. In the face of rising velocity of money, to keep the price level stable the corresponding monetary growth should have been slower. However, this was not the case. Thus, the fast increase in the growth rates of M1 and M2 from 11.8 percent and 15.3 percent respectively in 2005/06 to 24.4 percent and 22.2 percent respectively in 2006/07 was accompanied by faster increase in the growth rate of inflation (see Figure 3).

Figure 3: Evolution of money supply and inflation



Source: NBE (2007/08) and own computation.

Finally, It is imperative to note that before 2004/05 the government ran an IMF (and also World Bank) programs (such as Structural Adjustment Program (SAP), Enhanced Structural Adjustment Facility (ESAF) and Poverty Reduction and Growth Facility (PRGF)). During this period, the IMF advised the government to follow strict fiscal policies[5] which doesn't seem to be adhered to lately. Sooner than these programs were terminated in 2004/05 did the

[5] For detailed discussion of the recommendations of IMF to the government of Ethiopia, see Joseph E. Stiglitz, 2001, *Globalization and Its Discontents*, W. W. Norton & Company, Inc., New York.

government embarked on the less stringent fiscal and monetary policy exercise noted above.

In sum, from the foregoing discussion we learn that modeling inflation in Ethiopia needs to take all these developments in the macro economy into account. We have attempted to do that in the next section.

III. Modeling the Source of Inflation in Ethiopia

3.1 The Theoretical Model

Several cross-country and country specific studies have been conducted to find out the determinants of inflation in developing countries. They have found mixed results. External factors such as openness, exchange rate liberalization and devaluations are found to be important in some of these studies [see Romer (1993), Terra (1998), Chhibber (1991) and Isakova (2007), among others]. Monetary developments also appear to be among the key determinants of the inflationary process in Africa. Edwards and Tabellini (1990), Chhibber (1991), and Barnichon and Peiris (2007) show that huge fiscal deficits led to inflationary pressures in Africa via monetization of the deficits and/or devaluation of domestic currencies. Isakova (2007) also indicates that money supply played role in inflationary process of Central Asia. But its effect was not direct, rather through money supply adjustments to interest rate variations by authorities.

Other key determinants of inflation in developing countries include output gap [Isakova (2007), Barnichon and Peiris (2007)], international price movements and nominal exchange rate (Isakova, 2007) and political instability and political polarization (Edwards and Tabellini, 1990). In African case, however, most studies point out that the most important determinant of inflation remains monetary growth. Despite their importance in determining the inflationary processes in Africa, many argue targeting monetary aggregates to control inflation often doesn't produce success. Masson, Savastano and Sharma (1997), Özdemir, Kadioğlu and Yilmaz, (2000) and Barnichon and Peiris (2007) indicate that inflation targeting can be more effective in controlling inflation in developing countries than monetary and/or exchange rate targeting if there is high degree of monetary policy independence, freedom of fiscal dominance and absence of any firm commitment to particular levels of variables.

In addition to such cross-country studies, most country specific inflation studies in Africa found that money supply is the prime source of inflation. Laryea and Sumaila (2001) found that in the short run output and monetary factors stand as the main factors behind Tanzanian inflation. In the long run, in addition to output and monetary factors parallel market exchange rate was also found to be significant. Akinboade, Niedermeier and Siebrits (*n.d.*) indicate that the short-run determinants of inflation in South Africa are money supply, inflation expectation and structural factors (labor costs). Similarly, monetary factors stand as the prime source of inflation in Ghana in Chhibber and Shafik (1990). Simwaka (*n.d.*) finds that exchange rate movements had strong effects in Malawi's inflation followed by monetary growth and supply constraints, especially of food. Ubide (1997) also found that the money supply stand out as the most important determinant of inflation together with exchange rate movements and agricultural shocks in Mozambique.

Another set of country specific studies in Africa find structural factors as the main forces behind inflation. According to these studies money supply and exchange rate also affect inflation, but less so. Dlamani, Dlamani and Nxumalo (2001) studied the determinants of inflation in Swaziland and found that exchange rate, foreign prices and cost mark-ups are the main causes of inflation. They found that money supply was not an important determinant of inflation in Swaziland since the country is a member of a common monetary area[6] and has no direct control over money supply. Nell (2000) also found the South African inflation after 1983 has largely been cost-push as substantial capital outflows, the decline of the mining sector and the undiversified export sector exposed the economy to imported inflation. Ocran (*n.d.*) found that the long-run determinants of inflation in Ghana are exchange rate, foreign prices and terms of trade. Excess supply of money was found to be insignificant. In the short-run the determinants are inflation inertia, money growth, changes in Treasury bill rates, and exchange rate, however. Similarly, earlier literature noted these factors as important. Cooper (1971), Krugman and Taylor (1978) and Taylor (1979, 1981) cited in Yiheyis (2006) argue that devaluation serves as a cost push factor in inflationary process via three routes: cost of imports, labor cost and the cost of working capital. In the presence of working capital constrains, the effect of devaluation is severe in countries where production involves significant use of imported raw materials and wage is indexed.

The approach used in this study hypothesizes that there are three factors that determine the price level in Ethiopia: monetary factors, cost push factors and supply factors. The three factors are not independent of one another. Rise in the price level due to (say) rise in raw materials cost or exchange rate depreciation may have budgetary implications. High budget deficits may, in turn, lead the government into monetization of the deficits and hence growth of money supply. This, then, may lead to another round of price hikes. Associated with such price rises is the possibility of price-price and wage-price spirals as workers demand higher nominal wage rates to mitigate the rise in price. On the other hand, contractionary monetary policies may lead to contraction of investment which may have consequences for the supply of real output. This, in turn, brings about inflation pressure in the Economy.

The model we used is, thus, a synthesis of monetarist, cost push/structural models [see Chhibber and Shafik (1990), Kenny and McGettigan (1996), Ubide (1997) and Callen and Chang (1999)]. Such an approach encapsulates standard (classical/neoclassical) approaches and a set of other pragmatic structural approaches that takes on board the likely effects of factors peculiar to the economy and enables better understand the inflationary process in Ethiopia.

We assume a segmented goods market. There is a tradable sector comprising goods that are either traded or potentially tradable at price P_1. There is also a non-tradable sector with price P_2. The third market is one in which goods are offered at subsidized price P_3 (eg. fuel, transport, and utilities such as electricity, water, and telephone). We call this sector an administered sector. Noting Ethiopia is a small open economy, purchasing power parity

[6] The other members of the common monetary area are South Africa, Namibia and Lesotho.

(PPP) is assumed to hold in its tradable sector. The tradable price is, thus, defined as the product of foreign price and exchange rate, and given in log as[7].

$$p_1 = e + p_f \quad (1)$$

Where the lower case variables, p_1, e and p_f are the logs of P_1, E (nominal exchange rate) and P_f (foreign price) .

For various reasons (such as lower quality of the domestically consumed tradable items such as coffee, oil seeds and hides and skins, and the profit margin of intermediaries etc.), there has been gap between the domestic prices of Ethiopian tradable items (especially export items) and their foreign prices, rendering the assumption of PPP unrealistic. However, recent evidence suggests that the gap has continuously narrowed[8]. The tradable sector inflation can, thus, be specified as:

$$\Delta p_1 = \Delta e + \Delta p_f \quad (2)$$

In the non-tradable sector price is split into two: food price and non-food price. The non-tradable inflation is computed as a weighted sum of food inflation and non-food inflation. It is assumed that the price setting processes in the two segments of the non-tradable sector are different as discussed in detail below.

Where the level of income is very low, like in Ethiopia, the share of food expenditure in total household expenditure tends to be very high[9]. With rise in income, the share of food expenditure in total expenditure is, on average, likely to rise in the short and medium run, though the share is believed to fall in the long run following the Engel law. Thus, faster growth of income (GDP) due to deliberate monetary and fiscal expansionary measures or unanticipated positive supply shocks may induce greater increase in demand for food (see Kalecki, 1963). If the price level is to remain stable, the supply of food must grow at a rate faster than the income growth rate since demand for food grows at a higher rate relative to income in a familiar Kaleckian way. However, as the economy experiences fast increase in income, if the supply of food falls short of the fast growing demand, it may result in rising prices of food which may easily and significantly transmit into general inflation. Recent developments in Ethiopia seem to suggest that price movements are influenced not only by supply factors, as the reported fast growth of agricultural products failed to lower food prices of late, but also by demand factors.

Thus, food price developments could be considered as an outcome of the interaction of supply of and demand for food in a competitive market setup. The supply of food is assumed to be exogenously determined by weather condition, international prices and institutional factors that may included the land tenure system and political stability[10]. The

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[7] Here, the Ethiopian exchange rate is defined as units of Birr per Dollar. Until very recently, the parallel market premium remained very low, about 4 percent, and stable. Thus, no distinction between parallel and official rate will be considered in this study.

[8] This can be seen, for example, by comparing the CSA figure for domestic price of coffee and the international price of coffee in IMF's IFS database.

[9] As noted before, in 2006/07 the share of food expenditure in total expenditure stands at 57 percent.

[10] This assumption is in line with Kalecki (1963), who holds that the supply of food in developing countries is constrained by institutional factors. He suggests that agrarian reform is required to achieve fast growth of income. He seems to suggest that the supply of agricultural products (necessities) is roughly constant in the short run as the reforms indicated in his writings are likely to take longer time to materialize.

total supply is defined as the sum of total cereal output, imports of food and food aid. Total cereals output is composed of the on farm consumption of farmers and marketed surplus. Imported food and food aid similarly have a bearing on food price determination. Their size has often been considerable and served ease the domestic demand. The demand for food can be split into two parts. First, there is autonomous part which is necessary for survival of the producers (farmers). Second, there is a section of food demand that depends on the level of income (see Alemayehu and Huizinga, 2006).

The supply of food is given as:

$$P_2^f S_f = P_2^f Y_c + P_f^f E M_f + P_2^f A \quad (3)$$

Where, $P_2^f S_f$ is the value of food supply, P_2^f is domestic price of food , Y_c is the quantity of cereals production, P_f^f is foreign price of imported food, M_f is the quantity of imports of food and *A* is the quantity of food aid.

It is hypothesized that PPP also holds in the case food imports. Thus the domestic price of imported food reflects movements in international food price and exchange rate. The equation that relates the domestic price of food to foreign price of food is, thus, specified as:

$$P_2^f = P_f^f E \quad (4)$$

Substituting (4) in (3) and rewriting (3) in real terms gives:

$$S_f = Y_c + M_f + A \quad (3a)$$

Equation (3a) summarizes the exogenous quantity of food supply.

The demand for food is defined as:

$$C_f = \bar{C}_f + \mu_1 Y - \mu_2 P_2^f + \mu_3 ES, \qquad \mu_1,\ \mu_2,\ \mu_3 > 0 \quad (5)$$

where, C_f is real food consumption, $\bar{C}_f$ is autonomous real food consumption, Y is real income, ES is excess money supply defined as the difference between money supply and money demand, μ_1 is marginal propensity to consume food, μ_2 and μ_3 measure the change in food demand resulting from a unit change in domestic food CPI and excess money supply respectively.

The money demand equation is specified as

$$\frac{Md}{P} = \sigma_1 Y - \sigma_2 i - \sigma_3 \Pi^e \qquad \sigma_1,\ \sigma_2,\ \sigma_3\ > 0 \quad (6)$$

Where $\frac{Md}{P}$ is the demand for real money balances, Y is real income (GDP), i is interest rate and Π^e is expected inflation.

The food demand equation can, thus, be written as

$$C_f = \bar{C}_f + \mu_1 Y - \mu_2 P_2^f + \mu_3 (\frac{M}{P} - \sigma_1 Y + \sigma_2 i + \sigma_3 \Pi^e) \quad (5a)$$

Where M is stock of money supply and P is domestic price level (CPI).

Collecting like terms together, the (5a) will be

$$C_f = \bar{C}_f + (\mu_1 - \mu_3\sigma_1)Y - \mu_2 P_2^f + \mu_3(\frac{M}{P} + \sigma_2 i + \sigma_3 \Pi^e) \quad (5b)$$

In order to avoid the complications that may result from non-linear relationships between food price and the components of demand for and supply of food, the food demand and supply equations could be re-specified in logarithm form.

$$s_f = y_c + m_f + a \quad (3b)$$

$$c_f = \bar{c}_f + (\mu_1 - \mu_3\sigma_1)y - \mu_2 p_2^f + \mu_3(m - p + \sigma_2 i + \sigma_3 \pi^e) \quad (5c)$$

The small case variables in (3b) and (5c) (except interest rate[11]) are the logarithms of their upper case counterparts in (3a) and (5b).

Food price is determined by the interaction of supply of and demand for food. Since food supply is assumed exogenous, food price movements adjust any disequilibrium in the market for food. Thus, equating equations (3b) and (5c) gives,

$$p_2^f = \frac{1}{\mu_2}\left[(\mu_1 - \mu_3\sigma_1)y + \mu_3(m - p + \sigma_2 i + \sigma_3 \pi^e) - m_f - a - (y_c - \bar{c}_f)\right] \quad (7)$$

Since $\frac{1}{\mu_2} > 0$, equation (7) indicates real income and excess money supply are positively related to domestic price of food while food imports, food aid and marketed surplus $(y_c - \bar{c}_f)$ are negatively related to domestic price of food.

The inflation equation for the food, one of the non-tradable sub-sector, can easily be found by taking the first difference of equation (7).

$$\Delta p_2^f = \frac{1}{\mu_2}\left[(\mu_1 - \mu_3\sigma_1)\Delta y + \mu_3(\Delta m - \Delta p + \sigma_2 \Delta i + \sigma_3 \Delta \pi^e) - \Delta m_f - \Delta a - \Delta(y_c - cf)\right] \quad (7a)$$

Where is Δ the first difference operator.

The non-food price developments may have been driven mainly by strong growth in demand following fast growth in income. Associated with this is the resulting growth of market power (or influence) of producers (or traders) reflected in higher profit margins as supply may not expand at the rate of growth of demand in the short run. The non-food, the other non-tradable sub sector,[12] price is, therefore, assumed to be determined by markup over cost. The Ethiopian manufacturing industry is characterized by labor intensity and high use of imports. Likewise, the service sector is the second largest employer of labor force. Thus, the production process is assumed to involve the use of labor and imported raw materials[13].

$$P_2^n = (1 + \beta)(EP_f^n)^{\alpha_1} W^{\alpha_2} \quad (8)$$

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[11] In many studies interest rates come into estimation models in their level. This is justified by the fact that interest rates are often very small numbers (less than one) and their logarithms are, thus, negative.

[12] This sub sector includes domestic manufacturing and service sectors.

[13] Any price movements of domestically produced inputs used by the sub sector are assumed to be captured by the food, non-tradable, inflation equation.

P_2^n is domestic non-food non-tradable price, *E* is official exchange rate, P_f^n is foreign non-food price, β is the markup factor and *W* is unit labor cost. Taking the logarithm of equation (8) gives,

$$p_2^n = \theta + \alpha_1\left(e + p_f^n\right) + \alpha_2 w \qquad (8a)$$

Where θ is the logarithm of $(1+\beta)$ and the small case variables represent the logarithms of the upper case variables in (8). The non-food non tradable inflation can, thus, be stated as:

$$\Delta p_2^n = \Delta\theta + \alpha_1\left(\Delta e + \Delta p_f^n\right) + \alpha_2 \Delta w \qquad (8b)$$

Equation (8b) indicates that non-food non-tradable inflation results from increase in the markup factor, exchange rate depreciation, increase in foreign price of non-food items, and rise in unit wage cost.

Variations in θ can only drive from variations in the markup factor β. The markup (β) is a function of the degree of monopoly of producers/traders along Kaleckian line[14]. The monopoly power, in turn, is assumed to be derived from excess demand (*ED*) in the economy. Thus, variation in theta ($\Delta\theta$) is considered to be a function of variation in excess demand. It is assumed that excess demand[15] in the goods market might have resulted from excess supply in the money market. This is because, in the absence of well functioning financial system, such as the case in Ethiopia, with limited financial assets, there is strong substitution between money and goods than money and other financial assets (see Chhibber et al, 1989).

$$\Delta\theta = \gamma \Delta ED \qquad (9)$$

$$ED = \emptyset\left[\log\left(\frac{M}{P}\right) - log\left(\frac{Md}{P}\right)\right] \qquad (10)$$

By substitution (9) can be rewritten as:

$$\Delta\theta = \gamma\emptyset\left[\Delta\log\left(\frac{M}{P}\right) - \Delta log\left(\frac{Md}{P}\right)\right] \qquad (9a)$$

Where $\emptyset$ measures the degree of interaction of the money market and the goods market, and the other variables are as specified above. Assuming a standard money demand function as in (6), (9a) can be rewritten as

$$\Delta\theta = \gamma\emptyset(\Delta m - \Delta p - \sigma_1\Delta y + \sigma_2\Delta i + \sigma_3\Delta\pi^e) \qquad (9b)$$

Equation (9a) indicates that change in excess demand in the economy depends on the degree to which excess supply in the money market translates into excess demand in the goods market ($\emptyset$) and the growth differential of money supply and money demand.

[14] Fitzgerald (1993) notes that in Kalecki's model industrial prices are determined as unit labor costs with fixed mark-up derived from the degree of monopoly (see also Chilosi, 1999). Sawyer (1985) cited in Fitzgerald (1993) notes that in his early works Kalecki explicitly indicates the applicability of the pricing rule in developing countries.

[15] The effect of budget deficit on inflation is captured by the excess demand equation. Expansionary fiscal policies of the government lead to huge budget deficit, which would compel the government to monetize the deficits unless it decides to scale down its expenditures. Moreover, it is hypothesized that the degree of monopoly of producers or traders depends on the size of excess demand.

Substituting equation (9b) in equation (8b) we come up with a final equation for non-food (non-tradable sector) inflation given by (10).

$$\Delta p_2^n = \gamma\emptyset(\Delta m - \Delta p - \sigma_1\Delta y + \sigma_2\Delta i + \sigma_3\Delta\pi^e) + \alpha_1\left(\Delta e + \Delta p_f^n\right) + \alpha_2\Delta w \tag{10}$$

The total non-tradable sector inflation equation is stated as the weighted sum of food and non-food inflation within the non-tradable sector, given by (11).

$$\Delta p_2 = \delta_1\Delta p_2^f + \delta_2\Delta p_2^n \qquad \text{where the weights } \delta_1 + \delta_2 = 1 \tag{11}$$

Thus, substituting (7a) and (8c), equation (11) can be rewritten as:

$$\Delta p_2 = \frac{\delta_1}{\mu_2}\left[(\mu_1 - \mu_3\sigma_1)\Delta y + \mu_3(\Delta m - \Delta p + \sigma_2\Delta i + \sigma_3\Delta\pi^e) - \Delta m_f - \Delta a - \Delta(y_c - \bar{c}_f)\right] + \delta_2\left[\gamma\emptyset(\Delta m - \Delta p - \sigma_1\Delta y + \sigma_2\Delta i + \sigma_3\Delta\pi^e) + \alpha_1\left(\Delta e + \Delta p_f^n\right) + \alpha_2\Delta w\right] \tag{11a}$$

The third category of goods (administered goods) refers to those goods whose prices do not automatically adjust as market conditions change. Rather, the revision of the prices of such goods is done once in a while by the government. Thus, the price of administered goods is assumed exogenously determined.

Thus, the general price inflation is a weighted average of the tradable (exposed) sector inflation, the non-tradable (sheltered) sector inflation and the administered sector inflation as given by (12).

$$\Delta p = \varphi_1\Delta p_1 + \varphi_2\Delta p_2 + (1 - \varphi_1 - \varphi_2)\Delta p_3 \tag{12}$$

Combining equations (2) and (11a) and adding the exogenously determined price of administered items, equation (12) becomes:

$$\Delta p = \varphi_1\left(\Delta e + \Delta p_f\right) + \varphi_2\frac{\delta_1}{\mu_2}\left[(\mu_1 - \mu_3\sigma_1)\Delta y + \mu_3(\Delta m - \Delta p + \sigma_2\Delta i + \sigma_3\Delta\pi^e) - \Delta m_f - \Delta a - \Delta(y_c - \bar{c}_f)\right] + \varphi_2\delta_2\left[\gamma\emptyset(\Delta m - \Delta p - \sigma_1\Delta y + \sigma_2\Delta i + \sigma_3\Delta\pi^e) + \alpha_1\left(\Delta e + \Delta p_f^n\right) + \alpha_2\Delta w\right] + (1 - \varphi_1 - \varphi_2)\Delta p_3 \tag{12a}$$

Collecting like terms in (12a) together:

$$\Delta p = (\varphi_1 + \varphi_2\delta_2\alpha_1)\Delta e + \varphi_1\Delta p_f + \varphi_2\delta_2\alpha_1\Delta p_f^n + \varphi_2\frac{\delta_1}{\mu_2}\left[(\mu_1 - \mu_3\sigma_1)\Delta y - \Delta m_f - \Delta a - \Delta(y_c - \bar{c}_f)\right] + \left(\varphi_2\delta_2\gamma\emptyset + \varphi_2\frac{\delta_1\mu_3}{\mu_2}\right)(\Delta m - \Delta p - \Delta\sigma_1 y + \Delta\sigma_2 i + \Delta\sigma_3\pi^e) + \varphi_2\delta_2\alpha_2\Delta w + (1 - \varphi_1 - \varphi_2)\Delta p_3 \tag{12b}$$

Equation (12b) indicates that the Ethiopian inflationary process could be defined as a function of exchange rate, world price level, world non-food prices, real income, excess money supply, food imports, food aid, marketed surplus, unit wage costs and the exogenous administered prices.

3.2 Data and Estimated Results

For data consistency attempts have been made to rely on national sources. However, for some variables for which data from national sources are unavailable, international sources are used. The domestic consumer prices are compiled by Central Statistical Agency of Ethiopia (CSA). In compiling the indices, CSA gathers market price data on large number of goods and services in 119 representative markets in various regions. To ensure the prices reflect the market condition, price information is taken from three sources: consumers, traders and the market place. This price data is then weighted by the household expenditure weights of each item in consumption basket. The weights are derived based on results of Household Income, Consumption and Expenditure Survey (2004/05). A geometric mean of this price data is, then, taken to compute the monthly consumer price indices[16]. This is the data used.

The world price level P^f is computed as a weighted [17] wholesale price index of Ethiopia's major trading partners (China, Italy, India, Unites States, Japan, United Kingdom, Netherlands and Sweden). The price indices of Ethiopia's major trading partners and foreign food price indices are obtained from IMF's IFS data base. The foreign non-food indices are obtained as weighted differences of foreign price index and foreign food price index.

Marketed surplus is computed as total cereals output weighted by the share of marketed output in total farm production. The weight is obtained from Atlas of Ethiopian Rural Economy-mapped variables (2006). Interest rate is computed as simple average of saving deposit, time deposit and lending rates. Finally, the administered price index is computed as the weighted average of water, electricity, transport and communication and fuel indices. The weights applied are the shares of the items in household expenditures based on the results of Household Income, Consumption and Expenditure Survey (2004/05).

The data used in the study covers all four quarters of the 1996/97 – 2006/07 period and three quarters of 2007/08. However, for foreign price indices, cereals output and GDP data for 2007/08 is absent and hence forecast values for the last three quarters are used. Moreover, quarterly data of cereals output, GDP and food aid are generated from annual data using quadratic-match sum method of series conversion; and that of wages is converted using quadratic-match average technique of conversion.

To avoid spurious regression unit root test on all the variables of the model is done and it revealed that all variables are I(1). This is followed by test for the existence of cointegrating relationships among the variables of the model. The determination of the cointegrating relationships in the model is done using the VAR based Johansen's approach. Following Juelius (1992), in this study, therefore, the long run relationships will be derived using sectoral VARs. Two sectoral VARs (equations 13 and 14 below) will be estimated for the non-tradable food inflation and non-tradable non-food inflation defined above. Once the

[16] See any edition of CSA's country and regional level consumer price indices publications of 2008.

[17] The weight of each country is obtained as the average trade share of each country with Ethiopia for 2005/06 and 2006/07.

cointegrating vectors are identified from the two sectoral VARs, a single error correction model consisting of differenced endogenous variables and error correction terms derived from the sectoral VARs will be estimated (see also Durevall and Ndungu, 1999).

(a) The Food Price Model

The VAR model for food price is defined as:

$$p_{2t}^{f} = \delta_0 + \sum_{j=1}^{k} \delta_{1j} p_{2_{t-j}}^{f} + \sum_{j=1}^{k} \delta_{2j} y_{t-j} + \sum_{j=1}^{k} \delta_{3j} m_{t-j}^{*} + \sum_{j=1}^{k} \delta_{4j} i_{t-j} + \sum_{j=1}^{k} \delta_{5j} \pi_{t-j}^{e} + \sum_{j=1}^{k} \delta_{6j} sup_{t-j} + \sum_{j=1}^{k} \delta_{7j} p_{3_{t-j}} + \sum_{j=1}^{k} \delta_{8j} p_{1_{t-j}} + \varepsilon_{1t} \quad (13)$$

Where *sup* is the supply of food defined as the sum of marketed surplus, food imports and food aid, all the rest variables are as defined in preceding discussions, m^* is $m - p$, k is the appropriate lag length in the system determined by lag length criteria, mainly Akaike and Schwarz information criteria and ε_t is a white noise error.

Since the variables in the food price model are determined to be I(1), the appropriate modeling strategy is VECM. The VECM is estimated once the number of cointegrating relationships in the VAR model is determined. The resulting VECM can be specified as:

$$\Delta p_{2\,t}^{f} = \sum_{j=1}^{k} \delta_{1j} \Delta p_{2\,t-j}^{f} + \sum_{j=1}^{k} \delta_{2j} \Delta y_{t-j} + \sum_{j=1}^{k} \delta_{3j} \Delta m_{t-j}^{*} + \sum_{j=1}^{k} \delta_{4j} \Delta i_{t-j} + \sum_{j=1}^{k} \delta_{5j} \Delta \pi_{t-j}^{e} + \sum_{j=1}^{k} \delta_{6j} \Delta sup_{t-j} + \sum_{j=1}^{k} \delta_{7j} \Delta\, p_{f_{t-j}}^{f} + \sum_{j=1}^{k} \delta_{8j} \Delta p_{3_{t-j}} + \delta_9 D_{1t} + \alpha_1 \left(\beta_0 p_{2\,t-1}^{f} - \beta_1 y_{t-1} - \beta_2 m^{*}{}_{t-1} - \beta_3 i_{t-1} - \beta_4 \pi^{e}{}_{t-1} + \beta_5 sup_{t-1} + \beta_6 p_{f_{t-1}}^{f} + \beta_7 p_{3_{t-1}} \right) + \varepsilon_{1t} \quad (13b)$$

Where D_{1t} is vector of deterministic variables: intercept, trend, centered seasonal dummy[18] and structural break dummy, α_1 is the error correction parameter and measures the speed by which inflation adjusts for last period's disequilibria and β_i are coefficients of the long run relationship in the system.

In determining the number of cointegrating relationships the lag length used is 2 as determined using various information criteria[19]. Structural break dummy and centered seasonal dummy are also included in the model in unrestricted manner. The structural break dummy is intended to capture the effect of the shift in many macro variables observed in 2002/03 as before. The seasonal dummy is included to account for the seasonal nature of public expenditure and agricultural products. The bulk of public expenditure is spent in the

[18] Using centered seasonal dummy variables ensures that their introduction in the model doesn't affect the underlying asymptotic distributions upon which tests depend (see Harris, 1995).

[19] Tests of model reduction using PcGive 10 also suggest the same lag length.

fourth quarter of the Ethiopian fiscal year while agricultural products are harvested twice a year, the *Meher*[20] season being the most important one.

The Johansen procedure test results for cointegration with two lags in the system indicates that there are two cointegrating relationships. Both trace and maximum eigenvalue tests fail to reject the null of at most two cointegrating equations in the system. The trace and maximum eigenvalue test statistics are given in table 1.

Table 1: Johansen Cointegration Test for food price model

Hypothesized no of CEs	Eigenvalue	Trace test		Max Eigenvalue test	
		Trace Statistics	Critical level at 5% level of significance	Max-Eigen Statistics	Critical level at 5% level of significance
None*	0.87	249.58	159.53	103.41	52.36
At most 1*	0.65	146.17	125.62	53.29	46.23
At most 2	0.52	92.88	95.75	37.89	40.08

* indicates rejection of the null at 5% level of significance level

The two potentially cointegrating equations of the model are:

$$ECM_{11} = \log(DFCPI) - 0.86494\log(GDPR) - 1.86855\log(EXINF) - 1.49550\log(RNM2) + 2.493575\log(ACPI) - 0.496635\log(FFCPI)$$

$$ECM_{12} = \log(INT) + 6.61721\log(GDPR) + 3.053765\log(EXINF) + 9.594705\log(RNM2) + 20.87717\log(ACPI) + 4.464449\log(FFCPI)$$

Weak stationarity tests are conducted to identify the cointegrating equations. The tests conducted for the purpose are VEC Granger Causality/Block Erogeneity Wald Test and VEC coefficient restrictions. The former revealed that *INT*, log(*GDPR*), log(*SUP*) and log(*ACPI*) are weakly exogenous in the estimated model. When normalizing ECM_{12} for log(*DFCPI*) and restricting its adjustment coefficient to zero, the restriction was found to be binding, thus, again confirming the weak exogeneity of *INT*. Therefore, the number of cointegration equations in the model reduce to just one as the second equation vanishes. Diagnostic tests were conducted to test the adequacy of the model. The model satisfies all diagnostic tests (Autocorrelation, homoskedastic, Jarque-Bera test of residual normality). The estimated cointegration equation also produces a sound impulse response (not reported). The impulse responses complement the results obtained in the cointegration equation.

As can be seen from the cointegration equation, food inflation is positively related to real income. For a one percent increase in real income (GDP) inflation increases by approximately 0.86 percent. As we noted before, real GDP comes into inflation equation

[20] The *Meher* season comes around the end of the second quarter and the beginning of the third quarter.

from two sides: first directly as a determinant of food demand and second, as a component of excess money supply. In the first case, as income rises, demand for food rises, for a given supply of food, deriving food price up. In the second case, rise in income results in rise in demand for real money balances and, thus, reduces the excess supply of money, for a given stock of money supply, and drives food price down. The positive relationship between real income and inflation obtained in the cointegration equation indicates that the former effect outweighs the later.

Expected inflation, real supply of money and world food price all have the expected signs and the coefficients are significant. The significance of expected inflation indicates the importance of inflation inertia in Ethiopian food inflation. The reaction of agents to one percent expected inflation induces over 1.86 percent of actual inflation. As expected money supply has been a key factor in the current food inflation. For one percent real money growth, food price increases by over 1.49 percent. There is also an international food price pass through effect in Ethiopian food price inflation. A one percent rise in world food prices results in the domestic food prices responding by over 0.49 percent. The supply of food is negatively related to food prices, as should normally be the case. However, its coefficient is not statistically significant, indicating that the supply of food is not an important determinant of the current food price spirals. Administered price index, however, has an unexpected sign. The implication that can be derived from this result is that food price increases are not explained by administered price rises.

To summarize, the most important determinants of the food price inflation process in Ethiopia, in order of importance, are inflation expectation, real money supply growth, foreign food price movements and real income growth.

(b) The Non-food Price Model

The VAR model for the non-food non-tradable sector is specified as

$$p_{2t}^{n} = \delta_9 + \sum_{j=1}^{k} \delta_{10j} p_{2_{t-j}}^{n} + \sum_{j=1}^{k} \delta_{11j} y_{t-j} + \sum_{j=1}^{k} \delta_{12j} m_{t-j}^{*} + \sum_{j=1}^{k} \delta_{13j} i_{t-j} + \sum_{j=1}^{k} \delta_{14j} \pi_{t-j}^{e} + \sum_{j=1}^{k} \delta_{15j} e_{t-j} + \sum_{j=1}^{k} \delta_{16j} p_{f\ t-j}^{n} + \sum_{j=1}^{k} \delta_{17j} p_{3_{t-j}} + \sum_{j=1}^{k} \delta_{18j} w_{t-j} + \varepsilon_{2t} \quad (14)$$

All variables in the VAR are already identified to be non-stationary (I(1)). Thus, the relevant VECM for the non-food model is defined as

$$\Delta p_{2t}^{n} = \sum_{j=1}^{k} \delta_{10j} \Delta p_{2_{t-j}}^{n} + \sum_{j=1}^{k} \delta_{11j} \Delta y_{t-j} + \sum_{j=1}^{k} \delta_{12j} \Delta m_{t-j}^{*} + \sum_{j=1}^{k} \delta_{13j} \Delta i_{t-j} + \sum_{j=1}^{k} \delta_{14j} \Delta \pi_{t-j}^{e} + \sum_{j=1}^{k} \delta_{15j} \Delta e_{t-j} + \sum_{j=1}^{k} \delta_{16j} \Delta p_{f\ t-j}^{n} + \sum_{j=1}^{k} \delta_{17j} \Delta p_{3_{t-j}} + \sum_{j=1}^{k} \delta_{18j} \Delta w_{t-j} + \delta_{19} D_{2t} + \alpha_2 (\beta_8 p_{2_{t-1}}^{n} - \beta_9 y_{t-1} - \beta_{10} m_{t-1}^{*} - \beta_{11} i_{t-1} - \beta_{12} \pi_{t-1}^{e} - \beta_{13} e_{t-1} - \beta_{14} p_{f\ t-1}^{n} - \beta_{15} p_{3_{t-1}} - \beta_{16} w_{t-1}) + \varepsilon_t \quad (14b)$$

where Δ is first difference operator, D_{2t} is a vector of exogenous variables (i.e, constant, trend and dummy variables), α_2 is the long run equilibrium adjustment coefficient and βs are coefficients of the long run (cointegrating) equation in the model. All the other variables are as defined in the preceding sections.

Tests for determination of the appropriate lag length in the model indicate that the right lag length is one. Johansen cointegration test with one lag indicates the presence of three cointegration relationships in the system. The nulls of no cointegration, at most one cointegration and at most two cointegration equations are rejected. But the null of at most three cointegrating equations cannot be rejected as shown in table 2 below.

Table 2: Johansen Cointegration Test for non-food price model

Hypothesized no of CEs	Eigenvalue	Trace test		Max Eigenvalue test	
		Trace Statistics	Critical level at 5% level of significance	Max-Eigen Statistics	Critical level at 5% level of significance
None*	0.81	260.12	179.51	86.94	54.97
At most 1*	0.65	173.17	143.67	54.38	48.88
At most 2*	0.54	118.79	111.78	40.76	42.77
At most 3	0.41	78.03	83.94	27.27	36.63

* indicates rejection of the hypothesis at 5% level of significance.

The problem with the Johansen cointegration test above is that the number of cointegrating relationships implied by trace test and maximum eigenvalue test are different. Trace test indicates the presence of three cointegrating equations while maximum eigenvalue test indicates two. However, because of the high power of trace test over maximum eigenvalue test, the existence of three cointegrating relationships is accepted.

The three potentially cointegrating equations of the non-food model are given below.

$$ECM_{21} = \log(DNFCPI) - 0.100941 * INT - 0.960237 * \log(EXINF) - 0.947895 * \log(RNM2)$$

$$ECM_{22} = \log(ACPI) + 1.232541 * \log(FNFCPI) - 1.088594 * \log(EXINF) - 1.089614 * \log(RNM2)$$

$$ECM_{23} = \log(EXR) - 0.742523 * \log(FNFCPI) + 0.450888 * log(EXINF) + 0.370791 * \log(GDPR) + 0.917167 * \log(RNM2) - 1.888804 * \log(WAGES)$$

Weak exogeneity test using Granger Causality/Block Exogeneity Wald Test for identification of the cointegration relationships indicated that all variables except log(*DNFCPI)* and log(*EXINF)* are weakly exogenous . From the exogeniety test, it can be learnt that the last two potential cointegrating equations (ECM_{22} and ECM_{23}) are long run equations of weakly exogenous variables and, thus, should not enter the short run model as error correction terms. Zero restrictions on the long run adjustment coefficients of ECM_{22} and ECM_{23} after normalizing for log(*DNFCPI*) are found to be binding, confirming that there is only one unique cointegrating relationship in the non-food price model.

The result of this sectoral model shows that the signs of all variables in the cointegrating equation, except log(*WAGES*), are as expected. Despite having the expected sign, log(*FNFCPI*) and log(*GDPR*) are both insignificant. What these results indicate is that wage mark-ups are not important in the current non-food inflation as there is no real wage indexation in the Ethiopian labor market. There is no considerable international price pass through in the case of non-food non-tradable prices. The result is consistent with the fact that this category includes items that are not traded. Real income (GDP) is found to be positively related to non-food price, but the coefficient is found to be statistically insignificant.

The most important determinants of non-food inflation are inflation expectation, real money growth and interest rate, in order of their importance. Monetary growth leads to increase in demand and, for a given supply of non-food items, leads to rise in non-food price. The result indicates that for a one percent increase in real money supply non-food prices rise by 0.94 percent. Inflation expectation, on the other hand, feeds into the price system as agents expect price increases to persist and act accordingly to mitigate its effects. Provided the price rises have been persistent of late, this wouldn't be a surprising outcome. For a one percent increase in price agents expect, their actions lead to a 0.96 percent non-food inflation. Compared to food prices, the effect of inflation expectations is lower for non-food prices. The effect of interest rate movements on non-food inflation may come from two directions. First a rise in interest rate lowers demand for real money balances and raises the excess money supply in the economy, for a given stock of real money. This in turn exerts an upward pressure in price as discussed above. Second, a rise in interest rate means a rise of cost of production for domestic producers. This may translate into increased prices via mark-up pricing. The effect of interest rate movements on non-food prices, however, is relatively low. A one percent increase in interest rate induces a 0.1 percent increase in non-food price.

c) The Parsimonious Vector Error Correction Model of Inflation

Tradable prices and administered prices are assumed to be exogenous in this model. This implies that endogenous price adjustments take place only in the domestic food and non-food sub sector. Now that the cointegration relationships in the two sub sectors are

identified, the estimated cointegration equations could now enter the short run general price model as error correction terms (ECM_1 and ECM_2) to offer us the general picture of inflation in Ethipia. This is given as equation (15) below. It includes the present and lagged values of tradable price, administered price, real GDP, real money supply, interest rate, expected inflation, food supply, exchange rate, foreign non-food CPI, wages and exogenous variables (constant, dummies, and trend):

$$\Delta p_t = \gamma_0 + \sum_{j=1}^{m} \gamma_{1j} \Delta p_{t-j} + \sum_{j=0}^{m} \gamma_{1j} \Delta y_{t-j} + \sum_{j=0}^{m} \gamma_{2j} \Delta m^*_{t-j} + \sum_{j=0}^{m} \gamma_{3j} \Delta i_{t-j} + \sum_{j=0}^{m} \delta_{14j} \Delta \pi^e_{t-j} + \sum_{j=0}^{m} \gamma_{5j} \Delta e_{t-j} + \sum_{j=0}^{m} \gamma_{6j} \Delta p^n_{f\,t-j} + \sum_{j=0}^{m} \gamma_{7j} \Delta p_{3_{t-j}} + \sum_{j=0}^{m} \gamma_{8j} \Delta p_{1_{t-j}} + \sum_{j=0}^{m} \gamma_{9j} \Delta w_{t-j} + \sum_{j=0}^{m} \gamma_{10j} \Delta sup_{t-j} + \gamma_{11} D_t + \varphi_1 ECM_1 + \varphi_2 ECM_2 + \varepsilon_t \quad (15)$$

The formulation as equation 15 is the appropriate approach to specifying a single equation error correction model; however, due to strong multicollinearity problem the lagged domestic CPI are dropped from the model.

The estimated error correction model (of equation 15) passes all diagnostic tests. The forecasting power of this error correction model is also found to be good. The plot of the actual inflation series against the forecasted series with 95% confidence intervals for the forecasts shows that the forecast errors (variances) are low. Throughout the forecasting period the actual inflation series falls within the forecast intervals. Tests for the fit of the model also indicate that the model has a good fit. The final parsimonious model below (given as table 3) is arrived at based on statistical significance test of its coefficients.

Table 3: Parsimonious Error Correction Model (Dependent Variable: log(DCPI))

Variable	Coefficient	t-Statistic	Prob.
D(LGDPR(-3))	0.78	6.12	0.00
D(INT(-1))	0.04	7.45	0.00
D(INT(-3))	0.02	3.43	0.01
D(LEXINF(-2))	0.42	7.90	0.00
D(LEXR)	1.94	10.47	0.00
D(LFNFCPI)	1.09	4.75	0.00
D(LFNFCPI(-1))	0.48	3.17	0.01
D(LACPI(-1))	0.27	5.13	0.00
D(LFCPI(-3))	1.68	5.10	0.00
D(LWAGES)	5.17	9.16	0.00
D(LWAGES(-2))	1.73	4.15	0.00
D(LSUP)	-0.03	-3.43	0.01
ECM1(-1)	-0.02	-7.34	0.00

The results in table 3 appear to suggest that both demand and supply factors play role in short run price dynamics. The short run determinants of inflation in Ethiopia are found to be real income, interest rate, inflation expectations, exchange rate, international prices, administered prices, wages and food supply. There is also evidence of inflation deriving from cost mark-up pricing. Growth in real income, interest rate and wages fuel the demand and lead to rising prices for a given level of output while food supply growth serves to cool down the price pressures. The exogenous international prices and administered prices are also found to be significant. Interest rate and wages play into the inflation process from two directions. First, by increasing aggregate demand as discussed above, and second by raising the production costs which is reflected via mark-up pricing. Exchange rate also has a cost raising effect and play into domestic prices as a cost component.

Money supply, however, doesn't have a strong direct positive effect on short run inflation. It affects inflation indirectly through the error correction terms. This result is consistent with the view that in the absence of a well developed financial sector, as is the case in Ethiopia, monetary transmission might take longer than would be with well developed financial sector. Thus, the effect of monetary expansion may not be reflected in prices very fast. This result is also supported by the negative correlation between current and lagged real money supply growth and inflation (not reported).

The most important determinants of short run inflation in Ethiopia are wages, exchange rate and international prices. All appear to affect the domestic prices through cost mark-ups. The relatively fast and quite significant transmission of these cost raising factors into domestic prices indicates that there is a considerable market (monopoly) power in the hands of producers/traders. The results of the short run model seem to suggest that for a given rise in wages and international prices and exchange rate depreciation domestic prices rise more than proportionately. Wages increases translate into inflationary pressure fast as the current level of income is very low and for a given increase in income the marginal propensity to consume food is likely to rise. International price increases and exchange rate depreciation induce inflation through two likely routes. First, such conditions may discourage domestic production by raising cost of production creating supply shortages, which would eventually lead to soaring prices. Second, the effect of the rise in international prices and exchange rate depreciation may be directly transferred into prices by producers/traders. The estimation results suggest the second effect prevails in Ethiopian case.

The coefficients of the error correction terms are interpreted as speed of adjustment to long run equilibrium or the disequilibrium periodically transmitted to inflation from food prices and non-food prices. The coefficient of the error correction term of the price model is negative and less than one. This result ensures that food price convergences to its long run equilibrium. The coefficient of the error correction term of the non-price model, on the other hand, is less than unity but positive. The positive adjustment coefficient implies that any disequilibrium in non-food price continuously grows making convergence difficult. The speed of adjustment of the food price to its own long run equilibrium, however, is slow as shown by the small adjustment coefficient. Every quarter only just over 2 percent of the disequilibrium in food prices is adjusted.

IV Conclusion

The short run and long run model estimations conducted in this study indicated that the determinants of inflation in Ethiopia vary across sectors (food and non food) as well as over time horizons. The most important determinants of inflation in the long run are mainly domestic monetary developments while cost-push factors are the force behind short run inflation.

In the long run, domestic food prices are influenced mostly by income growth, inflation expectations, money supply growth and increase in international food prices. It is found that the positive effect of income growth through increased demand for food more than offsets the negative effect through money demand growth. Inflation expectations are also fueling the inflationary process. The strong inflation expectation effects observed in the long run food price model suggest that a price-price spiral may be imminent. The government's use of domestic sources of finance, mainly money creation, is significant. Provided, most of household income goes to food expenditure, as money creation results in increase in money stock in the economy, the demand for food is bound to rise. With supply of food failing to catch up the growing demand, food prices responded to the disequilibrium in food market. This argument is supported by the insignificance of food supply in the long run food price model. The implication is either the supply of food has not grown by a significant amount or

food demand is growing at a rate much higher than supply growth rendering the supply growth insignificant in the domestic food price dynamics. Moreover, the structure of investments in the country was more biased towards infrastructure development, which is characterized by long gestation period. Thus, such investments are found to have severe impact in the short to medium term on inflation owing to the food constraint, though their positive effect in the long run is undisputed.

The most important determinants of long run non-food inflation are found to be inflation expectations, money supply growth and interest rate. Like food prices, agents' expectation of persistent inflation appears to have fueled the non-food price dynamics. Money supply growth has also played into the non-food price inflation as both private and public demand increases following the monetary expansion. As in the case of the food price model, interest rates impacts non-food prices through two routes: demand for real money balances and cost of production, both of which inducing upward pressure on non-food prices. Wages, however, are found to have no significant role in the long run non-food price inflation process suggesting that there have been no persistent (continuous) and significant wage cost-mark ups. This is a reasonable result given that there is no system of real wage indexation in the country.

In the short run, both demand and supply appear important in the current inflationary process, with supply factors having the edge over demand factors in a familiar Kaleckian fashion. Especially, wages, international food and non-food prices, exchange rate and food supply are found to be the most important forces behind short run price movements. The effect of wages may derive from the fast increase in demand following wages increases and the transfer of the increase in wage bills into prices by producers/traders due to the latter's monopoly power. Despite its strong effect in the long run, money supply is insignificant in the short run. This may have resulted from slow monetary transmission due to underdeveloped financial sector in Ethiopia.

The estimated short run model revealed that food price converges to its long run equilibrium value. The speed of adjustment, however, is slow implying that it takes very long for food price to move back to its equilibrium once it drifts away from its long run equilibrium value – showing the imminent danger of the current food inflation.

The policy implications that can be derived from this empirical study are many. First, the policy interventions entail a possible trade-off between economic growth and macroeconomic stability as it is fueled by government excess spending and monetization. The fact that the determinants of inflation in the short run somewhat differ from those in the long run supports the above argument. In other words, money supply growth has been one of the prime sources of long run inflation. Therefore, in order to be able to curb the upward trend in prices, it is essential to adopt conservative fiscal and monetarynpolicy. This may, however, restrict the government on fiscal front and engender problem of slower growth as observed in pre 2003 period when the government followed conservative fiscal and monetary policies. Finding the appropriate balance would be the challenge for policy makers.

Second, another important variable in the long run inflation process is inflation expectation. At the moment, strong inflation expectations appear to be serving as effective inflation inertia and fueling continuous price-price spirals. Such may render efforts to control

inflation hopeless. This calls for government intervention in order to change the public opinion about inflation. The success of such efforts, however, raises the issue of policy credibility on the part of the government. It is important, therefore, for the government to announce monetary and fiscal policy targets (mainly money supply and inflation targets) and adhere to it for a considerable time period. There is, however, no consensus on which one is more effective.

Third, the current inflation trend is mainly derived by food inflation. Real income growth is found to be an important determinant of food prices. Since the level of income in Ethiopia is very low, most of a given increase in income is likely to be spent on food items. Therefore, in order to cool down the food price inflation it is essential that the government looks at ways of cooling down the economic growth, such as fiscal and monetary contractions, ensure supply of food through imports and avoid intervention in the cereal market as it was doing before 2003. In the future, investment planning need to be accompanied by food balance planning to arrive at Kaleckian 'warranted rate of growth' – a growth compatible with targeted food price inflation level.

Finally, all the above forms of intervention will only be effective in the long run. The current inflation process in the country is proving to be unbearable, especially for the urban working class and the poor. This is because there is no real wage indexation system or social safety net system for the poor. Therefore, it is also important to sanction policy interventions to temporarily contain inflation since the inflation crisis may easily and quickly lead to social crisis. This may take the direction of imported food supply the government is planning, as well as temporary freezing of administrative prices, tax rises, and subsidy for basic goods.

We hope that both the government of Ethiopia and other African governments that aspire to be a 'developmental state', characterized by large intervention through public spending, will learn from this unfortunate situation in Ethiopia.

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