Master thesis for the Master of Philosophy in Environmental and Development Economics

Sources of Economic Growth in Ethiopia:
A Time Series Empirical Analysis, 1981-2009

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Preface

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Abstract

This study is concerned with time series empirical analysis on sources of GDP growth in Ethiopia for the period 1981 to 2009. An aggregate Cobb-Douglas production function for Ethiopia is estimated by expressing the production function in intensive form. Growth equation is estimated with a time trend to capture the rate of technological progress within a cointegrational framework. Assuming constant returns to scale, the intensive production function is estimated with OLS and the regression result showed that input elasticities for capital and labor were 0.43 and 0.57 respectively. And average rate of technological progress was .001. These parameters are used to compute the growth contributions of capital, labor and technical progress. Capital, labor and technological progress contributed about 56%, 42%, and 2% respectively to GDP growth in Ethiopia the period 1981 to 2009. From 1981 to 1991 GDP, capital and labor annually grew on average by 1.2%, -0.03% and 3.1% respectively. And the contribution of capital, labor and technology to growth were -1.06%, 95.74% and 5.32% respectively in the same period. The dismal GDP growth performance and negative growth of capital formation during 1981 to 1991 occurred because of the socialist government's inappropriate economic policy and fall in agricultural output due to drought. From 1992 to 2009 GDP, capital and labor grew on average by 5.9%, 8.5% and 3.2% respectively. Capital, labor and technology contributions to growth were 66%, 32% and 2% respectively. The increasing capital formation and GDP growth attributed to EPRDF regime's liberalization policy and creation of relatively favorable conditions for private sectors and increase in agricultural out put. Capital labor ratio had positive effect on economic growth in short run as well as long run in Ethiopia during 1981-2009.

1. Introduction

1.1 Background of the Study

The sources of economic growth is a question of great importance concern for many economists who are interested to know and search for factors enabling some countries to grow and develop while others are suffering from abject poverty.

As witnessed by the recent experiences some East Asian countries have recorded astonishing economic performances while the Sub-Saharan Africa (SSA) countries have not been able to obtain the kind of sustained-growth which commonly regarded as premise of development. Ethiopia belongs to SAA countries where poverty is widespread though the country has recently experienced appealing economic growth. For instance, according International Monetary Fund (IMF) World Economic Outlook 2010 report, Ethiopian economy Gross domestic product grew annually by average 11% through the years 2004 to 2009.

What are the sources of the economic growth? Studies based on neoclassical growth model showed that the main sources of economic growth are factor accumulation and total factor productivity. In other words the total output of an economy is the function of its resource endowments (labor, physical capital and human capital) and the productivity with which these endowments are deployed to produce a flow of goods and services. Hossain (2006), undertook an empirical investigation of factors that contributed to economic growth in Indonesia using annual time series data for the period 1966 to 2003 and found that capital and labor accumulation contributed for economic growth about 60% and 32% respectively. Technological progress contribution was 8 percent. Geda et al. (2009) conducted growth accounting exercise based aggregate Cobb-Douglas production for Ethiopia using a time series data from 1953 to 1993. They found that average output growth rate of 3.2 of which the contributions of capital, labor and factor productivity were 0, 2.2, and 1 respectively.

National economic policies, which are influenced by political factors and institutional settings, do also have strong correlation with economic growth. Macroeconomic policies and external factors do play significant role in determining short run economic growth

performance. In order to understand the process of economic growth, we need to know how economies can increase the growth rate of factors of production and their total productivity. Easterly (1993) showed how taxes on international trade, income taxes and investment in communication are correlated with growth. Lee (1996) investigated the impact of government industrial policy and trade protection in Korea, and found that trade protection reduced growth rates of labor productivity and total factor productivity, while industrial policies such as tax incentives and subsidized credit were not.

With this background, this study explores the sources of growth in Ethiopia during the period 1981- 2009. The study will particularly examine the empirical relationship between economic growth, capital accumulation, labor force and total factor productivity (TFP).

1.2 Methodology

Understanding characteristics and determinants of growth requires an empirical framework that can be applied to a relatively long time frame. We also need relevant econometric methods (procedures) to estimate growth parameters. Approach of growth equation formulation and appropriate econometric methods used to estimate the growth equation are discussed as follows:

1.2.1 Growth Accounting

Economic growth, as proposed by neoclassical growth models, can be measured as the average annual change in the natural logarithm of GDP per person. Using the aggregate production approach (Cobb-Douglas production functions) of GDP measurement, Solow (1957) showed how factor accumulation and technological progress determine the path of economic growth in market economy. It seeks to answer the question what proportion of recorded economic growth can be attributed to growth in the capital stock, growth of the labor force and changes in overall efficiency. This procedure is usually referred to as growth accounting. It starts with the basic Cobb-Douglas production function. Growth equation can be derived by log transformation of the aggregate production function.

1.2.2 Econometric Methodology

For the base model estimation, time series data for Ethiopian economy on gross domestic product and capital formation at constant price in Ethiopian Birr is employed in addition to total labor force. Time series property tests of log GDP, log capital and log labor is examined by Dickey-Fuller (DF) stationarity test. These variables are tested for unit root and test results yield non stationarity. The GDP and capital formation are expressed in percapita form. The growth equation is estimated in intensive form with inclusion of constant, trend, and drought dummy variable. The percapita variables (that is log (GDP/Labor) and log (Capital/Labor)) tested for unit root and proved to be integrated of order one. Thus Engle-Granger ADF test of cointegration is conducted and the test result showed long run relation between log (GDP/Labor) and log (Capital/Labor). Having established long run production relation ship, long-term parameter values (that is, input elasticities and technological growth rate) are estimated to compute the contributions of capital, labor and technical progress to GDP growth. Short run dynamic behavior of output growth is estimated with in error-correction model frame work.

This study is organized in five chapters. Chapter two presents an overview of Ethiopian Economy. The third chapter is concerned with review of related literature. Chapter four is devoted to detailed presentation of growth model specification, econometric techniques and empirical results. Chapter five summarizes main findings and makes conclusion.

All estimation and tests results are given by PcGive version 13. In addition different computations and graphs are provided by Oxmetrics 6.1.

2. Overview of Ethiopian Economy

This chapter presents economic growth history of Ethiopia. Descriptive analysis of macroeconomic indicators since 1992 is also made. As discussed in chapter three a number of factors including investment, trade, economic policy, institution and many others affect economic performance of countries. Ethiopia will not be an exception. Different political regimes in Ethiopia followed unique political ideologies and consequently pursued dissimilar economic policies that affected the economic growth of the nation in each regime.

In modern Ethiopian political economic history, we can distinguish three regimes that followed unique macroeconomic policies with its impact on macroeconomic growth performance of the country. These are the period of pre 1974, the period 1974-1991 and 1991 to the present. Ethiopia's economic policy history is characterized by several radical policy changes and blows. During the monarchy (pre 1974) economic policy was mainly known to be a market-oriented economic system. The period 1974–1991 characterized by centralized economic system. Since 1991 EPRDF officially denounced the socialist system and supported market-oriented system. Geda and Degefe (2005) stated that "*cyclical political processes and regime shifts were unpredictable and violent with negative consequences on the economic performance of the country. Economic insecurity pervades the systems as a rule of law, and enforcement of contracts and property right insecurity are configured on an unstable political base*". The following sections discuss major economic growth/development planning and policy of each regime. For the first two regimes, I summarized and presented some of empirical studies conducted by other researchers about the economic policy and growth performance. For post 1991 Ethiopia, in addition to reviewing empirical findings of other scholars about growth performance and policy changes, I presented descriptive analysis of economic performance of the country by using secondary data from different sources.

2.1 The Imperial (Monarchy) Regime: Pre 1974

During the Imperial regime (Emperor Haile Selassie I reigned from 1930 to 1974), the land aristocracy (feudal structure) and the majority of peasants (tenants) constitute the major socio-economic agents. Land was the most important resource and source of power that served as institution to exploit the masses by the Monarchy and the Feudal land lords. Aristocrats and

the church owning most arable land and tenant farmers (mostly in the southern part of the country) paid exorbitant rents. The economy was predominantly subsistence agrarian.

During the early l950s, the emperor called for the transformation of the subsistence agrarian economy to an agro-industrial economy. In order to fulfill this objective the country needed to develop infrastructure, expand and improve health, education, communication and other essential services that enable to utilized resources and improve living conditions of the population. In order to carry through this new economic policy, the emperor framed centrally administered development plans. As presented by Ofcansky and Berry (1991), the government established the National Economic Council (chaired by the emperor) to coordinate the state's development plans during 1954/55 with the objective of improving agricultural and industrial productivity, eradicating illiteracy and diseases, and improving living standards for all Ethiopians. The National Economic Council played significant role in the preparation of the first and second of Ethiopia. The objectives of First Five-Year Plan (1957-61) were to develop a strong infrastructure (essentially transportation, construction, and communications) to connect remote regions; to establish skilled and semiskilled personnel to work in processing industries to help reduce Ethiopia's dependence on imports, and to accelerate agricultural development by promoting commercial agriculture. During the First Five-Year Plan, the gross national product (GNP) increased at a 3.2 percent annual rate as opposed to the projected figure of 3.7 percent, and growth in economic sectors such as agriculture, manufacturing, and mining failed to meet the national plan's targets. Exports increased at a 3.5 percent annual rate during the first plan, whereas imports grew at a rate of 6.4 percent per annum. The objectives of Second Five-Year Plan (1962-67) were diversification of production, introduction of modern processing methods, and expansion of the economy's productive capacity to increase the country's growth rate. During this plan the economy is expected to grow annually by 4.3 percent. Agriculture, manufacturing, and transportation and communications to grow 2.5, 27.3, and 6.7 percent respectively. Ministry of Planning was established and prepared the Third Five-Year Plan (1968-73) that pursued to facilitate Ethiopia's economic well-being by raising manufacturing and agro-industrial performance. During this planning period agriculture, manufacturing, and transportation and communications were expected to grow at respective rates of 2.9, l4.9, and l0.9 percent annually.

However, the development planning efforts of the imperial regime could not materialize its prime objective (i.e. the transformation of subsistence agrarian economy) and improve the living standards of the masses. Some of the factors that contributed for the failure were government's lack of administrative and technical capabilities to implement a national development plan and staffing problems in the planning agency. Many project managers failed to achieve plan objectives because they neglected to identify the resources (personnel, equipment, and funds) and to establish the organizational structures necessary to facilitate large scale economic development. Above all the political institutional structure (system) was the major obstacle for ability to transform the economy and achieve sustainable economic growth.

Land and military power were the vital resource to control land and other resources. Land was the economic basis of the ruling class, which the emperor himself was at the top of the system. According to Geda and Degefe (2005), an economic growth of average of 4 percent per annum during 1960-1974 was achieved. But it did not improve the lives of most Ethiopians. Majority of the Ethiopian population were subject to exploitation from feudal system. About 4/5 of the population was subsistence farmers who lived in abject poverty because they used most of their small production to pay taxes, rents, debt payments, and bribes to the feudal land lords and theirs affiliates.

By late 1960s new educated elite started to challenge the political system by articulating the misery under which the majority of the populations lived. Systemic exploitation by feudal and the monarchy outraged majority of the rural population (because of unjust distribution of land), who were basically in the state of serfdom.

There were a series of protests in 1974 against the feudal regime and the revolution toppled it the same year. The immediate causes for the revolution were associated the famine in Northern Ethiopia(Wollo); the strike by taxi drivers following the 1974 OPEC-induced oil crisis; a revised curriculum of education which was strongly opposed by the educated elite and salary increase demand by the soldiers (military). As these problems were not addressed responsibly, the military removed the emperor from power officially on 12 September 1974. In December 1974 Ethiopia was declared a socialist state. The monarchy was formally abolished in March 1975.

2.2 The Socialist (Derg) Regime: 1974-1991

The revolution in 1974 ultimately resulted in removal of the emperor from power. In September 1974 Provisional Military Administrative Council (PMAC) also called Derg, was established. Derg changed the political system and the economic structure of Ethiopia radically and the government embraced a Marxist-Leninist political philosophy. The government installed a socialist economic system where market forces were deliberately repressed and socialization of the production and distribution process followed strongly.

"*Planning became more ambitious and more pervasive, penetrating all regions and all sectors of the society*", Geda and Degefe (2005). After the revolution, the government's role in determining economic policies changed dramatically and a number of policy measures were undertaken. In January and February l975, the government nationalized financial institutions (including banks and insurance companies). It also nationalized other private properties such as extra houses and manufacturing firms. In March l975, the regime nationalized rural land and granted peasants (by dismantling feudal structure) possessing rights to parcels of land not to exceed ten hectares per grantee. The land reform policy of Derg regime was the major success history that earned credit to the socialist government and praised by the masses, except the feudal land lords, royal families and their associates. In December l975, the government issued Proclamation No. 76, which stated a 500,000 birr ceiling on private investment and advised Ethiopians to invest in enterprises larger than cottage industries.

In order to achieve the building of socialist state and consolidate political power, the government established different economic and political institutions (such as peasant association and cooperatives, marketing boards, huge military, nation wide worker's party).

Ethiopian economic growth performance during the Derg regime was dismal. According to Geda (2001), growth decelerated to 2.3 percent (-0.4 percent in per capita terms) between 1974/75 and 1989/90. Growth was drastically asymmetrical because of its dependence on volatile agricultural sector and negative shocks from political instability, and inappropriate institutions. The Derg regime's growth performance can be categorized in to four phases as discussed in Ofcansky and Berry (1991):

The first phase (1974-78) period of the revolution is characterized by internal political upheaval, armed conflict, and radical institutional reform. There was low economic growth performance because of the government's nationalization measures and the highly unstable political climate caused economic displacement. The military budget consumed a substantial portion of the nation's resources. Consequently, GDP grew sluggishly at an average annual rate of only 0.4 percent.

In the second phase (1978-80), the economy began to recover as the government consolidated power and implemented institutional reforms. The government's new development through Cooperation Campaign (known as ‘zemecha’) also contributed to the economy's improvement. More important, security conditions improved as internal and external threats diminished. In the aftermath of the 1977-78 war with Somalia and the decline in rebel activity in northern part of Ethiopia, the country a set production targets and mobilized the resources needed to improve economic conditions. As a result, GDP increased by of 5.7 percent. Benefiting from good weather, agricultural production increased at an average annual rate of 3.6 percent, and manufacturing increased at an average annual rate of l8.9 percent.

In the third phase (1980-85), the economy suffered from many obstacles. Except for Ethiopian fiscal year (EFY) 1982/83, the growth of GDP declined. Manufacturing output decreased and agriculture fall dramatically. Four factors accounted for these developments. First, the 1984-85 droughts severely affected the country. As a result, the government committed scarce resources to famine relief efforts while postponing long-term development projects. Second, the manufacturing sector deteriorated as agricultural inputs decreased. Manufacturing industries failed to meet the rising demand for consumer items. Third, the lack of foreign exchange and declining investment reversed the relatively high manufacturing growth rates of 1978-80. Finally, Ethiopia's large military establishment created a major burden on the economy. Defense expenditures during this time were absorbing 40 to 50 percent of the government's current expenditure. (ibid).

In the fourth period (1985-90), the economy continued to stagnate, despite an improvement in the weather in EFY l985/86 and EFY l986/87, which helped reverse the agricultural decline. GDP and the manufacturing sector also grew during this period, GDP increasing at an average annual rate of 5 percent.

2.3 EPRDF: 1991 to the Present

Recurrent drought, internal conflict (civil war) and the command economic system policy were among the major factors those contributed for poor growth performance the during Derg regime. Though it was too late, the Derg government declared the failure of the Marxist economic system in March 1990. It announced the adoption of a new strategy for the country's future progress and development including decentralization in planning and mixed economy in which the private and public sectors would play complementary roles. The new strategy would permit Ethiopian and foreign private individuals to invest in foreign and domestic trade, industry, construction, mining, and agriculture and in the country's development in general. But this policy change was not materialized. As discontent of people towards the regime grew, strong resistance from rebel forces across the country intensified, political and military situations deteriorated and finally coalition of opposition forces (Ethiopian People Revolutionary Democratic Front or the EPRDF) removed the Derg regime from power in May 1991 through military action.

EPRDF issued New Economic Policy in November 1991 by openly adopting a market-oriented economic policy. According to Geda (2001), some of the fundamental political factors that dictated the 1991 policy change were: First there was a challenge to socialism both domestically and internationally. Though the leaders of EPRDF were originally the keen sympathizers of Marxism- Leninism political ideology, they confronted domestic dissent toward socialism and the failure of that system in the international context following the collapse of the USSR. Then they are enforced to accept liberalization and decentralization which are antithesis of socialism. The second political factor relates to the deep-rooted dichotomy in Ethiopian elites' politics about the nature of the country's unity. The ruling EPRDF takes the position of "self-determination including cessation" for regions organized along language and cultural lines. EPRDF accepted the reform to get external endorsements (in the face of domestic opposition) and to use macro policy instruments (such as fiscal decentralization) to fight the hostile bureaucracy and promote equitable distribution. In addition to these political factors the regime accepted the reform to stimulate the crippled socialist economy by encouraging the participation of private sectors. The new regime began to carry out liberalization according to World (WB) and International Monetary Fund (IMF) policy prescriptions in a typical Structural Adjustment Program (SAP) packages. It promoted

domestic private sector and opened the door to foreign investors, except in the financial industry. The government devalued the Ethiopian birr against US dollar. It minimized intervention in the market and tried to establish institutions that are compatible with a liberalized economy. The major policy reforms of post EPRDF includes:

a) Domestic and external trade liberalization
b) Financial sector and labor market liberalization
c) Liberalization of the product market, in particular the agricultural sector
d) Pursuing conservative fiscal and monetary policy: expenditure reduction and switching, tax reform, tight monetary policy, exchange rate and public sector reform.

The Ethiopian Privatization Agency (EPA) was established and privatization program started in 1994 in order to encourage the role of the private sectors in the economy. The government has also adopted agriculture Development -led industrialization (ADLI) as grand policy direction for the development program that focuses on productivity growth on small farms and labor-intensive industrialization.

The following section discusses some macroeconomic indicators and related developments in Ethiopia since the reform.

2.3.1 Structure and Growth of GDP Since 1992

GDP can be disaggregated in to the three main sectors: agricultural, service and industrial sectors. Table 2.1 shows shares of the sectors in Ethiopian GDP over the years 1992 to 2009. Agriculture was the main sources of value added contribution to GDP. In the 1990s agriculture accounted about 52 percent of GDP on average. Its share declined to about 42 percent in 2009. The share of service during these two periods rose from 31 to 37 percent. The share of industry in GDP increased from 15 to 17 percent on average. These figures revealed that, sectoral shares fluctuate within a very narrow band. The share of the industrial sector did not show any meaning full change for the last two decades. This indicates absence of structural transformation in the Ethiopian Economy. Macroeconomic performance largely depends on volatile and vulnerable agricultural sector though its share was declining in favor of service sector over time. GDP growth performance of Ethiopian economy was mainly determined by what were happening in the agriculture. GDP growth had loose correlation with both industrial and service sectors. This can be observed from table 2.2. The growth

rates of industrial and service were positive through out all the periods though fluctuated with in limited band.

Table 2.1 Sectoral Share of GDP

Year	Percentage share (%GDP) of sectors		
	Agriculture	Service	Industry[1]
1992	59	29	13[2]
1993	55	30	15
1994	52	31	16
1995	51	32	17
1996	53	31	15
1997	52	31	15
1998	49	33	17
1999	48	34	17
2000	47	35	17
2001	47	34	16
2002	46	35	17
2003	42	38	18
2004	43	36	18
2005	44	36	17
2006	44	37	17
2007	43	38	17
2008	42	39	17
2009	41	41	17

Source: Own computation from World Bank Database

For instance, in the 1990s services grew on average 8% and industrial sector grew about 9%. While agriculture and GDP show similar trend in terms of their growth rate, fore example, in 1994 agricultural growth rate was -2.98% following poor rain fall. In the same year GDP showed growth rate of 3.14 %. Industrial and service sectors grew by 9.95 and 7% respectively.

Ethiopia's cyclical growth is reflected best in its dependence in rain-fed agriculture. For example, due to good rain and good harvest agriculture and GDP grew by 15.85% and 11.71 in 1996 respectively. During 1997/98, and 2002/3 Ethiopian harvest seasons there was rain shortage. As a result, GDP growth decelerated by 3.5% and 2.18% in 1998 and 2003 respectively.

[1] Industry includes manufacturing and non-manufacturing sectors (such as mining and construction ...etc.)
[2] In table 2.1 rows may not sum to 100% due to decimals rounding approximations.

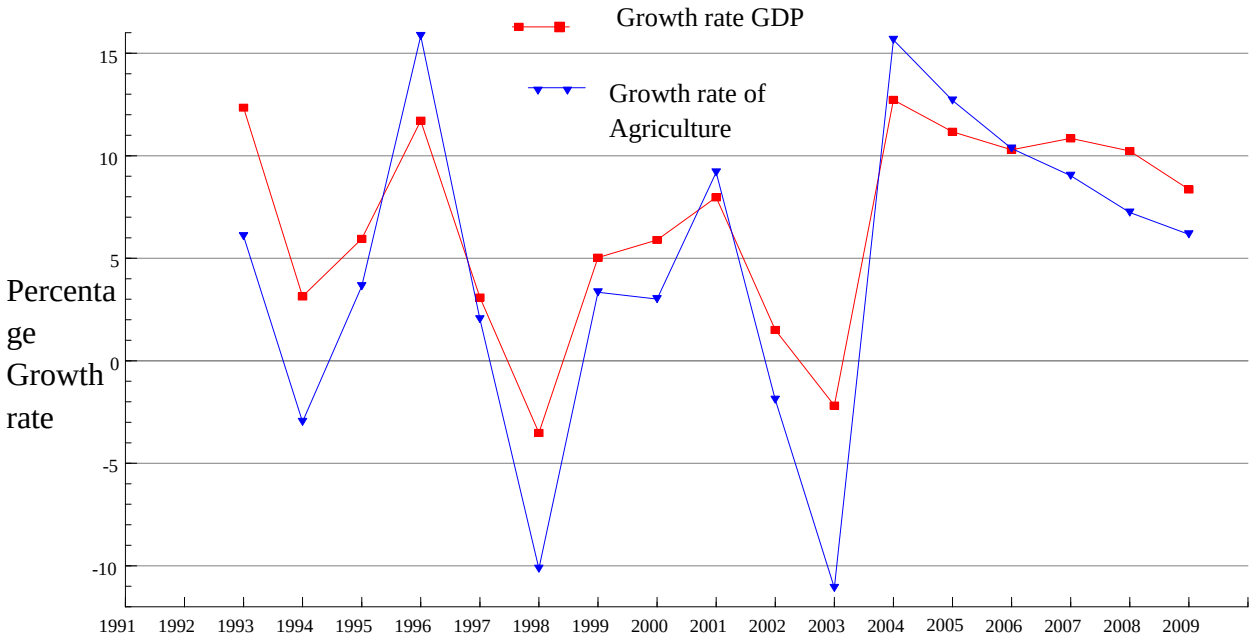
Table 2.2 Percentage growth rate of GDP, Agriculture, Industry and Services

Year	Sectoral Growth rate (in %)			
	GDP	Agriculture	Industry	Services
1992	-9.07	-1.29	-27.45	-13.81
1993	12.35	6.08	31.14	16.00
1994	3.14	-2.98	9.95	7.01
1995	5.95	3.64	8.42	9.06
1996	11.71	15.84	2.91	8.62
1997	3.09	2.03	2.99	3.91
1998	-3.52	-10.14	3.57	3.46
1999	5.03	3.34	6.11	7.26
2000	5.90	3.01	5.82	9.58
2001	7.97	9.19	4.53	5.12
2002	1.50	-1.89	5.99	4.19
2003	-2.18	-11.08	4.71	5.68
2004	12.73	15.65	9.74	5.87
2005	11.17	12.70	9.84	11.97
2006	10.29	10.35	9.79	12.03
2007	10.85	9.03	9.24	14.14
2008	10.24	7.23	9.06	14.23
2009	8.36	6.17	9.37	13.41

Source: Own computation from World Bank Database

GDP growth was positive through out the period of 2004 to 2009. In general the GDP growth performance of Ethiopian economy was closely linked to agricultural growth, which is highly dependent on natural rain. In order to see the how agriculture determines the nature of GDP growth in Ethiopia figure 2.1 is drawn from table 2.2. The figure shows periodic and irregular co-movement of GDP and agricultural growth. This was the direct result of the Ethiopian economy's extreme dependence on rain-fed agriculture. The GDP registered the highest figure when there was good rain and the lowest (sometimes negative) in dry years.

The drought in 1994, 1998, 2003, was accompanied by a sharp decline in out put (see figure 2.1). The good rain seasons during 1995/96, 2001/02 and 2004/05 explained increase in agricultural production that led the GDP to grow by 11, 7, and 12 percent respectively.



Source: Own computation from table 2.2 based on World Bank Database.

Figure 2.1 Growth rates of GDP and Agriculture

A study indicated that fall in agricultural production creates severe shock to the Ethiopian economy. According Geda (2001), dependence on rain-fed agriculture had negative multiplier effect on production levels in subsequent years. For instance the shock in one period is carried over into the next as the early years of the drought deprived peasants not only of current income but also of wealth (for example farmers may be enforced to sell oxen). The next agricultural season may not see an increase in harvest, as the farmers have been dislocated in terms of capital and perhaps also physically if forced to migrate in search of food.

With regard to policy the post 1992, agricultural policy is characterized by abolishing the marketing boards and cooperatives (of Derg era) and less emphasis on the state farms. A new policy package known as Agricultural Development Led Industrialization (ADLI) strategy is introduced. The policy emphasizes raising the productivity of smallholder agriculture and the importance of labor intensive industrialization where agriculture is considered as deriving force over all development destinies of the nation.

2.3.2 Gross Domestic Saving and Gross Investment

As we can see from table 2.3 savings rate in Ethiopia were very erratic over the last two decades.

Table 2.3 Saving and Investment

Year	Saving (% GDP)	Investment (% GDP)	Saving - investment gap (% GDP)
1992	2.09	14.36	12.27
1993	2.68	15.87	13.19
1994	10.25	19.28	9.03
1995	12.26	19.47	7.21
1996	9.40	16.87	7.47
1997	14.44	21.73	7.29
1998	14.25	22.78	8.53
1999	9.48	22.51	13.03
2000	8.34	20.28	11.94
2001	9,68	20,73	11.05
2002	10.37	22.99	12.62
2003	7.98	21.25	13.27
2004	8.78	23.18	14.40
2005	3.71	21.04	17.34
2006	2.54	22.47	19.93
2007	5.88	23.95	18.06
2008	4.22	21.40	17.18

Source: Own computation from World Bank Database

In the early 1990s, specifically in 1992 and 1993, saving as percentage of GDP was 2.09% and 2.68%. This was because of low private sectors saving as the economy transits from socialist economy to relatively liberalized economy, and high government consumption to rehabilitate the economy. From an average of 12 per cent of the GDP during 1994-1998, (because of improvement in tax collection, large revenue mobilized from privatization and international assistance to implement structural adjustment program), gross domestic savings as percentage of GDP went down to 9 per cent on average in the 1999 -2001. A major factor behind the depletion of the savings rate during these years was negative savings in the public sector due high military expenditure during war with Eretria (1998-2000). Savings as percentage of GDP increased to 10 per cent in 2002 following boom in agricultural production (see table 2.1). From 2003-2008 saving GDP ratio remains at low level of about 0.06 on average because of increasing government expenditure.

Compared to domestic savings, investment remains relatively high. The gross investment to GDP ratio stood more than domestic savings in the last two decades, resulting in average savings–investment gap as high as 9 and 15 per cent of the GDP in 1992-1998 and 1999 - 2008 respectively. The gap has been widening since 2005. In general there is high savings-investment gap as percentage of the GDP as public investment increases.

2.2.3 Fiscal Conditions

The fiscal situation in Ethiopia is generally weak with budget deficit remaining a permanent feature of the economy. The country depends highly on foreign aid and loan to finance its budget. The allocation of budget outlay between current consumption and developmental activities is of critical importance since it has direct implication for development prospectus of the nation.

Table 2.4 shows the average growth rates of different fiscal indicators for the periods 1992 to 1998, 1999 to 2000 and 2001 to 2009. The country always runs with budget deficit though the growth rate of the deficit from 1992 to 1998 was 2 percent on average. During the same period domestic revenue, grants and total expenditure grew on average by 16, 13, and 12 percent respectively. In 1999 fiscal condition was characterized by high current expenditure growth (38%), followed by historically (during the period of under study) highest budget deficit of (71%). This happened due to border conflict with Eritrea that led deadly war (from May 1998 to December 2000). Although revenue collection improved during 1993 -2001, domestic revenue showed growth rate of negative 2 percent. In 2006 grants decelerated by 20 percent because many international donors with hold aid to Ethiopia in protest to 2005 national election result disputes and aftermath violence. In recent years capital expenditures and revenue mobilization were increasing. Specifically in 2008 and 2009 revenue collection was improved leading to fall in budget deficit growth rate.

Generally fiscal situation of Ethiopia is determined by its capacity to mobilized revenues, whether conditions, external factors (donors' response). The deficit indicates the country's dependence on external resources

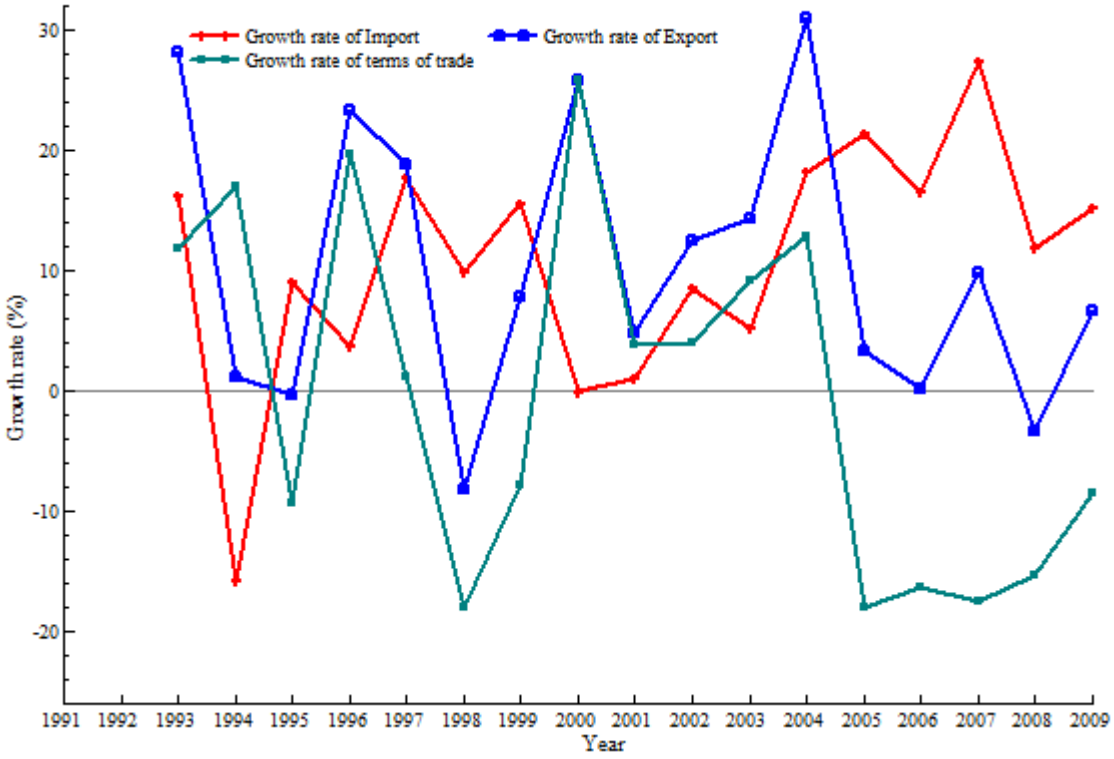
Table 2.4 Government Finance Indicators in Growth Rates

Year	Growth rate (%) of fiscal indicators						
	Revenue (excluding grants)	**Grants**	**Total Revenue**	**Current Expenditure**	**Capital Expenditure**	**Total Expenditure**	**Budget Deficit** (excluding grants)
1992	-20	16	-14	-11	-24	-14	-7
1993	37	-15	28	5	63	22	2
1994	21	75	30	25	41	31	44
1995	41	14	36	17	16	17	-25
1996	16	-3	14	7	12	20	27
1997	12	31	15	3	18	-2	-42
1998	6	-23	2	22	-17	8	17
Ave	16	13	16	10	16	12	2
1999	13	33	16	38	14	30	71
2000	2	-7	1	26	-7	18	41
2001	8	54	16	-27	32	-11	-41
Ave	8	27	11	12	13	12	24
2002	-2	-8	-3	1	15	11	34
2003	7	63	20	25	3	15	26
2004	22	-13	13	-12	27	10	-35
2005	11	13	11	9	33	19	35
2006	23	-20	15	16	20	17	5
2007	11	71	23	12	27	19	34
2008	31	27	30	28	27	28	21
2009	30	38	32	18	24	21	3
Ave	17	21	18	12	22	16	15

Source: Own Calculation Based Data from National Bank of Ethiopia (NBE)

2.3.4 Export, Import and Terms of Trade

The post Derg era foreign trade is characterized by relative liberalization. EPRDF has adopted trade liberalization policies as the appropriate strategy for economic growth. The government formulated different foreign trade policies and made institutional reforms. According to Geda (2001), these changes include: the liberalization of the exchange rate market using the auction system; simplification of licensing procedures, providing supportive services to private exporters and simplifying tariff structure and foreign exchange retention scheme. Figure 2.2 shows the growth rate of foreign trade since 1992. Export grew positively in the last two decades except in 1998 and 2008. Import was growing positively, except 1994.



Source: Own computations based on World Bank Data Base.

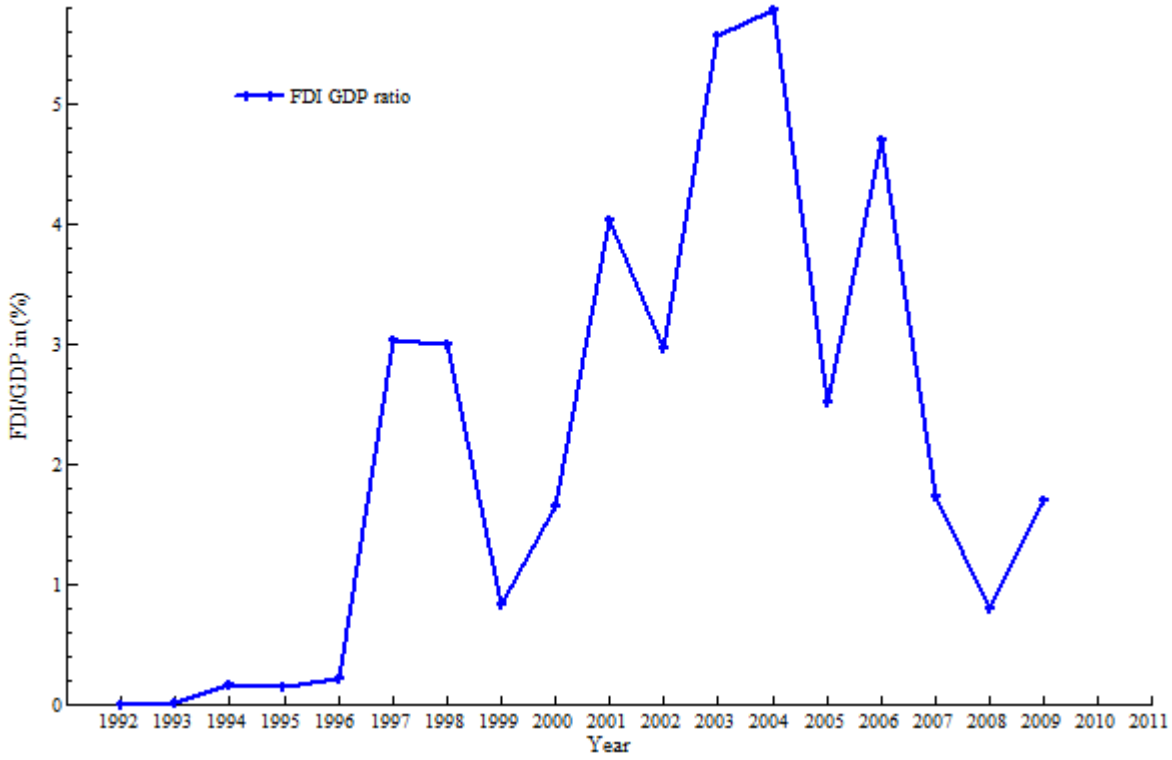
Figure 2.2 Growth in Foreign Trade

Ethiopia's terms of trade is deteriorating because increase in price and volume of imports and instable price and unsustainable export of primary agricultural goods.

2.3.5 Foreign Direct Investment

Upon coming to power, the EPRDF implemented market oriented development strategies where the role of the private sector involvement in the development process considered as integral part. Liberalization involves opening up the economy to out side world to attract foreign investors. As discussed in the previous section, the gap between domestic investment and savings in Ethiopia is wide because of low levels of income (more than 40% of the Ethiopian population live below poverty line) and domestic savings. Foreign direct investment (FDI) as a source of capital and other business know-how is recognized essential factor for economic growth. As presented in Haile and Assefa (2006) the Ethiopia had enacted investment legislation and established Ethiopian Investment Authority to create conducive investment environment and guarantee to foreign investors. These incentive and guarantee measures include 100 percent exemption from payment of import duties and import taxes levied on all capital equipment; exemption from payment of export taxes (except for

coffee); income tax holidays varying from one to five years; tax deductible research and development expenditure; tax exemption for the remittance of capital; full repatriation of capital and profits including dividends and interest payment on foreign loans; payments for technology transfer and management agreements and full repatriation of proceeds from sale or transfer of shares or liquidation of enterprises. Figure 2.3 shows the trend of FDI to GDP ratio in percentages since 1992.



Source: Own Calculation based on World Bank Data.

Figure 2.3 Foreign Direct Investment to GDP ratio

3. Theories of the Determinants of Economic Growth

In this chapter a review of the literature on growth theories and the determinants of growth are presented.

3.1 Models of Economic Growth

Though, we do not find a single generalized and unified theory, we have a number partial theories that discuss the importance of different approaches and factors in economic growth theory. Two main categories are: the neoclassical, which is based on Solow's (1956) growth model and theory of endogenous growth developed by Romer (1986) and Lucas (1988).

3.1.1 Exogenous Growth Model

There are a number economic growth models articulated by many economists. One of the most popular economic growth theories is the Solow's (1956) exogenous neoclassical model. The basic assumptions of the Solow model include: constant returns to scale, diminishing marginal productivity of capital, exogenously determined technical progress and substitutability between capital and labor. In addition, exogenous rates of population growth and technology are among the simplifying assumption. The basic Solow growth model postulates stable equilibrium with a long run constant income growth rate. The model emphasizes factor accumulation and technological progress as determinant of economic growth. Slow asserted that savings or investment ratio determines short-run economic growth. Technological progress, regarded as exogenous to the economic system, is deemed to be determinant of economic growth in the long run.

The neoclassical growth model emphasizes on labor, capital and exogenous technological progress as main determinants of economic growth. However, some of the assumptions and their implications failed to explain the key derivers of economic growth as refuted by empirical evidence on the model. Specifically the Solow model has a number of limitations. First, the model is based on the assumption of a closed economy. This implies that the convergence hypothesis supposes a group of countries having no type of interrelation, Barro

et al.(1995). The second limitation is that the implicit share of income that comes from capital (as empirically estimated from the model) does not match the national accounting information, Lucas (1988).

3.1.2 Endogenous Growth model

The limitations in Exogenous Growth model turned attention to alternatives explanations in which technological progress is endogenous in determining long run growth. It is basically neoclassical economic growth model in which there are (i) constant and increasing returns to capital (ii) the rate of growth is dependent on preferences between present and future consumption. This model is called endogenous growth theory. The theory proposed that the introduction of new accumulation factors, such as knowledge, innovation, Research and Development, brings about sustainable economic growth. Seminal contributions to this theory are made by Romer (1986) and Lucas (1988). Romer presented a formal model that yields positive, long run growth rates on the basis of technological progress driven by the role of externalities, arising from learning by doing and knowledge spillover. Lucas introduces a model in which human capital plays a fundamental role in perpetuating economic growth and preventing diminishing returns to physical capital accumulation.

3.2 Determinants of economic Growth

As shown by the discussions above, each growth theory stresses on several factors as fundamental determinants of economic growth. Neoclassical growth theory puts emphasis on the role of rates of savings/investment and technological progress in the short and long run respectively. Endogenous growth theory underlines human capital, research & development and innovation activities as determinants of economic growth. Other theories (such as New Economic Geography and Cumulative Causation) emphasize different economic and non-economic forces' role in growth. The following section discusses various determinants of economic growth and presents some empirical findings.

3.2.1 Capital Formation

Investment (capital formation) is the most fundamental determinant of economic growth identified by both neoclassical and endogenous growth models. According to the neoclassical

model investment has impact on transitional period while in the endogenous growth models it may have more permanent effects. The importance attached to investment by these theories has led to an enormous amount of empirical studies examining the relationship between investment and economic growth. For instance, Chow (1993) found that capital formation was the main source of growth in Chinese economy from 1952 to 1980. He estimated that the capital coefficient of Cobb-Douglas production function was about 0.60 for the aggregate economy. Kormendi and Meguire (1985), confirmed that the investment-to-income ratio had major effects on economic growth from cross section evidence for 47 countries in the period 1950-1977. Solow (1962) concluded that capital formation was at best a necessary condition for growth in productivity in US, though not a sufficient condition.

3.2.2 Human Capital, Innovation and R& D

According to the theoretical foundation of endogenous growth theory; human capital, innovation, and Research and Development (R&D) are among the most important and complementary determinants of economic growth.

Human capital refers to workers' acquisition of skills and know-how via education, training and experience. Human capital is the main source of growth in several endogenous growth models while it is one of the key extensions of the Solow growth model by human capital, Mankiw et al. (1992). Advances in technological progress often have strong links with education through innovation. The variables used in order to measure the quality of human capital include, expenditure on education and health, training, experience and several other social aspects. Many growth economists mostly pay attention to education variables such as enrolment rates in primary and secondary school, adult literacy rates, highest level of education attained, international test scores on mathematics and scientific skills, (Arvanitidis et al, 2010). The findings of some studies show that educated population is key determinant of economic growth. Barr (1991) showed a significant and positive link between growth rates of real GDP per capita and initial human capital. Mankiw et al. (1992) provided similar findings approximating human capital with schooling enrolment rates of the labor force.

Innovation and R&D activities can play a major role in economic progress increasing productivity and growth. This is due to increasing use of technology that enables introduction of new and superior products and processes. Innovation and R&D is integral part of the endogenous growth models. Innovation activity can be measured by some indexes such as

R&D investment and patent efforts like patent applications, patent grants and so on. Empirically Ulku (2004), found a strong positive relationship between innovation (patent stock) and per capita GDP in both OECD and non-OECD countries, given importance of market size for effective R&D sectors.

3.2.3 Economic Policies and Macroeconomic Conditions

The meaning of stable macroeconomic framework implies macroeconomic policy environment that is favorable to economic growth. The macroeconomic framework can be described as "*stable when inflation is low and predictable, real interest rates are appropriate, fiscal policy is stable and sustainable, the real exchange rate is competitive and predictable, and the balance of payments situation is perceived as viable*".[3]

Economic policies and macroeconomic conditions are the most important conditions for good economic performance because they establish the environment in which economic growth occurs. Economic policies can influence several aspects of an economy through investment in human capital and infrastructure, trade policies, fewer distortions of private markets, improvement of political and legal institutions. According Fischer (1991), the main channels through macroeconomic channels affect growth include rate of inflation, budget deficit, and financial systems and so on. Inflation has important adverse effects on long-run economic performance. Inflation reduces growth by reducing investment and productivity growth. Large budget deficits or heavy tax burdens may retard growth by decreasing the private capital accumulation and reducing productivity growth. Financial systems may have strong impact on growth through different channels. For instance a well-functioning and efficient financial system can boost economic growth via efficiency with which savings are channeled to investment that contributes increased productivity and faster growth. Generally, a stable macroeconomic environment encourages growth by signaling incentives, reducing uncertainty and risk.

Many research findings showed the impact of governmental policies and macroeconomic factors on economic growth. Fischer (1993), showed that growth is negatively associated with inflation, black market premium on foreign exchange and government deficits. He also concluded that a stable and sustainable fiscal policy is crucial for the development of a robust

[3] This definition is taken from Fischer (1993)

macroeconomic framework. Kormendi and Meguire (1985) found a negative effect of both inflation growth and of the monetary variance on economic growth, and no evidence that growth in the ratio of government consumption to output adversely affects economic growth. Grier and Tullock (1989) indicated a negative correlation between growth of government consumption and GDP growth.

3.2.4 Openness to Trade and Foreign Direct Investment

Openness to trade is broadly supported as one of the most important determinant of growth performance. The appealing justifications to be certain of a strong and positive link between openness and growth include exploitation of comparative advantage, technology transfer and diffusion of knowledge, increasing scale economies and exposure to competition. Foreign Direct Investment (FDI) plays vital role in internationalizing economic activity and transfer of technology. The ratio of trade volume (i.e. value exports plus value of imports) to GDP is commonly used as proxy measure of openness. According to Sachs and Warner (1995), an economy is called relatively open given the following criteria are met:

(1) Average quota and licensing coverage of imports are less than 40%
(2) Average tariff rates are below 40%
(3) The black market premium is less than 20%
(4) No extreme controls are imposed on exports, and
(5) The country is not under a socialist regime.

Grossman and Helpman (1990) emphasized the role of freer trade in generating technical progress. They claimed that through trade smaller open economies do adapt technology developed in developed countries more quickly which enables higher rate of equilibrium growth.

There are a number of studies exploring the link between openness and economic growth. According to Sachs and Warner (1995), the more economies are open to trade and capital flows, the higher is the GDP per capita and grew faster. They found a strong association between openness and growth, both within the group of developing and the group of developed during 1970-89. Within the group of developing countries, the open economies grew at 4.49 percent per year, and the closed economies grew at 0.69 percent per year. Within

the group of developed economies, the open economies grew at 2.29 percent per year, and the closed economies grew at 0.74 percent per year.

3.2.5 Institutional Factors

Institutional framework is among crucial determinants of growth that have been stressed in the literatures of economic growth. According to Wikipedia's definition ``*institution is any structure or mechanism of social order and cooperation governing the behavior of a set of individuals within a given human community. Institutions are identified with a social purpose and permanence, transcending individual human lives and intentions, and with the making and enforcing of rules governing cooperative human behavior.''*

Acemoglu et al. (2004) deliberated on the importance of institutions in long run economic growth. They argued that institutions matter because they have a role in defining the information and incentive structure within which economic outcomes are determined. The actors of an economy invest in resources, skills, knowledge, energy and time to achieve their desired level of welfare. Therefore, a rational, wealth-maximizing actor will find it useful to cooperate with other actors in an institutional framework for reducing the transaction costs which are an important factor of the economic performance. For instance, a clear system of laws and property rights reduces transaction costs and uncertainty, attracts investment, and creates an environment conducive to economic growth. In contrast, corruption may have adverse effect on growth through improperly allocation of human capital or less receiving on foreign direct investment.

Rodrik (2000) listed five critical institutions: property rights, regulatory institutions, institutions for macroeconomic stabilization, institutions for social insurance and institutions of conflict management. These institutions do have strong impact on economic growth, and other determinants of growth such as the physical and human capital, investment, technical changes and economic growth process.

At the empirical level, some studies showed strong and robust link that exists between institutions and economic performance. Knack and Keefer (1995) found a strong positive relation between economic growth and security of contracts and property rights. Acemoglu et al. (2002), concluded that higher institutional quality is associated with higher per capita income and lower macroeconomic volatility.

3.2.6 Demographic Factors

Debates were going for decades between experts to investigate how demographic variables affect economic growth. According to (Artelaris et.al, 2006), the most studied demographic factors include population growth, fertility/mortality rate, gender, population density, migration and age composition. For instance high population growth may negatively affect economic growth influencing the dependency ratio, investment and saving behavior and quality of human capital. Age distribution of the population does have significant effect on growth. A higher proportion of working-age population can significantly contribute a lot to growth, while population with higher dependency ratio is an obstacle economic growth. If properly managed, high population density can have positive relation ship with economic growth because of positive economies of scale resulting from increased specialization, labor market economies, knowledge spill over.

Barro (1997) indicated that a decrease in the total fertility rate significantly increases the long run growth potential of a country. Bloom et.al (1999) examined links between demographic change and economic growth in Asia during 1965-90. They showed that the overall rate of population growth had little effect on economic growth. However, they found that changes in life expectancy, age structure, and population density had a significant impact on growth rates. In addition they found strong evidence of feedback from higher income to population change via lower fertility, though a significant component of the demographic changes appears to have been exogenous. Their results suggested that the demographic transition acted both as a catalyst and as an accelerator mechanism, and that demographic effects explained most of East Asia's economic miracle. East Asia benefited from a "virtuous spiral" of income growth and fertility decline, while South Asia seems to remain caught in a low-level population-income trap.

3.2.7 Geographical Factors and Natural Resources

The role of natural resources, topography and climate is so crucial in determining economic growth because they affect productivity, economic structure, transport costs and competitiveness. For example, tropical climatic conditions may encourage the spread of diseases that lower workers' health and productivity levels. Land lockedness can act as serious constraint on exports and economic competitiveness. As discussed in the literature by

(Artelaris et.al , 2006) absolute values of latitude, distances from the equator, proportion of land within 100km of the coast, average temperatures and average rainfall, soil quality and disease ecology variables are used as proxies for geographical factors.

Empirically, Hall and Jones (1999) found a positive correlation between the distance from equator and the level of per capita income. Sachs and Warner (2001) found that countries with more natural resources grow at a slower rate than countries with fewer natural resources. They claimed that this paradox happened because of overvalued exchange rates, wasteful consumption, public investment behavior and high uncertainty due to declining prices of natural resources. Barrios et al. (2010) provided evidence that trends in rainfall have affected economic growth rates in sub-Saharan Africa which means that general decline in rainfall that had adverse effects on its growth rates and is likely to explain part of the puzzle of Africa's relatively poor performance. Their simulations suggested that if rainfall had remained at previous levels, the current gap in GDP per capita relative to other developing countries could have been between 15% and 40% lower.

4. Model Specification, Estimation Techniques and Empirical results

4.1 Accounting for Economic Growth

Lau and Park (2003) defined growth accounting as a "methodology for decomposing the growth of output by its proximate sources". It is the method disaggregating out put growth in terms contribution of factors of production growth and growth of technical progress (or improvements in productive efficiency over time).

According to neoclassical growth theory, economic growth is caused by factor accumulation and total factor productivity. The growth accounting frame work helps us study the behavior of production and indicate how we can estimate the contributions of capital, labor, and technology to economic growth. This approach was pioneered by Solow (1956, 1957). The idea is that economic growth rate can be could be attributed to the growth rates of the capital stock, labor force, and changes in overall efficiency, also called total factor productivity (or Solow Residual). The growth accounting procedure starts with a basic Cobb- Douglas production function such that

$$Y_t = A_t K_t^{\alpha} L_t^{\beta} \qquad (1)$$

Where Y is real output (or Gross Domestic Product at constant prices), A is total factor productivity (TFP), K is physical capital, L is labor. α is the elasticity of output with respect to capital and β is the elasticity of output with respect to labor. We assume that the sum of input elasticities (i.e. α+β) equals one, meaning that the production function exhibits constant returns to scale. We also assume perfect competition, so that wages and the interest rate equal the marginal product of labor and capital respectively. Accordingly, the share of income of capital in national income and is the share of wages in national income.

Equation (1) can be transformed into an output growth equation by taking natural logarithms of variables in both sides and by differentiating them with respect to time (t) this gives the following expressions:

$$\ln Y_t = \ln A_t + \alpha \ln K_t + \beta \ln L_t \qquad (2)$$

$$g_Y = g_A + \alpha g_K + \beta g_L \quad (3)$$

where g_Y is the output growth rate, g_A is the total factor productivity growth rate, g_K is the capital growth rate, and g_L is the labor growth rate.

In order to capture the rate of technological progress; the measure of total factor productivity can be defined as follows:

$$A_t = A_0 e^{\lambda_t} \quad (4)$$

Where, A_0 is the initial "stock" of knowledge and technology. A_t is assumed to grow at a rate λ per period.

The long run growth implications of the Solow growth exogenous growth-model can be derived from the above by reformulating the production function in Equation (1) by assuming that the stock of knowledge grows at constant rate of λ per period. The production function, therefore, is:

$$Y_t = A_0 e^{\lambda_t} K_t^{\alpha} L_t^{\beta} \quad (5)$$

According to Lau and Park (2003), there are two important assumptions about technological change in equations (1) and (5) that deserve explanation: Hicks- neutrality and exogeneity. Hicks-neutral technological change has the effect of increasing the efficiency of both capital and labor. More precisely, with neutral technological progress, production becomes more efficient in such a way that the capital labor ratio remains constant. Technological change is exogenous when its occurrence is independent of the variables in the growth model. Time is the only factor.

Equations (2) and (3) can then be adjusted, respectively, as follows:

$$\ln Y_t = \ln A_0 + \lambda_t + \alpha \ln K_t + \beta \ln L_t \quad (6)$$

$$g_Y = \lambda + \alpha g_K + \beta g_L \quad (7)$$

Equation (7) represents 'the fundamental equation of growth accounting', Hossain (2006). The equation says that rate of output growth equals the sum of weighted rates of growth of

capital and labor plus the rate of technological progress.

As explained above the growth accounting model can be used for the decomposition of output growth rate into the growth rates of capital and labor and TFP growth rate. From equation (7), the total factor productivity growth rate can be expressed as a residual:

$$\lambda = g_Y - (\alpha g_K + \beta g_L) \qquad (8)$$

Residual computed in equation (8) represents contribution to output growth of technological progress. In order to calculate λ, it requires the computation of exponential growth rate of capital and labor. We have to also estimate the elasticities of capital and labor (α and β). There are two approaches of estimating elasticities of capital and labor. These are: Fixed factor share approach and Econometric approach.

4.1.1 Fixed Factor Share Approach

According to this method α and β are estimated as income share of capital and labor in output respectively which assigns 1/3 to α and 2/3 to β. This method is based on three main assumptions. The assumption of profit maximization under perfectly competitive output and input markets; assumption of constant returns to scale (α+β=1), and the assumption of the Hicksian neutrality of technical progress permits the measurement of technical progress over 'T' periods as the summation of the rates of technical progress over the individual intervening periods.

However, if any one of these assumptions fails to hold, the estimated elasticities and total factor productivity growth rate will be biased. Specifically, as discussed in Lau and Park (2003), these estimation problems will follow (1) if returns to scale are increasing, technical progress is over-estimated and the contribution of the inputs is underestimated (and vice versa) (2) nonneutrality prevents simple cumulation over time (3) Constraints to instantaneous adjustments and/or monopolistic or monopsonistic influences may cause production elasticities to deviate from the factor shares, and hence the estimates of technical progress as well as the contributions of inputs using the factor shares may be biased and finally (4) with more than two fixed or quasi-fixed inputs, their output elasticities cannot be separately identified even under constant returns. In addition, Khatiwada and Sharma (2002) stated that

the fixed factor share measure can not be used universally since there are cross-country variations in the labor share and capital share in output. Because of these limitations econometric method deems to be more appropriate.

4.1.2 Econometric Approach

As discussed above, the main limitation of the factor share growth accounting approach comes from the uncertain assumptions. If the assumptions fail to hold, the factor share growth accounting approach may generate biased estimates of the rate of technical progress and the contributions of labor and capital to output growth. Therefore, it would be more realistic to estimate the elasticities directly use of regression. TFP can be derived from the estimated elasticities and the growth of the factors of production, equation (8). More specifically, Cobb-Douglas production function of the following type will be estimated.

$$Y_t = A_0 e^{\lambda t} K_t^{\alpha} L_t^{\beta} e^{U_t} \qquad (9)$$

Where, all variables are defined as before and U is a random error terms with zero mean and a constant variance. Taking logarithms on both sides of equation (9) gives:

$$\ln Y_t = a + \lambda_t + \alpha \ln K_t + \beta \ln L_t + U_t \qquad (10)$$

Where $\ln A_0 = a$, (constant term).

Equation (10) helps us make estimation in level (regular) form. If we assume constant returns to scale, α+β=1, estimation can be also made in percapita frame work (or intensive from). By dividing both sides of equation (9) by L, we can to express the aggregate Cobb-Douglas production function in intensive form.

$$(Y/L)_t = A_0 e_t^{\lambda t} (K/L)_t^{\alpha} e^{Ut} \qquad (11)$$

log transformation of equation (11) gives growth equation in intensive from.

$$\ln(Y/L)_t = a + \lambda_t + \alpha \ln(K/L)_t + U_t \qquad (12)$$

Whether to use level form of (10) or intensive form of growth equation (12) depends on the

plausibility and significance of the parameters estimated and consistency with economic theory and nature (importance) of the variables (data) used for the regression of growth equation.

In this study we adopted the econometric estimation approach. We also run regressions on equations (10) and (12) for Ethiopian data. The regression result (see appendix 1) showed that the intensive form growth equation (i.e. 12) is more appropriate for the estimation. Because of two reasons: First, it is consistent with the assumption of constant returns to scale. Second it minimizes estimation bias (specifically coefficient on labor seems to be over estimated) because of multicollinearity. Observation from correlation matrix indicated high correlation between lnK and lnL, (0.84). There is almost perfect correlation between lnL and trend, (0.999) if the growth equation is estimated level form. These are compelling reasons for estimating the production function in intensive form.

In addition, a dummy is introduced in to Ethiopian output growth equation to account for the effect of agricultural sectors significant contribution to GDP. As discussed in chapter two (see figure 2.1), out put growth is majorly determined by the performance of agricultural sector which is in turn subject to weather condition. Therefore, drought dummy is introduced for some years to account for sharp decline in GDP because of negative growth in agricultural output during dry seasons (years). Thus the basic model in this study is:

$$\ln(Y/L)_t = a + \lambda_t + \alpha \ln(K/L)_t + \phi DRT + U_t \qquad (13)$$

where, DRT= Drought dummy, and other variables are defined as before.

4.2 Data Definitions and Sources

Data used in this study are obtained from three main sources: These are National Bank Of Ethiopia (NBE), World Bank(WB), and United Nations Conference on Trade and Development (UNCTAD). Specific sources and definitions (adapted from definition given by WB) of these data are given as follows:

GDP: Gross Domestic Product is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. The unit of the data is in Ethiopian Birr at

constant price. Source: WB world Development indicators.

Capital: Gross fixed capital formation is used indicator of Capital used in the aggregate production function. According to World Bank definition, Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. The unit of the data is in constant local currency (i.e. Ethiopian Birr). Source: WB world Development indicators.

Labor: Total labor force is used a measure of labor. Definition: Total labor force comprises people ages 15 and older who meet the International Labor Organization definition of the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and the unemployed. The source of the data is World Bank population estimates for the years through 1981 to 2008. Total labor force for 2009 is obtained from United Nations Conference on Trade and Development (UNCTAD).

The number of total labor force, values of GDP, Capital and other variables' data used for the descriptive analysis in chapter two are available on data annex.

4.3 Econometric Analysis

First, before the estimating growth equation (13), the time series properties of lnY/L, lnK/L will be investigated with unit root tests of the Dickey Fuller test. If these variables are I(1), integrated of order one, test for co-integration will be conducted. Cointegration tests essentially Dickey Fuller tests applied on residuals from estimated production function of the form in equation (13). These tests help us to avoid spurious regression and determine whether the variables have long run relationships.

4.3.1 Unit Root Test

Even though I do not use the natural logarithmic level forms of GDP, capital and labor for regression, I present their stationarity test results for the log-levels data series for reference. The unit- root hypothesis is tested using the Augmented-Dickey- Fuller (ADF) test, which amounts to running the following set of regression for each variable:

$$\Delta \ln Y_t = \alpha + \beta_t + \Phi \ln Y_{t-1} + \varphi \sum_{i=1}^{p} \Delta \ln Y_{t-i} + \varepsilon_t \qquad (14)$$

where ε_t refers white noise error term.

The same type of equations are estimated for lnK, ln L and the rations ln (Y/L) and ln(K/L). These tests have determined that whether the estimates of Φ are equal to zero or not. In formal hypotheses statement form: H0: Φ=0 versus H1: Φ<1 is tested by using Dickey and Fuller critical value. (Dickey and Fuller, 1979) provided cumulative distribution of the ADF statistics by showing that if the calculated-ratio (value) of the coefficient is less than critical value from Dickey and Fuller table, then the variable is said to be stationary.

The test results for non-stationarity for the Ethiopian data (see table 4.1) indicated that lnY, lnk, lnY/L and lnK/L are none stationary in levels and stationary at first difference form. lnL is not stationary in both level and first difference forms. The values with two stars imply stationarity at 1% level of significance. Values with out star indicate that non-stationarity cannot be rejected. If a variable is non-stationary in levels, but stationary at first difference, the variable is said to be integrated of order one, I (1).

Table 4 .1 Augmented Dickey-Fuller (ADF) unit roots results *(with constant and trend*)

Variables at level	Computed ADF at lag		Variables in Difference	Computed ADF at lag	
	0	1		0	1
lnY	-0.6687	-0.8557	DlnY	-4.793**	-5.574**
lnK	-1.532	-1.230	DlnK	-6.133**	-3.393
lnL	0.06023	-0.5082	DlnL	-2.162	-2.559
ln*Y/L*	-0.8892	-1.119	Dln*Y/L*	-4.757**	-5.479**
ln*K/L*	-1.610	-1.152	Dln*K/L*	-6.089**	-3.472
Critical 1% values at	-4.34	-4.34	Critical 1% values at	-4.36	-4.36
5%	-3.59	-3.59	5%	-3.59	-3.59

Source: own computation
** = stationary at 1% level of significance.

4.3.2 Cointegration Analysis

Stationarity test result showed that the unit root hypothesis cannot be rejected at the conventional significance levels. Thus, the estimation of the production function requires a

cointegration frame work. Since both variables (i.e. ln(Y/L) and ln(K/L)) contain a unit root, a long-run relation ship between out put per capita and physical capital per capita will exist only if they are cointegrated. In other words, once we determine the order of integration of individual series, the next step is to find out whether the variables share a common stochastic trend, i.e. to test whether two or more variables are cointegrated. Cointegration of two or more variables suggests that there is a long run equilibrium relationship between the variables. This study applies the Engle-Granger ADF test of cointegration. And the cointegration test is conducted in two steps. First apply OLS on (13). Second conduct Dickey Fuller stationarity test on residuals, $\hat{u}_t$, from the OLS regression result from the first step. Residuals represent deviations from long –run equilibrium. If these residuals are stationary, then it means that ln(Y/L) and ln(K/L) in equation (13) are cointegrated. The following regression can be run on residuals to test for stationarity

$$\Delta\hat{u}_t = \rho u_{t-1} + \sum_{i=1}^{p} \delta_i \Delta\hat{u}_{t-i} + \nu_t \qquad (14)$$

From equation (14), if it can not be rejected the hypothesis that ρ =0, it can be concluded that the $\hat{u}_t$ contains a unit root and there fore ln(Y/L) and ln(K/L) can not be cointegrated. $\hat{U}_t$ is residual estimated from equation (13*). For Ethiopian data, the Engle-Granger ADF test (see table 4.2) indicated that the residuals are stationary. The residuals from equations (13*) are stationary at 1% level of significance indicating the existence of long run relation between ln(Y/L) and ln(K/L)

4.2: Engle-Granger ADF test results for residuals (with out constant and Trend)

Dickey Fuller Critical value	Computed ADF at lag			
	0	1	2	3
	-3.773**	-2.258*	-2.576*	-2.416*
At 1% significance level	-2.65	-2.65	-2.66	-2.66
At 5% significance level	-1.95	-1.95	-1.95	-1.96

Source: own computation using PcGive
* = stationary at 5% level of significance
** = stationary at 1% level of significance

The residuals from equation (13) are stationary at 1% level of significance indicating the existence of long run relation between ln(Y/L) and ln (K/L).

4.3.3 Estimation of Growth Equation

Given the presence of a cointegrational relation ship between output and input in annual Ethiopian data, a credible estimation can be made by running regression equation of natural logarithm of $(Y/L)_t$ as dependent variable on natural logarithm $(K/L)_t$. Equation (13) is estimated for the period 1981 to 2009 with constant and with a time trend as a proxy to capture technical progress. In addition as I stated in the previous section, to capture the negative growth in out put in 1984/85, 1998 and 2003 because of rain shortage, a drought dummy variable (called DRT) is introduced. DRT takes a value of negative one in these years and zero otherwise. Accordingly estimation of equation (13) by OLS for Ethiopia gives the following result:

$$Ln(Y/L)_t = 5.073 + 0.001017Trend + 0.4342(lnK/L)_t + 0.05063DRT_t \quad (13^*)$$

(t-value) (16.6) (0.674) (8.78) (1.91)

R^2 = 0.78694 F (3, 25) = 30.78 [0.000]**

The estimated equation (13*) suggests that the output elasticity of capital is about 0.43. Then assumption of constant returns to scale implies that the output elasticity of labor is about 0.57. The estimated equation also suggests that the average rate of technical progress is about 0.1 percent per annum. Given the estimated results, we can decompose output growth rate according to equation (7) that yields:

$$g_Y = 0.001 + 0.43g_K + 0.57g_L \quad (7^*)$$

By using results in equation (7*), I computed the sources of and contribution to GDP growth for Ethiopia during sample periods of 1981-1991, 1992-2009 and 1982-2009. The growth accounting result for Ethiopia is presented in table 4.3 according to the sample periods. The GDP growth rate on average output growth was 1.2%, 5.9% and 4.2% during 1981-1991, 1992-2009 and 1982-2009 respectively. The contribution of capital was nil or (negative) during the sampling period (1981-1991) of the socialist regime. The contribution of labor was consistently remains the same during the three sample periods. The contribution of capital to growth was significantly high during 1992- 2009. Total factor productivity as source of

growth for Ethiopia is virtually negligible. This indicates that factor accumulation, not factor productivity, has been the major factor for growth in Ethiopia.

Generally for last three decades, the calculated sources of growth indicate that the most important source of growth in Ethiopia was capital accumulation, about 56 percent. The contribution of labor to growth was about 42 percent and technology progress contributed only about 2 percent. (See the last column of table 4.3).

Table 4.3 Decomposition of sources and contribution to output growth[4]

Variables	1981-1991	1992-2009	1981-2009
Annual Average Exponential growth rate			
GDP	0.012	0.059	0.042
Capital	-0.0003	0.085	0.055
Labor	0.031	0.032	0.032
Sources of Growth			
Capital(K)*	-0.0002	0.037	0.024
Labor (L)**	0.018	0.018	0.018
Technology(T)	0.001	0.001	0.001
Sum of Estimates (SE= K+L+T)	0.0188	0.056	0.043
Actual output growth rate (AG)	0.012	0.059	0.042
SE/AG	1.567	0.95	1.024
Contribution to Growth (%)			
Capital	-1.67	62.71	57.14
Labor	150.00	30.51	42.86
Technology	8.33	1.69	2.38
Residual	-56.67	5.00	-2.4
Residual adjusted Contribution to Growth (%)			
Capital	-1.06	66.00	55.81
Labor	95.74	32.00	41.86
Technology	5.32	2.00	2.33

Source: own computation.

* Contribution of capital to growth equals 0.434156 times the exponential growth rate of capital

** Contribution of labor to growth equals 0.5658 times the exponential growth rate of labor

We can further interpret and investigate the growth performance of Ethiopian economy by dividing sample periods according the two regimes and implicate for policy (situation) shift effect on productivity. Results from table 4.3 indicate that the growth rates factors of production and their contribution to growth is quite dissimilar in different sub-samples.

[4] The estimated long-term parameter values are used to compute the contributions of capital, labor and technology to economic growth.

During the 1981-1991 (sub period of Derg regime), GDP and labor grew annually on average by 1.2 and 3.1 percent respectively. The growth rate of capital formation was -0.03 percent on average. It is on this account that capital negatively contributed to growth in out put (which is -1.67%). Possible justifications for negligible role of the capital during the Derge regime are (1) In the socialist mode of production and structure market forces and private agents are deliberately suppressed. The policy bottleneck (such as ceiling on amount of capital invested by private sectors) and bureaucratic hurdles killed the incentive of private sectors role the economy. Thus the contribution of private investment, which one of the most important source capital formation, was minimal. (2) The nationalization policy of the regime discouraged incentives to invest by private sectors since property rights and ownership securities were not enforced and protected under such policy. (3) The civil war and rebellion movements enforced the Derge government to allocate lion share of its budget to current expenditure (especially military expenditure) than to developmental sectors (i.e. capital expenditure) that can create bases for capital formation. In addition instability increases uncertainty and discouraged private investment, the key factor in capital formation. (4) Polices toward external sectors, such as foreign trade and foreign direct investment (FDI), was not conducive to capital formation. The flow of capital in the from of FDI was negligible, sometimes negative, (see data Annex C) and trade policy was characterized by import substitution and protectionism. Foreign exchange rate was kept fixed and overvalued. (5) Surpluses (savings) from agricultural sector were not extracted because small farmers were forced to sell their meager produces (on quota bases) to peasant associations (that in turn supply to the government owned Agricultural Marketing Corporation). There was no incentive to produce more. More over during mid 1980s grave drought hit the country and dramatically reduced agricultural produce. From regression result in equation (13*) the drought dummy affected output only at 10% level of significance a for the sample estimation 1981-2009. However this dummy significantly determined output growth during 1981-1991 at 1% level of significance. The estimated regression result for this sub- sample is:

$$\begin{aligned} &\text{LnY/L} = \quad 6.916 - 0.01341\text{Trend} + 0.1545\text{lnK/L} + 0.09893\text{DRT} \\ &\text{(t-value)} \quad (18.6)^{**} \quad (-4.37\ )^{**} \qquad (2.62)^{**} \qquad (3.86)^{**} \\ &R^2 = 0.86665, \quad \text{Adj.}R^2 = \quad 0.8095, \qquad F(3,7) = 15.16\ [0.002]^{**} \end{aligned}$$

Generally the dismal growth performance during the Derg regime was occurred due to inappropriate policies and institutions those inherent to socialist governments as well as

country specific condition, such high dependence on fragile agricultural sector and internal instability. These factors were not conducive for capital formation. Market forces and property rights as the fundamental incentive creating institutions were manipulated to serve the interest of the regime than promoting the participation of the private economic agents in the economy. Internal insecurity, foreign trade and investment policies and subjection of the agricultural sector to vagaries of nature put additional impediments to the capital formation in Ethiopia during 1981- 1991 and resulted in poor growth performance.

Regarding the EPRDF regime's growth record, we observe from table 4.3 GDP, capital and labor grew annually on average by 5.9, 8.5 and 3.2 percent respectively during 1992-2009. The residual adjusted growth contributions of capital, labor and technology were 66, 32 and 2 percent respectively. Compared to pre liberalization, the capital formation and GDP showed a vivid surge in their exponential growth rates. Labor force growth rate was almost the same. Thus, it seems reasonable to conclude that the post 1991 Ethiopian growth performance was mainly attributed to increase in capital formation. Here is the estimated regression result for 1992-2009 sample periods:

$(\ln Y/L)_t =$ 5.376 + 0.008903Trend + 0.3597$\ln(K/L)_t$ + 0.07006DRT

(t-value) (9.13)** (1.38) (3.16)** (1.69)

R^2 = 0.904368 Adj.R^2 = 0.883876 F(3,14) = 44.13 [0.000]**

Some of factors that contributed to the increase in capital formation since 1991 were mainly the internal and external market liberalization. The EPRDF government created private sector friendly regulatory and institutional frameworks. For detail policy changes post 1991 see section 2.3. Market forces were allowed to come into action and appropriate institutions were installed. Here I will explain policy changes that may have contributed to capital formation. First financial sectors (banks and non-banks) were liberalized to Ethiopian nationals. Proclamation No. 84/1994 allowed Ethiopian nationals to participate in the banking and insurance businesses. By virtue of their nature, financial institutions play significant role in mobilizing saving and channeling to funds to private investment activities. Second the liberalization of external sectors (such foreign trade and foreign direct investment) and other sectors created incentive to economic argents. As we see from figure 2.3 the flow of FDI to Ethiopia was remarkable especially since 1996. Third, agricultural output was growing positively, particularly since 2004 (see table 2.2). Fourth as we can see from table 2.4,

international institutions and communities assistance was increasing. If these grants are allocated to developmental activities (as expected) they can make dent on capital formation. Finally relative internal political stability and security contributed to good growth performance in Ethiopia for the last two decades.

Continuity of such growth performance is of serious concern for the country. First, given the structural condition of Ethiopian economy and its high susceptibility to exogenous shocks the sustainability of the growth is doubtful. The economy still depends on vulnerable and backward subsistence-based agricultural sector, where agriculture output value accounts for 41(%GDP) as of 2009. If rain fails to turn out, the economy will plunge into inevitable growth deceleration. There is low degree of structural transformation. The share of industrial sector as percentage of GDP did not show any change since 2005, see table 2. Generally the economy lacks dynamism. Second as discussed section 3.2.3, economic policies and macroeconomic conditions are the most important conditions for good economic performance since they establish the environment in which economic growth occurs. In recent years Ethiopia is experiencing high inflationary pressures. Data from NBE (see data annex B.) showed inflation rate is very high. Annual inflation rates were 25.3 and 36.4 percent in 2008 and 2009 respectively. Inflation has important adverse effects on long-run economic performance. Inflation reduces growth by reducing investment and productivity growth, Fischer (1991). Thus if Ethiopia can not contain the inflationary pressure by addressing its root causes through informed policy intervention and relevant instruments, inflation will continue to pose threat to the country's growth prospectus.

4.3.4 Error Correction Model

In section 4.3.2, we have verified the presence of stable long run relation between ln(Y/L) and ln (K/L) in the Ethiopian data. In an error correction model (ECM) the changes in a variable depends on the deviation from long run equilibrium relation. The residuals from the long run estimates (residuals from equation 13*, in this case) can be used as error correction term (ECT) to explain the short run dynamics (Engle-Granger 1987). Given cointegrational relation ship, there is corresponding error correction representation in which changes in the dependent variable is formulated as function of the level disequilibrium in the cointegration relationship and fluctuations in other stationary explanatory variables. The error correction model representation of this study can be expressed as follows:

$$\Delta \ln(Y/L)_t = a_0 + \theta ECT_{t-1} + \sum \psi_i \Delta \ln(Y/L)_{t-i} + \sum \mu_i \Delta \ln(K/L)_{t-i} + \phi DRT + \varepsilon_t \quad (15)$$

ECT_{t-1} is one period lagged residual, μ_i and ψ coefficients of stationary variables, Δ is the difference operator, a_0 is constant, θ of representing the coefficient error correction term, and all other variables defined as before.

Equation (15) helps us examine the short run effect of capital labor ratio growth rate on the growth rate of output. Because of small size sample, making regression with only lagged variables did not yield desired result. Hence after experimentation with different regressors, I included $\Delta \ln (K/L)_t$ in the regression in order to account for small size sample in the data (so that we should not miss important information). This gave the desired result for error correction model.

$$\Delta \ln(Y/L)_t = 0.001 + 0.1029\Delta \ln(Y/L)_{t-1} + 0.282\Delta \ln(K/L)_t - 0.003\Delta \ln(K/L)_{t-1} - 0.515ECT_{t-1} - 0.0023DRT \quad (15^*)$$

(t-value) (0.0625) (0.373) (3.94)** (-0.0279) (-2.21)* (-0.0569)

Sample: 1983-2009, F (5, 21) = 3.772 [0.014]*

Durbin-Watson statistic: DW = 1.80454, R^2 = 0.47314

According to discussion in (Hossain, 2006), coefficient of one-period lagged error-correction term measures the speed of adjustment to the cointegration relationship if the actual relationship deviates from the long-term relationship due to disturbances or shocks. Engle and Granger (1987) stated that the coefficient must have negative sign. The above regression result shows that the coefficient of ECT_{t-1} is -0.515. Thus the adjustment coefficient is of the expected sign. This coefficient indicates fast adjustment process (about 52%) every time deviations occurred from long run equilibrium path in growth equation in Ethiopian data for sample period of 1983-2009. In addition the coefficient of one time differenced natural logarithm of capital labor ratio is significant in percapita out put growth rate. This indicates short run effects factor accumulation on economic growth in Ethiopia.

ECM describes how out put and inputs behave in the short run being consistent with the long –run cointegrational relation ship. Thus it can be concluded that the growth rate of capital-labor ratio has positive affected on economic growth rate in Ethiopia both in short run as and long run during the sample period of 1981-2009.

5. Summary and Conclusion

This study undertakes an empirical examination of sources of economic growth in Ethiopia for the period 1981 to 2009. An aggregate Cobb-Douglas production function for Ethiopia is estimated by expressing the production function in intensive form. Growth equation is estimated with a time trend to capture the rate of technological progress within a cointegrational framework. A drought dummy is also introduced in to the growth equation in order to account for agriculture's lion share in Ethiopia's GDP. Assuming constant returns to scale, the intensive production function is estimated with OLS and regression result showed that elasticities of capital and labor are 0.43 and 0.57 respectively. And average rate of technological progress is .001. Exponential growth rates of GDP, capital and labor are also computed for periods 1981 to 1991, 1992 to 2009 and 1981 to 2009.

The estimated long-term elasticities and technical progress are used to compute sources of economic growth in Ethiopia for each sample periods. Residual adjusted calculated sources of growth showed that the most important source of growth in Ethiopia was capital accumulation, about 56 percent. The contribution of labor to growth was about 42 percent and technology progress contributed only about 2 percent for the period 1981 to 2009. However the contribution of capital was negative during 1981 to 1991. Average GDP growth rate was 1.2 percent. This was the result of socialist government's (Derg) deliberate overwhelming in the economy that subdued capital formation. The dismal growth performance during the Derg regime was occurred due to inappropriate policies and institutions those inherent to socialist governments as well as country specific condition, such high dependence on fragile agricultural sector and internal instability. Market forces and property rights as the fundamental incentive creating institutions were manipulated to serve the interest of the regime than promoting the participation of the private economic agents in the economy. Internal insecurity, foreign trade and investment policies and subjection of the agricultural sector to vagaries of nature put additional impediments to the capital formation in Ethiopia during 1981- 1991 and resulted in poor growth performance.

The post 1991 capital growth rate was surprisingly positive and increasing. Capital grew by 8.5 percent on average from 1992 to 2009. Average annul GDP growth rate was 5.9 percent. The residual adjusted growth contributions of capital, labor and technology were 66, 32 and 2 percent respectively during the EPRDF regime. The regime's liberalization policy and

creation of relatively favorable conditions for private sectors helped boost capital formation. The EPRDF government created private sector friendly regulatory and institutional frameworks. Specifically, market forces were allowed to come into action and appropriate institutions were installed; financial sectors were liberalized to Ethiopian nationals; foreign trade and foreign direct investment were encouraged and foreign assistance increased. Since 2004 agricultural sector was growing positively. I argue that these factors had contributed for good growth performance in Ethiopia for the last two decades. However given the structural condition of Ethiopian economy and its high susceptibility to exogenous shocks and high inflationary pressure, the sustainability of the current Ethiopian economic growth performance is dubious.

The short run dynamic behavior of output growth in Ethiopia is also examined by estimating an error-correction model for the growth rate of per-capita out put. The test result showed that capital-labor ratio significantly determined short-run output growth rate. Thus it can be concluded that capital labor ratio had positive effect on economic growth in short run as well as long run in Ethiopia during 1981-2009.

References

Acemoglu, D., Johnson, S., James, R. Thaicharoen, Y.(2002): "Institutional Causes, Macroeconomic Symptoms: Volatility, Crises and Growth", NBER, Working 9194

Acemoglu, D. Johnson, S. and Robinson. J (2004): "Institutions as the Fundamental Cause of Long-Run Growth'' Handbook of Economic Growth, MIT and Berkley

Artelaris, P. Arvanitidis, P. Petrakos, G. (2006): "Theoretical and Methodological Study on Dynamic Growth Regions and Factors Explaining their Growth Performance" Dynamic Regions in a Knowledge – Driven Global Economy: Lessons and Policy Implications for the EU, Work package No. 1

Arvanitidis P.A., Petrakos G. and Pavleas S. (2010): "On the Dynamics of Growth performance" Journal of Contributions to Political Economy 29, 59–86

Barrios, S. Bertinelli, L. and Strobl, E (2010): "Trends in Rainfall and Economic Growth in Africa: A Neglected Cause of the African Growth Tragedy", The Review of Economics and Statistics, 92(2), 350–366

Barro, R. J. (1991): "Economic Growth in a Cross Section of Countries" The Quarterly Journal of Economics, Vol. 106, No. 2, 407-443

Barro, R. J. (1996): "Determinants of economic growth, a cross-country empirical study" Research Program in Economic Fluctuations and Growth, NBER, Working Paper 5698

Bloom, D.E, Canning, D., and Malaney, P.N. (1999): "Demographic Change and Economic Growth in Asia", Center for International Development at Harvard University, Working Paper No. 15

Chow G. (1993): "Capital Formation and Economic Growth in China" The Quarterly Journal of Economics, Vol. 108, No. 3, 809-842

Easterly W. and Rebelo J.(1993): ''Fiscal policy and economic growth: An empirical investigation''. Journal of Monetary Economics 32. 417-458.

Engle, R.F. and Granger, W. J. (1987): "Co-Integration and Error Correction: Representation, Estimation, and Testing" Econometrica, Vol. 55, No. 2

Fischer, S.(1991): "Growth, Macroeconomics, and Development", The University of Chicago, NBER Macroeconomics Annual, Vol. 6, 329-364.

Fisher, S. (1993): "The role Of Macroeconomic Factors in Growth" Journal of Monetary Economics 32,485-512.

Geda A. and Degefe B. (2005): ``Explaining African Economic Growth Performance: The Case of Ethiopia´´. African Economic Research Consortium, Working paper ###

Geda A.(2001): “Macroeconomic Performance in Post-Derg Ethiopia”: Northeast African Studies, Vol. 8, No 1, 159-204

Geda, A., Shimeles, A. and Weeks, J. (2009): ‘’Growth, poverty and inequality in Ethiopia: Which way for pro-poor growth?’’. Journal of International

Grier, K. & Tullock, G. (1989): An empirical analysis of cross-national economic growth, 1951-1980” Journal of Monetary Economics 24, 259-276

Grossman, G.M. and E. Helpman (1990): “Trade, Innovation and Growth", American Economic Review, Vol.80, May, 86-91

Grossman, M.G. and Helpman, E. (1994): “Endogenous Innovation in the Theory of Growth” The Journal of Economic Perspectives, Vol. 8, No.1, 23-44.

Haile, G. and Assefa H. (2006): "Determinants of Foreign Direct Investment in Ethiopia: a times series analysis", WestminsterResearch/Policy Studies Institute, paper presented on 4th International Conference on the Ethiopian Economy, Addis Ababa, June 10-12

Hall R. and Jones C. "Why do Some Countries Produce so Much More Output than Others?’’ , NBER, Working Paper 6564

Hossain, A. (2006): ‘’Sources of Economic Growth in Indonesia, 1966-2003’’. Applied Econometrics and International Development, Vol. 6, No. 2

Khatiwada, Y. R. and Sharma, S.K. (2002): "Nepal: Country Study Report", Global Research Project, South Asia Network of Economic research Institute, Kathmandu November 2000

Knack,S. and Keefer, P. (1995): “Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures”, Journal of Economics and politics,Vol.7, No.3, 207–227

Kormendi, R. and Megruire, P. (1985): “Macroeconomic Determinants of Growth: cross-country Evidence” Journal of Monetary Economics, 16, 141–163

Lau, L. J. and Park, J. (2003): "The Sources of East Asian Economic Growth Revisited". Paper presented at the Conference International and Development Economics in Honor Henry Y. Wan, Jr., Cornell University, Ithaca, September, 6-7.

Lee J. (1996): “Government interventions and productivity growth”. Journal of Economic Growth, Vol 1, No 3, 391-414

Lucas R.. (1988): “On the Mechanics of Economic Development” Journal of Monetary Economics 22, 3-42

Mankiw, N., Romer, D. & Weil, D. (1992): “A Contribution to the Empirics of Economic Growth” The Quarterly Journal of Economics, Vol. 107, No. 2, 407-437.

Ofcansky, P. T. and Berry L. (1991), ``Ethiopia: A Country Study´´. Washington: GPO for

the Library of Congress, available at http://countrystudies.us/ethiopia/76.htm

Rodrik, D. (2000): ‘‘Institutions for High-quality Growth: What they are and How to acquire them’’, National Bureau of Economic Research, Working paper 7540

Romer, P. (1986): “Increasing returns and long run growth”. The Journal of Political Economy, Vol. 94, No.5, 1002-1037.

Sachs, J. and Warner, A. (2001) “The curse of natural resources” European Economic Review 45 , 827-838

Sachs, J. and Warner, A. (1995): ‘‘Economic reform and the process of global integration’’, Brookings Papers on Economic Activity, Vol. 1995, No.1, 1-118.

Solow R. (1956): ‘’A Contribution to the Theory of Economic Growth’’. The Quarterly Journal of Economics, the IMT Press, Vol. 70, No. 1. 65-94.

Solow R. (1957): ‘‘Technical Change and the Aggregate Production Function’’. The Review of Economics and Statistics, The IMT Press Vol. 39, No. 3. 312-320

Solow, R. (1962): “Technical Progress, Capital Formation, and Economic Growth” The American Economic Review, Vol. 52, No. 2

Ulku, H. (2004): ``R&D, Innovation, and Economic Growth: An Empirical Analysis´´ International Monetary Fund Working Paper, WP/04/185

Data Annex

Data Annex A.

Year	GDP at constant price In Eth. Birr	Capital formation at constant price in Eth. Birr	Total Labor Force in Number of People	Agriculture at constant price In Eth. Birr	Services value at constant price In Eth. Birr	Industry[5] value at constant price In Eth. Birr
1981	41939549402	8279994742	16309630	22388623893	11887301323	7670618437
1982	42323738530	8508130954	16779048	21676947807	12428946287	8259043923
1983	45809132138	8245321832	17289355	24746580208	13087922625	8823883015
1984	44504497896	10645605900	17897136	21627949303	13338769331	9278996973
1985	39544782259	7370998918	18518647	17165738245	13348545124	9716923523
1986	43365353981	11074550836	19078525	20059814070	13746967909	10148195929
1987	49375618096	11199741058	19624953	23567937804	15437156804	10805686479
1988	49624186372	12483941516	20233000	23170839237	16076775696	10714335395
1989	49445098503	13344793838	20887030	23340233728	16020966660	10719296626
1990	50793182312	10489887258	21539929	24712287463	16677044190	10128105347
1991	47167924281	8251588215	22272716	25558470830	14113818135	7209191970
1992	43077155674	6185230518	23030583	25229693887	12293338388	5478448508
1993	48738716026	7735917186	23690471	26811360668	14426894935	7480147047
1994	50293579499	9695636384	24382688	26025466305	15475270836	8262553870
1995	53375322640	10393664422	25073457	26990525868	16943159266	8988768689
1996	60007695815	10122978551	25728783	31624163398	18468703454	9254038735
1997	61888375000	13450451164	26448719	32272728000	19205302000	9535134000
1998	59748154000	13611099583	27215339	29161585000	19880941000	9881213000
1999	62832596000	14146003621	27942221	30152436000	21378938000	10504145000
2000	66648331000	13516000000	28989445	31072973000	23528717000	11133590000
2001	72181097000	14965433905	30092668	34063533000	24765793000	11649932000
2002	73274436000	16843857954	31214658	33424732000	25824413000	12369127000
2003	71690915000	15237001688	32394495	29920206000	27334063000	12965265000
2004	81421065000	18874445101	33595136	34990166000	28987508000	14291492000
2005	91044094000	19159027995	34856067	39728806000	32672963000	15769323000
2006	100908384172	22674656042	35924730	44062631000	36851043172	17390888000
2007	112468464151	28669514128	36996181	48225807000	42448142489	19074208000
2008	124590538624	28201034465	38152272	51843482678	48939359795	20883043845
2009	135450496843	38133392824	39961668	55141185740	55960546312	22934895735
Source[6]	WB	WB	WB&UNCTAD	WB	WB	WB

[5] Industry does inlude manufacturing and non-manufacturing(such as mining, construction) values

[6] WB= World bank, UNCTAD= United Nations Conference on Trade and Development, NBE= national Bank of Ethiopia

Data Annex B.

Year	Export value at constant price in Eth. Birr	Import value at constant price in Eth. Birr	Real Effective Exchange rate	Foreign exchange Per US$	Inflati-on rate
1981	3897230729	7376595094	184.27	2.07	0.06
1982	3652890245	8050481901	201.44	2.07	0.06
1983	3876190299	8179917476	204.07	2.07	-0.01
1984	4298356358	9491531310	252.86	2.07	0.08
1985	3857525401	9203074884	255.85	2.07	0.19
1986	4716789438	10141174628	212.9	2.07	-0.1
1987	4379463825	10352791521	193.79	2.07	-0.02
1988	4469394697	10649055172	195.1	2.07	0.07
1989	5282166171	10214726907	208.67	2.07	0.08
1990	4719368588	9091242547	241.67	2.07	0.05
1991	3880980883	10427827995	295.43	2.07	0.36
1992	3062853968	9135678396	179.78	2.07	0.11
1993	4056201841	10744569336	135.1	3.69	0.04
1994	4103670412	9171773162	125.03	5.11	0.08
1995	4091929805	10031344950	115.79	5.86	0.1
1996	5163524569	10398609424	113.45	6.31	-0.05
1997	6230775256	12406273034	106.27	6.50	0.02
1998	5739626498	13685383056	103.04	6.88	0.03
1999	6201669962	15988389170	100.06	7.50	0.08
2000	8019937600	15976289600	100	8.15	0.01
2001	8419376302	16137232271	88.79	8.33	-0.08
2002	9540156652	17570295068	91.56	8.54	0.02
2003	11001295849	18503338809	90.41	8.58	0.18
2004	14999631514	22197418488	89.93	8.62	0.03
2005	15507032789	27476105212	98.36	8.65	0.12
2006	15536445354	32413575709	109.17	8.68	0.12
2007	17149461132	42604243684	114.66	8.79	0.17
2008	16577172207	47982292720	139.04	9.24	0.253
2009	17728548253	55850045041	184.7	10.42	0.364
Source	WB	WB	NBE	NBE	NBE

Data Annex C

Year	FDI Million US$	Revenue Million Birr	Grants In Million Birr	Capital Expen-Diture Mil.Birr	Current Expenditure Mil.Birr	Total Expen-diture Mil. Birr	Gross Saving in Ethiopian Birr	Gross investment in Ethiopian Birr
1981	0.06	1757	190	505	1777	2282	5622250922	8279994742
1982	2.04	1877	262	715	1915	2630	4880647583	8508130954
1983	-2.59	2175	259	1245	2541	3786	4758779421	8245321832
1984	5.06	2294	254	933	2236	3169	6358617452	10645605900
1985	0.17	2323	631	1187	2636	3823	2838699237	7370998918
1986	-0.57	2806	443	1472	2590	4062	6644566895	11074550836
1987	-2.57	2926	322	1383	2620	4003	6149699074	11199741058
1988	1.7	3467	636	1401	3420	4821	7246526127	12483941516
1989	-0.5	3899	799	1940	3786	5726	9525827996	13344793838
1990	12	3143	401	1440	3843	5283	7112958289	10489887258
1991	6	2706	463	1214	3640	4854	2442514648	8251588215
1992	0.17	2208	543	952	3254	4205	901472673	6185230518
1993	3.5	3191	466	1785	3435	5219	1305086990	7735917186
1994	17.21	3939	987	2694	4400	7094	5156166047	9695636384
1995	14.14	5913	1132	3157	5216	8372	6542796462	10393664422
1996	21.93	6966	1097	3563	5582	10194	5642235834	10122978551
1997	288.49	7886	1493	4264	5750	10015	8936098069	13450451164
1998	260.67	8381	1185	3608	7191	10899	8513553301	13611099583
1999	69.98	9551	1645	4144	10533	14677	5957128442	14146003621
2000	134.64	9770	1531	3855	13677	17532	5559648000	13516000000
2001	349.4	10599	2628	5296	10441	15737	6989761692	14965433905
2002	255	10408	2424	6129	10550	17650	7597796541	16843857954
2003	465	11149	4554	6313	13527	20496	5721996803	15237001688
2004	545.1	13916	4002	8271	11961	20504	7151593148	18874445101
2005	265.112	15466	4565	11515	13036	24774	3376414510	19159027995
2006	545.257	19529	3732	14042	15234	29325	2560214294	22674656042
2007	221.992	21798	7583	18398	17166	35607	6596517883	26851615031
2008	108.5375	29794	9911	24121	22794	46915	5269760466	26712610469
2009	93.57284	40174	14454	30559	27176	57774	-	-
Source	UNCTAD	NBE	NBE	NBE	NBE	NBE	WB	WB

Appendix 1

Regression results and correlation Matrix for Regular and Intensive forms

Regular form:

lnY = - 41.75 - 0.08779*Trend + 0.3974*lnK + 3.442*lnL + 0.061*DR

Correlation matrix

	lnY	Trend	lnK	lnL	DRT
lnY	1.0000	0.92854	0.94810	0.93529	0.12817
Trend	0.92854	1.0000	0.83060	0.99939	0.071714
lnK	0.94810	0.83060	1.0000	0.83791	0.050013
lnL	0.93529	0.99939	0.83791	1.0000	0.073414
DRT	0.12817	0.071714	0.050013	0.073414	1.0000

Intensive Form:

lnY/L = + 5.049 + 0.001026*Trend + 0.43*lnK/L + 0.06535*DRT

Correlation matrix

	lnY/L	Trend	lnK/L	DRT
lnY/L	1.0000	0.39275	0.87419	0.18347
Trend	0.39275	1.0000	0.37146	0.071714
lnK/L	0.87419	0.37146	1.0000	0.0086700
DRT	0.18347	0.071714	0.0086700	1.0000