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Determinants of Recent Inflation in Ethiopia

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SISAY MENJI

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Chapter I

Introduction

1. Back ground[1]

Ethiopia is a country with a population of 76 million (in 2006/07) where 74% of the population lives in rural areas. The country has a total area of 1.14 million sq.km of which 45 % is arable land and 3 % is irrigated land. The population density (person per sq.km) is near 65: 1 sq.km.The age dependency ration is around 85. The population has been growing at an average rate of 2.74% per year for the past 9 years. This high growth rate of the population in line with the age structure is undermining the economic progress made. In addition it also creates pressure on the existing resources. The life expectancy at birth is around 53 for males and 55 for females. The total fertility rate is around 6 children per women.

The gross domestic product of Ethiopia is around 170,921.4 million birr in 2006/07. The real GDP per capital has been 1369 birr in the same year. The overall performance of the Ethiopian Economy has been satisfactory during recent years. This can be revealed by the higher growth rate of real GDP. The growth rate of real GDP has been 11.8% on average starting from 2003/04. In addition the growth rate of real GDP has also been positive in the last 10 years (including 2007/08), except in 2002/03. The consecutive growth of the economy is due to suitable weather conditions in terms of timely and adequate rainfall, some efforts and support for farmers in the form of extension packages and an increase in cultivated land. Due to the relative performance of the

[1] The information on this part is taken from NBE quarterly bulletin of 2007/08 second quarter and EEA/EEPRI report on the Ethiopian economy volume V, 2005/06.

agricultural sector, more emphasis on the rural sector by the government and increased urban population, per capita income growth in rural areas has been higher than that of urban areas.

Agriculture in Ethiopia accounts for nearly half of the gross domestic product. Due to this the performance of the agriculture sector determines the path that the whole economy would take in both its magnitude and direction. The dominance of agriculture is also due to the stagnant share of the industry and service sectors. This may be depicted by the higher growth rate of agriculture as compared to industry and services. Agriculture has been growing at 19% and 12% in 2003/04 and 2004/05 while the growth rate of industry and services have been below 8%. Not only the level and growth rate of GDP but its variability is also mainly influenced by the performance of the agricultural sector.

Inflation has been low in Ethiopia in the past due to various reasons. During the Derg regime the price control by the government has kept prices stable .The government was also rationing goods at fixed prices to the public which in turn has contributed to the lower inflation attained during the Derg regime. In addition the lower and pegged exchange rate has also helped to lower the impact of international price hikes on Ethiopia; of course it also makes imports cheaper. During the earlier years of the present regime inflation has been low despite the huge inflow of money by the IMF and other donors. This happened because the displacement of former government soldiers and lay offs of workers due to the structural adjustment policy (SAPS) followed by the country had depressed demand. This depression of demand has counteracted the inflationary impact of increased demand due to the inflow of aid. But in recent years inflation has been high in Ethiopia. There is still no argument on the causes of the high inflation experienced in recent years. The government state supply bottlenecks, market

structure, increased income in the rural sector and international price developments especially of petroleum to be the cause of inflation. IMF and most economists argue that inflation is caused due to increased demand caused by expansion in money supply, increased remittances. In addition deficit is also regarded as a cause of inflation. In short the government attributes inflation to supply factors while international organizations and most economists attribute inflation to demand factors.

2. Statement of the problem

Inflation is bad not because people hate it but because it affects people adversely. Inflation reduces the real income of people, specially those with fixed incomes, reduce their living standard and reduces saving. The reduction in saving is due to the desire of more money to buy goods and services. This results in lower investment and capital formation. Inflation also hinders foreign direct investment because rising cost of materials and inputs makes foreign investment less profitable. Uncertainty about prices and increase in production costs also reduce production. Inflation also causes misallocation of resources.

Inflation also results in reduction of exports. This is because rise in domestic input prices makes the price of domestically produced products expensive in the international market. In addition inflation also results in increased imports. This is because the inflation results in higher price of domestically produced products which in turn results in increased demand for imports. The increase in imports and the decline in exports caused by inflation in turn results in adverse balance of payments in the country. Most importantly inflation redistributes income from wage earners and fixed income groups to profit recipients and from creditors to debtors. This in turn increases the number of poor and on the other hand increases the number of the rich and hence resulting in more in equality. (Jhingan,1997)

It is clear that the currently high rate of inflation in Ethiopia will retard the growth of the country achieved in recently years. The current inflation has a dampening effect on the current development of the export sector. This is because inflation makes Ethiopian products dearer in the international market which in turn makes them less competitive. In addition inflation also adversely affects domestic industries. This is because the increase in production cost of domestic industries results in higher product price. This increase in the price of domestically produced products results in increased imports, which also adversely affects the balance of payments, and in turn makes domestic industries to be uncompetitive. By reducing savings and increasing uncertainty inflation reduces investment and capital formation in Ethiopia in the long run.

Inflation in Ethiopia is also hampering Ethiopia from reducing poverty and hunger. The living standard of urban dweller has been adversely affected by inflation in Ethiopia. Inflation also redistributes wealth there by increasing the number of poor people in the county. Even if it is, said by the government that farmers benefit from rising food prices, something that needs empirical investigation, rise in food prices are causing many to be unable to feed themselves. Most importantly inflation in Ethiopia may misallocate resources from productive to unproductive sectors.

3. Objectives of the study

3.1 General Objectives

- To known the main determinants of recent inflation in Ethiopia

3.2 Specific Objectives

- To identify variables which have significant impact on inflation in Ethiopia
- To suggest possible course of actions to remedy the problem.

4. Methodology

In this study econometric technique of Co – integration is employed to identify the determinants of inflation in Ethiopia in the long run. The co – integration equation will reveal the long run determinants of inflation in Ethiopia. In order to test for the existence of co – integration, i.e. long run relationship among the variables, a unit root test on the residuals from the long run equation has been conducted and the residuals were found to be stationary and hence conforming for the existence of Co-integration.

The study made use of secondary data obtained from various sources. Quarterly data on CPI (general, food and non food), official exchange rate, average lending rate of commercial banks and Gas Oil price have been taken from NBE. Annual data on GDP is taken from NBE and converted to quarterly data using Lisman and Sandie method of smooth GDP disaggregation[2]. Quarterly data on broad money supply is taken from various EEA/EEPRI quarterly macroeconomic reports. Similarly data on overall deficit is taken from various quarterly macroeconomic reports of EEA/EEPRI and NBE.

5. Scope of the study

In this study the determinants of recent inflation Ethiopia will be studied. The study will cover the time period from third quarter of 1997/98 up to the second quarter of 2007/08. The study will employ quarterly data. The period was chosen because it can explain the inflationary trend experienced in Ethiopia recently. In addition lack of quarterly data on some variables has limited the study period to be limited in 10 years. Quarterly data has been used in order to incorporate more observations in order to improve the strength and reliability of the results.

[2] I would like to thank a researcher at NBE for giving the disaggregation method to me.

6. Significance of the study

Most importantly the study is expected to raise the interest of scholars to work on inflation. It will also serve as starting point for students working on inflation. The study also serves as a mirror in showing the major inflationary forces in the economy.

7. Limitations of the study

The study is expected to have limitation due to luck of time by the researcher. The usage of consumer price index instead of GDP deflator to calculate real GDP is also a limitation of the work. This is due to the absence of quarterly GDP deflator data. In addition lack of price index to analyze the impact of international price trends on Ethiopian inflation is a limitation of the work. Due to this quarterly Gas Oil price has been used as a proxy to international price, of course Gas Oil is used due to lack of quarterly petroleum prices.

8. Organization of the Study

After the first chapter, which is the introduction, a review of literature on inflation will be made. Both theoretical and empirical review on inflation will be presented. In the following chapter data trends and methodology will be presented. The trend of the various explanatory variables will be presented with that of inflation in order to see whether the trends have theoretically expected movements or not. In the forth chapter analysis of the results of the econometric model will be made. In addition model specification and estimation results will be forwarded. In the final chapter conclusion and recommendation will be forwarded.

Chapter II

REVIEW OF RELATED LITERATURE

2.1 Theoretical Review

2.1.1 Definition and measures of inflation

Inflation is a highly controversial term which has undergone modification since it was first defined by the neo-classical economists. Neo-classicals defined inflation as a galloping rise in prices caused by excessive increase in the quantity of money. For Keynesians true inflation happens when money supply increases beyond full employment level (Jhingan, 1997). Though various economists define inflation in different ways there is an agreement that inflation is a sustained increase in the general price level.

Even though inflation is a sustained rise in prices it may be of various magnitudes. When the rise in prices is very slow Like that of a snail or creeper, it is called creeping inflation. Creeping inflation happens when prices increase less than 3 percent per annum. Such an increase is regarded as safe and essential for economic growth. When prices rise at a rate greater than 3 but less than 10 percent per annum, it is called walking inflation. Walking inflation is a warning signal for the government to control inflation before it be comes running inflation. An annual increase in prices at rate of 10 to 20 percent is called running inflation. When inflation rate goes above 20 percent it is called hyper inflation. (Jhingan, 1997)

Measures of Inflation

The widely used definition of inflation states that inflation is a sustained rise in general price level. In formulas;

$$\pi = \frac{p_t - p_{t-1}}{p_{t-1}} \times 100$$

where π–inflation (in percentage)

p_t – present price level

p_{t-1} – past price level

There are various price indexes which are used to measure inflation. The following are the major ones stated by Dornbusch et al (2001)

1. Consumer Price Index (CPI)

   It is a measure mostly used to measure inflation. The CPI measures the cost of buying a fixed basket of goods and services representative of the purchase of consumers. Inflation is measured by measuring the percentage change in the prices of a given basket goods over time as compared to the price in the base year: In Ethiopia the central Statistical Authority computes the CPI. The authority makes house hold expenditure survey every five years.

2. GDP Deflator

   It is the ratio of nominal GDP in a given year to real GDP of that year. It includes all the goods produced in a country but excludes imports. The deflator measures the change in prices that has occurred between the base year and the current year.

3. producer Price Index (PPI)

   It is a measure of the cost of given basket of goods, however, it differs from the CPI partly in its coverage, which includes raw materials and semi finished goods. In addition PPI measures prices at an early stage of the distribution system, where as the CPI measures prices when house holds do their spending.

2.1.2 Theories on causes of inflation

A. Demand Pull Theory

Demand pull inflation or excess demand inflation is the traditional and most common type of inflation. (Jhingan,1997). It occurs when aggregated demand exceeds aggregate supply. This excess demand may occur due to increase in one or all components of aggregate demand which includes consumption, investment, government expenditure and net exports. The excess demand creates disequilibrium and pulls up

prices until equilibrium is restored. This is because the increase in aggregate demand causes shortage of goods and services at old prices. As a result consumers, business, and government bid against one another for a fixed quantity of available goods and services. This in turn leads to price increases until equilibrium is restored.(Campbell R and L.Stanley, 1986).

B. Cost push theory

Cost push inflation results from the increase in costs pushing up prices in the absence of excess demand in the market. The cost increase may come from two sources. The first cause of cost push inflation is the rise in money wages more rapidly that of the productivity of labor. This can be illustrated using the following equation:

$$\text{Unit labor cost} = \frac{\text{Total Wage bill}}{\text{Total output}} = \frac{\text{Wage rate x number of hours worked}}{\text{Total output}}$$

$$= \frac{\text{Wage rate}}{\text{Total output/No of hours worked}} = \frac{\text{Wage rate}}{\text{productivity}}$$

As we can see from the above equation, unit labor cost equals the ratio of wage rate to productivity. The rate of change in unit labor costs equals rate of change in wage rates minus rate of change in productivity. This implies that a rise in wage rates exceeding productivity increases the unit labor cost. As unit labor cost rises, the production cost of firms also rise. Firms in turn raise prices of their products. In this way, the wage increase leads to cost-push inflation. (Campbell R and L.Stanley, 1986)

In developed countries, trade unions have been capable of getting wage rate increase in excess of productivity in creases due to union market power, markup pricing, wage imitation, explicit and implicitly contrasts,

productivity declines and monetary accommodation. (Campbell R and L.Stanley, 1986)

The second cause of cost push inflation is an increase in the price of domestically produced or imported raw materials. The increase in raw material prices increases production cost of firms. This in turn results in higher prices because firms pass the cost increase to consumers. (Jhingan, 1997)

C. Keynesian Theory

The initial Keynesian explanation of inflation is the inflationary gap approach. (Jackman,et al1981) According to inflationary gap approach inflation arises when aggregate demand exceeds the value of aggregate supply at full employment level. The increase in demand may arise from the increase in one or more components of aggregate demand, i.e. consumption, investment and government spending. In the Keynesian case money has inflationary impact indirectly through interest rate. (Jhingan, 1997). Hence, Keynesian theory is a combination of demand pull and cost push models.

Keynesian theory is also well known for the Philips curve. The curve shows the inverse relationship between inflation and unemployment. According to Keynesian economists there is a tradeoff between inflation and unemployment. The curve shows that lower inflation and lower unemployment, and higher inflation and higher unemployment can not exist simultaneously; rather higher inflation is accompanied by lower unemployment and lower inflation by higher unemployment. (Jackman, et al1981)

D. Sect oral / Demand – shift theory

Demand shift theory states that inflation can be caused by sect oral shits in demand. The theory has been developed by Shultz in his study of the

inflation in America from 1955- 1957, but now it has been generalized in the case of modern industrial economies. (Jhingan, 1997)According to the theory prices and wages are flexible upward in response to excess demand but they are rigid down wards. This implies that excess demand in some sectors of the economy and deficient demand in other sectors will lead to inflation even in the absences of excess aggregate demand. This is because prices do not fall in deficient demand sectors but rise in excess demand sectors and remain the same in other sectors. The net effect is an increase in the price level.

Moreover, increase in prices in excess demand sectors can spread to deficient-demand industries through the prices of materials and the wages of labor. (Jhingan,1997). Excess demand in some sectors will lead to the rise in the prices of labor and inputs used by the sectors. The rise in input prices will affect the production cost of other sectors where there is no excess demand and hence forcing the firms to increase prices to keep their profit margin. In addition the price rise of the outputs of excess demand sectors and other sectors using same inputs as the excess demand sectors will increases the production cost of firms which use the final products of the sectors as input. (Jhingan, 1997)

In addition, excess demand in some sectors also bids up wage in the sectors. This rising wages will also occur in other sectors, even in the sectors with deficient demand, because firms will raise wages to avoid inefficiency and productivity falls due to workers dissatisfaction. Other things remaining the same the effect of increasing costs will be longer at the final stage of production. Thus producers of finished goods will face a general rise in the level of costs, there by leading for higher price of final goods and hence inflation. (Jhingan, 1997)

E. Mark up Theory

The theory is based on the assumption that both prices and wages are "administered" and are settled by workers and business firms. Firms fix administrative prices for their goods by adding to their direct materials and labor costs and some standard mark up which covers profit. Labor also seeks wages on the basis of a fixed mark up over its cost of living. (Jhingan,1997).

If one firm rises in order to maintain its desired markup, the costs of other firms are raised which, in turn, raise their prices and this process of chains will lead to rise in the general price level in the final. According to the theory, the mark up can be based on either historical experience or expectations of future costs and prices. Jhingan (1997) summarized the ideas as follows

> *"The sizes of the mark up depend on the degree of excess demand felt in the economy. When demand is moderate, the markups may be applied to historically experienced costs and prices and hence price rise may be slow. But, when demand is intense, the markups are based on anticipations of future costs and price rapidly. Thus there can be no inflation with out some change in the size of markup".*

Mark up theories are related to cost push models if prices rise due to the expectations of firms and workers that their markups are lower than the required costs and prices regardless of the state of aggregated demand. The theory may also be related to demand Pull models if firms and workers raise their markups due to increase in demand.

F. Quantity Theory of money

In its crudest from, quantity theory of money states that any change in prices must be accompanied by an equal proportional change in the quantity of money. Its earlier explanation is found in the familiar identity of Fishers' equation of exchange.

$$MV = PT,$$

where M is the nominal stock of money, V its velocity of circulation, that is the number transactions under taken over that period of time, T is the total number of transactions undertaken over that period of time and P is the average price level. The equation of exchange must hold of the necessity because MV and PT are two ways of measuring the same thing, the aggregate value of all transactions taking place over some given time period. (Jackman, et al 1981)

Neither Irving Fisher nor other classical quantity theorists believed that V and T were constant. Rather they argued that in equilibrium V was determined by people's habits and by the technology of exchange, while T was determined by the free interactions of the forces of supply and demand. In addition quantity theorists made two assumptions to propose how an actual economy would behave overtime.

The first assumption states that the real force that affect V and T change only slowly over time. The second assumption, which is the most important of the assumptions, states that the economy would quite quickly return to equilibrium. Based on these assumptions, Jackman ,etal (1981)opine that any change in the quantity of money will initially affect V and T as well as P, but the economy will soon return to equilibrium with unchanged values of V and T and hence price changed in proportion to the change in the quality of money. To state it in simple terms quantity theorists held that inflation is always and every where a

monetary phenomenon, that arises from a more rapid expansion of the quantity of money than in total output. (Richard, et al 1981)

G. Purchasing Power Parity Theory

PPP is based on the idea that an equivalent of a perfectly competitive world market for each of the different goods exists, so that there is a single price for each good through out the world. (Jackman, et al, 1981)
According to PPP, exchange rates equate the purchasing power of the different currencies, or equivalently the ration of the price levels in two countries will equal the reciprocal of the exchange rate between their currencies. The form the price equalization will take place depends on the kind of the exchange system used. In a fixed exchange rate, prices adjust to equate the fixed exchange rates. This implies that inflation rates should be equalized across countries. Under flexible exchange rates, PPP implies a convergence of exchange rates to offset differential price movements between different countries. This implies that a counties inflation rate is completely insulated from the world inflation rate and depends only on domestic factors. (Jackman, et al,1981).

But in the short-run PPP do not hold and the inflation rate of a country with flexible exchange rate is not completely insulated from the world inflation. (Jackman, et al,1981). Jackman, etal opine that expansionary monetary policy within a country would tend to lower interest rates and hence encourage an outward flow of capital there by lowering the exchange rate. This would lead to a fall in the exchange rate, which would in turn raise the price (interims of domestic currency) of foreign goods. By contrast a fiscal expansion would raise interest rates, and thus lead to an appreciation of the exchange rate and hence a fall in the domestic currency price of foreign goods".
On the contrary, Jackman, et al(1981) state that expansionary monetary policies in the rest of the impact of expansionary policies in rest of the

world will lower the inflation of a country by encouraging inflow of capital. But the effect of fiscal expansion in the world in a country's inflation is indeterminate. In short PPP theory states that inflation of a country with fixed exchange rate is determined by the world inflation rate in the long run while that of flexible exchange rate is completely insulated from international price developments.

H. Expectations hypothesis

This new development in inflation theory is the argument that expectations play a crucial role in the inflationary process. (Jackman ,et al 1981). There are two views on how expectations affect the inflationary process. According to the traditional view, adaptive expectations approach, people correct their expectation of the inflation rate gradually. This is because people base their expectation of inflation on past inflation. This view tell us that in the short run before people adjust their expectations policies of the government have the power to influence unemployment and output. But in the long run people adjust their expectations and it is impossible for the government to use policies because actual and expected inflations are equal. (Campbell R and L.Stanley, 1986)

According to the recent view, rational expectations, economics agents use all the available information to make rational expectations. Due to this actual and expected inflations always equal. As a result any expansionary policy adopted by the government both in the short run and long run will generate only inflationary pressures. (Campbell R and L.Stanley, 1986)

I. Structural inflation

According to this view inflation arise in developing counties due to structural rigidities of their economy. The advocates of structural inflation say that the agricultural sector is irresponsive to price increases in developing countries due to defective system of land tenure, lack of irrigation, lack of storage and marketing facilities, bad harvest and the depends of agriculture on rain. (Jhingan, 1997) To prevent the price rise of food products, through imports is not possible due to foreign exchange constraints. Moreover the price of imported products is relatively higher than their domestic prices.

Another cause of structural inflation is that the rate of export growth in a developing country is slow and unstable (Jhingan, 1997)). The sluggish growth rate of exports and the foreign exchange constraints lead to the adoption of the policy of industrialization based on import substitution. Such a policy leads to inflation due to the rise in price of industrial products, income increases in the non-agricultural sectors and the relative inefficiency of the new industries during the "learning" period. The secular deterioration in the terms of primary products of developing counties further limits the growth of income from exports leading to exchange rate devaluation. Jhingan (1997) summarized structural inflation as follows:

> *"Thus structural inflation may result from supply inelasticity leading to rise in agricultural prices, costs of import substitute's deterioration of the terms of trade and exchange rate deprecation".*

In this section, a review of theories on inflation was made. The demand pull theory states that excess demand due to expansionary monetary and fiscal policies is a cause of inflation. Rise in production costs is perceived as cause of inflation in cost push theory. The Keynesian theory on the

other hand is a hybrid of demand pull and cost push theories. It also shows that there is a trade off between inflation and unemployment. Sect oral shift theory which has been generalized to the case of modern industrial economies attributes sect oral shifts in demand as a cause to inflation. Marks ups set by firms and workers were explained as a cause of inflation by Markup theory.

Quantity theory of money, on the other hand, states that inflations is always and every where a monetary phenomena. Role of exchange rates in inflationary process was emphasized by PPP theory. According to PPP, in the long run, the inflation of a country with flexible exchange rate is completely determined by domestic factors while that a fixed exchange rate is determined by world inflation. Expectations hypothesis theory reveals that expectations about prices have influence on inflation. The last theory, structural theory, attributes inflation to structural variables such as inelastic supply of output, exchange rate depreciation, deterioration of the terms of trade and others.

2.1.3 INFLATION TARGETING- RECENT CONCEPT

Inflation targeting is a monetary policy in which a central bank attempts to keep inflation in a declared target range – typically by adjusting interest rates. It has been introduced in New Zealand in 1990, has been very successful, and as of 2007 had been adopted by more than 20 industrialized and non-industrialized countries. It is characterized by (a) an announced numerical inflation target, (b) an implementation of monetary policy that gives a major role to an inflation forecast and has been called 'inflation-forecast targeting', (c) and a high degree of transparency and accountability. Svenson (2007) Inflation is usually measured as the change in prices for consumer goods, called the consumer price index (CPI). Inflation targeting assumes that this figure accurately represents growth of money supply. Thus central banks or the

responsible authority fixes the target based on the change in consumer price index.

The success of inflation targeting rests on four conditions. Carare, et al (2002) The first condition is a mandate in support of an inflation objective and an accountability for achieving this objective to pursue an inflation target. This requires setting inflation targeting as a primary objective, an authority (most of the time the central bank) with sufficient discretion to set monetary instruments as needed. In addition accountability and transparency are also necessary. This results in inflation target to be explicit to the public including the monetary instruments. Second, macroeconomic stability which includes absence of fiscal dominance and external stability is important for the success of inflation targeting. Third, a sufficiently and well developed financial system is important condition for inflation targeting. Finally effective monetary policy instruments were forwarded to the success of inflation targeting.

Criticisms say that since inflation is measured by consumer price index (CPI), inflation targeting leads to misleading policy measures when price rises due to external factors. This is because the increase in CPI, hence increased inflation, makes central banks to raise interest rate which in turn inhibits investment and growth. In addition, inflation targeting gives much weight to inflation stabilization than to the stability of the real economy. Despite these shortcomings, so far, since its inception in the early 1990s, inflation targeting has been a considerable success, as measured by the stability of inflation and the stability of the real economy. There is no evidence that inflation targeting has been detrimental to growth, productivity, employment, or other measures of economic performance. The success is both absolute and relative to alternative monetary-policy strategies, such as exchange-rate targeting or money-growth targeting. No country has so far abandoned inflation

targeting after adopting it, or even expressed any regrets. For both industrial and non-industrial countries, inflation targeting has proved to be a most flexible and resilient monetary-policy regime, and has succeeded in surviving a number of large shocks and disturbances. As of 2007, long lists of non-industrial countries were asking the International Monetary Fund for assistance in introducing inflation targeting. Svenson (2007)

2.2Review of Empirical Literature

In this part, a review of empirical works on inflation will be done. The section is divided in to 3. The first section, other countries experience, a review of literature on some European, Asian countries and literatures which attribute to money countries will be made. In the second part literatures an African countries will be reviewed. Finally, in the third section, a review of literature of Ethiopian inflation will be made.

A. Other counties experience

Mogsin and Schimmelpfenning (2006) in their study of inflation in Pakistan used monthly data from January 1998 to June 2005. The researchers used a stylized monetarist model that includes monetary variable, exchange rate, out put and wheat support prices. The results from the model show that in the short run inflation in Pakistan is determined by monetary factors and wheat support price mainly. Output and nominal effective exchange rate have also found to affect inflation in the shot run. In the long run, the results show that inflation is mainly determined by monetary variables. A long run relationship has been found to exist between CPI and private sector credit in Pakistan. The researchers concluded their result as:

"The answer to the question "Money or wheat?" is money".

Finally, the researchers recommended using monetary policy in targeting inflation around 5%.

Maliszewski (2003) is his study titled modeling inflation in Georgia used monthly data from January 1996 to February 2003. The researcher used a short run ECM and a long run co integration models. The results from the short run model show that inflation in Georgia is determined by changes in exchange rate and imported oil prices. The results from the long run model show that inflation in the long run is determined by money supply, exchange rate and output but the exchange rate variable is found to be dominant in explaining inflation.

The researcher concluded the results by stating that inflation in Georgia is mainly determined by exchange rate fluctuations. The researcher also stated that it is possible to estimates robust price and inflation equation for Georgia. Maliszewski (2003) recommends to further accumulation of foreign reserves, develop indirect monetary control instruments and to develop a deeper Treasury bill market to increase the capacity of national bank of Georgia to respond to shocks.

Hammermann and Flangan (2007) in their studies of persistent inflation differentials across 19 transition economies used annual data from 1995-2004. The researches used an OLS panel regression model. The results from the model show that central banks incentive towards higher short run inflation is a key reason for the observed inflation differentials. Unanticipated shocks to supply and demand are also found to be important determinates of cross country inflation differentials. The evidence on the political and constitutional milieu is mixed but result stressed the fact that the more a central bank is independent the lower inflation in that country. Fiscal considerations have also found to explain the inflation differentials, countries with high government debt and low financial market development have been found to have high inflation.

The researchers conclude results by stating:

> "*Central banks in Russia, Ukraine, Belarus and Moldova appears to have a reason to choose higher inflation rates due in some cases to fiscal pressure but mainly to make up for, and to perhaps exploit lagging internal and external liberalization in their economies out of forecasts based on projected developments in terms of trade in the underlying structure of these economies and assuming now change in institutions, suggest that incentives towards inflation may be diminishing, but not to the point where inflation levels below 5% would credibly announced as targets".*

Hammermann and Flangan (2007) recommended in liberalizing the economy, to promote faster financial market development, to eliminate labor market over hangs and to improve the independence of central banks, in order to avoid high inflation rates.

Ghosh et al (1996) in their analysis of the influence of the various exchange rate regimes on inflation and growth used data comprising all IMF members from 1960-90. The paper draws on material originally contained in IMF working paper 95/121. The researchers classified exchange rare regimes in to pegged, intermediate (i.e. floating rates, but with in a predetermined range), and floating.

The results from the sample show that countries with pegged exchange rates had an average annual inflation of 8% compared with 14% for intermediate regimes, and 16% for floating regimes. The researchers state that the difference comes from two separate effects. The first is disciple, countries with pegged exchange rates have lower rate of growth in money supply. The second effect is confidence. Due to high confidence of the public in pegged regimes, for a given growth rate of money supply there will be higher demand for money which in turn leads to low in inflation.

The results from the sample used to analyze effect of exchange rate on growth show that growth was fastest under the intermediate regimes over aging more than 2% a year, while it was 1.4% for pegged and 1.7.% under floating rates. The researchers conclude that there exists a strong link between the choice of exchange rate regime and macro economic performance. A adopting a pegged exchange rate can lead to lower inflation, but also to slower productivity growth.

Gutierrez (2003) in the study of inflation performance and constitutional central bank independence in Latin American and Caribbean countries used an index based on five criteria to measure the dejure independence and accountability of the central bank based on the constitutional provisions. The paper estimated the correlation between the index and a measure of inflation during the period 1995- 1999 to test whether the entrenchment of central bank independence in the constitution results in lower inflation. Gutierrez presents the results as:

> *"The results of the estimation indicate that controlling for other factors, countries that entrench the indecencies of the central bank in the constitution tend to have lower inflation than countries that do not …. The results also indicate that having a fixed exchanged rate regime reduces inflation while the occurrence of banking crisis increases inflation, other things equal. Level of public deficit and the degree of openness of the economy turned out not to be significant".*

Gutierrez (2003) concludes the results by saying that those countries that entrench the independence of the central bank in the constitution have a better inflation performance. Finally, the researcher recommended to Argentinean legislators to enhance the credibility of the central bank by entrenching its independent in the constitution.

Catao and Terrones (2003) analyzed the relations between fiscal deficit and inflation over 107 countries using an annual data from 1960-2001.

The researchers' model inflation as non linearly related to fiscal defect though the inflation tax base using dynamic panel techniques that explicitly distinguish between short- run and long-run effects of fiscal defects. To account for heterogeneity, the researchers divided the panel into groups by level of financial development and inflation performance.

The result indicates that budget deficit is significant deriver of inflation in most groups with the exception of low inflation economies and advanced countries. The estimated effect of budget deficit on inflation is found to be very strong for developing countries in general. It was shown that a 1% reduction or increase in the ratio of budget defect to GDP lowers (increases) inflation by 83/4 % points on average, all else constant.

By the second classification, high Vs lower inflation groups, budget deficit have been found to have a very strong effect on inflation. The researchers opine the trade openness was found to matter for the developed country group, 1% point increase in openness loading to 0.09 percentage points drop inflation, but not for all countries, and little evidence was fount that fixed exchange regimes help lower inflation in a systematic manner. Catao and Terrones (2003) finally concluded that there exist a strong positive association between deficits and inflation among high inflation and developing country groups, but not among law-inflation advanced economies.

Crowe (2006) used a political economy model to analyze the interaction between inflation, inequality and elite bias in the political system. The researcher uses two line periods, 1975-1989 and 1990-2004 for the study. The results reveal that

> *"comparing two 'low inequality" countries where one experiences a significant fall in political bias and one does not, the former sees a greater rise (or smaller faller)*

in inflation of around 7%; where as comparing two "high inequality" countries, the differential is in the other direction."

The result also reveals the positive impact of democratization in low inequality counties on inflation. The results reveal the positive impact of inequality and elite bias on inflation. Crowe (2006) concludes the results by stating that in the presence of elite bias in the political system, higher income inequality creates a more skewed distribution of political power which in turn makes policies more beneficial to the elite, including regressive shift in tax incident through seignior age.

This report supports a more general conclusion that democratic and open institutions may be harder to achieve in economically divided societies, however, it is in these societies that they likely deriver the greatest benefits. Crowe (2006) recommends for further research on the impact of democratization in low income countries on inflation.

The review made in this section reveals various factors as a cause of inflation. The review on Pakistan reveals the positive effect of money supply on inflation. The experience from Georgia reveals threat exchange rate devaluations has positive impact on inflation. The study on persistent inflation differentials across transition economies show that incentives by central banks to higher inflation lead to inflation. The study also shows that fiscal deficits have positive impact on inflation while central bank indecencies and openness have been found to have deflationary impact. The study conducted on all IMF members reveals that pegged exchange rate regimes have low inflation rates wile floating exchange relates to have high inflation. Constitutional central bank independence has been found to have deflationary impact from the experience of Latin American and Caribbean countries. Fiscal deficit was found to be inflationary form the study made on 107 countries. The last

study implies that elite bias in political system tends to promote inflation.

B. African experience

Mwase (2006) used quarterly data from Q1:1990 up to Q1:2005 in his study of inflation in Tanzania. Mwase (2006) uses a structural vector auto regression (VAR) model to capture the relationship between short term movements in exchange rate and inflation. The results of the study indicate that currency appreciation is associated with a decrease in inflation rate, with one quarter lag. The exchange rate pass through to inflation Tanzania is found to be incomplete and decreasing. A low, significant and persistent pass through existed thought the period 1990: Q1 to 2005: Q1, while zero pass through exited during the period 1995:Q3 to 2005:Q1. Mwase (2006) argues that the non conventional response of inflation to exchange rate movement could be attributed to the effect of macroeconomic and structural reforms.

Mwase (2006) concludes that the decrease in the pass through is attributed to the macro economic and structural reforms that took place in Tanzania. The researcher stressed that the results were primarily due to the opening up of sectors previously sheltered from completion and due to the deflationary effects of expansion in clothing, furniture, production and the house hold sector. Mwase (2006) finally recommends for authorities to seek to maintain low and stable inflation and to continue on the on going structural reforms to increase efficiency and production.

Egwaikhide, et al (2006) in their study of the impact of exchange rate on inflation and budget deficit in Nigeria used an annual data from 1973 to 1989 using co integration and ECM models. The researchers used inflation and revenue and expenditure equations to analyze the impacts of exchange rate on inflation and budget deficit. The results from the inflation equation show that official exchange rate is the main

determinant of inflation. Output and money supply have also found to be significant but price expectations were found to be insignificant.

The results from the revenue and expenditure equations reveal that devaluation has raised both revenue and expenditures but the increased in the expenditure exceeds the increase in revenue.

Egwaikhide, et al (2006) concluded their results by stating that the official exchange rate in Nigeria is the main determinant of inflation and budget deficits. Finally, the researchers recommend using restrictive monetary policy to complement the exchange rate policy adopted.

Fannizza and Soderling (2006), in their analysis of fiscal determinants inflation in five Middle East and North African (MENA) countries for the years 1998-2005 used cash-in advance model using Fiscal Theory of Prices. The main aim of the research was to know the main reason for the existence of low inflation in MENA countries despite the increase in money supply in the countries. The results show that strong fiscal position in MENA countries has resulted in lower inflation. According to the results Morocco's privatization frame work, Egypt's defacto exchange rate and Lebanon's high debt but largely dominated in foreign currency were the main factors that contributed largely to the strong fiscal position of the countries. The researchers conclude results as follows:

> *"Countries fiscal policy and public debt deserve particular attention for maintain macro economic stability. In particular a "sound" fiscal position constitutes a necessary condition for macro economic stability where as a "sound" monetary policy constitutes neither a sufficient nor a necessary condition."*

Fannizza and Soderling (2006) recommend for monetary programming to focus on reserve money rather than broad money and to use Fund Policy analysis.

Barung (1997) has tried to study the determinants of inflation in Uganda. Barung (1997) used an Error Correction Model to identity the role played by monetary base, real exchange rates and supply shocks in explaining inflationary pressure in Uganda. The results from the model show that monetary expansion is the main source of the variations in prices in the short term. Supply shocks have also been found to be significant in explaining the variations in the price level. The real exchange rate has been found to have negative sign also in significant. The negative sign of the real exchange rate comes from the financing of large volume of imports through import support grants which may have offset the inflationary impact of the real deviation. Barung (1997) concludes the results by stating

> *"The evidence suggests that over the medium term high inflation is mainly due to increase in money supply,-----, deviation has been found to have an indirect impact on the general price level through its effect on the parallel exchange rate and the budget, but this transmission mechanism has been deflationary. Supply side shocks appear to have significant impact in the short run."*

Barung (1997) recommends giving strong emphasis on the non-inflationary financing of government budget and on reduction of fiscal imbalances. The paper also states that policies based on Aid can not be successful in the long run.

Sowa and kwakye (1993), analyzed the sources of inflationary pressure in Ghana using on annual data from 1962 up to 1989. The researchers used an econometric model, OLS technique which states price level as a

function of money supply, output, and exchange rate and price expectations. The results from the model show that supply constraint and monetary constraint have been found to have inflationary impacts, but the study found that supply effects are stronger than monetary effects. Exchange rate devaluations have also found to have inflationary impacts.

The researchers recommended in enhancing production and supply of specially food. They also suggested on improving distribution and road networks to reduce costs.

Acute, et al (2001) used annual data form 1974 to 2000 to identify the determinants of inflation in Swaziland. The study employed econometric technique of Co-integration and Error Correction Modeling (ECM). The results show that the impact of money supply on inflation was found to be insignificant, suggesting that money supply growth in Swaziland does not accord with normal behavioral expectations towards inflation. Interest rate is also found to be insignificant in explain inflation. Exchange rates and wage rates have been found to have significant long run influence on the level of prices in Swaziland. The researchers concluded the results as:

> *"The positive but insignificant long run relationship between real income growth and inflation suggest that economic growth does not necessarily lead to reduced inflation due to the existence of monopolistic or oligopolistic elements in the economy."*

The study recommends some actions to reduce inflation. These includes forming a more competitive commercial and trading environment which will limit the ability of traders to pass prices on to consumers, to reduce dependence on imports by promoting the manufacturing base and to

change the labor act to increase sensitivity of real wages to supply and demand in the labor market.

Yahyak (1989) in his study of inflation in Nigeria used basic macroeconomics accounting frame work using annual data from 1970-1976. The results show that money supply is the main determinant of inflation. Anderson stated

> *"Reckless increase in the supply of money with out due regard for the absorptive capacity of the economy will always lead to inflation"*

Yahyak (1989) recommends for adjustment policies to take into account the role of money and credit in the economy and to make growth of monetary variables in line with growth of output.

The review on African countries reveals the positive impact of monetary expansion, adverse supply shocks, devaluations, wage increase and budget deficits on inflation. The study on Uganda reveals monetary expansion and supply shocks as causes to inflation. Supply shocks, money supply and devaluations have been found to affect inflation in Ghana. When we come to Swaziland Exchange rates, wage rates found to affect inflations. Swaziland's results also show unexpected positive association between inflation and output growth. The reviews on Nigeria depict the inflationary impacts of monetary expansion and exchange rate devaluation. The results from MENA countries reveal the impact of strong fiscal position as a hedge against inflation.

C. Ethiopian Experience

There is not much literature on Ethiopian inflation because of the low inflation experienced in the past. Getachew (1996) is his study of inflation in Ethiopia used two models. In the first model monetarists' model has been used using monthly data from July 1990/91 to

February. In the second model, a long run model, an assessment of annual data from 1972/73 up to 1990/91.

The results from the first model show that in the short run money stock has been found to be significant determinant of inflation in Ethiopia. The long run model shows that in the long run inflation in Ethiopia is determined by supply factors Getachew (1996) recommends that in the short run controlling money supply is important to control inflation while in the long run he suggested in removing the bottlenecks of the supply side of the economy. Getachew (1996) concludes the results by saying.

> *"Inflation in the Ethiopian case is more associated with supply bottlenecks in the crucial sector of the economy, agriculture."*

Yohannes (2000) in this study of inflation in Ethiopia used quarterly data from 1967/68 to 1998/99. Yohannes used three econometrics models monetarists, demand and supply side model and structuralism model. Results from the first model show that money supply is a cause of inflation in the short run. The results from the second model sow that inflation inertia and actual world inflation affect Ethiopian inflation in the short run. In the last model structural variables have been found to explain both short run and long run inflation in Ethiopia while inflation inertia, money supply and world inflation explain inflation only in the short run.

Yohannes (2000) recommends that the primary concern of policy makers should not be to control inflation, rather to give priority to the supply side. He also adds that demand side factors should not be ignored but must be delegated secondary importance.

Mehari and Wondafrash (2008) investigated the impact of money supply on inflation in Ethiopia. The researchers used quarterly data from the first quarter of 1996/97 until the second quarter of 2006/07. Mehari and Wondafrash (2008) used independent models for the narrow money supply and broad money supply. The result from their work reveals that money supply has a direct impact on inflation. The impact of narrow money supply which includes currency outside banks and net demand deposits was found to be greater than that of broad money supply which includes narrow money supply and quasi money.

From the studies reviewed on Ethiopia; in the short run money supply, inflation inertia and actual world inflation have been found to affect inflation while in the long run Ethiopian inflation is attributed to structural factors, mainly to the bottle necks of the agricultural sector, and to monetary factors.

CHAPTER III

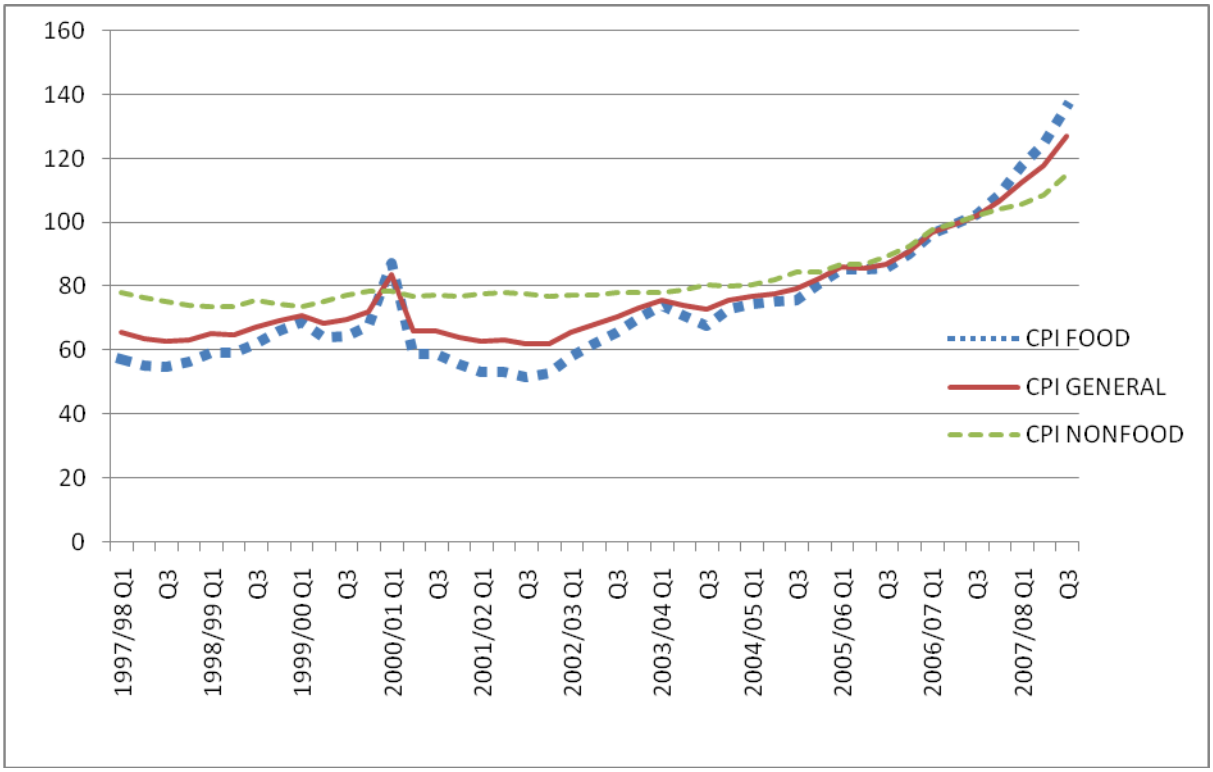
DATA TRENDS

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

3.1 TREND OF CPI

The trend analysis revealed that CPI General and CPI Food showed a similar trend, they initially increased, then declined and finally started to increase .But CPI Non Food showed a peculiar trend, it was constant initially and then starts to increases gradually.Figure1 show that CPI General was having almost similar trend with that of CPI Food. CPI Non Food was having a constant trend for most of the period, but, after 2003/04 Q1 CPI Non Food was having an upward trend which was similar with that of CPI General. CPI general and food gradually increased from 1997/98 Q3 up to 2000/01 Q1, reaching a maximum of 78.4 and 83.7 respectively. They then declined sharply and gradually from 2000/01 Q1-2oo1/02 Q4 reaching a minimum of 62.2 and 52.7 respectively. After 2001/02 Q4 CPI general and food started to increase gradually and then sharply. CPI non food was nearly steady until 2003/04 Q1 and then it starts to increase.

FIGURE 1 CPI GENERAL, FOOD and NON FOOD (drawn using the data from NBE)



The figure reveals that CPI General and Food were having similar trends. This shows the influence of CPI Food on the trend of CPI General.This influence may be due to the huge share of food (57.01 %) in CPI General. The stability of the price of Non Food products may have contributed to the lower impact of CPI Non Food on the trend of CPI.[3]But recently, after CPI Non Food was influencing the trend of CPI. This may come from the rise in petroleum and internationally traded commodities such as cement,consumer goods etc.

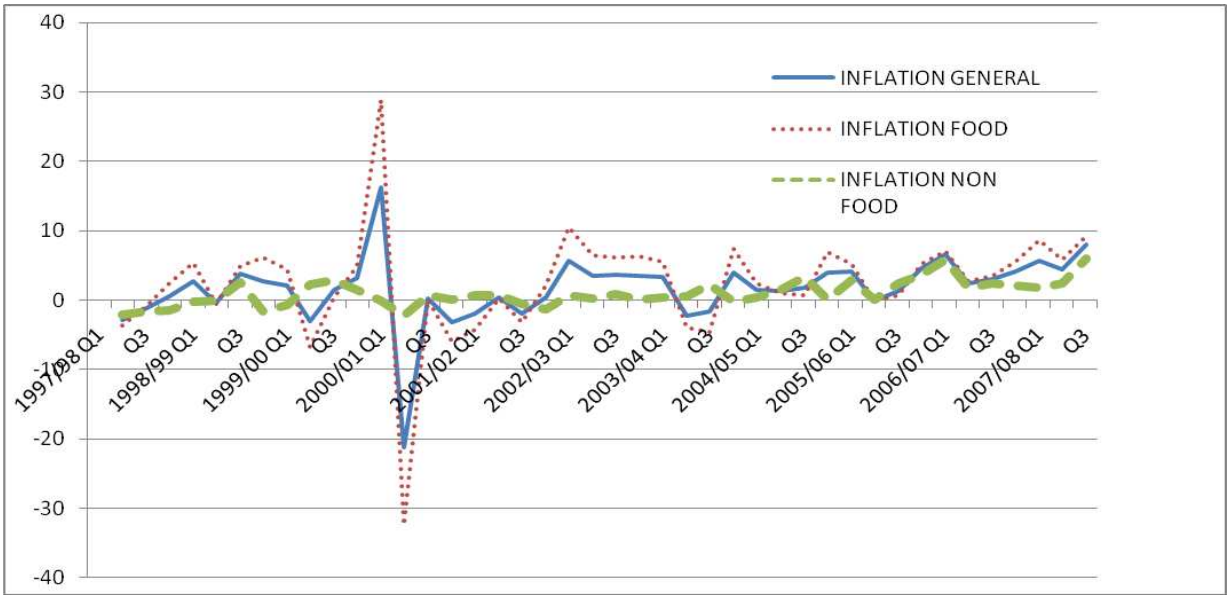
3.2 TREND OF INFLATION

Inflation in Ethiopia during 1997/98 Q1-2007/08 Q3 showed a fluctuating behavior characterized by successive ups and downs. The impact of CPI food on the trend of CPI is also revealed by the similar trends of general and food inflation. Inflation non-food has also showed ups and downs but its impact on influencing the trend of inflation was minimal. But after 2005/06 non food inflation starts to have similar

[3] CPI and CPI General are the same things.

trends to that of general inflation and influencing the trend of general inflation.

Figure2 INFLATION GENERAL, FOOD AND NON FOOD (drawn using the data from NBE)



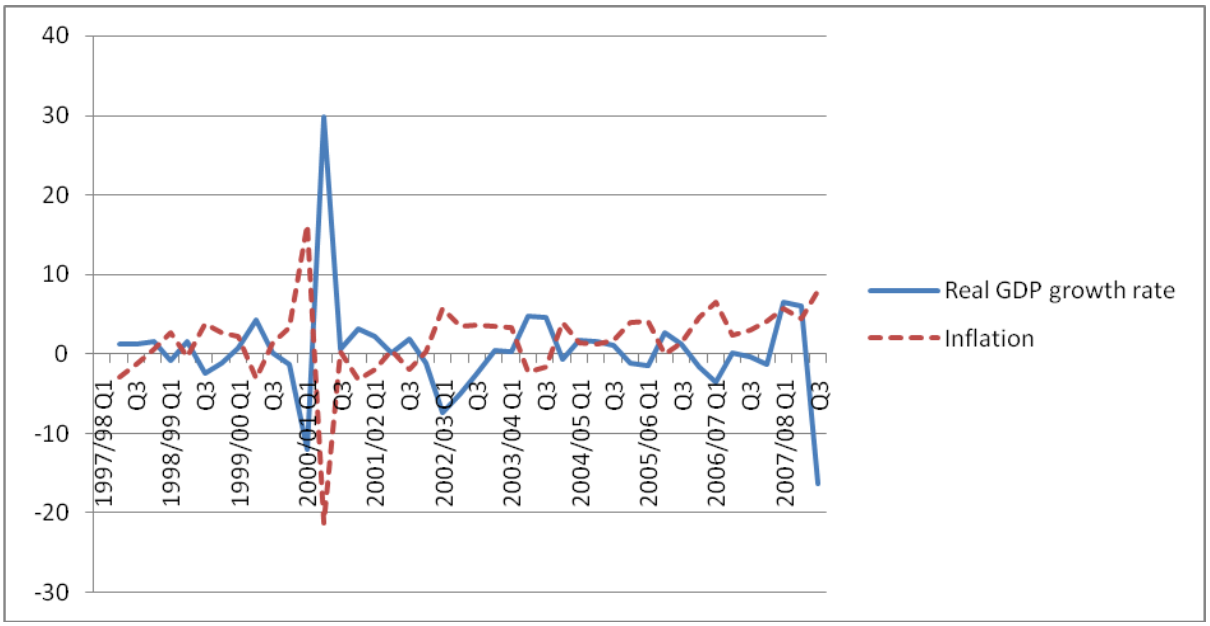
The similar trend of General and Food inflation comes from the huge share of food items in the CPI. The recent rise of non food inflation due to rise in the prices of petroleum and other internationally traded commodities may have contributed to the similar trends of CPI general and noon food. As the figure reveals, the year 2000/01 was peculiar in that both the highest and lowest inflation rates were revealed. The first quarter with an inflation rate of 16.3 was the highest in the period under study, while the second quarter with an inflation rate of -21.2 was the lowest. The highest inflation in 200/01I was due to the lower output growth revealed in the quarter (-12%), while the lower inflation in the second quarter is attributed to the highest output growth revealed in the quarter (29.8). (See figure 3)

3.3 INFLATION and REAL GDP GROWTH

According to economic theory inflation and output growth go in opposite direction. During 1997/98 Q1-2007/08 Q3 inflation and real GDP

growth have been moving in opposite direction most of the time which is in harmony with theoretical expectations.

Figure 3 Inflation and real GDP growth rate (drawn using the data from NBE)

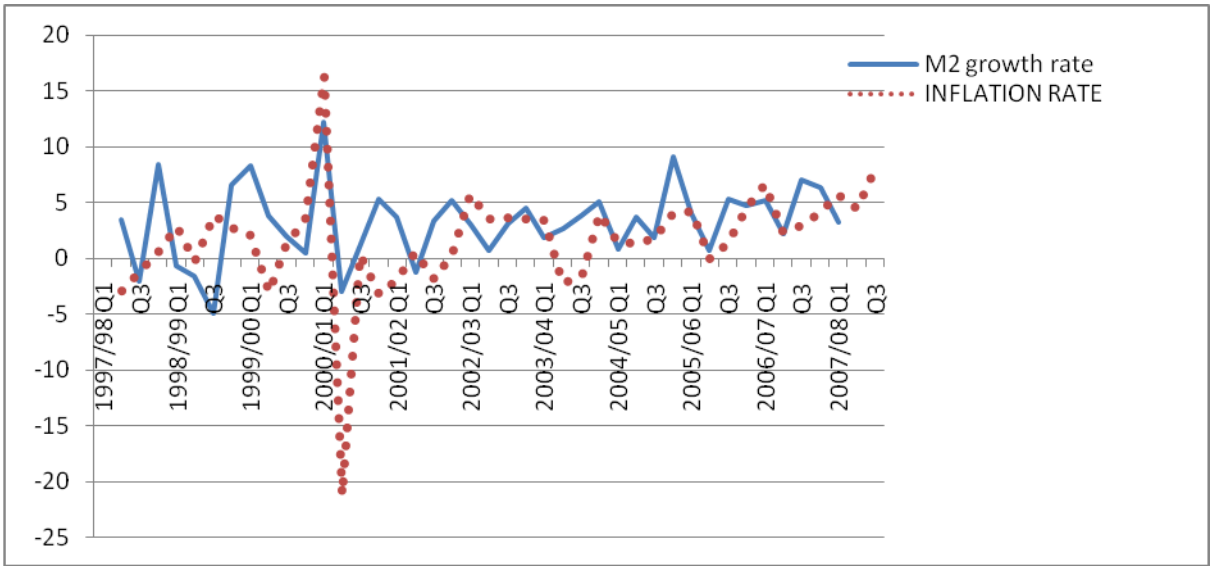


The above figure reveals that In all quarters, except 2000/01 Q1-Q3 where real GDP growth exceed inflation with high differences , inflation and real GDP growth rates exceed one another with small amounts interchangeably. But in recent quarters (starting from 2004/05 Q2) inflation has exceeded output growth. The figure also reveals the close association of inflation and real GDP growth. The highest inflation during the study period occurred when output growth was the least. Similarly lowest inflation rate occurred when output growth was the maximum. The strong and inverse relationship between inflation and output growth is due to the dominance of Agriculture. As a result increased output is accompanied by increased food production; food is the major share holder in the CPI, which intern results in reduced inflation.

3.4 INFLATION and BROAD MONEY SUPPLY [4](M2) GROWTH

The Quantity Theory of Money states that increase in money supply has a positive and direct impact on inflation. Looking at the trend of broad money supply, M2, growth rate and inflation reveals that both variables were moving in the same direction during the period under study.

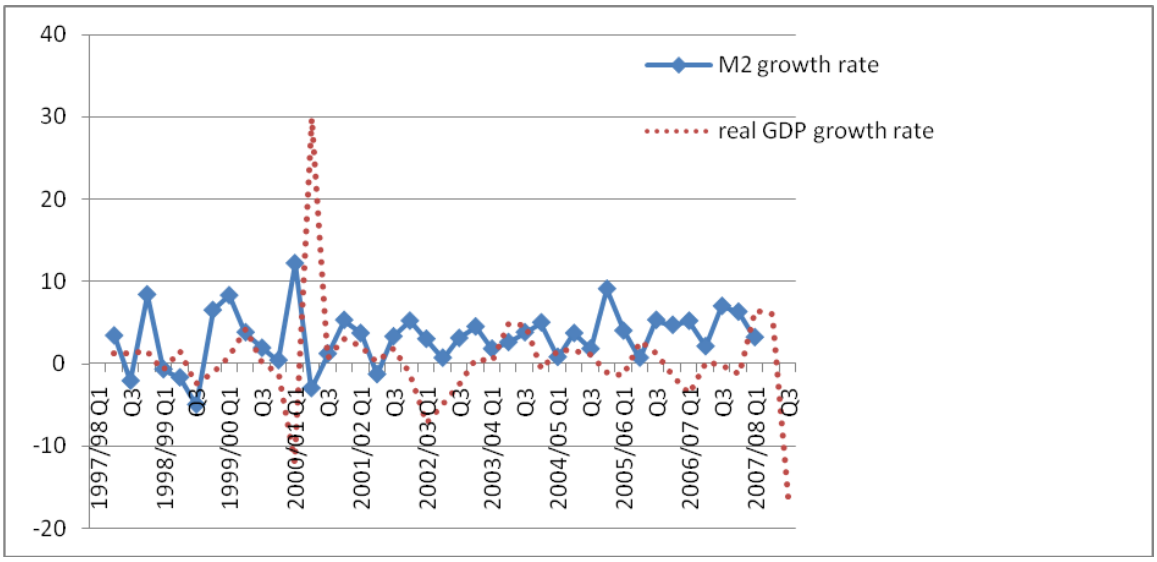
Figure4 Inflation and broad money supply, M2 growth rate (drawn using the data from NBE and EEA)



As figure 4 reveals, though moving in the same direction M2 growth rate was greater than inflation in most of the quarters. This shows the presence of expansionary monetary policy in the country. As it can be seen from the above figure money supply was continuously increasing during all quarters except 1997/98 Q1, 1998/99 Q1-3, 2ooo/01 Q2, and 2001/02 Q2. Most strikingly M2 growth rate was also higher than that of output growth rate in almost all quarters. (See figure5) The higher growth rate of M2 than that of output during the study period implies the strong impact of M2 on inflation in Ethiopia.

[4] Broad Money Supply(M2) includes narrow money supply(currency outside banks and demand deposits) and Quasi-Money(saving deposits and time deposits)

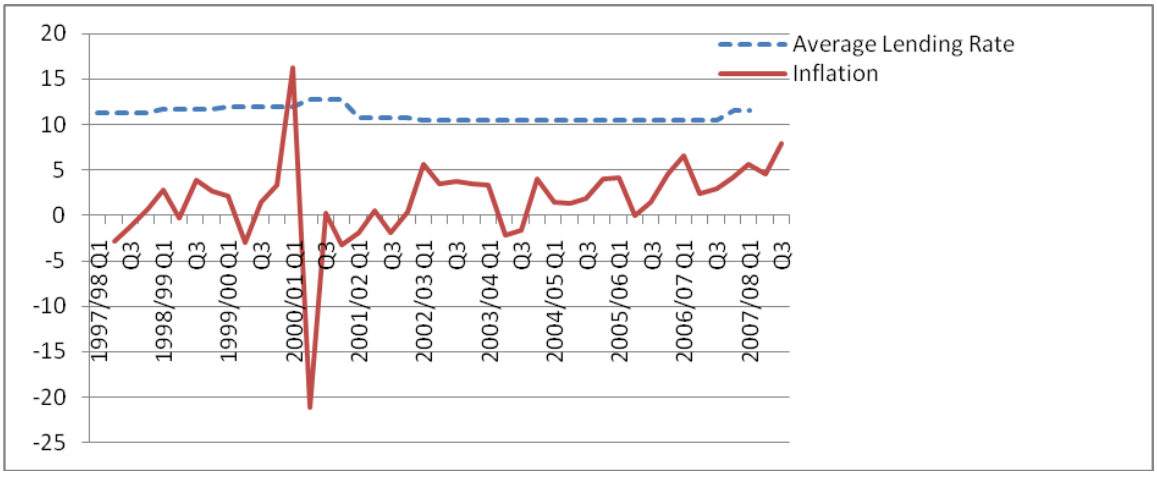
Figure 5 broad money supply growth rate and real GDP growth rate during 1997/98 Q1-2007/08 Q3 (drawn using the data from NBE and EEA)



3.5 INFLATION and AVERAGE LENDING RATE

According to Keynesian economics interest rate has an indirect impact on inflation through investment. This is because lower interest rates induce investment which in turn increases output and hence reduce inflation. Higher interest rate inhibits investment; lowers output and hence increase inflation. Looking at the trend of inflation and average lending rate for Ethiopia in figure 6 reveals the economically unexpected result.

Figure 6 Inflation and average lending rate during 1997/98 Q3-2007/08 Q2 (drawn using the data from NBE)

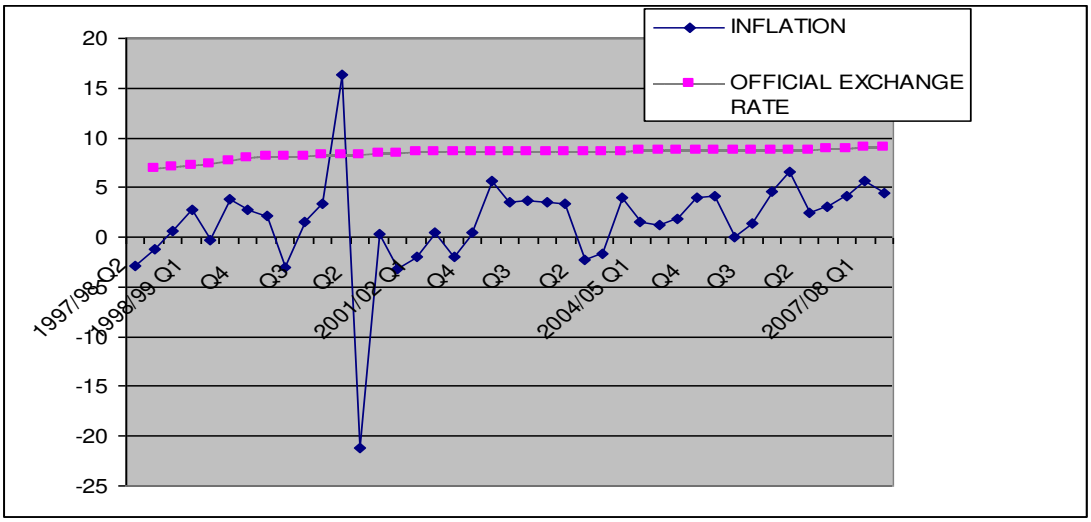


As it can be shown in the graph average lending rate has been more or less stable during all quarters but inflation has shown ups and downs. This stable trend of lending rate has lessened the impact of average lending rate trend on the trend of inflation.

3.6 INFLATION and EXCHANGE RATES

As that of lending rates, the trend of official exchange rate has been stable. This stable trend of exchange rate may have resulted in the lower impact of its trend on the trend of inflation minimum.

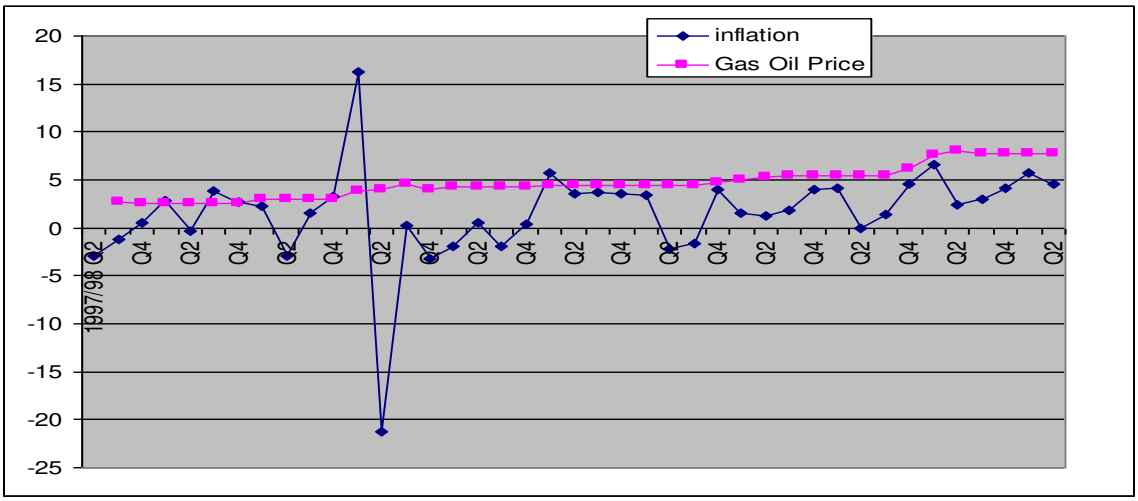
Figure 7 Exchange rates and inflation during 1997/98 Q2-2007/08 Q2 (drawn using the data from NBE)



3.7 INFLATION AND GAS OIL PRICE

As can be seen from the figure below Gas Oil price has been steady but also showing a gradual increment during the study period. This is due to the subsidy given by the government which has reduced the impact of international price fluctuations on the domestic retail price.

Figure 8, Inflation and Gas Oil Price (drawn using the data from NBE)



The steadiness of Gas Oil prices may have contributed to the insignificant impact of the trend Gas Oil prices on the trend of inflation. In addition the improvement on roads has also contributed to the lower impact of Gas Oil price on inflation. This arises because the reduction in tear and wear of vehicles, which reduce cost for the vehicles, has made transport cost of goods to remain stable despite the increase in Gas Oil price.

As it can be seen from the above trend analysis, the trend of CPI was inline with the trend of CPI food, which may be due to the gross share (57%) of food in CPI. The recent increase in the price of petroleum and other internationally traded goods like cement has contributed to the similar tend of CPI general and non food. Inflation was showing ups and downs reaching a maximum of 16.3 and a minimum of -21.2. Similar to that of CPI, inflation was having similar trend with that of food inflation while non food inflation was having similar trends with inflation after 2005/06. As it is expected theoretically inflation and real GDP growth were having opposite trends, which may be attributable to the close association of output growth and food production in Ethiopia.

Broad Money supply was having similar trend with that of inflation. M2 growth rate was also higher than inflation during most of the quarters. Contrary to expectations average lending rate, exchange rate and Gas Oil price were having stable trend which is not inline with that of inflation. To conclude, the above trend analysis reveals that inflation was having theoretically expected trend with the trends of real GDP growth and broad money supply, M2. On the contrary average lending rate, exchange rate and Gas Oil price were having stable trends which were not inconformity with the trend of inflation.

CHAPTER IV

REGRESSION ESTIMATION and ANALYSIS

4.1 MODEL SPECIFICATION and REGRESSION ESTIMATION

4.1.1 MODEL SPECIFICATION

Based on theoretical and empirical grounds two models were specified to explain inflation in Ethiopia. The models are stated as follows

$$CPI = B_0 + B_1 RGDP_t + B_2 M2_t + B_3 E_t + B_4 R_t + B_5 OD_t + B_6 LCPI_t + B_7 LM2_t + B_8 G_{t+Ut} \quad \ldots\ldots 1$$

where CPI is consumer price index, RGDP is real gross domestics product, M2 is broad money supply, E is the value of birr against dollar, R is average lending rate of commercial banks, OD is overall budget deficit (with grant), LCPI is one period lagged consumer price index, LM2 is one period lagged money supply and G is price of gas oil. All the variables, except RGDP, are expected to have a positive sign. Lagged consumer price index (LCPI) variable has been incorporated in to the model to account for the impact of expectations inflation. Lagged M_2 (LM2) is incorporated on the rational that a given money injection in a given quarter may not completely get in to the economy in that quarter but it may have effect on the following quarter. G, Gas Oil price, is incorporated in the model to analyze the impact of international price developments on Ethiopian consumer price index. Gas Oil is chosen due to luck of quarterly world price index and quarterly petroleum index. Gas Oil is chosen because it accounts for more than half of petroleum imports of Ethiopia.

According to time series econometrics, a given regression like equation 1 can explain the long-run relationship among the variables either if all the variables are stationary at level, i.e. I (o), or if they are co integrated. Regression based on non stationary time series leads to spurious

regression, very high R square but with no meaningful relationship among the variables. In order to avoid spurious regression, the presence of stationarity is conducted using Unit Root Test.

4.1.2 Unit root test

Since the data set is a time series data, stationary of the variables is important. First a regression based on non stationary time series explains the relationship during the study period only. This means that it is impossible to infer about the long run relationship of the variables. In addition, regression of non stationary time series on another non stationary time series may lead to spurious regression. In order to avoid these problems stationary test has been conducted on the variables using Eviews 3.1. Augmented Dickey Fuller (ADF) test has been chosen to test for the existence of unit root because it accounts for correlation. In addition it is also widely used in unit root tests. The results are depicted below.

Table – 1 unit root test

Variable	Stationary at	Significance level (%)
CPI	First difference	1
RGDP	First difference	5
M_2	First difference	1
R	First difference	5
E	Level	5
LCPI	First difference	1
LM2	First difference	1
OD	Level	1
G	First difference	1

The above table shows that all the variables, except official exchange rate and overall deficit, are non stationary. This implies that a regression based on the above variables can not explain the long run relationship among the variables; in addition it may also lead to spurious regression. But a regression of a unit root time series on another unit root time series can be meaningful if the variables are co integrated.

4.1.3 Testing for co integration

As has been made clear above, a regression based on unit roots is meaning if the variables are co integrated, i.e. have long run relationship.

According to time series econometrics, if the residuals from a regression of unit roots are stationary then the variables are said to be co integrated. This is because even if the variables are individually non stationary their linear combination is stationary which is depicted by the stationarity of the residuals. It is now clear that if the residuals from the regression of model 1 are stationary, i.e. the variables are co integrated; the results from the model will show the long run relationship among the variables. In order to check for the existence of long run relationship, co integration, in the model a unit root test on the residuals from the regression has been conducted using Augmented Engle-Granger (AEG) test. The result from the test gives an AEG test statistic of -4.404. The AEG 5 percent critical value is -3.5. Since the computed t is greater than the critical value in absolute terms, the residuals from the regression of CPI on the other variables are I (0); that is they are stationary. Thus regression of equation 1 shows the long run relation ship among the variables.

4.1.4 Estimation and Results

Equation 1 has been estimated using Eviews 3.1 and the result is as follows.

CPI = 49.37-2.21E-7 RGDP + 1.19E-9 M2 + 0.86E + 2.71 R + 2.39E-10 OD+0.29 LCPI +

0.88G +9.93E-11 LM2

Prob[5] = (0.00) (0.00) (0.00) (0.43) (0.00) (0.0.53) (0.00)

(0.29) (0.83)

R^2 = 0.9853 F = 259.8041

Adjusted R^2 = 0.98 Prob(F-statistic)= 0.000

D = 1.7859

From the above results, it can be shown that 98.53 % of the variation in consumer price index is explained by the independent variables. In simple the model explains 98.53% of the variation in the dependent variable, i.e. CPI. The adjusted R^2 value, which accounts for the number of variables, shows that the explanatory variables account for 98% of the variation in consumer price index. The over all significance of the model is also significant. This shows the variable that the variables incorporated in model account for the changes in the dependent variable. The Durbin -Watson value of 1.7859 which is approximately 2 shows the absence of auto correlation in the model. The R^2, the adjusted R^2, the F value and the Durbin-Watson value show that the model is strong.

4.2 DATA ANALYSIS

The value of the constant term, 49.37, which is also significant[6] shows that CPI will have a value of 49.37 units if all the explanatory variables (included in the model) are zero. It may also imply the impact of excluded variables on CPI, other variables kept constant. As it is expected theoretically, holding other variables constant, as real GDP increases by 1 million birr consumer price index decreases by 0.221 units. This relationship is significant. This inverse relationship between CPI and real GDP may be due to the following reasons.

[5] The probability of the t-statistic has been given.(the regression output is available in annex 2)

[6] Significant is used to imply a variable which is significant at all levels (including 1%, 5% and 10%)

First, In Ethiopia as real GDP grows it is due to the performance of Agriculture which accounts for nearly half of the GDP. Agriculture has been performing well in Ethiopia in recent years due to suitable weather condition and due to the effort made by the government to improve Agricultural performance. As output increases, agriculture will hold the great share of the increase. This in turn implies that the output of food items will increase. Food accounting for more than half of CPI (57% in 2006 base), its increased output will result in lower CPI, holding other things constant.

In addition, the market structure of Ethiopia is likely to make output to be inversely related with price. In situations were monopolies elements prevailing in the economy output and price may be positively correlated as it happened in Swaziland. (Acute, etal 2001) But in Ethiopia there are many producers (farmers). This implies that it is impossible for farmers to collude in order to raise price despite output increase. In short, there are many producers who fight for market in Ethiopia. Hence, in such a situation output increase is followed by price fall.

Quantity theorists say that inflation is always and every where a monetary phenomenon. An increase in broad money supply by 1 billion birr, holding other variables constant, is followed by1.19 units increase in consumer price index. The significant impact of M2 on CPI may be due to the expansionary monetary policy followed by the country. This is revealed from the trend of M2 growth rate which was positive in all quarters except 1997/98 Q1, 1998/99 Q1-3, 2ooo/01 Q2, and 2001/02 Q2. As was revealed in the data trends, the growth rate of M2 is higher than that of real GDP. This implies that more money is injected into the economy than is needed.

Average lending rate of commercial banks was found to have a significant impact on inflation in Ethiopia. A rise by 1% of the lending rate, holding other variables constant, results in a 2.71 units increase in consumer

price index and this relationship is found to be significant. It is hard to accept this result which shows the significant impact of lending rate on consumer price index due to two main reasons. First as it is seen in the data trends lending rate was nearly constant and low during the study period , due to this it is hard to conclude that a constant and small lending rate influences another variable(CPI).In addition in Ethiopia the credit market is too small to affect the economy. Looking at the trend results and the small share of the credit market in the economy, it is hard to accept the results of the econometric model which shows the significant impact of lending rates on inflation.

As contrary to theoretical expectations, an increase in the official exchange rate by1 birr, keeping other things constant, reduces consumer price index by 0.86 units. But this relationship is found to be insignificant. This insignificant and deflationary impact of exchange rate may result from three reasons. First the ban of the export of agricultural produce of cereals like teff, wheat etc, which have huge share in CPI (22.54% in 2006 base) has helped in the stabilization of their prices which in turn results in lower consumer price index.

In addition even if exchange rate increase is expected to make imported goods dearer and result in inflationary trend, the cost effectiveness of international firms made imports to be cheaper countervailing the price increase caused by the exchange rate increase. Finally though the devaluation followed by the country after 1992 was expected to increase exports theoretically, research results indicate that the depreciation does not have significant impact on exports. (Paulos, 2008) This implies that exchange rate increase do not lead to much increase in exports and hence showing the lower impact of exchange rates on consumer price index.

Adaptive expectations theory reveals that people base their price expectation on past price level and hence states that expectations affect

inflation. As previous consumer price index increases by 1 unit, other things kept constant, consumer price index increases by 0.29 units. This relationship is found to be significant. This impact of expectations may come from the speculative and hoarding activities. In Ethiopia the availability of credits to farmers led them to hoard their produce in expectation of higher price. In addition traders make speculative activities and hoard the product until prices increase. In addition consumers also rush to buy goods in expectation of high prices in the future. All these speculative activities of farmers, traders and consumers may result in the inflationary impact of expectations on consumer price index.

Overall budget deficit was found to have inflationary impact, but this impact is found to be insignificant. This finding is in contrast to the result of a paper presented on the recent international conference of EEA. The difference in the results may be due to data (quarterly Vs annual) or methodology. As deficit increases by 1 billion birr, other things kept constant, CPI increases by 0.2396 units. This unexpected and insignificant impact of deficit on inflation may be due to the structure of federal government expenditure. More than half of the government expenditure is used to finance current and capital expenditure. (Various quarterly macroeconomic reports of NBE and EEA/EEPRI) Most of the current expenditure is used to finance general services which consists mainly military expenditure. The purchasing power created in general services is low as compared to the expenditure. This in turn may have resulted in lower impact of deficit on inflation. In addition capital expenditure enhances the productivity of the economy in the long run which may have lessened the inflationary impact of deficit.

Through lagged money supply has been influential in the inflationary trends in some countries Carlson (1980); one quarter lagged money supply has been found to have insignificant impact on Ethiopian CPI. As

lagged money supply increases by 1 billion birr, holding other variables constant, consumer price index increases by 0.09 units. This insignificant impact of lagged money supply may be due to lack of organized money market in Ethiopia. Due to this there is no way generally where people can put their money in the form of equities, treasury bills, stocks etc. As a result given money injection gets into the economy immediately. This implies that a given money injection gets into the economy in that quarter and its pass through effect on the coming quarter is insignificant.

As contrary to expectations, Gas oil prices have been found to have no significant influence on CPI. Not only being insignificant, Gas oil price has also unexpected sign. According to the regression result a 1 birr/liter increase in the price of Gas Oil, other variables kept constant, leads to a 0.125 units decline in CPI. The insignificant impact of Gas oil prices is likely to be due to two reasons. First, even if international prices of Gas oil were increasing, domestic retail prices were subsidized. This may have made the impact of Gas oil prices price low in two ways. On the one hand the subsidy reduces the domestic price of Gas oil and hence reducing the inflationary impact. On the other hand along with the subsidy the government was also fixing the prices. As can be seen in the data (Annex 1), Gas oil price was nearly constant for four successive quarters. Not only Gas oil price was constant but it also showed a gradual increase. This may have contributed to the insignificant impact of Gas Oil on consumer price index

In addition the expansion of road network and the quality of roads has contributed to the insignificant impact of Gas Oil prices on CPI. This is because the reduction in tear and wear of vehicles has outweighed the cost increase due to increased Gas Oil price. The increase in vehicles may have also resulted in competition which may have resulted in stable transport cost of goods. The above two reasons also are likely to result in

the deflationary impact, but insignificant, of Gas Oil price. This is because stability of transport costs in a situation of rising prices results in lower real transport cost.

CHAPTER V

Conclusion and Recommendations

5.1 Conclusion

Inflation in Ethiopia is structural. It stems from the fact that output is incapable of growing at a rate that can satisfy the rapidly rising population. This is good news to Ethiopia because by improving on avoiding the structural bottlenecks in the economy it is possible to curb inflation. In addition inflation in Ethiopia is found to be a monetary phenomenon. This mainly attributes to the monetary expansion followed by the government. Growth rate of money supply was in excess of the growth rate of output and hence revealing the impact of money on CPI.

As inline with theoretical expectation, average lending rate is found to have a significant positive impact on consumer price index. This may reveal that production decisions are affected by changes in lending rates in Ethiopia. Despite the expectation that devaluations lead to inflationary trends, exchange rate have been found to have a negative and insignificant impact on CPI. The stability of the exchange rate, restriction of exports of agricultural produce and the import of cheap products has made exchange rate to have an insignificant and negative impact on CPI.

Though deficits were found to be inflationary in various countries (Gosh, etal1996), deficit was found to have insignificant and deflationary impact on CPI. This may be due to the structure of government expenditure. Expectations were found to be inflationary in Ethiopia. This is due to the speculative actions of farmers, traders and consumers. Lagged money supply is found to be significant on influencing CPI. This may be due to lack of organized money market.

As contrary to theoretical and empirical grounds, Gas oil price has been found to be insignificant in influencing CPI. This may be due to the subsidization of Gas Oil prices and improvement in road networks and

quality of roads. In conclusion inflation in Ethiopia is in the long run due to structural, monetary expansion, lending rates and expectations. On the other hand exchange rate, one quarter lagged money supply, Gas Oil prices and deficit have been found to have no significant impact on inflation in the long run.

5.2 Recommendation

Based on the findings of the study, the following measures may help in reducing inflation in Ethiopia.

1. Inflation in Ethiopia is structural. Hence avoiding the structural bottleneck of the economy should be given priority. Most importantly structural bottlenecks of the agricultural sector shall be removed, but at the same time removing the bottlenecks of the other sectors also is important. In order to achieve this productivity must be increased in the agricultural sector. Since we have failed in feeding ourselves using small holder agricultural, the government shall promote commercial farms (private sector).
2. Not only the government must improve productivity in agriculture, but due consideration to increase the production of domestically consumed products (i.e. Food items). It is vivid that if productivity increases in flowers and coffee, then inflation will rise despite the increase in agricultural output. So increasing productivity of domestically consumed products must be done by providing incentives to the farmer and in the private sector.
3. As Friedman states, inflation in Ethiopia is also a monetary phenomena. To make money to contribute to the growth of the economy, but not to inflation, it is necessary to anchor money supply growth in line with output growth. It is also important to improve the national banks independence.

4. Though budget deficit has been found to be in significant making a detailed study of the impact of deficit on inflation should be done. Therefore further study on the impact of deficit on inflation must be done.

5. There is still a controversy whether inflation is imported or not in Ethiopia. Even if Gas Oil price has been found to be insignificant in affecting consumer price index in Ethiopia in the findings of the study, it is impossible to make conclusions about the impact of international price developments on Ethiopian consumer price index based on Gas Oil prices. So it is important to make a detailed analysis of the impact of international prices on Ethiopia CPI.

6. Even though the study has not incorporated market structure variable, the recent act of few traders on salt shows that a lot have to be worked to make the market more competitive. Increasing access to information and avoiding oligopoly elements in the economy must be given priority. In short a lot must be done to make the market as competitive as possible

References:

- Alina Carare, Andrea Schaechter ,Mark Stone , and Mark Zelmer (2002) Establishing Initial Condition in support of Inflation Targeting.
- Anderson YahyaK. (1989). Structural Disequilibrium and inflation in Nigeria. New Jersey
- Atish R. Ghosh, Ann-Marie Gulde, Jonathan D. Ostry and Holger Wolf (1996). Does The Exchange Regime Matter for Inflation and Growth?
- Ayalew Yohannes (2000). The dynamics of inflation in Ethiopia. (Unpublished Master Thesis).Addis Ababa.
- Barung Mbire Barbara (1997). Exchange rare policy and inflation (the case of Uganda). AERC[7]
- Bekele Paulos (2008) The impact of Exchange Rate on International Trade : a Case Study of Ethiopia(A paper presented on the 7th Multidisciplinary Conference at Unity University College)
- Belay W. Getachew (1996). Economic Analysis of inflation from the short run and long run, perspectives (the case of Ethiopia). Vienna, Austria.
- Christopher Crowe (2006).Inflation, Inequality and Social Conflict
- Connell Mc. Campbell R and Brue, L. Stanley. (1986) Contemporary Labor Economics
- Damodar N. Gujarati(2003). Basic Econometrics . Fourth Edition
- Dlamini acute, Dlamini Armstrong and Tsidi Nxumalo (2001). A co integration Analysis of inflation in Swaziland
- Domenico Fanizza and Ludvig Soderling (2006). Fiscal determinants of inflation, A Premier for the Middle East and North Africa. IMFWP /06/216
- Ethoipian economic Association/ Ethiopian economic policy research institute (2007). Report on the Ethiopian economy volume V 2005/06. Addis Ababa, Ethiopia.
- Eva Gutierrez (2003). Inflation Performance and Constitutional Central Bank Independence: evidence from Latin America and the Caribbean. IMFWP/103/153
- Fetus O. Egwaikhide, Lois N. Chete and Gabriel O.Falokin(1994). Exchange Rate Depreciation, Budget Deficit and Inflation: The Nigerian Experience. AERC

[7] AERC stands for AFRICAN ECONOMIC RESEARCH CONSORTIUM

- Flex Hammermann and Mark Flangan (2007) What Explains Persistent Inflation Differentials across Transition Economies .IMFWP/07/189
- Keith M. Carlson (1980). The Lag From Money to Prices
- Lars E.O. Svenson (2007) Inflation Targeting. Princeton University
- Luis Catao and Marco E. Terrones (2003). Fiscal Deficits and Inflation IMFWP/03/165
- M.L Jhingan (1997). Monetary Economics 4th edition. Virinda publication India.
- Mekonnen Mehari and Abera Wondafrash (2008). The Impact of Money Supply on Inflation in Ethioia(A paper presented on the 7th Multidisciplinary Conference at Unity University College)
- Mohsin S. khan and Axel Schimmelpfenning (2006).Inflation in Pakistan: Money or Wheat? IMFWP/06/160
- National Bank of Ethiopia Quarterly Bulletin(2007/08) volume 23, number 2.
- Nilk Sowa and John K Kwakye. (1993). Inflationary trends and control in Ghana. AERC
- Nkunde Mwase (2006).An empirical Investigation of Inflation in Tanzania. IMFWP/06/150
- Richard Jackman, Charles Mulvey and James trevithick (1981). The economics of inflation. Oxford
- Rudiger Dornbusch, Stanley Fisher, Richard Starz (2001). Macroeconomics (3rd) Edition
- Wojciech Maliszewski (2003).Modeling Inflation in Georgia IMFWP/03/212

Annexes

Annex 1 data[8]

Quarter	CPI	RGDP	M2	R	E	OD	G	LCPI	LM2
1997/98									
Q3	63	2.20E+08	1.72E+10	11.25	6.9094	4.26E+08	2.7	63.7	1.75E+10
Q4	63.3	2.24E+08	1.86E+10	11.25	7.03	1.58E+09	2.51	63	1.72E+10
1998/99									
Q1	65.1	2.22E+08	1.85E+10	11.25	7.1529	-3.22E+08	2.51	63.3	1.86E+10
Q2	64.9	2.25E+08	1.82E+10	11.25	7.3711	71200000	2.51	65.1	1.85E+10
Q3	67.4	2.19E+08	1.73E+10	11.75	7.5925	3.70E+08	2.51	64.9	1.82E+10
Q4	69.2	2.17E+08	1.84E+10	11.75	7.928	2.40E+09	2.51	67.4	1.73E+10
1999/00									
Q1	70.7	2.15E+08	1.99E+10	11.75	8.1426	1.24E+09	2.95	69.2	1.84E+10
Q2	68.6	2.25E+08	2.07E+10	11.75	8.1268	5.08E+08	2.95	70.7	1.99E+10
Q3	69.6	2.25E+08	2.10E+10	12	8.1489	1.50E+09	2.95	68.6	2.07E+10
Q4	71.9	2.22E+08	2.11E+10	12	8.1972	2.30E+09	2.95	69.6	2.10E+10
2000/01									
Q1	83.7	1.96E+08	2.37E+10	12	8.2393	62900000	3.79	71.9	2.11E+10
Q2	65.9	2.54E+08	2.30E+10	12	8.2836	2.31E+08	4.04	83.7	2.37E+10
Q3	66.2	2.55E+08	2.33E+10	12	8.3575	1.37E+09	4.54	65.9	2.30E+10
Q4	64.1	2.64E+08	2.45E+10	12.75	8.4311	1.14E+09	4.04	66.2	2.33E+10
2001/02									
Q1	62.9	2.70E+08	2.54E+10	12.75	8.4927	9.77E+08	4.3	64.1	2.45E+10
Q2	63.2	2.70E+08	2.51E+10	12.75	8.5605	2.53E+08	4.3	62.9	2.54E+10
Q3	62	2.75E+08	2.59E+10	10.75	8.5605	1.15E+09	4.3	63.2	2.51E+10
Q4	62.2	2.72E+08	2.73E+10	10.75	8.5643	2.59E+09	4.3	62	2.59E+10
2002/03									
Q1	65.8	2.52E+08	2.82E+10	10.75	8.5697	6.34E+08	4.4	62.2	2.73E+10
Q2	68.1	2.39E+08	2.83E+10	10.75	8.5768	1.09E+09	4.4	65.8	2.82E+10
Q3	70.6	2.34E+08	2.92E+10	10.5	8.5845	1.43E+09	4.4	68.1	2.83E+10
Q4	73.1	2.35E+08	3.05E+10	10.5	8.5927	2.02E+08	4.4	70.6	2.92E+10
2003/04	75.6	2.36E+08	3.10E+10	10.5	8.6057	6.60E+08	4.4	73.1	3.05E+10

[8] See the note in the next page.

Q1									
Q2	74	2.47E+08	3.18E+10	10.5	8.6166	4.88E+08	4.4	75.6	3.10E+10
Q3	72.8	2.59E+08	3.30E+10	10.5	8.6244	-1.34E+09	4.4	74	3.18E+10
	75.7	2.57E+08	3.47E+10	10.5	8.6322	1.96E+09	4.7	72.8	3.30E+10
2004/05									
Q1	76.8	2.61E+08	3.49E+10	10.5	8.6408	1.98E+09	4.98	75.7	3.47E+10
Q2	77.8	2.65E+08	3.62E+10	10.5	8.6483	-9.69E+08	5.25	76.8	3.49E+10
Q3	79.2	2.68E+08	3.69E+10	10.5	8.6554	1.78E+09	5.5	77.8	3.62E+10
Q4	82.4	2.65E+08	4.02E+10	10.5	8.6625	1.69E+09	5.5	79.2	3.69E+10
2005/06									
Q1	85.9	2.61E+08	4.18E+10	10.5	8.6702	2.23E+09	5.5	82.4	4.02E+10
Q2	85.8	2.68E+08	4.21E+10	10.5	8.6776	7.77E+08	5.5	85.9	4.18E+10
Q3	87	2.72E+08	4.43E+10	10.5	8.6847	1.92E+09	5.5	85.8	4.21E+10
Q4	91	2.68E+08	4.64E+10	10.5	8.6914	1.38E+09	6.22	87	4.43E+10
2006/07									
Q1	97	2.58E+08	4.88E+10	10.5	8.6986	1.50E+09	7.64	91	4.64E+10
Q2	99.3	2.59E+08	4.98E+10	10.5	8.7197	1.81E+08	8.04	97	4.88E+10
Q3	102.3	2.58E+08	5.33E+10	10.5	8.83153	2.46E+09	7.7	99.3	4.98E+10
Q4	106.5	2.54E+08	5.67E+10	10.5	8.9275	1.87E+09	7.7	102.3	5.33E+10
2007/08									
Q1	112.5	2.71E+08	5.85E+10	10.5	9.0344	1.32E+09	7.77	106.5	5.67E+10
Q2	117.5	2.87E+08	6.11E+10	11.5	9.0704	2.59E+09	7.77	112.5	5.85E+10

Source : NBE and EEA/EEPRI

Note;

- CPI is consumer price index, RGDP real domestic product, M2 is broad money supply, R is average lending rate of commercial banks, E is the exchange rate , OD is overall budget deficit , G is Gas Oil price, LCPI is one quarter lagged CPI and LM2 is one period lagged broad money supply
- CPI, RGDP, M2, OD, LCPI and LM2 are in birr. Gas Oil is in terms price in birr per liter. Exchange rate is in birr (i.e. price of dollar in terms of Ethiopian birr) Average lending rate is in percentage units

Annex-2 regression and co integration test results [9]

Dependent Variable: CPI
Method: Least Squares
Date: 08/21/08 Time: 10:51
Sample: 1 40
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	49.37438	10.47366	4.714149	0.0000
RGDP	-2.21E-07	2.72E-08	-8.115337	0.0000
M2	1.19E-09	4.23E-10	2.826324	0.0082
R	2.712755	0.666467	4.070350	0.0003
E	-0.864858	1.088288	-0.794696	0.4328
OD	2.39E-10	3.82E-10	0.626200	0.5358
G	-0.887126	0.830714	-1.067908	0.2938
LCPI	0.291806	0.090268	3.232655	0.0029
LM2	9.93E-11	4.71E-10	0.210963	0.8343

R-squared	0.985304	Mean dependent var	77.01500
Adjusted R-squared	0.981512	S.D. dependent var	14.66439
S.E. of regression	1.993947	Akaike info criterion	4.413217
Sum squared resid	123.2505	Schwarz criterion	4.793214
Log likelihood	-79.26433	F-statistic	259.8041
Durbin-Watson stat	1.785912	Prob(F-statistic)	0.000000

Unit root test for residuals

ADF Test Statistic	-4.404234	1% Critical Value*	-4.2165
		5% Critical Value	-3.5312
		10% Critical Value	-3.1968

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESIDUALS)
Method: Least Squares
Date: 08/22/08 Time: 06:01
Sample(adjusted): 3 40
Included observations: 38 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESIDUALS(-1)	-1.098848	0.249498	-4.404234	0.0001
D(RESIDUALS(-1))	0.159653	0.179224	0.890801	0.3793
C	0.360671	0.641910	0.561871	0.5779
@TREND(1)	-0.015514	0.027895	-0.556157	0.5817

R-squared	0.469087	Mean dependent var	0.114586
Adjusted R-squared	0.422242	S.D. dependent var	2.432961
S.E. of regression	1.849303	Akaike info criterion	4.166796
Sum squared resid	116.2774	Schwarz criterion	4.339173
Log likelihood	-75.16912	F-statistic	10.01354
Durbin-Watson stat	2.038371	Prob(F-statistic)	0.000071

[9] The difference between ADF and AEG unit root tests is only on their critical values.