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ANALYSIS OF AGRICULTURAL POLICY AND ITS EFFECTIVENESS IN ECONOMIC GROWTH

AN EMPIRICAL INVESTIGATION IN THE ETHIOPIAN CASE

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"Analysis of Agricultural Policy and its Effectiveness in Economic Growth: An Empirical Investigation in the Ethiopian Case."

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List of abbreviations and acronyms

ADDP – Ada District Development Projects

ADF – Augmented Dickey-Fuller

ADLI – Agriculture development led industrialization

AIC – Akaike Information Criteria

BIC – Bayesian Information Criteria

CADU – Chilalo Agricultural Development Unit

DPP – Comprehensive Package Program

CSA – Central Statistic Authority

DF – Dickey – Fuller

EG – Enger Granger

GDP – Gross domestic product

GDPA – Gross domestic product of agriculture

GDPI – Gross domestic product of Industry

GDPT – Gross domestic product total

GEA – Government expenditure on agriculture

MEDaC – Ministry of Economic Development and Cooperation

MOA – Ministry of Agriculture

MoFED – Ministry of Finance and Economic Development

Mpp – Minimum Package Program

MT – Metric tone

NBE – National Bank of Ethiopia

NGO – Non-government organization

RRW – Rural Workers

SIDA – Swedish International Development Authority

TAHADU – Tahtay Adyobo and Hadegti Agriculture Development unit

WADU – Welyta Agricultural Development Unit

WB – World Bank

Abstract

This study has tried to identify the sources and determinants of agricultural product at aggregate level. Agricultural product is examined as a result of labor, land, change in policy environment and weather condition (rainfall).

The common finding in the agricultural policy analysis is that agricultural policies fail to achieve their main objectives of farm income support efficiently at national and regional level.

The sectoral analysis of the study shows that agriculture had a highest fluctuation throughout the sample period in comparison to other sectors. Nevertheless the production (yield) of major crops has been grown and government attention in terms allocating government expenditure on agriculture has been also increased in recent government than the previous.

The time series result of the study shows that labor and land in the short run as well as in the long run are found to affect agricultural product positively and statistically significant. In the short run government expenditure also affects the sector significantly and positively. The contribution of growth of agriculture to national well-being, on the other hand, is found to be less than that of the non-agricultural sector in the long run.

The statistical analysis also shows that the agricultural sector which still provides the livelihood for most of the population made increasing growth rate but with a declining contribution to the over all economic growth as compare to other sector. Rapid population growth and low productivity of land and labor are the main challenges which need great policy attention to improve the work ethic as well as technological expansion to transform and play the sector's significant role on the overall economic growth.

I. INTRODUCTION

1.1 Background of the study

Ethiopia like many countries in the Eastern and Southern Africa region has undergone rapid transition and adjustment in its agricultural sector. Throughout the adjustment process, concerns have arisen regarding the overall implication of the extension package program on crop production, animal rearing and land administration and distribution process for national agricultural growth. Nevertheless the country is one of the most famine- prone countries in Africa, having a long history of famine and food shortages that can be traced back to 250 BC i.e. More than half the Africa's food insecure population live in Ethiopia and six other countries: namely Chad, Zaire, Uganda, Zambia and Somalia, (Ramakrishna et al, 2002, pp.127-143).

Needless to say, agriculture is the mainstay of the Ethiopian Economy. During 2003/04 the agricultural sector contributed 42 percent of GDP. The share of agricultural production in total GDP has been declining overtime and falling below 50 percent. Rural labor force has been growing at an increasing rate of 2.9 percent while the agriculture has been growing at slower rate of 2.8 percent for the 1980/81-2004/05. Nevertheless, the sector is still a primary source of foreign exchange and employment opportunities. This can be evidenced by the fact that the sector provides employment for 85

percent of the population, generates about 90 percent of export earnings, and it also supplies about 70 percent of country's raw material requirement for large and medium sized industries that are agro based (MEDaC, 1999).

Agriculture is the foundation of the country's food production and hence the major contributing sector to food security. As a result of agriculture's role to total output and employment, government policy of the sector expect to identify the basic problem and direct alternative mechanisms to improve living standards of the people; particularly attention must be given to increase incomes and productivity in the agriculture sector. In other word enhancement of agricultural productivity is thus an important one in alleviating rural poverty, and increasing household food security which helps to stimulate the overall economic growth in all non-agricultural sectors.

Improvement in economic growth and survival mechanism for the agriculture sector may use different package approaches for different people and areas, many things are unclear about the characteristic causation and possible remedies of hunger and food insecure in the modern world. A great deal of investigation-analytical as well as empirical is required as background to the analysis of agriculture policy. Additional evidence is needed based on specific data analysis upon the sector.

1.2 Statement of the Problem

There is a long history in economic development with regard to the role of various sectors in development and the choice of strategic sectors. The emphasis on agriculture is clearly justified when one considers the fact that it is the dominant economic sector and on the other hand it is predominantly of subsistence nature characterized by small scale farmers who have been adopting low quality and quantity inputs, rainfed, mixed farming with the use of backward traditional technology implements and practice. Almost all of field operations are performed using hand tools and century old tillage implements with human and animal power, i.e. farmers also use bare hands or very rudimentary tools.

The Ethiopian economy witnessed on average a growth rate of 3.2 percent GDP and the agriculture sector also achieved a growth rate of 2.2 percent per year for the period 1971-2005. This trend of growth is very weak to overcome the existing poverty problem. The productivity performance of the agriculture sector is also crucial to the improvement of the over all economic well being in the country. So the sustainable and rapid growth of the economy as well the agriculture sector becomes a basic issue of the country.

Rapid and sustainable growth will be simply an envisage unless and otherwise it is accompanied by a strong need for stability, better government and improved policies to help break Ethiopia's backward economic performance and put communities on to more sustainable

development paths. It is at that time where poverty can be reduced and economic growth to be improved. Especially urgent is the need for effective development strategies that address the basic issues of agriculture sector where drought risk is high or agricultural policy is ineffective to spillover the overall economy.

Agriculture involves much more than the production of crops and animals for food consumption. The complex nature of the sector requires farmers in the agriculture sector to play many roles. Particularly for almost all Ethiopian farmers it is a way of life too. These show that the sector demands top attention of government and non-government institutions to make a radical change upon the growth of sector even though it is not as we envisaged in different policy formulation.

The present study attempted to identify and quantify the relative contribution of different sources of agricultural growth in Ethiopia over the past three decades. A better understanding of different sources of growth and their magnitude would provide an empirical support for the design of policies to accelerate agricultural growth. At the same time it is of paramount importance to know the possible response of land, labor and government expenditure on agriculture in the context of Ethiopian agricultural product.

1.3 Objectives of the study

1.3.1 General Objective

Taking into consideration the Ethiopian agriculture, the general objective of this study is to look at the trend of agricultural output growth and to identify its determinants. And also to analyze its contribution on the over all economic growth.

1.3.2 Specific Objectives

- To assess the contribution and allocation of government expenditure on agricultural production
- To asses the significance of labor and land for the agricultural production
- To analyse the agricultural and non-agricultural product interdependency and their contribution to economic growth
- To show the trend of agricultural and non-agriculture output in different time period
- To quantify the changes in the contribution of different agricultural inputs to the growth of output
- To forward policy recommendations

1.4 Hypotheses of the study

This thesis tests the hypotheses for the current issue

- Government expenditure on agriculture is one of basic significant factor accelerating agricultural output.

- Policy reforms made on the agriculture as well as on the overall economy has positive effect.
- The amount of input utilized in the form of land and labour have a positive effect on the real agricultural output.
- The growth on the agricultural and non agricultural product has a positive and significant contribution on economic growth.

1.5 Significance of the Study

As the researcher of this study try to investigate, no systematic analysis has been done on the agricultural policy issue in terms of identifying the determinant factor in time series examination.

Policy makers in general depend primarily on policy analysis which helps them to recognize and define problems, choose policy priorities, undertake policy formulation and implementation. In this regard the Ethiopian agricultural policy is one of the most debatable issues which needs a rigorous research work in different aspect of the sector.

This study enables to give an overview of the sector's performance and also an explicit analysis is made to identify the significance of determinant inputs of the agricultural product. So policy maker will have an understanding about the statistical estimations on the effectiveness of the agriculture sectors on economic growth in comparison to the other sectors.

The final result obtained in this study is useful in improving policy design, to become as source document to policy maker, and also to researchers who are working in government and non-government organizations. Further more it enable as fulfillment of master thesis.

II. A BRIEF OVERVIEW OF AGRICULTURAL POLICY

2.1 The Evolution of Agricultural Policy in Ethiopia

In this section a brief description is given on the evolution of the agricultural policy in Ethiopia since the imperial period focusing on the effectiveness to economic growth and the reforms made in different periods.

2.1.1 Agricultural policy during imperial

Ethiopia had attempted to make a development planning in 1975 for the first time. Prior to this, there was a ten year program for industrial development that had been initiated as early as 1945. During the 1957-1973 three five year plans were prepared and implemented under the then imperial government of Ethiopia. For analytical purpose, it is better to emphasise on the bimodal strategy for agricultural development in the late 1960s (Haile, 1995).

The main intention of the strategy was that modernize peasant agriculture in all parts of the country at the same time is not possible. But a start would have been made in selected and promising areas. So it could step by step duplicate to the other areas. The direction of the philosophy is concentrating development efforts in the selected areas.

Two approaches were outlined in line with the overall strategy:

1. Package program
2. large scale commercial farms

1. Establishment and development of package projects

The package program relies on the provision of inputs and services to the selected area in the form of package. These projects were suggested and financed by Swedish International Development Authority (SIDA) and World Bank (WB) in which these package projects were implemented in Ethiopia following the Green Revolution principles of Mexico and India (Haile, 1995)

First the package program was implemented in the form of comprehensive package program (CPP) and then later the minimum package program (MPP) was introduced.

The comprehensive package projects (CPP) were selected based on the criteria of

1. Conducive natural condition of the areas which includes rainfall, good weather and soil fertility
2. Accessibility to transport market and communication and
3. Farmers' willingness to accept the innovation.

This CPP uses an integrated rural development designed to supply necessary inputs and services in a package form. These inputs and services were:

1. extension services
2. Marketing services
3. input provision like fertilizer and high yield seeds and pesticides
4. Credit facility at lower interest rate.
5. Expansion of education, nutrition and health services, and
6. To rely on research and development to transfer from one sector to another.

Based on the objective or criteria of (1) raising the living standard of the poor peasant, (2) creating employment opportunities and encouraging local participation, the following CPP projects were launched.

a. CADU- (Chilalo Agricultural Development Unit) launched in 1967 in Arsi with an areas of 10,000 sq. km mainly financed by SIDA.
b. WADU- (Welyta Agricultural Development Unit) launched in 1970 and financed by WB.
c. ADDP- (Ada district development projects) launched in 1972.
d. Others, TAHADU (Tahtay Adyobo and Hadegti Agriculture Development Unit, and Southern Region Development Unit. These were planned but not implemented and some were in their formative phase.

The CPP resulted in increased agricultural production and increased income. But the benefit shifted to the land lords in the form of increased land rent. So the benefit shifts to the non-targeted lords and they start evicting tenants to establish large scale farms.

The CPP was too expensive to be duplicated to these areas. As a result, the government launched the MPP in 1972 having the same philosophy and strategy with CPP, but it differs only on the intensity of the inputs. The minimum package program was intended to provide the most crucial inputs and services mainly chemical fertilizer, improved seed, credit and farm implements.

The government of the period said that by providing such services at low cost it was envisaged to cover bigger areas of the country with in a short period of time. These MPP were divided in to two. MPP_1 (1971-1980) and MPP_2 (1981-1984). The first project was established in 1971 and the program continued well even during the Derg regime and its second phase

was launched in the first half of the 1980 but the projects were largely concentrated on the coopertivization process.

2. Large scale mechanized commercial farm

As all know such large scale commercial farm requires bringing extensive area of land under cultivation with the use of modern agricultural inputs such as modern technology, machinery, equipments etc, and also needs a lot of capital which was in short supply in the country. So the government of the time tried to invite and attract foreign capital through incentives of policy measure taken as tax holiday for 5 years, low tax and use, low fee per hectare and free import of heavy machinery and equipment etc

As result many of foreigners come and invested in large scale farm such as Wonji sugar enterprise, Tendaho plantation and Setit Humera plantation. The objectives of these projects were to increase consumption of agricultural production but they were producing industrial inputs. The end results became the capital flow to their own home and the country couldn't get the benefit of capital and employment.

2.1.2 Agricultural policies and strategies during Derg Regime

The emperor HaileSellasie was overthrown in 1974 largely as a consequence of famine in Wollo and Tigray, as well as the question of land tenure raised by the masses. The Revolutionary Government committed itself early to addressing the issue of hunger through raised agricultural output. The principal articulation for the commitment was the implementation of three major policy initiatives aimed as state led growth in agriculture (a) land reform, (b) the aggregation of production units

(cooperatization and association) and (c) a narrow sectoral and geographical concentration of investment. Regardless of the low overall investment in the agricultural sector (averaging 9 percent of total government expenditure from 1974 to 1984), these initiatives were responsible for fundamental changes in the rural economy (Webb, et al. 1994, PP: 41).

A. Land Reform

The government nationalized all rural lands by the proclamation 31/1975 as result private property of land was outlawed. According to the proclamation, transfer of land by buying or selling and mortgaging of land was forbidden, tenancy was abolished and renting of land was not allowed. Further more all communal lands, church land, state and private land was transform to pubic or state ownership of rural land.

Land reform contributes some way towards equalizing access to land and providing security for the landless. Such measures were welcomed most in the central and southern regions formerly characterized by extensive absentee in ownership of land, tribute farming, and large scale commercial agriculture.

The decisive element of this system was the smallholder sector. Individual households were granted access rights to a maximum of 10 hectares for private production, among the 90 percent of national production (Ibid: 42).

B. Aggregation of production

The government had also organized a long socialized line for the purpose of collective production and marketing of agricultural outputs, and

distribution of inputs. To implement this objective, three types of associations were established.

1. Service cooperatives (EDDC.AMC etc)
2. Producers cooperatives and
3. state farms

To create the second targets of the new rural system, peasant associations were encouraged to work toward the formation of cooperatives. The first step was the organization of service cooperative. These organizations were designed to sell farm inputs, provide storage and processing facilities, offer low interest loans, and marketing of agricultural outputs.

The producers' cooperatives were pooled land, labor, and other resources in an attempt to capture economies of scale. In order to attract members, the cooperatives offered low taxes, interest free loans and priority access to inputs and consumer goods.

The third and smallest component of the farming system was made up of state farm. The private commercial farm functioning before 1974 were converted into state farms.

C. Concentration of investment

The third direction of the 1970s and 1980s was the government to emphasis on the provision of improved inputs to selected farmers in high growth potential regions and to the state farms. This was the ruling government philosophy in contrast to focusing resources on capital intensive mechanized farming of Imperial strategies. As result, ten year perspective plan (1984-1994) was proposed to raise agricultural expenditure. In the meantime, the government formed a committee to plan

rural development program with the formation of Peasants Agricultural Development of Extension Program (PADEP) in 1989. (Haile,1995:68).

D. Impact of socialist policy

The Marxist era was concentrated on the public commitment to improve the welfare of the rural poor by revitalizing agriculture served as the justification for policy experiments. Most of them were target at charging the structure of productive relationships between land, labor, capital and output. Nevertheless, the effects of such policies on productivity in general and on the level of food self-sufficiently in particular have been limited.

Haile (1995) and Webb et al. (1994) had summaries that the process of social and economic aggregation was emphasized to improve the economics basis of land use resulting from reform and redistribution. However, new organizations rarely met their potential for stimulating rural growth. First, they were perceived as tools for enhanced state control of the rural environment, giving preferential treatment to party members. Second, cooperatives suffered from a lack of resources (improved inputs and credit) to meet demand. Third, price incentives necessary to raise productivity were lacking there by limiting any potential gains made possible either by land reform or cooperatives.

2.1.3 Agricultural policy adjustment of the 1991

After the downfall of the Derg in 1991, a new economic policy was announced by the Transitional Government of Ethiopia. The objectives of replacing the previous centrally planned economy with market-oriented economic system was based on the ideology to implement principles of decentralization, autonomy, competition, efficiency and profit

maximization has steadily improved the overall policy environment in the agricultural sector.

The new economic policy announced on November 1991 replaced the previously command economy targeting to

(1) Dissolve producers and service cooperatives

(2) Encourage smallholders and commercial farms

(3) Reduce public investment in state farm and abolished quota and

(4) Restore free trade.

The economic policy of the Transitional Government of Ethiopia develops strategy of agricultural development led- industrialization (ADLI) and this becomes the base for the agricultural policy. The main goals of the strategy become to enhance small holder agricultural of domestic raw material focusing on labor intensive technology. The strategy adopted forward and backward linkage between agriculture and industrial sector and visualizes export led growth as a subsequent step which leads to an independent agricultural and industrial development.

The linkage can be expressed in two ways:

I. Providing food requirement supply industrial inputs and provide commodities for export and

II. Expands market for domestically produced goods as a result of increased income of farmers.

At program level, agricultural development led industrialization (ADLI) consists of:

1. Ensuring accelerated economic growth through rural-centered development program or strategy which mainly focuses on the development of agricultural sector's output using package program. These programmes uses policy instrument distributing improved

seeds, fertilizers, extension services, provision of credit facilities, small scale irrigation scheme, live stock resources development etc.

2. Ensuring accelerated economic growth with target at improving the living standards of urban population which includes rapid change in urban dwellers living conditions and supporting indigenous investors.
3. Adopting effective education strategy by including specifying instruments of targets and sub targets in the short and long time period, and
4. Preventive and primary health care strategies of the programs are among the basic once.

Furthermore, the economic policy on agriculture gives high attention for agricultural extension. The system of agricultural extension named participatory, demonstration and training extension system is formulated. The system is based on the philosophy of bottom up approach demonstration and training farmers on proven technology. It is one among the crucial instruments of raising the productivity of the smallholder farmers participating at the grass root level. In this approach special emphasis is given to human resource development hoping to transfer appropriate technology for rural areas. Focusing on the important of extension strategy, the government has launched national extension intervention program (NEIP) since 1994/95. The program is mainly geared to words assisting small scale farmers to improve their productivity through disseminating research generated, information and technology on major food crops.

2.2 Nature of the Ethiopian Agriculture

As almost all know, the nature of the Ethiopian agriculture is generally characterized by mixed farming of small holder farmers using crude implements of labour, this account for about 95% of the cultivated land. This is a result of Policy change since 1975 in Ethiopia which ensured land to be held and operate by small scale farmers. Peasant holding is very small; the average holding in the country wide is less than one hectare per farmer.

There are three farming systems categorized in Ethiopian context namely (1) small holding system accounts for about 90% of the total agricultural out put (2) pastoralist nomadic farming system, which is mainly found in the low land areas of the country, and (3)commercial farming system of production also account for about 5% of the arable land Haile(1995).

2.3 Role of Agriculture to Economic Growth

As we have discussed agriculture remains the main activity in the Ethiopian economy. Indeed, we can classify and explain the contribution made to the Ethiopian economy.

A. Contribution to Gross Domestic product (GDP)

Agriculture is the most important contributor to the countries GDP. Based on the 1980/81 constant prices, agriculture on average constituted about 52.85 percent for the period 1980/81-1991/92 and 45.8 percent for the period 1992/93-2005/06. At the end of the sample year the share of agriculture is about 42.5 percent of the GDP. The agriculture sub-sectoral contribution to GDP is also significant of all. In this regard crop sub-sector contribution on average about 31.08 percent following by animal farming

and forest 11.84 and 5.46 percent respectively for the period 1988-1998 E.C (see appendix 7).

B. **Agricultural Revenue Contribution to GDP**

The agriculture sector is one among the different revenue generating sources. In this sector Government earns revenue in the form of a land use tax, agricultural income tax and also in the form of export duties on agricultural goods. For instance, the contribution of agricultural land use tax and income tax was on average, about birr 67 and 75 million per year for the period 1981/82-2004/05. In this regard, agriculture income owns a share of 0.554 percent of GDP for the time 1981/82-1990/91 and 0.58 percent of GDP for the period 1991/92-2004/05. At the same time rural land use fee earns 0.44 and 0.54 percent of GDP respectively. This is of course very low amount but revenue contribution of the sector increases with the increasing agricultural products (see appendix 8).

C. Employment and Livelihood Contribution

The sector plays a significant contribution to the country labor force employment and population livelihood. The total labor force engaged in the agriculture sector, on average, is about 89.58 percent for the period 1971-2004.

Table 2.1 Employment and livelihood contribution

Years	Livelihood	Employment
	Rural Population to total population (%)	Rural labor force to total labor force (%)
1971-1990	87.86	90.52
1991-2004	85.66	88.25
1971-2004	86.96	89.58

Source: National Bank of Ethiopia and own computation

As the table 2.1 indicates very stagnant decline of employment opportunity is observed from 90.52 percent during 1971-1990 to 88.25 percent for the period 1991-2004. In terms of livelihood the sector directly accounts for almost 87.86 percent and 85.66 percent of rural population for the same time period.

The agriculture sector also indirectly contributes to industry and service sectors. As all know majority of rural population is not food self sufficient which ensure almost all rural and many urban population is dependant on agriculture for their livelihood.

III. REVIEW OF LITERATURE

3.1. Nature and principles of policy

3.1.1. Introduction

The emphasis here is up on the inputs and the transformational processes operating upon the construction of Agriculture policy. Attempts to analyse the policy process are inescapable based up on explicit or implicit models of the system.

Monitoring and evaluation can be aimed at providing direct results to policy makers about the impact and effectiveness of specific policies. Post hoc review of policy impact may be used for feasibility analysis in the future policy design via the specification of a feasible set of actions.

The objective of policy analysis is to reform policy makers of the limits of possibility. Better policies might then be these which are more closely tailored to the constraints of feasibility imposed by the intractable external world of the policy matters. The concept of policy has a particular status in the rational model as the relatively durable element against which other premises and actions are supposed to be tested for consistency (Rausser and Just).

3.1.2. Elements of policy

Policy involves planning based on certain beliefs, values, and goals, taking into account the resources that may be available for reaching the goals,

and also analyses the benefits and costs of using one plan or another. Accordingly, Halcrow (1984) stated that elements of policy involve

1. The goals that may be established
2. The means that may be used to reach these goals
3. Implements such as agents or agencies that activates and control the means and
4. Constraints that are applied to the plan or program.

According to him the basic concept of policy is that of deliberate action or activity involving these four elements.

Government policy, directed primarily at development and settlement of family farms, determined the economic structure of agriculture, and the conditions under which it would develop and grow.

Basic policy decisions involve what is to be attempted and how objectives are to be achieved. In any country, policy makers will come up against constraints. They will have to develop policies which also tackle the very awkward interrelated problems of unemployment and under employment in rural areas, mechanization and the use of appropriate technology.

> *"Decision-making can be assisted, by pilot projects, trial programmes, by tackling part of a problem and by decentralization. The final question may well concern which comes first and which later, rather than what to leave out". Mollett, 1984: 155.*

There are two broad types of policy matter to be concerned with. 1st, there are priorities among regions, subsectors and objectives. Strategy helps here by laying down the broad outline or framework to show where the sector is to go. It is only a guidance which it derives from the working of policy issues like incentive structures, reform of marketing and input

supply, employment technology and investment criteria. Priorities must be worked out in details to establish the criteria by which decisions can be made in the day to day implementation of the plan. Investment policy, for instance, should set the discount rates at which funds made available for different private and semi-public activities. Natural resource policy may have to allocate water, for instance, between rural agricultural and urban or industrial uses.

The second type of policy problem involves the choice of instruments for achieving objective. Establishment of priorities and selection of ways to carry out objectives are related aspects of the policy setting process. Different policy instruments may also be connected, for example, price policy may be ineffective at reaching largely subsistence farmers. Hence, it will be necessary to establish land tenure, marketing and extension policies to bring these farmers more fully in to the market economy if price policies are to reach them.

3.1.3 Defining Agricultural policy

Agricultural policy which considers as an important area of public policy may be defined as a course of public action directed primarily but not exclusively toward the farm and agribusiness sectors of society. It involves the full range of public decision that influences individuals and firms to decide what products shall be produced, how they shall be produced, and for whom.

Agricultural policy applies to two broad sets of markets: The agricultural input market through which the resources and commodities used in farming are made available for production and the agricultural product markets through which farm food products are marketed and processed for consumption at home and abroad. Policy in the input market applies to

the use of land and other natural resources, agricultural credit, industrial products used by agriculture, and the human resources employed in all sub-sectors of agriculture. Policy in the product market involves a broad range of laws, government rules and regulations that apply to these markets. Policy in such condition deals with issues of free markets, or price supports with production and marketing controls relatively free international trade in farm food products and subsidies, relaxation of tariff and non-tariff barriers to trade, consumer food subsidies and other actions may be taken as policy direction (Halcrow, 1984: 5).

Both the input and product markets are characterized by a significant amount of government involvement and the policy choices that are made, affect us all in more ways than we can imagine.

Any country's policy towards the agricultural sector as whole or towards one particular interest group such as grain producers or fertilizer manufactures can be characterized as consisting of three sets of elements (1) objectives (2) instruments of policy and (3) rules for operating the instruments of policy. This is to mean a policy is usually framed in terms of several simultaneous objectives and involves several instruments which are applied according to specific rules devised in order to achieve the objectives. It is the way in which the rules are set for the operation of the instruments which determines the outcomes of policy, thereby controls the extent to which the different objectives are individually achieved. Frequently what is actually achieved in terms of the balance between alternative objectives is substantially at variance with the rhetoric of official policy statements. (Colman et al.1989:265).

As circumstances change, new instruments of policy are added, old one scrapped and the rules of operation changes so as to achieve a new balance between objectives.

3.1.4 Classification of instruments of policy

Policy makers have adopted a multitude of different means (instruments) of influencing the behavior of the agricultural sector. Colman et al. (1989) attempted to produce a classification of instruments in order to highlight differences between major groups of instruments. Among many alternative criteria for classification, it is better to choose and consider the level in the production and distribution system at which intervention is applied. In this approach instruments are listed according to whether they are imposed (1) directly at the farm level, (2) at the national frontier, and/or (3) at some other point in the domestic market.

According to Colman (1989), the general significance of the three classifications can be summarized as follow:-

a. Frontier-level-instruments alter the relationship between the domestic and international markets. It shifts the relationships between domestic and international prices and the volume of trade flows from their free-trade levels.
b. Instruments applied at the farm level permit the amount and type of economic activity in farming to be adjusted relatively to the levels which would be dictated by competitive pressures from national and international markets.
c. Instruments operated at the market level may be used in a variety of general ways; state marketing boards can use their powers to raise or lower prices received by farmers thus causing farm output to deviate from competitive levels, or consumers thus raising consumption from the level it would otherwise be, or in conjunction with a frontier instrument they can be used to raise or lower prices to producers and consumers simultaneously.

Mollett (1984) also strengthened this, policy instruments as the range of option from direct measures to increase farm output and productivity to less direct such as price and tax incentives, institutional changes particularly land reform, credit and marketing improvements, etc.

The other means of influencing the behavior of the agricultural sector is classified instruments by policy objectives. In this regard Colman (1989) use as a basis for assessing the effectiveness of instrument with such common objectives as,

1. Increasing the food consumption of those with low incomes, or
2. Increasing the incomes and output of small farms.

In either case the main purpose of any classification is to focus attention on particular aspects of policy objective.

A basic rule of economic policy is that there must be at least as many instruments as there are objectives (rules of policy). For instance, there is a single objective of policy, increasing grain output in a country by a specific amount above the level likely with free-trade. In the absence of freely competitive condition at least one policy instrument would be required.

The instruments chosen might be

1. Raising the price of grain received by producers, such as an import tax or a production subsidy
2. An instrument to reduce the cost of grain production, such as an input subsidy or capital grant, or
3. It might, less plausibly, be an instrument which reduces returns to products which compete with cereals for land, causing substitution of resources into cereal production. It is due to this fact that more than one instrument may be simultaneously employed to pursue a single objectives.

In general, there are various agricultural policy instruments viz, price supports, taxes, marketing board, credit, tenure systems, extension services, and provision of inputs are all means for carrying out policies. They cover activities directly undertaken by the government as well as those designed to influence the private and semi-public sectors.

3.2 Overall Economic Growth and Agricultural Growth

3.2.1 Economic growth

Economic growth can be defined as the expansion of an economy's productivity potential over a long period of time. Economic growth is therefore concerned with the long-run trend of rise in output rather than its fluctuations, which focuses on short-run fluctuations in output and prices. In the long run all factors of production are variable, so all capital and labor inputs must be considered in the production function.

The long-run trend of rise in output or productivity potential raises two measurement issues. The first is that it can only be measured over long intervals of time or between periods when the utilization of resources was similar. The rate of growth is measured as the average slope of the time path of output. If the growth rate is measured between t_2 and t_3, the rate of growth is higher than measure from t_2 to t_3.

The second measurement issue is with the concept of productivity potential itself. The productivity potential of an economy depends up on the resources available. Therefore larger countries with greater resources may have a tendency to grow faster than smaller countries. To overcome

this problem it is common to measure the growth of GDP relative to the size of the population called GDP per capital (Pentecost, 2000: 316).

3.2.2 Sources of economic growth

The potential sources of economic growth stem from the aggregate production function which link factor inputs to output for a given level of technology. That is Y = Af(K,N), where Y is the level of real output, A represents the state of technology, and K and N are the factor inputs. To keep the analysis simple, the production function has specific functional form of Cobb-Douglass constant return to scale production function, written as

$$Y = AK^{\Theta} N^{1-\Theta} \quad \text{---------- (3.2.1)}$$

Where, Θ is the share of capital input in output, and $1-\Theta$ the share of labour input in output. If we differentiate equation (3.2.1) with respect to time it gives the rate of change of output over time, written as:

$$\frac{dY}{dt} x \frac{1}{Y} = \frac{dA}{dt} + \Theta \frac{dK}{dt} x \frac{1}{K} + (1-\Theta) \frac{dN}{dt} x \frac{1}{N} \quad \text{---------- (3.2.2)}$$

Re-arranging equation (3.2.2) in hat notation

$$\hat{Y} = \hat{A} + \Theta\hat{K} \quad (1-\Theta)\hat{N} \quad \text{---------- (3.2.3)}$$

Thus, the rate of growth of output is identically equal to the rate of change of technology (technical progress $\hat{A}$), called total factor productivity (TFP), plus the rate of growth of each of the factor inputs multiplied by their

respective shares in total output. TFP is the amount by which output would increase as a result of improvements in methods of production with all inputs unchanged and is distinct form labour productivity.

Equation (3.2.3) of that the growth in total factor productivity can not be measured directly. According to Solow cited by Pentecost (2000), on derived estimate of Â explained by inverting the equation and deriving Â as a residual. As Pentecost mentioned this measure of total factor productivity is therefore referred as the Solow residual and defined as:

$$\hat{A} = \hat{Y} - [\Theta\hat{K} + (1-\Theta)\hat{N}] \text{ ---------- (3.2.4)}$$

Accordingly, if we suppose capital's share of income is about 0.3 and that of labour 0.7. Then if the labour force grows at 1 percent, the capital stock at 3 percent with total factor productivity of 1 percent, then the growth rate must be 2.6 percent.

3.2.3. Sources of Agricultural growth

In a competitive factor markets, the rate of growth of output should equal to the weighted average of the rate of growth of its inputs. In this trend the source of agricultural growth is also basically relates to its input growth rate. This equality may be either due to the value of output specified as equal to the income paid to the inputs, or due to the production function establishes on equality between output and inputs in agriculture. In either case the growth of agricultural output depends on the input use in production (Elias, 1985:14).

According Elias (1985) the production function for agriculture can be defined as

$$A_t = f\{H_t, L_t, K_t\} \text{ ----------[3.2.5]}$$

Where A= Output of agriculture in time t

H= land input in time t

L= Labour input in time t

K= Capital input in time t

Assuming competition in the factor markets, the rate of change of A can be derived in the following expression.

$$A = W_h h + W_L L + W_k k + g \quad \text{---------- ---------- (3.2.6)}$$

Where W_h = the share of land in agricultural out put

W_L= the share of labor in agricultural out put

W_k= the share of capital in agricultural out put

g= represent contribution of other inputs

And L, H, and K are rate of change of the corresponding variables defined as the change in the natural logarithm of a variable between period t and t-1. The contribution of each input to the growth of output is measured by the product of the rate of change of input in the corresponding period and the share of the input in total output.

The production function as defined above includes only inputs of labor, land and capital. A more complete account of agricultural growth should include other inputs, such as fertilizers, irrigation, and new seeds. So, the contribution of each input can be analyzed separately in production function.

3.2.4. Production function approach

There are several kinds of expenditures, all of which should be considered as inputs in agricultural production. In order to include government expenditure on agriculture into the production function as an input, the concept of the public input, G, is used. So the Cobb-Douglas production function is used a variable parameter model and a multiple production

function. The variable parameter model provides an alternative way of incorporating the public input in the production. The model developed by Elias (1985) including public input is as follow:-

A. Cobb-Douglas production

The Cobb- Douglas production function, in logarithmic form, is

$$LnA_t = a + b\ln H_t + c\ln K_t + d\ln L_t - - - m\ln G_t + U_t - - - -(3.2.7)$$

Where, G_t is the public input in period t and other have the same meaning as before.

B. Multiple production function

The multiple production function used by Elias (1985) enables him to verify specification errors in the production function estimates that arise from aggregating the components of agricultural production. One such error could lie in the assumption, implied by such an aggregation, those crops and livestock are perfect substitutes even if output data of livestock and crops in most countries is separated, there is no disaggregated input data. So it is not possible to estimate separate production function for crops and live stocks.

This multiple production function follows the Cobb-Douglas specification:-

$$\ln A_t = a + b\ln H_t + c\ln K_t + d\ln L_t + e\ln B_t + U_t - - - - - - - - - -(3.2.8)$$

Where, A is the output of crops and B is the output of livestock.

The agricultural market has convex form while competitive markets require concave function and hence the Cobb – Douglas for outputs is not

appropriate .But if agriculture is taken as an aggregate, a case can be made for accepting the Cobb-Douglass form. To obtain estimates of the different parameters in cost minimization condition, a relationship is established between the contribution of inputs to total output and the corresponding parameters.

C. Variable parameter model

One way of introducing the public input in the production function is the variable parameter model. The public input, G is entered in this model as a variable affecting the output elasticities of the other inputs.

The variable parameter model for the Cobb-Douglas production function has the following form:

$$\ln A = (a + a_g \ln G_t \ln K_t) + (b + b_{g_t} \ln G \ln H) + (c + c_{g_t} \ln G_T \ln K) + (d + d_g \ln G_t \ln L_t) + U_t \text{ --(3.2.9)}$$

The parameters in equation (3.2.9) are variable and depend on G. In this case production can vary with time and this variability is explained in part by G.

Equation (3.2.9) can be estimated using this form

$$\ln A = a + a_G \ln G_t + b \ln H_t + c \ln K_t + d \ln L_t + b_G \ln G_t \ln H_t + c_G \ln G_t \ln K_t + d_G \ln G_t \ln K_t + U_t \text{ ---(3.2.10)}$$

The first part of equation (3.2.10) is like the common Cobb- Douglas production function. The second part includes the product of G and the other inputs considered as interaction terms. These mean that some connection between the coefficients of the interaction terms can be expected and the random term U_t stands for difference through time that cannot be explained by G.

3.2.5 Determinants of Government Expenditure on Agriculture (GEA)

There are some regression equations which can verify the degree of exogeneity of expenditure policies. These can also help to find determinants of the ratio of GEA to total government expenditures, such equation is:

$$\text{Ln } Y_t = ß_0 + ß_1X_t + ß_2Z_t + ß_3 R_t + ß_4W_t + ß_5 (La)_t + ß_6 (La/L)_t + U_t \text{ -------(3.2.11)}$$

Where

Y = the share of GEA in total government expenditure

X = the share of agriculture in the gross domestic product

Z=PA/Pt = the terms of trade between agricultural and industrial product

R = the ratio between agricultural and industrial wages

W = the world price of important crop in real terms

L_a = the share of labor in agricultural output and

L_a/L = share of the agricultural labour force in the total labor force

T= the time period at t

A government can set its policy instrument to attain any of its objectives. Elias (1985) who made an extensive study in this regard interprets the above parameters as follows. Accordingly, the signs of the parameters in equation (3.2.11) depend on the objective of the government. For instance, if government objective may be interested to promote agricultural growth, and to have an equalize income distribution between agriculture and the rest of the economy or to stabilize farm income, the effects on the terms of trade between agriculture and industrial product and the world prices of

important crops in real terms should be positive. The sign for the other parameters depend on how the objectives affect the income distribution (Elias, 1985:16-18).

3.3 Theoretical Framework

3.3.1 The contribution of agriculture to over-all economic growth

Agriculture is an important branch of the whole economy in most of the developing countries. Its importance can be gauged from the percentage of population engaged in agriculture compared with the total population and that of agricultural GDP in relation to the total GDP.

Malassis (1975) has classified agriculture's chief contribution to the over all economy as follows:

1. Contribution through growth of agricultural and food production, in line with the growth of internal and external demand.
2. Contribution through transfer of resources (labor and capital) from agriculture to the other sector of the economy.
3. Contribution to the earning of foreign exchange and to a stable balance of payment
4. Contribution to industrialization either through the provision of raw materials to the agricultural and food industries or through the purchase of industrial goods, thus stimulating industrial growth.

Valdes and Foster(2005) strengthen the idea that the direct contributions of the agriculture sector (crops, livestock, forestry, and usually fisheries) to the functioning of the national economy is reflected by its manifestation in total GDP, its foreign exchange earnings, and

its role in supplying savings and labor to other sectors. With respect to the links between agriculture and the rest of the economy, they provide evidence demonstrated that the farm sector could have significant multiplier effects and therefore that agricultural growth could be propagated to other sectors in the economy. Consider the effect of an increase in agricultural GDP (G_A) on national per capital income, y, which is defined as the sum of agricultural GDP and non-agricultural GDP (G_{NA}) divided by population, pop.

$$Y = G_A + G_{NA} \text{ ----------(3.3.1)}$$

$$y = \frac{G_A + G_{NA}}{Pop} \text{ ---------- (3.3.2)}$$

Where Y = GDP, y = per capita GDP

The derivative of equation (3.3.2) with respect to the agricultural GDP, it becomes:

$$\frac{dY}{dG_A} = \frac{d(G_A + G_{NA})/pop}{dG_A} = \frac{1}{pop}\left(1 + \frac{dG_{NA}}{dG_A}\right) \text{----------(3.3.3)}$$

The term $\frac{dG_{NA}}{dG_A}$ captures multipliers and externalities, an estimate of which would measure the impact at the margin of the additional contribution of agricultural growth to national growth beyond simply its share. (Ibid: 7)

3.3.2 Effect of agriculture on economic growth

1. The relative growth of agriculture

The rate of growth of agriculture has an effect on over all growth. The magnitude of which depends on the proportion of GDPT represented by

GDPA. With two sectors model (agriculture and industry) Malassis (1975) has developed a model which states, as over-all economic growth is equal to the weighted average economic growth of agriculture and industry.

According to his model, let β_a and β_i be the relative size of the values added by agriculture (a) and industry (i) in GDPT. And let R_a and R_i be the respective growth rates of agriculture and industry. Over-all economic growth (R_y) is then expressed:

$$R_y = \beta_a R_a + \beta_i R_i \text{ ---------- (3.3.4)}$$

Many literature argue agriculture's share in most of the developed countries is frequently less than 10 percent and sometimes less than 5 percent while for LDCs, the share of agriculture (GDPA) is much more higher. In either case the growth of non- agricultural production is higher than that of agricultural production.

The effect of agriculture depends on its share and as the share of agriculture in the total is greater compare to others, a relatively slower growth, has a lower over- all growth rates, and vice versus is true. Agriculture certainly contributes to over-all growth by its own growth.

2. The relative decline of agriculture.

Malassis (1975) also analyses the relative decline of agriculture using equation (3.3.4) above, let

$$\text{Let } YR_y = Y_a R_{ya} + Y_i R_{yi} \text{ ---------- (3.3.5)}$$

$$\Delta y = \Delta y_a + \Delta y_i$$

Where Y, Y_a, Y_i = GDPT, GDPA and GDPI respectively and R_y, R_{ya}, R_y = the growth rates of y, y_a and y_i respectively.

Dividing the last equation by Δy, it results

$$\Delta y/\Delta y = \Delta y_a/\Delta y + \Delta y_i/\Delta y = 1 \quad \text{---------- (3.3.6)}$$

The variation of GDPA in relation to GDPT is the marginal structural coefficient of agriculture.

This can be re-arranged as

$$\beta_a = \Delta y_a / \Delta y = 1 - \Delta y_i/\Delta y \quad \text{---------- (3.3.7)}$$

By expanding and simplifying equation (3.3.7), we have:

$$\beta_a = \frac{1}{1+\frac{y_i R_i}{Y_a R_a}} \text{----------(3.3.8)}$$

The above formula shows that the marginal structural coefficient of agriculture diminishes if the weighted industrial growth is higher than the weighted agricultural growth rate.

If this process is continued, reduction of the marginal coefficient leads to a reduction of the average coefficient. The experience of the DCs, and the shorter experience of the LDCs, confirms that this occurs in relation with over all growth. According to the model, as share of industry increases compare to agriculture , a relative decline of agriculture leads to a more rapid growth in the over all economy (i.e. if R_i is greater than R_a). At last the growth of agriculture is vital for the process of development, even if the policy objective is the industrializations of the economy. The effect of agriculture becomes adverse if the population is at the subsistence level. Subsistence agriculture may mean that agricultural production is wholly or mainly intended to satisfy the requirement of the agricultural population. In subsistence agriculture at least 50 percent of production is intended to consumption of the agricultural population and hence the contribution for capital formation becomes low and its effect on overall growth depends on its sustainability.

3.3.3 Theories of balanced and unbalanced growth

There are different theories of balanced or unbalanced growth. Theory of unbalanced growth emphasizes that great concentration should be given for specific sector and this sector can have a significant role for the over all growth. For instance, the 'key industry' theory defines by Malassis (1975) in this regard that, the mechanism where by rapid-growth industries encourage structural change to affect their environment. It tends to modify growth rates, facilitate innovation, transform economic and social structures and behavior pattern and propagate growth.

Balanced growth depends on harmonized development of the different sectors of the economy and recognizes that investment in infrastructure, productive investment and social investment are complementary. According to professor Hirschmann cited by Malassis (1975) theory of balance growth is unrealistic and from the point of view of investment policy impracticable.

Now a day, many argue that concentration on dispersed growth is linked with the theory of 'technological options' in which if the ratio of capital invested per worker is high, preference being given for industry provided that capital is necessarily limited. If, on the other hand, the capital invested per labour unit is small, preference being given to the improvement of agriculture, crafts, small industries, etc. development can be more evenly distributed.

This theory involves analyzing the mechanisms where by certain sectors are capable of stimulating growth in other sectors and bringing about changes in their environment.

In countries where the growth of the economy as a whole is found on the agricultural sector, agricultural under-development can be regarded as the root cause of over all underdevelopment and a transformation of agriculture should therefore be given priority. But transformation is possible only if agriculture is stimulated by effective demand. This can only be done by developing the non-agricultural sectors (Ibid: 85).

3.3.4 Agriculture and industry

As regards the link between agriculture and development, the theory of unbalanced growth encourages us to support the decision to give priority either to industry or agriculture. In this case Malassis (1975) has been summarized as:

A. The arguments to give priority to agriculture are based on the economic functions of the agricultural sector in the process of development.

1. Agriculture is the basic and characteristic function of food supply. In many countries food consumption per head is stationary or even declining. In this regard to improve the standard of nutrition and meet the challenge of population growth, priority should be granted to agriculture.

2. They relate to the role of agriculture in establishing the basic economic equilibria: balance of employment, balance of payments, and balance of savings and investments can be achieved by the economy and LDCs give high priority to agriculture.

   If the flow of labour towards the towns is not to out-strip the creation of jobs outside agriculture, agriculture itself must be modernized and standards of living raised in order to prevent this

pathological exodus from the land which leads to an increase of urban unemployment and generates all kinds of other problems.

The balance of payment of many LDCs is seriously in deficit and the contribution of agriculture towards reducing this deficit is essential as these countries do not normally have any alternative. International competitiveness requires that agricultural productivity should be improved and this enables agriculture itself to modernize.

3. In favour of giving preference to agriculture relates to the specific contribution, agriculture has to make to the process of development. In order to enable agriculture to supply industry with the manpower, capital, currency and raw materials which it need and to stimulate industrial expansion by increased demand for industrial goods in the agricultural sector, and hence agriculture must be modernized and its productivity improved.

B. In favor of giving priority to industry, they argue that industrial growth is one of the most outstanding characteristics of countries which have made a success of economic development. The basic point of giving priority to industry is connected with population growth and balance of employment. The high rate of population expansion in LDC means that the size of the potential labour force is continually increasing and that jobs should be created at a rate which will enable surplus labor to be absorbed. Experience shows that in most cases, the extra employment created by growth in the agricultural sector is not sufficient to absorb population increase. In such circumstances it is absolutely essential to provide employment outside agriculture.

This argument in favour creating jobs outside agriculture is further supported by the fact that the resulting increase in income increases the demand for food products and encourages the development for market-

oriented agriculture which becomes a basic precondition for agricultural growth.

In general agriculture as a sector to succeed there are three basic requirements:

- It must adjust the growth of agricultural production to that of effective food demand
- It must adjust the size of its working population to the demand of industry for transfer of manpower, and
- Lastly, contribute the other basic economic equilibria

If on the other hand agriculture is called on to play the role of a 'leading' sector in development, its task is much more ambition, it must then create the surplus which will make it possible to achieve take-off in the economy as a whole.

The preferable option of the role of agriculture becomes, first as a sector whose role should be to 'adjust' and then to play its role as a 'leading' sector. This approach to inter-sector relations in the process of development is much more fruitful than which argues in terms of priority for agriculture or for industry. The important thing is that each sector should fulfill the role which is assigned to it in the process of development (Ibid: 168)

3.4 Empirical literature

1. Most of the empirical studies in relation to the topic at hand are found to focus on the issue of productivity and growth of the agricultural sector. The list of such studies on developing countries are (Fulginiti, Parrin and Yu, 2004); (Konde, 2005); (Veldes and Foseter, 2005); (Bench and Nerner, 1999), and (Mundelak,Y., Larson, F. and Butzer, R.(---))

Mundlak et al., made a study on the determinants of agricultural growth in Thailand, Indonesia and The Philippines. They use a Cobb-Douglass production function with inputs of irrigated land, rain fed land, fertilizers, capital and labour. The strong multicolinearity problem of the equations decreases the precision of the OLS estimation. The sum of elasticities of a function with inputs alone was larger than one; some elasticities are larger than one, whereas others are negative or not significantly different from zero. The next step they follow was to introduce incentives. They found that factor accumulation played an important role in output growth and that accumulation from policy driven investments in human capital and public infrastructure were important sources of productivity gains. This implies policies that ease constraints on factor markets and infrastructure provide the best opportunities for agricultural growth.

The study by Martin and Mitra, found that high rates of technical progress in both agricultural and manufacturing appears to have been faster development in agriculture than in manufacturing. In the study, least developed countries, developing (middle income) and industrial countries was selected and the growth rate of total factor productivity in general showed a strong tendency to converge in agriculture than in manufacturing provided that point of reference in the study was U.S.A.

Fulginiti et al. examined agricultural productivity in 41 Sub-Saharan African countries from 1960 to 1999 using semi-nonparametric frourier production frontier. Though out the four decades, the estimated rate of productivity measure reveals a significant reduction during political conflicts and wars, and a significant increase in agricultural productivity among these country with higher levels of political rights and civil liberties.

Konde, on his part studied on the challenges of agricultural productivity that in Sub-Saharan African and his study shows African's total cereal per hectare is much lower than Asia, Latin American and Caribbean. A key solution for his study was to increase substantially agricultural productivity in terms of yields per hectare.

Valdes and Foster also made a study to analysis the total effect of agriculture on growth using panel data in a reduced form approach. By considering the direct contribution of agriculture on other sector their finding suggests significant spillover effects agriculture to non-agriculture in developing countries. Along with the lower income elasticity of demand for primary products, the finding of this study implies that agricultural growth would lead over time to a lower share of GDP.

Blunch and Verner, studied sectoral growth and the dual economy model of three African countries (CÔte d'Ivoire, Ghana, and Zimbabwe for 1965-97). They examine the long-run properties of the series by performing co-integration and impulse response analysis and also the short run properties of sectoral growth. The empirical analysis of the sectoral components of growth in GDP in these three economies reveals the existence of one long run sectoral relationship in CÔted'Ivoire and Zimbabwe while in Ghana there is no cointegration relationship at the aggregate level. This investigation is against the basic dual economy model which they argue that, a long run relation can not exist between agricultural and industrial output. However, the finding of the above study strengthened by the impulse response and short run analyses. Both the result pointed out that there is a positive link between growth in the industry and agriculture sectors. This finding revealed a large degree of interdependence in sectoral growth.

The common feature of all the studies above attempted to give focus mainly on economic policy in general and agricultural productivity in particular. They all consider agriculture also has a vital for economic growth. As result more effective and efficient one is addressing polices to include all sectors.

2. Some studies such as (Fan and Huffman, 2005); (Zhang and Fan 2000); (Mendez, M. and San Juan,C. 2003); attempted to show the input and output relation in the presence of government policy support.

Fan and Huffman use a normalized quadratic to provide new economic evidence on eight central states for the agriculture supply and input demand over the year 1960-1993. The study found that the estimates a theoretically consistent output supply function for crops and livestock as well as input demand function for capital, labor and materials was found to be positive and statistically significant.

Zhang also tries to estimate crop specific production technology using generalized maximum entropy approach. The study results land elasticity for grain crops is lower while non-land input of fertilizer and machinery elasticities are generally higher. In terms of absolute values, labor and draft animal inputs in grain production have been stagnant implying in China farmers are increasing relying on modern inputs (fertilizers and machinery) in their grain production.

Mendez and San Juan, drawing their study on the time series and co-integration literature, the models were estimated over Spanish agricultural data (1970-2000) to analysis the common agricultural policy in 1986 and the application of the reforms in 1992. According to the study agricultural output is responsive to agricultural price and the reforms have been instrumental in restraining agricultural production. All the variable inputs

with the exception of rain and temperature satisfy the statistical properties necessary for the existence of co-integrating relations.

Elias (1985) used Cobb-Douglass production function and multiple production function by inclusion of public input as additional input. The estimate of the parameters of all the inputs improves with the addition of government expenditure on agriculture as public input. Even though some results suggest for future research, the effects of public inputs were in general positive, the study found that public polices were designed to increase agricultural growth objectives and reach some income distribution targets.

3. Coming to the review of study in Ethiopia (Abrar), (Webb and VonBraun, 1994); attempt to analyze the relation between output and input elasticity.

Abrar estimated the supply response in the presence of technical inefficiency in Ethiopia using the output CRS DEA approach from the DEAP soft ware. The survey study for non-price elasticity's of inputs land size, rain and land quality are analysis as the most important factors of output. The output response of these inputs become positive and statistically significant for all crops in the national wide survey of rural house holds conducted during 1994-2000. Ethiopia responds positively and significantly to price incentive and hence fertilizer usage appears to be more responsive to output prices of main crops. So policies directed at improving output prices may be most effective way to encourage increased fertilizer use.

Webb developed a simple link between rain and yield. He was analysis using statistical regression model that matches cereal yields and production with total rain fall for the years 1961/62 to 1988/89, the result showed a relatively large share of the actual variance in both cereal yields and production over time with regard to the level of rain fall. Assume other yield improving technologies and inputs are constant, rainfall clearly depicts an explanatory power (R^2) of exceeding 75 percent variation in that time period. According to this study found that 10 percent decline in rain fall below the long-term national average, results in 4.2 percent a fall in all cereal yields. This shows Ethiopian agriculture remains extremely dependent on rain fall for its success or failure.

IV. MODEL SPECIFICATION AND METHODOLOGY

4.1. Model Specification

In analyzing the agriculture policy, the study attempt to evaluate the basic factors of agricultural output and subsequently its effectiveness on economic growth in comparison to the non agricultural sectors.

The starting point for the standard growth accounting and for the production of output values derived here from aggregate production function is related to the famous neoclassical growth models of Solow(1956,1957) cited by Smolny (2002) becomes:

$$Y = F(K, L, residual) \text{----------} (4.1)$$

Where, Y is real output, K is physical capital, and L is labour input

Output in this condition is produced with capital and labour as input; the residual also refers to technological efficiency which increases exogenously overtime. The standard growth accounting relies on the assumption of constant return to scale for labour and capital. Then output growth is determined by the growth of those two factor inputs, weighted by their respective output elasticities and residuals.

Among many alternative, Solow's (1957) growth model is more applicable to capture the growth of agricultural out put analysis and its contribution on economic growth.

The equation from Solow model can be re-written in a very general form with a given time:

$$Y_t = F[K_t, L_t, t] \quad \text{---------- (4.2)}$$

Where, t is the time index which appear separately in the production function to indicate technology itself may not be constant over time. According to Solow (1957) cited by Heijdra (2004), the model is developed based on the assumption of perfect competitive behavior of firm to indicate production function must obey the constant return to scale. The basic growth accounting approach decomposes to the growth of gross domestic product of agriculture in to several components. The point of departure is a usual Cobb-Douglas type of macro economic production function

$$G_{Ag} = AK^{\alpha} L^{\beta} \quad \text{whare} \quad \beta - \alpha \angle 1 \quad \text{---------- (4.3)}$$

Where G_{Ag} = gross domestic product of agriculture

A = technology level

K and L = capital and labor respectively

α and β = are parameter elasticity's

Taking logarithms on both sides and subsequently differentiating with respect to time gives

$$\text{Ln}(G_{Ag}) = \ln(A) + \alpha \text{ Ln}(K) + \beta \text{ Ln}(L) \quad \text{---------- (4.4)}$$

$$\frac{d\ln(G_{Ag})}{dt} = \frac{d\ln(A)}{dt} + \alpha\frac{d\ln(k)}{dt} + \beta\frac{d}{dt}\ln(L) \quad \text{----------(4.5)}$$

If we assume that $\frac{d\ln(G_{Ag})}{dt} = \hat{G}_{Ag}$, then equation (4.5) becomes

$$\hat{G}Ag = \hat{A} + \alpha\hat{K} + \beta\hat{L} \quad \text{---------- (4.6)}$$

In the context of aggregation of production theory, the output and inputs of agriculture sector can be aggregated to crop and livestock as output. And inputs such as cultivated land, oxen, tractors, labor force, fertilizers, improved seed, extension services, rainfall, capital and recurrent expenditure can also be aggregated to capital and labor inputs. But these are different type of inputs and aggregation of them is problematic.

If aggregation is not possible, the obvious solution must be to disaggregate. Temple (2005) has discussed growth models that disaggregate inputs in manageable ways. Accordingly in the case of growth accounting, it is possible to formulate

$$Y = F(k_1, K_2, \text{------}, K_m, L_1, L_2, \text{-----}L_n) \text{ ---------- (4.7)}$$

Where there are M different types of capital input and N different types labor inputs.

As temple cited such approach has been developed and made operational by Jorgenson and co-authors, in a series of contributories.

Temple further cited Mankiw, Romer and Weil (1992) in the classical analysis of growth regression, and they modeled human capital precisely as a second kind of capital good. According to the neoclassical argument cited by Smolny (2002) they introduce human capital as third factor of production incorporated in the model as follows:

$$Y = F(K, L, HK, U, residuals) \text{ ----------(4.8)}$$

Where, HK is human capital per worker and U is an indicator of the business cycle factor utilization. The important point becomes production theory and growth accountings do not inherently require aggregation of different types of input. This condition validate for the disaggregating of agricultural inputs to accommodate for different types of input.

This is all background to the model and hence assuming that total output of agriculture can be sum up to the gross domestic product of agriculture. There are many different factors affecting to the output growth of the sector. But based on the data availability, the following basic ones are incorporated in the analysis.

1. As mentioned earlier, real agricultural output in our context can be determined by the cultivated agricultural land, agricultural labor force, rainfall, and total sum of government spending on agriculture in the form of capital and recurrent expenditure as well as the policy environment implemented in different time period.

Each input components is taken to be a function of output growth including dummy variable to account the policy conditions and to control the time trend (variable).

The equation for each of the component is constructed in a linear function as:

$$RAP = F(CTTL_t, GEA_t, ARF_t, RRW_t, D_t, U_t) \text{ ---------- (4.9)}$$

This equation can also be written in the form of ln:

$$\ln RAP = \alpha_0 + \alpha_1 t + \alpha_2 \ln CTTL_t + \alpha_3 \ln GEA_t + \alpha_4 \ln ARF_t + \alpha_5 \ln RRW_t + \alpha_6 D_t + U_t \text{ ---------- (4.10)}$$

Where

RAP_t = Real agricultural product in million birr at 1980/81 constant price at time t

GEA_t = Government expenditure on agriculture in million birr at time t

$CTTL_t$ =Agricultural land is measured as the sum of cultivated land in thousand hectares at time t

ARF_t = Average Rainfall sample for nine selected areas in (mm) at time t

RRW_t = Agricultural labor is measured in millions of persons who are economically actively engaged in agriculture at time t

D_t = Dummy variables of policy effect i.e.

$$\begin{Bmatrix} 1 \text{ if it is since } 1991 \\ 0 \text{ otherwise} \end{Bmatrix}$$

U_t represents for the other factor inputs which increase output.

2. To analysis the contribution of agriculture on economic growth, it is possible to use an alternative approach of estimating total effect of agriculture on growth in comparison with the contribution of non-agricultural products (output).

This can be illustrated as

$$GDP\text{-}pop_t = \beta_0 + \beta_1 RAP\text{-}pop_t + \beta_2 GRAP_t + \beta_3 GRNAP_t + \beta_4 D_t + U_t \text{ ------ } (4.11)$$

Where

$GDP\text{-}pop_t$ = national per capital income at time t

$RAP\text{-}pop_t$= per capital income of real agricultural product at time t

GRAP = growth of real agricultural product at time t

$GRNAP_t$ = Growth of real non agricultural product at time t

D_t = Dummy variable for policy change at time t

$$\begin{Bmatrix} 1 \text{ if it is since } 1991 \\ 0 \text{ otherwise} \end{Bmatrix}$$

U_t= total factor productivity or technological factor at time t

Estimating is made using the OLS method for each of the above national output to agricultural and non-agricultural as well as agricultural output to its input functions. This is operated, first with out the dummy for the policy change for the different ruling classes. Then, it can be estimated the effect of policy change on the output of the agriculture and gross domestic product.

4.2. Data Type and Source

The time series data of production function use an observations of the period 1971/2 – 2005/6. All the real data are in terms of the 1980/81 constant price. All the data is obtained from the reports of different government institutes (Central Statistical Agency, Ministry of Finance and Economic Development and National Bank of Ethiopia) in Addis Ababa.

The need to regress time series becomes based on the awareness for the possibilities of spurious correlation that exist in correlated time trend rather than a meaningful economic relationship. A combination of various series that contain time trend, non-stationary may lead to spurious correlation. Non-stationary has a sever implication in time series data for the reason that the data are highly susceptible to autocorrelation. This results fitting regression equation by regressing one non-stationary

variable on another is very likely to obtain good looking regression which may totally spurious (Harris,1995).

Therefore, to overcome the problem of spurious correlation estimate should be between the rates of change of variable rather between their absolute levels. The effect of changing the rate in a variable is typically important to remove any trend elements. Many non-stationary economic time series become stationary when they are first differenced (Thomes, 1993).

One has to test whether the time series are stationary or not. Concerning the test of non-stationary, the most widely used tests are the Dickey Fuller (DF) test and the Augmented Dickey Fuller (ADF) test. These are used to test, the null hypothesis that the series has unit root i.e. non-stationery against the alternative hypothesis of stationery.

4.2.1. Test for unit roots

The discussion of the test for unit root is made mainly based on the Harris (1995) which starts by building the following model.

$$\Delta Y_t = \alpha + \gamma T + \beta Y_{t-1} + \sum_{i=1}^{i=k} \lambda_i \Delta Y_{t-1} + U_t \text{ ----------(4.12)}$$

Where Y_t is the variable in question, T is a time trend, and U_t is a random variable assumed to be white noise. Then the lag length k is selected using Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Both criteria are used to reflect the closeness of fit and the number of parameters estimated (Maddala, 1992).

The main purpose of testing equation (4.12) is to estimate the ADF statistic in order to test for the null hypothesis of non-stationary against the alternative hypothesis of stationarity. We test H_o: $\beta = 0$ against H_1: $\beta < 1$ provided that β is in absolute value. The joint hypothesis $\beta = \gamma = 0$ is tested for using the usual F-statistic. Failure to reject these hypothesizes imply that the series is not stationary with a significant trend. That is Y_t subject to a stochastic but not a deterministic trend. Significant of the trend variable can be tested using individual t- statistic. The procedure of testing results in four possible outcomes. Namely:

1. Non-stationary with a significant trend.
2. Non-stationary with insignificant trend
3. Stationary with a significant trend and
4. Stationary with insignificant trend.

In logarithmic form of regression Harris (1995) recommended to exclude trend.

Trend can't be removed by first difference, so a deterministic trend can be removed by regressing on time. The residuals from such a regression will not display any deterministic trend (Thomas, 1993). We run the above model for those variables found to be non stationary with significant trend to find-out a stationary with insignificant trend.

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=1}^{i=k} \lambda_i \Delta Y_{t-1} + U_t \text{ ----------(4.13)}$$

The difference between (4.12) and (4.13) is that the former trend variable is dropped in the later case.

The existence of non-stationarity could be resolved by differencing the variables, even though this procedure results in a loss of valuable long run

information in the data. The concept of cointegrating series is one solution to this problem. Maddala (1992) stated that if the economic series are cointegrated they can be combined in levels. Non-stationary economic series are said to be cointegrated if they can be transformed in to a single series that exhibits stationarity. Running test of stationarity that decides the number of times a series should be differenced to achieve stationary. This also helps to proceed to the co-integration discussion. A series that differenced d-times to achieve stationarty contains d-unit roots and is said to be integrated of ordered, denoted I (d). If two series are 1(1), then there exists a vector β such that $\varepsilon_t = y_t - \beta x_t$ is I (0) i.e. a lower order integration (Harris, 1995).

In other words if the two series are both I (1), then this parallel difference between them implies the series are drifting together at roughly the same rate. Two series that satisfy this requirement are said to be integrated and the vector (1-β) or any multiple of it is a cointegrating vector (Green, 1997). The existence of an equilibrium relationship between x and y requires them to be integrated to the same order and also requires that a linear combination of two series be I (0) or stationary (Thomas, 1993).

4.2.2. Test for cointegration and Error Correction Model

The test of co-integration is needed to identify whether a linear combination of the series has a lower order of integration than any of the series in the combination. As a result, this test will help to describe the existence or non-existence of an equilibrium relationship among two or more economic time series (Thomas, 1993).

There are many methods of testing cointegration in which two are widely used in time series econometric regressions. These are the Johnson

methodology and the Engle–Granger (EG) approach. The Johanson approach is recommended for multivariate regressions, while the EG procedure is important for the univariate equation. This study preferred to employs Johansen approach (1995).

There are four basic steps in Johansen's methodology in which two of them are used for modeling cointegration. Namely:

1. Specify and estimate a VAR (P) model for Y_t.
2. Construct likelihood ratio tests for the rank of $\prod$ to determine the number of cointegrating vectors.

The first step in the Johansen procedure is to test for the existence of a cointegration vector(s). In the Johansen procedure, there is no a priori categorization of variables as exogenous and endogenous. Hence given equation (4.12) and (4.13) for stationary test, the general framework of the statistical analysis of unrestricted Vector Auto regression(VAR) involving up to k-lag of Y_t of the Johansen procedure becomes:

$$Y_t = \prod_1 Y_{t-1} + \prod_2 Y_{t-2} + \text{---} + \prod_i Y_{t-k} + \Theta D_t + U_t \quad \text{----------(4.14)}$$

Where, Y_t is an (nx1) vector of endogenous variable. And each of $\prod_i$ is an (nxn) matrix of parameters, D_t represents the vector of dummies for policy interventions, and the disturbances U_t is independent and identically distributed with mean null vector O and variance of normally Ω. i.e. $U_t \sim IIN(O,\Omega)$. The system is in reduced form with each variable on only lagged values of both the variable in equation and all the other variables in the system. Thus, OLS is an efficient way to estimate each equation in the system consists of a common set of lagged regression. And hence equation (4.14) can be respecified into a vector error-correction (VECM) form:

$$\Delta Y_t = \Gamma_1 Y_{t-1} + \Gamma_2 Y_{t-2} + \text{-----} \Gamma_{k-1} Y_{t-k+1} + D_t + \prod Y_{t-k} + U_t \text{ ----------(4.15)}$$

Where, estimate of Γi =-(I-∏-...∏i), i= 1,.....,k-1), and ∏=-(I-∏1-.....∏k). This way of specifying the system contains information on both the short and long run adjustment to changes in Y_t, via the estimates of $\hat{\Gamma}$ and $\hat{\prod}$ respectively.

$\Pi = \alpha\beta'$, where α represents the speed of adjustments to disequilibrium, while ß' is a matrices of long run coefficients such that the term ß'Y_{t-k} represents up to (n-1) cointegration relationships in the multivariate model which ensure that the Y_t converge to the long run steady state solutions (Harris, 1995). Testing for cointegration amounts to the rank of ∏ implies finding the number of r linearly independent column in ∏ . If the rank (r) of ∏ is zero, then there are no cointegration relationships and no stationary linear combination can be identified in the variables Y_t.. If ∏ has full rank, there are r = n linearly independent columns in ∏, where n is the number of variables entering the co-integrating space. It implies that each variable is "Co-integrated" to itself, and hence each these variable is an order of I (0).The interesting case in this condition becomes that ∏ has a reduced rank, that is, there are r< (n-1) co-integration vectors presents in β.

The next step becomes to construct the likelihood ratio (LR) test for rank of ∏ to determine the number of cointegrating vectors. In the Johansen procedures there are two tests help to identify the number of cointegrating vectors, called the trace (λ trace) test statistic and the maximal (λ max) statistics. These tests are given as follow:

A.) Johansen Trace statistic

Johansen's LR statistic tests the nested hypothesis of $H_0(r)$: $r=r_0$ Vs.Hr (r_0):$r>r_0$ in which it commonly called the trace statistic is given by

$$LR_{trace}=\lambda_{Trace\,(r)} = -T\sum_{i=r_0+1}^{n} \ln(1-\hat{\lambda}_i)$$

The sequential procedure for determining the number of cointegrating vectors is

1. First test H_0 ($r_0=0$) against H_1 ($r_0> 0$). If this null is not rejected then it is concluded that there are no cointegrating vectors among the n variables in Y_t.
2. If H_0 ($r_0 = 0$) is rejected then it is concluded that there is at least one cointegrating vector and proceed to test H_0($r_0=1$) against H_1($r_0>1$). If this null is not rejected then it is concluded that there is only one cointegrating vector.
3. If the H_0 ($r_0=1$) is rejected then it is concluded that there is at least two cointegrating vectors.
4. The sequential procedure is continued until the null is not rejected.

B.) Johansen's Maximum Eigenvalue statistic

Johansen also derives LR statistic for the hypotheses

H0 (r_0): $r=r_0$ vs. H_1 (r_0): $r_0=r+1$

The LR statistic, called the maximum eigenvalue statistic, is given by

$$\lambda \max (r,\ r+1) = -T \ln (1- \lambda_{r+1}) , \qquad r=0,1,2,\ldots,n-2,\ n-1$$

Where, λ_i = Eigen vectors,

T = number of observations and n is the number of variables in both the trace and maximum eigenvalue statistic.

As with the trace statistics, the asymptotic null distribution of LR_{max} (r_0) is not chi-square but instead is a complicated function of Brownian motion which depends on the dimension of $n-r_0$ and the specification of the deterministic terms.

In general the trace statistic is used to determine whether there are at most r cointegrating relationships against alternative $r>r_0$, while the maximal statistics tests the null-hypothesis of r co-integrating vector against the alternative of r+1. Since each eigenvector of estimated ß' value has a corresponding eigenvalue, then the magnitude of λ_i is a measure of the strength of the cointegration relations denoted as $ß_{i1}$ Y_i are correlated with the stationary part of the model.

V. EMPIRICAL INVESTIGATION ON THE ETHIOPIAN AGRICULTURE AND GDP

5.1 Growth performance of Agriculture and GDP

Being agriculture the dominant sector in its share of GDP, its growth trends in compare to GDP has been growing very slowly. As table 5.1 below shows, for the period 1971-1980 and 1981-1990, on average, the economy has recorded annual growth of 2.22 and 2.35 percent of GDP with an agricultural growth of 1.077 and 1.237 percent per year respectively. The per capita income growth during the same period was birr 265.45 and 244.95 per year of national per capita income and birr 147.42 and 112.32 per year of agricultural per-capita. The growth rate of the economy in general and agriculture sector in particular strives to increase. During the period of 1991-2000 and 2001-2005 both accounts about 3.695 and 5.33 of national growth with 2.139 and 6.124 percent agricultural growth. In these two time period the trend of the national per capita income increases from birr 236.34 to 263.97 per year while the agricultural per capita in come has decline from birr 102.86 to 98.56 per year. In terms of the non-agricultural output the growth rate as well as the per capita income was continuously increasing with a slow growth rate. This is clearly observed from the table 5.1 below.

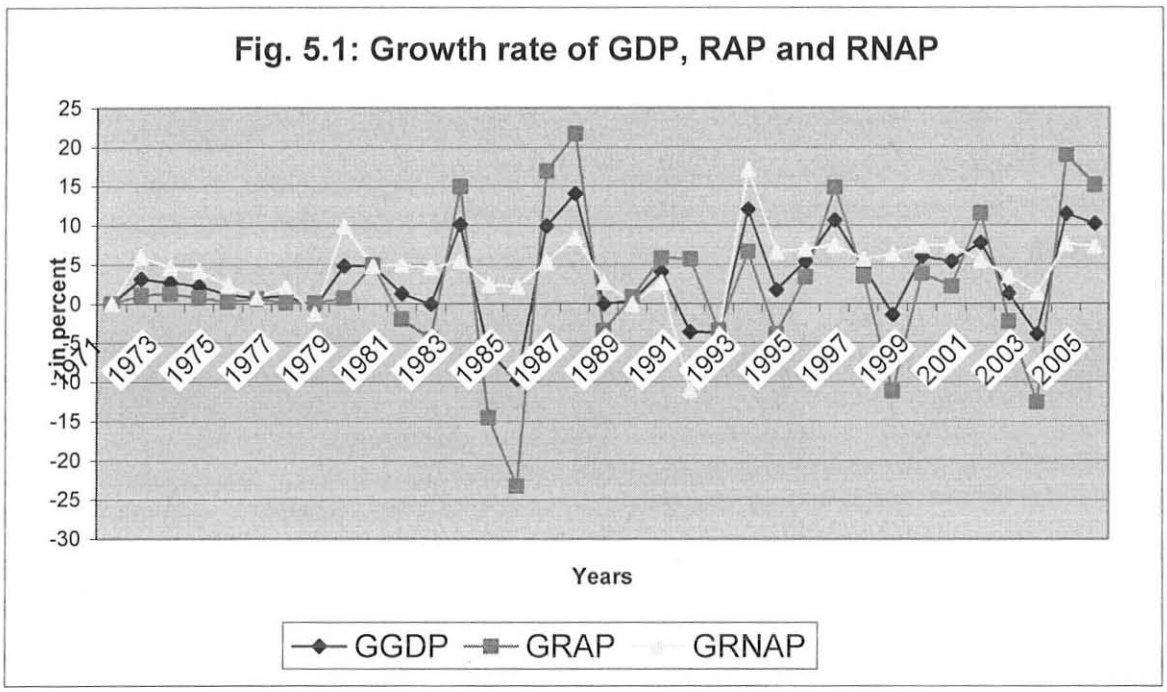
Table 5.1 trend of real agricultural product and GDP growth

Years	GDP		RAP		RNAP	
	growth in %	**Per capita (Birr per person)**	**growth in %**	**Per capita (Birr per person)**	**growth in %**	**Per capita (Birr per person)**
1971-1980	2.22	265.45	1.077	147.42	3.7	118.03
1981-1990	2.35	244.95	1.24	112.32	3.85	132.63
1991-2000	3.69	236.34	2.14	102.86	4.98	133.47
2001-2005	5.33	263.97	6.13	98.56	5.033	165.41
1971-2005	3.151	251.06	2.179	117.68	4.322	133.38

Source: National Bank of Ethiopia and own computation

As it is shown in the table 5.1 during 1971-1980 the growth rate as well as the per capita income of non-agricultural product was 3.7 percent and birr 118.03 respectively. This trend continuously increases up to growth rate of 5.033 percent and per capita income of Birr 165.41 per year. Unlike to non-agricultural products, the average growth of GDP and agricultural GDP has shown a stagnant progress. Nevertheless in the last five year the economy recorded a highest growth.

Based on the annual data of the study period the growth rate of GDP, RAP and RNAP are provided in Figure 5.1 below. The figure shows existence of high fluctuation in growth rate throughout the study period. During 1970's the economic growth rate was low and almost stable. In this regard the trend in the contribution of agriculture to the country's total GDP is clearly explained with the relationship between the performance of agriculture, climate and the total economy.



Source: National Bank of Ethiopia and own computation

In the years of drought and famine (1984/85, 1999/00 and 2003/04) are associated with low contribution and shrinking the economy downward. During good whether condition (1987/88, 1997/98 and 2005/06), the agriculture sector increases the economy upward. A lower performance of non-agriculture was observed during the beginning of transitional government (1992/93). And figure 5.1 clearly shows a better stability is observed in the non-agricultural than the agricultural products during the study period.

5.2 **Productivity performances of Agriculture and GDP**

Economic growth of once country is highly determined by trend and growth of labor as well as capital productivity. In our context labor and land are the main means of production. Considering the labor productivity

of output, their productivity trend can be analysed output to the total labor and agricultural output to rural labor force. This is shown in table 5.2 as follow:

Table 5.2 Total and agricultural Output productivity trend

Years (in G.C)	Real national output productivity Birr/person	Real agricultural output productivity Birr/person
1971-1980	638.93	390.168
1981-1990	589.57	299.98
1991-2000	568.85	279.09
2001-2004	625.46	265.24
1971- 2004	601.99	316.27

Source: National Bank of Ethiopia and own computation

As it is shown in the table 5.2 the estimated total labor force of the nation was about birr 638.93 per year and rural labor force was birr 390.168 per year during 1971-1980. This trend continuously decline and in the last period of 2001-2004 the national productivity of labor as well as agricultural labor force becomes birr 625.46 and 265.24 per year. While the value of real out put grows from time to time, productivity trend shrinks as a result of lower productivity growth in which it unable to capture to population growth.

5.3 Sectoral Growth Comparison

The Ethiopian economy is characterized by dualistic nature of the subsistence sector dominated by peasant agriculture and the modern sector composed of the industry and service sectors. Nevertheless,

structure of the economy is categorized as agriculture with its allied activities, industry, distributive service and other services.

The industrial sector includes mining and quarrying large and medium scale manufacturing, small scale industry & handcrafts, electricity, water and finally construction. The sector generates much of the annual output, huge amount of labor force and generates a considerable proportion of the foreign exchange earnings of the country.

The service sector also can categories as distributive services and other services. The distributive services include trade, hotels, restaurant, transport, & communications. Finally other services also consists banking, insurance, real estate, public administration, defense, education, health and etc.

Table 5.3 Sectoral share and growth performances

Years	agriculture		industry		services	
	Share of GDP in %	Annual growth rate in %	Share of GDP in %	Annual growth rate in %	Share of GDP in %	Annual growth rate in %
1980/81-1989/90	52.18	1.66	12.5	2.67	35.29	4.54
1990/91-1999/00	50.32	2.12	10.43	3.83	39.24	5.7
2000/01-2005/06	42.41	4.87	11.26	6.167	46.32	5.144
1980/81-2005/06	49.21	2.61	11.43	3.97	39.36	5.149

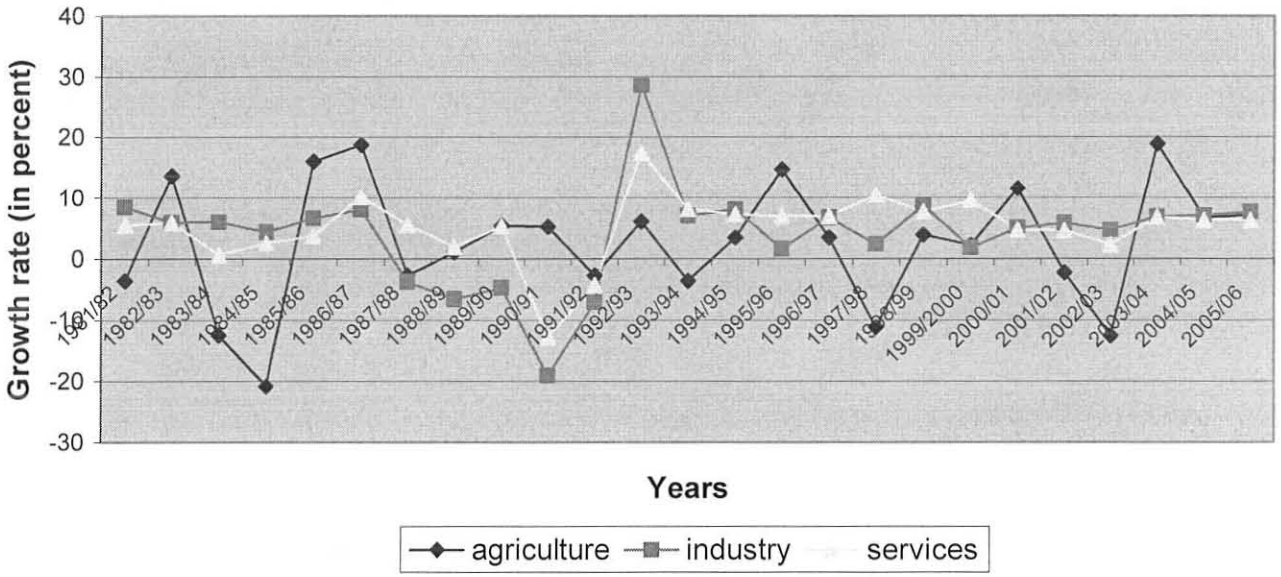
Source: Ministry of Finance and Economic Development (MOFED) and own computation

Table 5.3 shows the growth and share of gross domestic product by industrial sector at 1980/81 constant factor cost. This indicates as share of agricultural value decline from 52.18 to 50.32 percent, the share of

service sector increase from 35.29 to 39.24 percent for the period between 1980/81-1989/90 and 1990/91-1999/00 respectively. At the same time this trend of antagonistic relationship for both sectors extends, during 2000/01-2005/06 with the share of 42.41 percent and 46.32 percent for agriculture and service sector respectively.

In terms of their growth rate, during 2000/01-2005/06 the industrial sector performs the highest growth rate of about 6.16 percent followed by the service and agricultural sector of 5.144 percent and 4.87 percent respectively. Graphical analysis of all the sectors is presented as follow.

Fig. 5.2: Sectoral Growth Comparison



Source: Ministry of Finance and Economic Development (MOFED) and own computation

As shown in the Figure 5.2 above the agriculture sector shows highest fluctuation throughout the sample period. The industrial sector shows lesser fluctuation in comparison to agriculture but it becomes greater in comparison with service sector. A highest fluctuation of the industry

sector was recorded during the downfall of Derge and beginning of Transitional government. Nevertheless, the service sector had highest stability in comparison to the fluctuation of agriculture and industry.

5.4 The Performance of the Different Agricultural Sub-sectors

5.4.1 Crop production

A. cereal production

A proper agriculture constitutes crop and livestock sub-sectors. In the Ethiopian agriculture cereals dominate the crop sub-sector. Studies show that cereals production accounts for about 85 – 95 percent of the total crop production. Maize, sorghum teff, barley and wheat are among the most important cereals in volume of output.

Table 5.4, Area, production and Yield of major crops

years	Area ('000ha)	Production ('000MT)	Maize Yields (quintal/ha	barley yields (quintal /ha)	wheat yields (quintal /ha)	Teff yield (quintal /ha)
1973-1990	5,675.2	7,395	14.38	10.35	10.6166	7.96
1993-2005	8,055.7	99,578	16.53	10.58	12.746	8.566

Source: Central Statistical Agency (CSA) statistical abstract and own computation

Even though there is a considerable potential for agricultural production, Ethiopia is unable to be self-sufficient in food production due to lower level of productivity. As can be seen from Table 5.4 above the total area cultivated under major crops has increased from 5,675.2 thousands hectare to 8,055.7 thousands hectare in average from the 1973 – 1990 to

the 1993 – 2005 years. Consequently the production of crops has also increased on average from 7,395 thousand metric tones to 99,578 thousand metric tones over the same period. Though specific data of each crop type is not available, it is possible to analysis the productivity of major cereals for a given hectare of cultivated land. Accordingly maize, barley, Teff and wheat productivity on average was 14.38, 10.35, 10.6 and 7.96 quintal per hectare for the first phase and for the second phase their productivity, grew to 16.53, 10.58, 12.746 and 8.56 quintal per hectare respectively. The productivity trend is stagnant in comparison to green revolution of extremely high out put of quintal per hectare.

Table 5.5 Growth and productivity performance of major crops

years	Growth		Productivity growth of			
	Production (MT)	Cereals (MT)	Maize Quintal/ha	Barley Quintal/ha	Wheat Quintal/ha	Teff Quintal/ha
1965-1982	2.0445	3.74	3.62	6.63	1.76	4.18
1985-1997	8.184	8.45	.928	3.24	0.56	2.12

Source: Central Statistical Agency (CSA) and own computation

The growth performance of agriculture sector in table 5.5 shows 8.18 percent and 8.45 percent metric tons annual growth of total and cereal production respectively in the period 1985-1997 while during 1965 to 1982 the total agricultural production as well as cereals in particular performs annual growth of 2.04 percent and 3.74 percent respectively. In terms of productivity growth over the period barley performed best followed by teff.

B Area cultivated

There is a difference in the size of cultivable and cultivated land area in Ethiopia. For instance Teshome (1992) indicates that a total area of 122.6 million hectares of land is suitable for agricultural production. While the Ministry of Economic Development and Cooperation ((currently renamed as the Ministry of Finance and Economic Development), estimates the total cultivable land area of Ethiopia to be about 73.6 million hectare, which is 66 percent of the country's total land area. Out of the cultivable land, about 22 percent or 16.5 million hectare is estimated to be under cultivation of which about 14.6 million hectares are under annual crops and the remaining is under perennial crops such as Enset, Coffee and Others. With regard to ownership, around 96 percent of the cultivated land area is under smallholder farming and the remaining under commercial farms. Regarding land allocation, 50 percent of peasants per capita land holdings on average less than two hectares including grazing land (MEDaC 1999).

On the other hand, the agricultural statistical bulletin of the Ministry of Agriculture – MOA (2000) reveals that grazing land accounts 51 percent, cultivated with perennial and annual crops 14 percent, forest land 3.6 percent, bush and shrub land 8.10 percent, currently unproductive land 3.8 percent, and un-utilizable land 18.7percent. This shows that land is allocated in less proportion of crop production next to grazing and un-utilizable land.

C **Labor Productivity**

There is huge potential of work age population in the rural areas. But peasant productivity is not as such promising. As result they can not produce enough amounts for their subsistence. There are many causes

of low productivity, among the many problems, the basic once are backwardness and recurrent drought. As it is shown in table 5.6 below the labour productivity performance for the period 1971-1991 and 1992-2003 was about Birr 343 and 274 per rural worker respectively. This study is very similar to the study made by Teshome (1992) in which labor productivity in rural economy is estimated at Birr 234 per capita in 1986.

Table 5.6 agricultural Productivity in value and quintal analysis of rural population

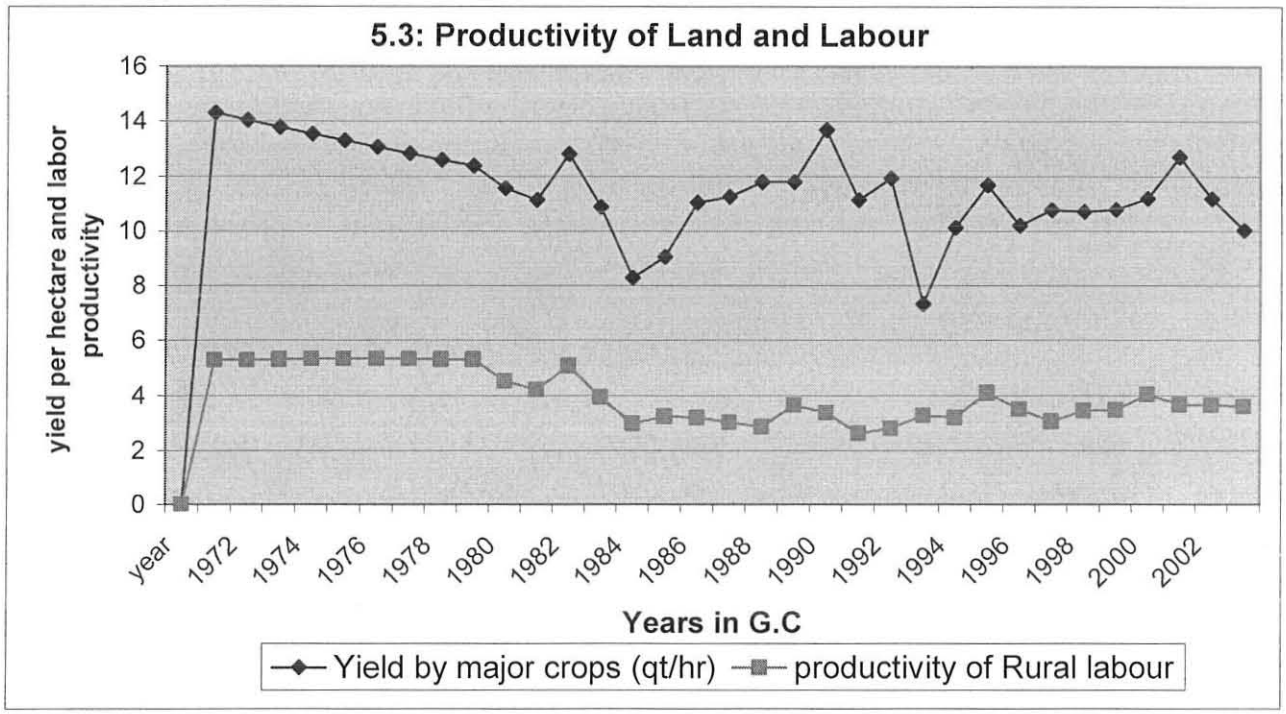
Years	Labour productivity (birr/labor)	Labour productivity (quintal/labor	Average Population(1999)	
			Total rural population	Active Work age population
1971-1991	342.68	4.3	32322578	15304735
1992-2003	273.6	3.6	51407638	24990850.2

Source: Central Statistical Agency (CSA), National Bank of Ethiopia and own computation

In terms of quantity production, as it is shown in table 5.6 these rural workers who are actively participating in the agricultural work can produce about 4.3 quintal per worker on annual average for the period 1971-1991 and 3.6 quintal per worker for the period 1992-2003.

Assuming that average family size of 5 in the rural Ethiopia and two of them are among the active work age, about 8 quintal will be the annual family income rural population. productivity of labor decline from 4.3 to 3.6 quintal per head results mainly on the one hand due to rapid growth of population and on other hand the growth trend of agricultural production couldn't catch up or grow in a parallel manner, which implies that the existing rural population has a momentum effect to the next years continuously while agriculture sectore is rainfed with limited

modernization. Obviously this backward sector couldn't feed even farmers, unless they are trying to subsidize themselves through different income generating system apart from the agriculture sector. Such as off farm and other means of generating income. These data reveals the productivity of rural work age is very low. This is also shown in Fig. 5.3 below for the study period. This shows the existence of fluctuating trend in the productivity of labor and land over the period from 1970/71 – 2004/05.



Source: Central Statistical Agency (CSA), National Bank of Ethiopia and own computation

5.4.2 Livestock Production

Livestock plays a crucial role in the economies of rural population. It contributes up to 80 percent of farmers' income and accounts about 12 percent share of GDP. Ethiopia has the largest livestock population in Africa. Most peasant farmer hold some amount of livestock as cattle, sheep and goats. They benefited as a means of generating income for

consumption to sustain their subsistence livelihood. Rearing livestock for the marketable purpose is not common in our country except some private commercial sector expanding in recent time. Nutritional factors are the most binding constrain of livestock production.

Further more, livestock is source of food, draught power, fuel and cash income. They provide employment and means of security and investment. There are different types of animal product. The principal importance is draught power and other product in approximated order of importance includes meat, milk, hides and skin and manure.

Table 5.7 Average annual growth of animal rearing and hunting

Years	Values ('000) birr	Growth rate (%)	Percent distribution
1995/96-1999/00	7308231.67	1.34	12.78
2000/01-2005/06	7686280.6	1.9	10.7

Source: Ministry of Finance and Economic Development (MOFED) and own computation

As it is shown table 5.7 the percentage distribution of livestock and allied animal rearing accounts about 12.78 and 10.7 percent of the total gross domestic product for the period 1995/96-2000/01 and 2001/02-2005/06 respectively. This amount of share is similar to the industrial sector share.

In relation to the performance of growth rate during the past ten years, this subsector grew for about 1.34 percent and 1.9 percent per annual for the first and second five year. The survey study made by MEDaC (1999)

indicates the livestock population growth rate over the period 1994-1997 for cattle, sheep and goat were 1.9, 2.6 and 1.86 percent annual respectively. Their study is almost similar to the growth rate indicated in the table 5.7 above.

5.5 Government expenditure on Agriculture

5.5.1 Size and Trend of Government Expenditure on Agriculture

Government expenditure on agriculture includes all expenditure that are used to increase agricultural production. It is composed of expenditure on administration, irrigation, research studies and extension, agricultural development projects, resettlements and other natural resource development.

Since expenditure is a fiscal instrument of government policy, government uses agricultural expenditure to stimulate agricultural growth. The level of total government expenditure increase from Birr 2281.5 million in 1980/81 to reach the level of Birr 20184.6 million in 2005/06.

The size of current and capital expenditure on agriculture also increase from Birr 138.3 million to Birr 1242.2 million for the same period under consideration. This indicates expenditure on agriculture of 1980/81 grows eight times to reach that of 2005/06 (See Appendix 5).

Structural trend of expenditure on agriculture

The government expenditure on agriculture is structured as current and capital expenditure. The trend and change made on agricultural expenditure can be analyzed in relation to each other and with respective

to total government expenditure. According to the expenditure structure, three different ratio analyses are computed. These are (1) recurrent expenditure of agriculture to total current expenditure. (2) Capital expenditure to total capital expenditure and (3) capital to recurrent expenditure each other on agriculture. As it is shown in the following table 5.8, government expenditure in general and expenditure on agriculture in particular has shown a tremendous increment.

Table 5.8 Share of Recurrent expenditure on agriculture

Years	Recurrent expenditure on agriculture		
	Share to the total recurrent Expenditure (%)	Percentage of Increment	Recurrent to Capital Ratio in (%)
1974/75-1990/91	2.74	12.938	30.44
1991/92-1997/98	5.94	21.198	94.84
1998/99-2005/06	6.52	12.704	116.94

Source: Ministry of Finance and Economic Development (MOFED) and own computation

The ordinary expenditure on agriculture in relation to the total ordinary expenditure increases form time to time. Its share recorded on average about 2.75, 5.94 and 6.52 percent per annual for the period 1974/75-1990/91, 1991/92-1997/98 and 1998/99-2005/06 respectively. The annual increment of expenditure on the agriculture fluctuates up ward and down ward during the study period as shown in the table 5.8. At first increment was on average about 12.94 percent. This amount tremendously increases to 21.198 percent and at the same time falling to 12.7 percent for the last six year.

The share of capital expenditure on agriculture in relation to the development expenditure is higher in comparison to the share of ordinary expenditure on agriculture with its own total.

Table 5.9 Share of Capital expenditure on agriculture

Years	Share to the total capital expenditure	% share in GDP	Incremental change in Percentage
1974/75-1990/91	26.95	1.839	20.19
1991/92-1997/98	13.52	1.0147	4.21
1998/99-2005/06	14.44	1.975	30.21

Source: Ministry of Finance and Economic Development (MOFED) and own computation

As it is indicated in the table 5.9 the share of agricultural capital expenditure to total for period 1974/75-1990/91, 1991/92-1997/98 and 1998/99-2005/06 was about 26.95 percent, 13.52 percent, and 14.44 percent and its percentage share to GDP for the same period was also 1.83, 1.014, and 1.975 percent respectively.

The ratio analysis between each other reveals, the capital expenditure on agriculture was much greater than recurrent expenditure on agriculture. As shown in the table 5.8 the percentage ratio result of recurrent to capital was 30.44, 94.84 percent for the period 1974/75-1990/91 and 1991/92-1997/98 respectively. A higher ratio of recurrent expenditure was recorded during 1998/99-2005/06 which was about 116.9 percent share of recurrent to capital expenditure on agriculture. So the share of capital

expenditure on agriculture is higher in the previous government than the present government compare to its recurrent expenditure.

Though the total expenditure amount on the agricultural increase, their dimension and coverage differ based on the government policy on agriculture. In the post 1991 the share of total government expenditure on agriculture grew to implement a command economic system in accordance with the socialist economic principle in the mid 1970s. The trend of the expenditure also increase for the enlargement of the bureaucracy with some cooperative activities directly related to production, including construction projects, training programme and establishment of state distribution and marketing union and infrastructures Teshome (1992).

Since 1992 on word, the country's economy policy is based on the direction of agricultural development led industrialization (ADLI). Hoping this sector to play significant role in the economy, attention of government towards this sector is high. As result the trend of the expenditure also increase more than two to three fold of post 1992. The increment of budget in the agriculture is based on the policy direction of ADLI in relation to the enlargement of the bureaucracy in accordance with the relevance of the sector as well as to expand considerable development activities directly related to production, including construction projects, training programme of rural human resource development to the extent of higher level education. Finally a great emphasis is given for the implementation of extension service on extension agents. The return from the sector is very low due to the fact that the main input used in production is natural rainfall. So, it may or may not rain as it is needed.

5.5.2 Allocation of Government Expenditure on Agriculture

As it is obviously knows, the effort of many individuals as well as the intention of government expenditure on agriculture is to bring sustainable change in the agricultural sector in terms of productivity and growth to achieve its ultimate objective of food self sufficiency and contribute significantly to the overall growth of the economy. As result, different alternative policy options are implemented with different instruments. All these instruments are accompanied by expenditure, so expenditure on agriculture is expected to play a multiplier effect on the growth of the sector.

The trend of expenditure on agriculture can be preferably analyses and evaluate by the amount and size spend on each rural population, rural worker, and land cultivated in hectare. Annual average agricultural expenditure to the cultivated land in hectare, per the agricultural rural worker, and per the total rural population (base on 1999 census) is calculated and summarized as follow.

As it is shown in table 5.10 there is an increasing allocation of government expenditure on agricultural per hectare and per rural person. Accordingly, the government spends to agriculture in the form of capital or recurrent for the period 1974/75-1990/91 was on average Birr 53.11 per hectare of land.

Table 5.10 Allocation of GEA on land and rural population

Years	GEA per hectare land cultivated By major crop Birr/hectare land	GEA per total rural population Birr/rural person	GEA per active rural worker Birr/rural worker
1974/75-1990/91	53.11	8.46	19.77
1991/92-1997/98	97.63	13.56	31.68
1998/99-2005/06	192.24	28.68	67.029

Source: Ministry of Finance and Economic Development (MOFED) and own computation

As it is shown in the table 5.10 government expenditure on agriculture per rural worker grew from Birr 8.46 to Birr 28.68 per person per annual as well as per total rural population also grew from Birr 19.77 to Birr 67.00 per person per annual within the sample period respectively.

Based on the policy direction a considerable amount of GEA is financed for research and extension, irrigation, resettlement and education and health. There was a much increment in GEA per person employed as well as per hectare. As with real GEA per hectare, real GEA per Person employed in agriculture increased over the period. From table 5.10 any one can conclude that every six or seven year the GEA per person or per hectare land increases almost twice. This shows much faster increment of government expenditure on agriculture is observed in recent government than in the previous one

VI. TIME SERIES EXAMINATION

6.1 Stationarity Test on RAP and GDP-pop Specifications

Estimation of the parameters of the models in this study has employed time series data for the period 1971-2005. In the models the first equation provide the over all performance of some agricultural input to its real value of output. While the next equation estimate the contribution agriculture and non-agricultural growth on the overall economic growth. The parameter estimates in each equation were found running ordinary least square (OLS). Their estimation has shown that almost all have the correct sign and a palatable magnitude.

Evaluation of the overall significance of the model and the goodness of fit of the predicted values is made using the F-static, coefficient of determination and residual sum of squares. In every equation except the error correction model the residual sum of square are found to be very small, the F-static indicates there is a good fit at 1 percent level of significance.

The formal testing system of the time series data is used in each model. It is examined using the ADF test of level, first difference with inclusion of constant, trend and trend with constant. In this paper only level with intercept and first difference with intercepts are reported. These results of the test for unit root are summarized in table 6.1 on the next page.

Table 6.1 Tests for unit roots (ADF test)

Variables	Specifications	ADF Test	Critical value at		
			1%	5%	10%
Ln RAP	*LWI*	0.28	-3.65	-2.95	-2.62
	DWI	-7.7	-3.65	-2.95	-2.62
Ln RRW	*LWI*	0.35	-3.64	-2.95	-2.61
	DWI	2.86	-3.64	-2.95	-2.61
lnGEA	LWI	-.92	-3.66	-2.96	-2.61
	LWI	-6.0	-4.27	-3.55	-3.2
lnCTTL	LWI	-1.08	-3.64	-2.95	-2.61
	LWI	-5.66	-4.26	-3.55	-3.2
lnARF	*LWI*	-2.58	-3.63	-2.95	-2.62
	DWI	-5.78	-4.25	-3.55	-3.2
GDP-Pop	*LWI*	-0.91	-3.6	-2.95	-2.62
	DWI	-3.57	-3.67	-2.96	-2.62
RAP-pop	*LWI*	-1.84	-3.65	-2.95	-2.62
	DWI	7.46	-3.65	-2.95	-2.62
GRAP	LWI	-1.04	-3.65	-2.95	-2.62
	DWI	-8.019	-3.64	-2.95	-2.62
GRNAP	LWI	-2.38	-3.63	-2.95	-2.62
	DWI	-4.56	-3.65	-2.95	-2.61

Where LWI= level with intercept

DWI= first difference with intercept

6.2 Estimation on real agricultural product Specification (RAP)

A. Cointegration Model

Once checked for stationary and is determined the order of integration, the next step is estimation of the long run relationship using the Johansson's co-integration estimation techniques. The first step becomes to determine the lag length of the VAR using the AIC and (BIC) the test system. The lag lengths selection is made on the consideration to problem of small sample size which affects the short run behavior while long length lag also erode the degree of freedom. Based on the akaike information criteria (AIC) and the Bayesian information criterion (BIC) the appropriate lag length of this equation is lag two.

The results for co-integration test and long run coefficients for the RAP specifications are reported as follow. As it is shown in the table 6.2(a) and (b) below the number of cointegration in the model can be identified using the two likelihood ratio tests of cointegration such as maximal Eigenvalue Test (λ_{max}), and trace test (λ_{trace}) are summarized.

Table 6.2 Test for the number of co-integration vector on real agricultural product (RAP)

a) Based on the maximal eigenvalue

H_0:rank=r	H1	Eigen value	Test statistic adjusted	95% critical value
r=0	r=1	0.931038	34.76*	33.5
r=1	r=2	0.848753	24.55	27.1
r=2	r=3	0.50640	9.178	21.0
r=3	r=4	0.362688	5.856	14.1
r=4	r=5	0.0135048	0.1768	3.8

* denotes rejection the hypothesis at the 5% level

** denotes rejection the hypothesis at the 1% level

b). Based on trace test

H_0:rank=r	H1	Eigen value	Test statistic adjusted	95% critical value
r≤0	r≥1	0.931038	74.53*	68.5
r≤1	r≥2	0.848753	39.77	47.2
r≤2	r≥3	0.50640	15.21	29.7
r≤3	r≥4	0.362688	6.033	15.4
r≤4	r≥5	0.0135048	0.1768	3.8

* denotes rejection the hypothesis at the 5% level

** denotes rejection the hypothesis at the 1% level

The maximal Eigen value test of the null hypothesis is that at most r cointegrating vector against the alternative of r+1. The result for table 6.2 (a) shows that the null hypothesis of no cointegrating vector (r=0) against

the alternative (r=1) is rejected. And hence the test statistic (34.76) is greater than the 95 percent critical value (33.5). This shows that there is at least one cointegrating vector. The null hypothesis of $r \leq 1$ against r=2 can not be rejected implies that there is a unique cointegrating vector.

In table 6.2 (b) the trace test of the null hypothesis also reports that there is at most $r \leq 0$ cointegrating vector against the alternative of $r \geq 1$ cointegrating vector. Since the adjusted test of 74.53 exceed the 95% critical values of (68.5) λ_{trace} statistic, it is possible to reject the null hypothesis of no cointegrating vectors and accept the alternative of one or more cointegrating vectors. However, adjusted test of 39.77 is less than the 95% critical value of 47.2. So we cannot reject the null hypothesis at this significant level. This trace test statistic ensures that there is one co-integrating vector at the 95% level of significance.

Next, we proceed to the identification of α and β' matrices. The standardized β' Eigenvector and the standard α coefficient of the variables are presented in table 6.2 (c) and (d) to express the long run relationship of β's and speed of adjustment of α s.

c) Standardized β' Eigen vector

lnRAP	lnRRW	lnCTTL	lnGEA	lnARF
1.0000	-1.547	-0.59876	0.35074	2.2019
-1.1860	1.0000	-2.9232	0.48649	2.2793
-1.4660	-0.80922	1.0000	0.23719	0.59301
2.6578	-4.8534	-0.38697	1.0000	-2.9511
-1.4477	2.3959	-1.5034	0.69604	1.0000

d) Standardized α coefficients

lnRAP	-0.24632	0.17394	0.17786	-0.036238	-0.00694
lnRRW	-0.008	0.0013705	0.003484	0.00026374	0.00024
lnCTTL	0.016692	0.2582	-0.23508	0.0023568	-0.00342
lnGEA	-0.27371	-0.38923	-0.73377	-0.21101	0.02913
lnARF	-0.51462	-0.048306	-0.059682	0.026223	-0.00176

In order to improve the statistical specification of the model, tests of exclusion from the co-integrating space and tests of weak exogenity were carried out. Weak exogenity test is conducted by imposing a zero restriction on the α coefficients of the 1st column using the likelihood ratio test see table 6.3 (a).

Table 6.3 test for zero restrictions on

(a) α coefficients for real agricultural product specification

	lnRAP	lnRRW	lnCTTL	lnGEA	lnARF
α-coefficient	-0.24	-0.008	0.016692	-0.27371	-0.51462
LR-test $\chi^2(\approx 1)$	6.7697	1.6858	0.0017749	0.14775	1.8507
p-value	0.0093**	0.1942	0.9664	0.7007	0.1737

* denotes rejection the hypothesis at the 5% level

** denotes rejection the hypothesis at the 1% level

As it is shown in table 6.3 (a) the null hypothesis of weak exogenous is not rejected for rural labor force (RRW), government expenditure on agriculture (GEA), average rainfall (ARF) and cultivated land (CTTL) at 1 percent level of significance except real agricultural product (RAP).

To determine which variable uniquely constitutes the co-integrating vector, a zero restriction is imposed on the long run coefficients of the respective variables.

(b) Test for zero restrictions on β' coefficients of long run real agricultural product specification

	lnRRW	lnCTTL	lnGEA	lnARF
β –coefficient	-1.547	-0.59876	0.35074	2.2019
LR-test $\chi^2(\approx 1)$	7.2403	6.2091	3.1243	1.5382
p-value	0.0071**	0.0127*	0.0771	0.2149

* denotes rejection the hypothesis at the 5% level

** denotes rejection the hypothesis at the 1% level

Table 6.3 (a) indicates there is at least one statistically significant long run relationship between each input and output variable. Table 6.3(b) also implies labour and land especially have large degree of interdependency in the long run.

Once we establish the weak exogenity conditions, we can write the co-integrating vector in an equation format by classifying the variables in to endogenous and exogenous. Hence we can construct that for real agricultural product conditioning on the other variables as:

LnRAP=1.547lnRRW+ 0.599lnCTTL - 0.351lnGEA- 2.210lnARF ---- (6.1a)

The coefficient of equation (6.1a) can be interpreted as follow:

The sign of rural workers (RRW) is positive as expected and it implies that in the long run a 1 percent increase in the rural workers or agricultural

labor force will increase real agricultural product by 1.547 percent per year. The sign of cultivated land also has a positive as it is expected, and implies that in the long run a one percent increase in the size of land will increase the value of real agricultural product by 0.59 percent per year.

The results obtained on government expenditure and rainfall are negative in contrast to our hypothesis. However, similar results are also found by other research works in other countries. For instance, Elias (1985) came across a negative relationship of agricultural output and government expenditure on agriculture in Brazil and Mexico but government expenditure on research and extension was found positive affecting agricultural output. In our case the latter data is not available for a long period of time and difficult to incorporate such a variable in the model.

The speed of adjustment coefficient (α_{11}=-0.246) in this regard implies that the adjustment towards long run equilibrium, has negative sign. This can be interpreted as those populations who are dependent on the agriculture sector expect to adjust themselves about 24% towards the long run disequilibrium condition whenever there is man-made or natural disaster or any other shock occurred during the period under review. In this statistical analysis one can argue that the Ethiopian agriculture sector is one of the most backward and majority of the population are hand to mouth way of living system. It is very difficult to adjust even for less than one year. So the result needs a relative analysis of concentration on the bases of potential capacity and recent promising trend of sector accompanied by good whether condition.

B. Vector Error Correction Model

The co-integrating result assured as the existence of long run relationship among non-stationary variables. But obtaining long run estimates of the co-integration is only a first step to estimate the complete model (Harris, 1995). The short run structure of the model is paramount important for the short-run adjustment behavior of economic variables and from policy view point as estimates of long run. In this approach we start with model having many explanatory variables based on their relevant and data availability, then we following Hendry approach of general-to-specific modeling. After that we drop the insignificant explanatory variables to arrive to the relatively sound model having strong significance.

Having established the existence of long run relationship among the relevant variables by employing the Johansen test, the next step is to set up a vector error correction model in which vector error correction terms are included. The Pcfiml estimation result of (OLS) unrestricted reduced form error correction specification of real agricultural product equation is presented as follow.

$$\triangle(\ln RAP) = -0.24845 + 32.88\triangle \ln RRW_t - 28.663\triangle \ln RRW_{t-1} \quad \text{---------(6.2a)}$$
$$\quad (-1.246) \qquad (4.926) \qquad\quad (-4.53)$$
$$+ 0.52997\triangle \ln CTTL_t + 0.1123\triangle GEA_{t-1} - 0.5778\ ECM_{t-1}$$
$$\quad (3.387) \qquad\qquad (2.197) \qquad\quad (-1.009)$$

Diagnostic tests

- -AR1-2 F (2, 13) = 2.6879 (0.1055)
- Vector AR1-2 F (2, 13) = 2.6878 (0.1055)
- Normality X2 (2) = 4.914 (0.0857)
- Vector normality x2 (2) = 4.914 (0.0857)
- ARCH F (1, 13) = 0.16268 (0.6933)

Where

ECM_{t-1}stands for the first lag of the cointegrating vector error correction. Values in parentheses of the above equation to each coefficient are t-value. This equation is formulated by dropping the insignificant variables (see appendix -1). The diagnostic test also indicates, the hypothesis or problems of autocorrelation, non-normality and heteroscedasticity are rejected.

The most important parameter in the estimation of this short run dynamic model is the coefficient of the error correction terms in which it measure the speed of adjustment of the real agricultural product to its equilibrium level. This term has negative sign as theoretically expected. The magnitude of the coefficient (-0.5778) clearly implies that about 57.78 percent of disequilibrium in real agricultural product is being eliminated weakly during the study period. The speed of adjustment mainly depends on the natural whether condition and productivity of agricultural determinants specified above.

The coefficient of the short run dynamics of current agricultural labor force, cultivated land, and previous year government expenditures on agriculture are found to be significant and have positive effect. This implies that 1 percent increase in the number of workers (in agricultural work) has an effect of increasing agricultural productivity by 32.88 percent annually. In terms of the cultivated land, in the short run a 1 percent increase in the size of cultivated land would have an effect of increasing the agricultural productivity by 0.52997 percent per annum. The previous year government expenditure on agriculture also implies that one percent increase in the agricultural expenditure will have an effect of increasing the agricultural productivity by about 0.1123 percent per annual. Nevertheless the previous year agricultural labour decreases the agricultural productivity by 28.66 percent per annually.

6.3 Some Econometric Evidence on the Contribution of Agriculture to Economic Growth

In this section the contribution of agriculture can be discussed in comparison to non-agricultural growth. As it is shown in the stationary test table 5.3.1 national per capita income, agricultural per capita, rate of agricultural growth and non-agricultural growth are I(1). Their test summaries also indicate that there is no problem of autocorrelation, and non-normality of residuals at 1 percent level of significance.

A. Co-integration model test

With the same procedure as before the co integration test is made then after we proceed to the error correction test. Based on the akaike information criteria (AIC) and the Bayesian information criterion the appropriate lag length of this equation is lag two.

Table 6.4 Test for the number of co integration vector
on national per capita income (GDP-POP)
a) Based on the maximal eigenvalue

H_0:rank=r	H1	n-r	Eigen value	Test statistic adjusted	95% critical value
r=0	r=1	4	0.793528	35.52*	27.1
r=1	r=2	3	0.668306	10.97	21.0
r=2	r=3	2	0.14289	3.559	14.1
r=3	r=4	1	0.005541	0.1874	3.8

b). Based on trace test

H_o:rank=r	H1	n-r	Eigen value	Test statistic adjusted	95% critical value
r≤0	r≥1	4	0.793528	48.23*	47.2
r≤1	r≥2	3	0.668306	14.71	29.7
r≤2	r≥3	2	0.14289	3.747	15.4
r≤3	r≥4	1	0.005541	0.1874	3.8

The result of table 6.4 (a) for the maximal test of the null hypothesis stating, there are at most r cointegrating vectors against the alternative r+1 exist. Accordingly the test of the null hypothesis of no cointegration vector (r=0) against the alternative(r=1) is rejected due to the fact of test statistic (35.52) is greater than the 95 percent critical value of (27.1). Further more the null hypothesis of r=1 against r=2 can't be rejected in which there is at least one cointegrating vector. And hence this implies that there is a unique cointegrating vector.

The trace test of table 6.4 (b) also reports the test result of the null hypothesis assume that there are r cointegrating vector. Since the adjusted test of 48.23 exceeds the 95 % critical value of (472.) λ_{trace} statistic test result of the null r=0 against r≥1 is rejected. However the null hypothesis of r=1 against alternative r=2 can't be rejected. The trace statistic suggests that the null hypothesis of zero cointegration relationship can be rejected in favour of one co-integrating vector. So based on the maxima and trace test the model has rank of one co-integrating vector.

Once the cointegration rank is determined, we can impose a rank restriction in the cointegration space to obtain a unique relationship. Then

after we proceed for the identification of α and ß' matrix. The standardized ß eigenvector and the α coefficient of the variables are presented in table 6.4 (C) and (D) to express the long run relationship of ß's and speed of adjustment of α

C) Standardized β' Eigen vector

GDP-pop	RAP-pop	GRAP	GRNAP
1.0000	0.23213	-4.2732	-30.598
-0.95297	1.0000	51.257	-28.36
-0.36875	-0.45909	1.0000	2.3069
-0.62271	0.43665	-0.03042	1.0000

d) Standardized α coefficients

GDP-pop	-0.32102	-0.013181	0.2376	0.0044854
RAP-pop	-0.17828	-0.015139	0.17845	-0.039227
GRAP	-0.18703	-0.035289	0.15575	-0.033806
GRNAP	-0.15909	-0.00434	0.042254	0.034153

In order to improve the statistical specification of the model, we can proceed to test the restrictions on the α and ß. We test for weak exogeneity, and then for linear hypothesis on the cointegration relations were carried out. So weak exogeneity test is conducted by imposing a zero restriction on the α coefficients of the first column using the like hood ratio test (see table 6.5 (a).

Table 6.5 (a) test for zero restrictions on α coefficients for national per capita income model

	RAP-pop	GRAP	GRNAP
α-coefficient	-0.178	-0.187	-0.159
LR-test $\chi^2(\approx 1)$	3.3785	3.5214	3.534
p-value	0.0661	0.0606	0.0657

* denotes rejection the hypothesis at the 5% level

** denotes rejection the hypothesis at the 1% level

As it is indicated in table 6.5 (a) the null hypothesis of weak exogeneity test not rejected for the agricultural per capita in come(RAP-pop), growth rate of agricultural and non- agricultural product (GRAP & GRNAP) respectively at 1 percent level of significance.

To determine which variable uniquely constitutes the cointegrating vector, a zero restriction is imposed on the long run coefficients of the respective variables see table 6.5 (b)

b) Test for zero restrictions on β' coefficients for the long run national per capita income model

	RAP-pop	GRAP	GRNAP
β-coefficient	-0.2321	4.273	30.548
LR-test $\chi^2(\approx 1)$	3.7164	2.245	14.67
p-value	0.0539*	0.1298	0.001**

* denotes rejection the hypothesis at the 5% level

** denotes rejection the hypothesis at the 1% level

Table 6.5 (b) clearly shows growth rate of real agricultural product, growth of real non-agricultural product have at least one long run relationship with that of national per capita income. Of all the growth rate of real non-agricultural product have strong long implication.

Once we establish the weak exogeneity conditions, we can write the cointegrating vector in equation format by classifying the variables into endogeneous and exogeneous. Hence we can write national per capita income conditioning on the other variable.

With this assumption, GDP-pop as a dependent on the other variables, the normalized long run per capita income model of table 6.5(b) is formulated as

GDP-pop=-0.2321RAP-pop +4.2732GRAP+ 30.598GRNAP----------(6.1b)

The coefficients of equation (6.1b) for growth of real agricultural product and non-agricultural product were statistically significant and have positive sign. This implies that in the long run a 1 percent increase in growth of real agricultural product will increase real national per capita in come by 4.2732 percent. In terms of non-agricultural product, a one percent increase in the growth of non-agricultural product will have an effect of increase the value of real national per capita income by 30.598 percent per year in the long run.

The coefficient of equation (6.1b) for the agricultural per capita has the unexpected interpretation in terms of its sign with significance. The most probable reason may be due to fact that share of agriculture on the gross domestic product as well as the trend of agricultural per capita income is decreasing from time to time(see appendix 4). The other probable

justification becomes with the increasing the over all economic development in the long run the contribution of agriculture will decrease in compare with the non-agriculture.

To proceed for the long run analysis it is important to discuss the speed of adjustment coefficients (α_{11} =-0.321) at this stage. It implies that the adjustment towards the long run equilibrium has negative sign. This can be interpreted as national per capita income of the economic agent adjust by about 32% to the long run steady state if there is any shock happened in the economy. The absolute value of this speed of adjustment indicates for at most two years the long run disequilibrium will be fully adjusted.

In this statistical analysis one can argue that the Ethiopian economy is highly dependent on the agriculture sector. If any natural condition affects to agriculture, it is very difficult to adjust even for less than one year. So the result needs a relative analysis of concentration on the bases of potential capacity and recent promising trend of the economy in general and non agricultural sector in particular accompanied by good whether condition.

B. Vector error correction model test

As it was clear in the previous section in which we established the existence of long run relationship among the relevant variables by employing the Johansen test. The next step is to set up the vector error correction model in which vector error correction terms are included.

So it is possible to estimate the short run dynamic following the Hendry's approach of general to specific method. In estimating the vector error correction model dummy variable for the policy effect is introduced. After dropping the insignificant variables of the first short run estimation (see appendix 2), we found the following results.

$$\triangle GDP\text{-}pop = -0.77299 + 0.9872\triangle RAP\text{-}POP_t - 1.046\triangle RAP\text{-}pop_{t-1}$$

P-values	(0.0598)	(0.000)	(0.000)
t- Value	(-1.99)	(48.027)	(-41.76)

$$+ 1.1872\triangle GRNAP_t + 1.054D_t - 0.01557ECM_{t-1} \quad \text{--- (6.2b)}$$

(0.000)	(0.0465)	(0.3981)
(31.849)	(2.115)	(0.863)

Diagnostic tests

AR 1- 2 F (2, 19)	=	2.4108 [0.1167]
Normality Chi^2(2)	=	2.4584 [0.2925]
ARCH 1 F (1, 19)	=	2.2408 [0.1508]
Xi^2 F (13, 7)	=	1.0565 [0.4947]

As the diagnostic tests indicate, the test result of the short run model has no problem of autocorrelation, non-normality, hetroscedasticity and misspecification. This can be ensured based on the AR-test, the normality on the bases of skewnes and kurtosis, the autoregressive conditional hetroscedastic test, Ramsey's Reset test of misspecification respectively.

In terms of coefficients of the variable, the vector error correction term (VECM) has a negative sign as expected but not statistically significant. By considering the over all diagnostics test the model is correctly specified. The short run model indicates the current change in the agricultural per capita has a positive sign and has significant contribution on the national per capita income. A one percent increase in the agricultural per capita

income has an effect of about 0.987 percent increase in the national per capita income. On the other hand, the previous period change in the agricultural per capita have a negative and significant effect. The current change in growth of real non-agricultural product has positive and significant effect on the current change of national per capita income. In this regard the contribution of current real non-agricultural growth implies that a one percent increase in the growth of non-agriculture has an effect of increase the national per capita income by 1.1872 percent per year.

The policy measured by the dummy variable for the current and previous government has positive and significant effect on the current change in national per capita income. This implies that policy has played significant role on the economic growth as well as well- being of the society.

VII. Conclusion and policy recommendation

7.1 Conclusion

This paper has examined the determinant factors of agricultural production at macro level. The variables examined by the model in the analysis were active agricultural labor force, cultivated land, government expenditure on agriculture and rainfall for the years of 1971-2005. Based on the Solow's (1957) growth model, the production function was disaggregated so as to incorporate the above variables in a linear form.

The description of the main policy variable of government expenditure on agriculture shows a remarkable incremental rate. However, the area of cultivated land, agricultural production and yield of major crops has been increased with lesser rate. The basic problem faced to increase per capita income as well as agricultural production is emanated mainly due to the rapid population growth and low productivity of land and labor.

The time series model estimated using co-integration and vector error correction methodology. The quantitative result reveals that active labor force has greater effect to increase agricultural out put value compared to the effect of cultivated land. This implies that increased training of labor force leads to use systematic means of production in a better way. Previous year government expenditure is more effective than any other years' expenditure on current output in the short run.

This study also examines the contribution of agriculture to the over all economic growth. And hence it is found that growth rate of real agricultural product is effective in raising per capita income growth rate by

a far lower scale than that of the non-agricultural production in the long run. To put in figures, a 1% increase in the growth of agriculture and non agricultural product will have an effect of increasing national per capita income by 4.27 percent and 30.59 percent, respectively. In the short run too, present agricultural per capita income is slightly less effective than current growth rate of non-agricultural product to the present national per capita income. This implies that agriculture certainly contributes to the over all growth by its own growth rate. With increasing the country's economic development the share and contribution of agriculture decline in compare to non-agriculture.

The statistical analysis also shows that growth rate of agriculture as well as non-agriculture has one long run relationship. And finally the agricultural sector which still provides the livelihood for most of the population recorded a promising growth rate but a declining contribution to the over all growth.

7.2 Recommendations

Based on the findings of this study the following recommendations are forwarded to policy makers.

1. Agricultural productivity is a key to achieve growth and the strategies should aim to realize the link between increasing agricultural productivity and growth in the economy. Policy environment and investment decision in agriculture should work to realize this condition specially in the short run:

- Government should play a proactive role in stimulating and facilitating agricultural development to direct the pathway to more diversified and faster economic growth.

- Giving priority to agricultural development in places where significant productivity gains are possible and the potential links to the wider economy are strongest.
- Giving priority to strategies designed to overcome the most significant obstacles to increased productivity and employment. Particularly special attention should be given to small-scale, labor intensive farming.
- The main productive resources such as land and labor quality should be increased using:-
    1. soil and water conservation system
    2. utilizing natural and manmade fertilizers
    3. Giving training to farmers i.e. extension training on productivity and innovation of new technology

2. The finding of this study shows us the long run government expenditure on agriculture is not a promising indicating weak strength of long term investment in the sector. So great attention should be given to:
    - Expansion of irrigation in all the suitable areas
    - mechanization of large scale agricultural production should also be expanding as fast as possible
3. Current population growth rate of the country is very fast compared to the value of agricultural growth and gross domestic product. Hence necessary actions should be taken to control the population pressure

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APPENDIXES

Appendix 1: SYS (72) Estimating the unrestricted reduced form by OLS
The present sample is: 5 to 27

URF Equation 1 for D2lnRAP

Variable	Coefficient	Std.Error	t-value	t-prob
D2lnRAP_1	0.77088	0.35765	2.155	0.0745
D2lnRAP_2	-0.36945	0.32409	-1.140	0.2978
Constant	-0.11579	0.24006	-0.482	0.6467
D2lnRRW	41.188	13.094	3.146	0.0199
D2lnRRW_1	-55.968	13.691	-4.088	0.0064
D2lnRRW_2	17.017	13.252	1.284	0.1054
D2lnCTTL_1	-0.21918	0.40759	-0.538	0.6101
D2lnCTTL_2	-0.32028	0.48041	-0.667	0.5298
D2lnSEA	-0.13621	0.064240	-2.120	0.0782
D2lnSEA_1	0.13108	0.063757	2.056	0.0855
D2lnSEA_2	-0.11148	0.077246	-1.443	0.1991
D2lnArainf	0.23489	0.33176	0.708	0.5055
D2lnArainf_1	-0.061105	0.25803	-0.237	0.8207
D2lnArainf_2	0.44756	0.27063	1.654	0.1493
ECM_1	-0.66278	0.75111	-0.882	0.4115
Dummy	0.032772	0.056323	0.582	0.5819

After dropping the insignificant variables

Equation 1 for D2lnRAP

Variable	Coefficient	Std.Error	t-value	t-prob
D2lnRAP_1	0.42553	0.15986	2.662	0.0178
Constant	-0.24845	0.19946	-1.246	0.2320
D2lnRRW	32.885	6.6759	4.926	0.0002
D2lnRRW_1	-28.663	6.3269	-4.530	0.0004
D2lnCTTL	0.52997	0.15648	3.387	0.0041
D2lnSEA	-0.079647	0.050788	-1.568	0.1377
D2lnSEA_1	0.11232	0.051127	2.197	0.0442
ECM_1	-0.57788	0.57298	-1.009	0.3292

\sigma = 0.085941

loglik = 61.359779 log|\Omega| = -5.33563 |\Omega| = 0.00481686 T = 23

Correlation of residuals

```
            D2lnRAP
D2lnRAP       1.0000

D2lnRAP: Portmanteau 3 lags=   4.0149
D2lnRAP: AR 1- 2 F (2, 13)    =  2.6878 [0.1055]
D2lnRAP: Normality Chi^2(2) =  4.914 [0.0857]
D2lnRAP: ARCH 1 F (1, 13)    =  0.16268 [0.6933]
Vector portmanteau 3 lags    =  3.0887
Vector AR 1-2 F (2, 13)          =  2.6878 [0.1055]
Vector normality Chi^2(2)     =  4.914 [0.0857]

Appropriate lag   2


Progress to date
system  T    p    log-likelihood        SC          HQ          AIC
    4   24   48  COINT 414.55008 -28.190    -29.921    -30.546 3    24
84 COINT 492.94740 -29.956    -32.985    -34.079

Tests of system reduction
m 3 --> System  4: F(36,  24) =    2.3530 [0.0154] *
```

Appendix 2: Estimating the model by OLS
The present sample is: 7 to 35

Equation 1 for D3gdp-pop

Variable	Coefficient	Std Error	t-value	t-prob
D3gdp-pop_1	0.62197	0.31869	1.952	0.0769
D3gdp-pop_2	0.20838	0.39243	0.531	0.6060
D3gdp-pop_3	0.18945	0.35900	0.528	0.6082
Constant	-0.27648	0.59161	-0.467	0.6494
D3rap-pop	0.90157	0.16277	5.539	0.0002
D3rap-pop_1	-0.85860	0.36900	-2.327	0.0401
D3rap-pop_2	0.11777	0.47206	0.249	0.8076
D3rap-pop_3	-0.14873	0.37888	-0.393	0.7022
D3GRAP	0.10026	0.19110	0.525	0.6103
D3GRAP_1	0.40710	0.19542	2.083	0.0614
D3GRAP_2	-0.0032831	0.18531	-0.018	0.9862
D3GRAP_3	0.044545	0.036047	1.236	0.2423
D3GRNAP	1.1949	0.049469	24.154	0.0000
D3GRNAP_1	0.51116	0.39073	1.308	0.2175
D3GRNAP_2	0.27941	0.40902	0.683	0.5087
D3GRNAP_3	-8.5365e-005	0.051360	-0.002	0.9987
ECM_1	-0.015572	0.041866	-0.372	0.7170
DUMMY	0.73664	0.66513	1.108	0.2917

\sigma = 0.841166

Loglik=19.072313 log|\Omega|=-1.31533|\Omega|0.268385 T=29

Correlation of residuals

	D3gdp-pop
D3gdp-pop	1.0000

D3gdp-pop: Portmanteau 4 lags= 9.8832
D3gdp-pop: AR 1- 1 F(1, 10) = 0.12755 [0.7284]
D3gdp-pop: Normality Chi^2(2) = 4.1979 [0.1226]
D3gdp-pop: ARCH 1 F (1, 9) = 2.5231 [0.1467]
Vector portmanteau 4 Lags. 7.3347
Vector AR 1-1 F (1, 10) = 0.12755 [0.7284]
Vector normality Chi^2(2) = 4.1979 [0.1226]
MOD (5) Estimating the model by 2SLS (using GRR11.xls)
The present sample is: 7 to 35

Appendix 3: Data used for computing the agricultural product specification

year	Real agricultural Product RAP (in million birr)	Rural active worker RRW (in million birr)	Cultivated Land CTTL ('000ha)	Capital expenditure agriculture CEA (in million birr)	Recurrent Expenditure REA (in million)	Government Expenditure GEA (in million birr)	Rain fall (in mm)	Average rainfall (in mm)
1971	4435.65	10.66582	7039	33	12.518	45.518	10981.31	1220.146
1972	4484.64	10.90702	7107	32.8	13.84	46.64	9772.23	1085.803
1973	4541.74	11.12756	7030	39.9	14.84	54.74	11333.71	1259.301
1974	4576.16	11.36582	6920.6	75.633	18.86	94.493	11887.5	1320.833
1975	4586.47	11.61842	6136	64.887	27.123	92.01	11403.4	1267.044
1976	4613.28	11.89217	5538.8	108.657	26.488	135.145	11818.21	1313.134
1977	4618.57	12.20081	5565	143.061	31.184	174.245	11385.21	1265.023
1978	4620.89	12.50881	5232.2	158.595	36.732	195.327	10198.12	1133.124
1979	4652.73	12.82867	5441.7	103.03	41.067	144.097	9846.82	1094.091
1980	4880.51	13.17128	5427	95.514	42.78	138.294	10324.32	1147.147
1981	4783.33	13.52505	5731.8	158.458	50.15	208.608	10313.91	1145.99
1982	4565.87	13.90579	5590	493.677	57.27	550.947	10521.28	1169.031
1983	5248.36	14.29929	5542.7	182.828	61.615	244.443	11085.19	1231.688
1984	4483.80	14.70747	5990.3	284.221	66.8	351.021	9155.64	1017.293
1985	3441.42	15.06269	5270.6	402.032	69.3	471.332	10804.92	1200.547
1986	4022.67	15.55085	5364.4	335.149	80.4	415.549	10281.55	1142.394
1987	4894.38	16.04532	5518.4	326.295	107.1	433.395	10318.49	1146.499
1988	4724.62	16.52028	5862.1	331.468	117.8	449.268	11191.09	1243.454
1989	4765.63	17.01628	5627.6	339.016	129.4	468.416	11494.9	1277.211
1990	5043.22	17.53325	5720.4	249.682	121.4	371.082	10806.65	1200.739
1991	5330.71	18.07112	5780	245.24	135.1	380.34	9886.4	1098.489
1992	5147.39	18.6445	5043	343.501	173.57	517.071	11200.76	1244.529
1993	5488.27	19.22758	4868.4	373.26	250.175	623.435	12013.86	1334.873
1994	5271.85	19.73082	7167.8	292.295	336.96	629.255	10115.95	1123.994
1995	5450.00	20.14312	7689.4	357.658	378.564	736.222	9517.17	1057.463
1996	6256.55	20.72522	9035	356.47	418.67	775.14	12906.72	1434.08
1997	6471.61	21.31588	8020.3	293.01	447.4	740.41	12083.85	1342.65
1998	5748.12	21.91039	6829..9	702.14	518.83	1220.97	12106.07	1345.119
1999	5967.69	22.5126	7994.87	546.9893	543.5863	1090.576	10845.67	1205.074
2000	6098.97	23.12209	8200.44	579.76	662.397	1242.157	11622.8	1291.422
2001	6799.10	23.73671	9468.38	1063.047	761.299	1824.346	11667.8	1296.422
2002	6642.73	24.35947	7836.94	929.3	730	1659.3	10502.15	1166.906
2003	5805.77	24.98822	7865.3	1875.6	870	2745.6	10256.5	1139.611
2004	6905.63	25.62382	8692.44	288.8	1158	1446.8	10163.1	1129.233
2005	7948.36	26.29587	9829.62	2199.2	1111	3310.2	10357.7	1150.856

Appendix 4: Real values, per capita income and growth rate of GDP, RAP and RNAP

A.	Real output value in million				B. Per capita income			C. Growth rate of real values		
				total population						
year	GDP	RAP	RNAP	('000)	gdp-pop	rap-pop	rnap-pop	GGDP	GRAP	GRNAP
1971	7567.87	4435.65	3132.22	28120982	269.12	157.73	111.38	-	-	-
1972	7804.77	4484.64	3320.14	28781542	271.17	155.82	115.36	3.1304	1.104	6
1973	8015.53	4541.74	3473.78	29388832	272.74	154.54	118.20	2.70033	1.273	4.628
1974	8194.80	4576.16	3618.64	30044203	272.76	152.31	120.44	2.2366	0.758	4.17
1975	8287.28	4586.47	3700.81	30738825	269.60	149.21	120.40	1.12854	0.225	2.271
1976	8343.42	4613.28	3730.13	31490846	264.95	146.50	118.45	0.67734	0.585	0.792
1977	8428.75	4618.57	3810.18	32336868	260.65	142.83	117.83	1.02273	0.115	2.146
1978	8381.18	4620.89	3760.29	33182891	252.58	139.26	113.32	-0.5644	0.05	-1.309
1979	8783.04	4652.73	4130.31	34062105	257.85	136.60	121.26	4.79477	0.689	9.84
1980	9208.91	4880.51	4328.40	35003612	263.08	139.43	123.66	4.84882	4.896	4.796
1981	9324.55	4783.33	4541.22	35976712	259.18	132.96	126.23	1.2557	-1.991	4.917
1982	9315.36	4565.87	4749.49	37023634	251.61	123.32	128.28	-0.0985	-4.546	4.586
1983	10253.80	5248.36	5005.44	38106720	269.08	137.73	131.35	10.0741	14.95	5.389
1984	9608.19	4483.80	5124.39	39231249	244.91	114.29	130.62	-6.2963	-14.57	2.376
1985	8676.91	3441.42	5235.49	40216738	215.75	85.57	130.18	-9.6926	-23.25	2.168
1986	9536.02	4022.67	5513.35	41559600	229.45	96.79	132.66	9.90111	16.89	5.307
1987	10874.76	4894.38	5980.38	42922210	253.36	114.03	139.33	14.0388	21.67	8.471
1988	10868.98	4724.62	6144.36	44235450	245.71	106.81	138.90	-0.0532	-3.468	2.742
1989	10906.06	4765.63	6140.43	45607933	239.13	104.49	134.64	0.34115	0.868	-0.064
1990	11349.58	5043.22	6306.36	47039661	241.28	107.21	134.06	4.06673	5.825	2.702
1991	10938.24	5330.71	5607.53	48530633	225.39	109.84	115.55	-3.6243	5.701	-11.08
1992	10534.61	5147.39	5387.22	50120344	210.19	102.70	107.49	-3.6901	-3.439	-3.929
1993	11798.79	5488.27	6310.52	51739678	228.04	106.07	121.97	12.0003	6.622	17.14
1994	11999.25	5271.85	6727.40	53147566	225.77	99.19	126.58	1.69897	-3.943	6.606
1995	12644.35	5450.00	7194.35	54678811	231.25	99.67	131.57	5.37619	3.379	6.941
1996	13987.08	6256.55	7730.53	56372000	248.12	110.99	137.13	10.6192	14.8	7.453
1997	14640.27	6471.61	8168.66	58117000	251.91	111.35	140.56	4.66995	3.437	5.668
1998	14429.10	5748.12	8680.98	59882000	240.96	95.99	144.97	-1.4424	-11.18	6.272
1999	15294.10	5967.69	9326.41	61672000	247.99	96.77	151.23	5.99483	3.82	7.435
2000	16112.34	6098.97	10013.38	63495000	253.76	96.05	157.70	5.35006	2.2	7.366
2001	17357.70	6799.10	10558.60	65344000	265.64	104.05	161.58	7.72921	11.48	5.445
2002	17572.80	6642.73	10930.07	67220000	261.42	98.82	162.60	1.23922	-2.3	3.518
2003	16883.10	5805.77	11077.33	69127000	244.23	83.99	160.25	-3.9248	-12.6	1.347
2004	18818.20	6905.63	11912.57	71066000	264.80	97.17	167.63	11.4618	18.94	7.54
2005	20732.70	7948.36	12784.34	73059389	283.78	108.79	174.99	10.1737	15.1	7.318

Appendix 5: Recurrent and capital expenditure on agriculture

Years (G.C)	Recurrent expenditure on agriculture			Capital expenditure on agriculture				Ratio of
	value in million Birr	share of total expenditure	increment %change	value in million birr	in % of total capital expenditure	in % of GDP	In% increment change	*recur/capital on agriculture
1974/75	18.86	2.371644	0	75.633	31.82912357	1.362511	0	24.9362051
1975/76	27.123	3.013757	43.8123	64.887	22.94157142	1.082208	-14.20808	41.8003606
1976/77	26.488	2.645097	-2.341186	108.657	33.46443113	1.585192	67.45573	24.3776287
1977/78	31.184	2.307427	17.72878	143.061	43.4344753	1.96111	31.66294	21.7976947
1978/79	36.732	2.511976	17.79117	158.595	42.99913511	1.978258	10.85831	23.1608815
1979/80	41.067	2.446207	11.8017	103.03	23.24421884	1.207303	-35.03578	39.8592643
1980/81	42.78	2.40814	4.171232	95.514	18.91212793	0.890881	-7.294963	44.7892456
1981/82	50.15	2.619153	17.22768	158.458	22.16127616	1.404657	65.90029	31.648765
1982/83	57.27	2.25397	14.19741	493.677	39.64309116	3.936818	211.5507	11.6007025
1983/84	61.615	2.755622	7.586869	182.828	19.59548173	1.542943	-62.96607	33.7010742
1984/85	66.8	2.533758	8.415159	284.221	23.94484499	2.048262	55.45814	23.5028376
1985/86	69.3	2.675211	3.742515	402.032	27.31613188	2.773916	41.45049	17.2374338
1986/87	80.4	3.068702	16.01732	335.149	24.23232152	2.162084	-16.63624	23.9893301
1987/88	107.1	3.132073	33.20896	326.295	23.28456559	2.039739	-2.64181	32.8230589
1988/89	117.8	3.111241	9.990663	331.468	17.08906246	1.964441	1.585375	35.5388755
1989/90	129.4	3.367266	9.847199	339.016	23.54097951	1.896943	2.277143	38.1692899
1990/91	121.4	3.334862	-6.18238	249.682	20.56539559	1.260059	-26.35097	48.621847
1991/92	135.1	4.152311	11.28501	245.24	25.76637742	1.179492	-1.779063	55.0888925
1992/93	173.57	5.053771	28.4752	343.501	19.2445621	1.2879	40.06728	50.5296928
1993/94	250.175	5.686236	44.13493	373.26	13.85344432	1.317594	8.663439	67.0243262
1994/95	336.96	6.460779	34.68972	292.295	9.260168618	0.862609	-21.69131	115.280795
1995/96	378.564	6.781663	12.34687	357.658	10.03910574	0.942753	22.362	105.845249
1996/97	418.67	7.280711	10.59425	356.47	8.359049638	0.859687	-0.332161	117.448874
1997/98	447.4	6.222081	6.862207	293.01	8.120377017	0.653452	-17.80234	152.691034
1998/99	518.83	4.925729	15.96558	702.14	16.94287865	1.438714	139.63	73.892671
1999/00	543.5863	3.974045	4.771558	546.9893	14.18872747	1.028373	-22.09683	99.3778623
2000/01	662.397	5.601841	21.85683	579.76	10.3780071	1.069457	5.991104	114.253657
2001/02	761.299	5.898992	14.93093	1063.047	17.07986985	2.051474	83.35984	71.6148016
2002/03	730	5.388249	-4.111262	929.3	12.37400301	1.793368	-12.58148	78.5537501
2003/04	870	7.263923	19.17808	1875.6	18.56845857	3.619543	101.8293	46.3851567
2004/05	1158	8.748867	33.10345	288.8	2.815857725	0.557328	-84.60226	400.969529
2005/06	1111	10.38415	-4.058722	2199.2	23.18461668	4.244028	661.4958	50.5183703

Appendix 6: Allocation of government expenditure and rural population trend

	GEA per Cultivated land	GEA per total Rural Population	GEA per active Rural Population	total Rural population	Active work age rural population
years	Birr/ha	Birr per person	Birr per person		
1974/75	13.44139403	3.558403702	8.313785815	26554884.69	11365820.83
1975/76	16.61430119	3.389567285	7.919319665	27145057.84	11618422.28
1976/77	24.28481581	4.864018841	11.36419986	27784637.44	11892170.3
1977/78	33.30370795	6.112627626	14.28142535	28505744.28	12200812.99
1978/79	35.88590851	6.683478176	15.61514957	29225351.66	12508813.9
1979/80	26.54697863	4.80761605	11.23242147	29972651.41	12828667.48
1980/81	24.12665736	4.49398494	10.49965979	30773133.83	13171283.91
1981/82	37.31806798	6.601588108	15.4238232	31599669.14	13525051.3
1982/83	99.39509291	16.95783988	39.6199702	32489220.56	13905790.37
1983/84	40.80851419	7.316774316	17.09477047	33408574.52	14299285.3
1984/85	61.88663611	10.21530924	23.86685159	34362249.03	14707469.84
1985/86	89.41984443	13.39308633	31.29134872	35192187.11	15062693.66
1986/87	77.4411107	11.43732915	26.72195535	36332695.74	15550845.54
1987/88	78.55628059	11.56090576	27.01067735	37487979.67	16045321.42
1988/89	95.54827733	11.63977414	27.19494392	38597656.16	16520276.76
1989/90	83.43712148	11.78212212	27.527523	39756505.26	17016278.58
1990/91	64.86313582	9.058656828	21.16447119	40964351.23	17533251.68
1991/92	65.80276817	9.008309963	21.04684175	42221016.1	18071119.86
1992/93	102.5324212	11.87014066	27.73316783	43560646.39	18644498.29
1993/94	132.9569205	13.87787473	32.42399901	44922944.75	19227578.92
1994/95	87.90933222	13.65016537	31.89198325	46098708.9	19730820.6
1995/96	95.83728196	15.64366155	36.54954929	47062000	20143121.17
1996/97	100.7460359	16.00801289	37.40081273	48422000	20725218.08
1997/98	98.26277372	14.86707361	34.7351442	49802000	21315875.23
1998/99	148.5184284	23.85126292	55.72563091	51191000	21910384.51
1999/00	136.0159111	20.73416432	48.44290184	52598000	22512598
2000/01	151.482561	22.99353967	53.72166284	54022000	23122087.71
2001/02	197.5683344	32.89599336	76.85756477	55458000	23736713.56
2002/03	211.7534456	29.15502609	68.11724095	56913000	24359471.65
2003/04	349.0465294	47.02819362	109.875765	58382000	24988221.92
2004/05	151.3389121	24.1669033	56.46308702	59867000	25623820.38

Appendix 7: Growth and percentage of Gross Domestic Product by Economic Activity at Constant Prices

	B. Growth Rates (%)			C. Percentage Distribution				
YEARS	A. Agriculture, Hunting and Forestry	Crop	Animal Farming and Hunting	Forestry	A. Agriculture, Hunting and Forestry	Crop	Animal Farming Hunting	Forestry
1988					54	34.9	13	5.6
1989	2.5	2.7	1.7	3	53	34.8	13	5.6
1990	-11	-17	0.2	2	50	30.3	14	6
1991	3.6	4.6	1.5	3	49	29.8	13	5.8
1992	3.2	4.7	0.3	2	47	29.5	12	5.6
1993	10	15	3	3	49	31.7	12	5.4
1994	-2	-4	-0.3	3	47	30.2	12	5.5
1995	-11	-17	-5	3	43	26.1	11	5.8
1996	17	26	6	3	45	29.3	11	5.3
1997	13	20	1.8	2	47	31.7	10	4.9
1998	11	14	7	3	47	32.9	9.7	4.6

Appendix 8: Sample of revenue contribution of agriculture to GDP

Agricultural Revenue Contribution				Share		total share
EC	Agricultural income tax	Rural land use fee	Total agricultural revenue	Agricultural income	Rural land use fee	
1973	99.664117	50.2	149.8641	1.068836	0.538364	1.6072
1974	50.3	49.8	100.1	0.53659	0.531256	1.067846
1975	52.6	51.3	103.9	0.509369	0.49678	1.006149
1976	48.6	48.1	96.7	0.502285	0.497117	0.999402
1977	41.9	41.4	83.3	0.479696	0.473972	0.953668
1978	46.9	44	90.9	0.488679	0.458462	0.94714
1979	50	45.8	95.8	0.456674	0.418313	0.874987
1980	57	47.4	104.4	0.52065	0.432962	0.953612
1981	61.52	45.19	106.71	0.559966	0.411327	0.971293
1982	54.2	34.6	88.8	0.474078	0.30264	0.776718
1983	54.7	33.5	88.2	0.500086	0.306268	0.806355
1984	3.5	3.6	7.1	0.033224	0.034173	0.067397
1985	48.845	44	92.845	0.413985	0.372921	0.786906
1986	53.6	45.6	99.2	0.446691	0.380021	0.826712
1987	68.4	58.1	126.5	0.540955	0.459495	1.00045
1988	82.5	77.2	159.7	0.592209	0.554164	1.146372
1989	99.6	95.8	195.4	0.680318	0.654362	1.33468
1990	107.587262	97.49812	205.0854	0.745633	0.675711	1.421344
1991	112.8	108.9	221.7	0.737543	0.712043	1.449585
1992	117.7	111.6	229.3	0.730497	0.692637	1.423134
1993	119.65	116.55	236.2	0.689452	0.671589	1.361041
1994	130.16	112.64	242.8	0.738188	0.638826	1.377014
1995	72	88	160	0.424993	0.519436	0.944428
1996	115.9	109.0706817	224.9707	0.613197	0.577065	1.190262
1997	150	140	290	0.745086	0.695414	1.4405

Appendix 9: Trend of Ethiopian population census

years	population condition of Ethiopia					
	Total population	Rural population	total active population	active population Rural	livelihood	employment
					in percent rural/totalpop	rural active o total active
1971	28120982	24919418	11683109	10665821	88.61504	91.29266
1972	28781542	25482951	11957545	10907020	88.53921	91.21454
1973	29388832	25998209	12209849	11127557	88.46289	91.13591
1974	30044203	26554885	12482129	11365821	88.38605	91.05675
1975	30738825	27145058	12770715	11618422	88.3087	90.97707
1976	31490846	27784637	13083149	11892170	88.23084	90.89685
1977	32336868	28505744	13434636	12200813	88.15246	90.8161
1978	33182891	29225352	13786124	12508814	88.07355	90.73481
1979	34062105	29972651	14151401	12828667	87.99413	90.65298
1980	35003612	30773134	14542558	13171284	87.91417	90.57061
1981	35976712	31599669	14946842	13525051	87.83368	90.48769
1982	37023634	32489221	15381795	13905790	87.75265	90.40421
1983	38106720	33408575	15831772	14299285	87.67108	90.32018
1984	39231249	34362249	16298968	14707470	87.58898	90.23559
1985	40216738	35192187	16708398	15062694	87.50632	90.15044
1986	41559600	36332696	17266301	15550846	87.42311	90.06472
1987	42922210	37487980	17832410	16045321	87.33935	89.97843
1988	44235450	38597656	18378007	16520277	87.25503	89.89156
1989	45607933	39756505	18948217	17016279	87.17015	89.80411
1990	47039661	40964351	19543041	17533252	87.08471	89.71609
1991	48530633	42221016	20162478	18071120	86.99869	89.62747
1992	50120344	43560646	20822938	18644498	86.91211	89.53827
1993	51739678	44922945	21495704	19227579	86.82494	89.44847
1994	53147566	46098709	22080624	19730821	86.7372	89.35808
1995	54678811	47062000	22716793	20143121	86.0699	88.67062
1996	56372000	48422000	23420243	20725218	85.89725	88.49275
1997	58117000	49802000	24145219	21315875	85.69265	88.28197
1998	59882000	51191000	24878504	21910385	85.48646	88.06954
1999	61672000	52598000	25622175	22512598	85.28668	87.86373
2000	63495000	54022000	26379556	23122088	85.08072	87.65154
2001	65344000	55458000	27147740	23736714	84.87084	87.43532
2002	67220000	56913000	27927140	24359472	84.66677	87.22508
2003	69127000	58382000	28719420	24988222	84.45615	87.0081
2004	71066000	59867000	29524995	25623820	84.24141	86.78687

Appendix 10: Gross Domestic Product by Industrial Sector at Constant Factor Cost (1980/81) (Million Birr)

G.Y.	Agriculture and allied activities	INDUSTRY	Distributive services	Other services	Total sum of services
1980/81	5384.810277	1011.800706	1292.76067	1635.174934	2927.9356
1981/82	5189.684553	1097.52237	1349.324844	1737.478608	3086.80345
1982/83	5895.225541	1162.213313	1386.730241	1882.332299	3269.06254
1983/84	5155.780639	1231.741953	1391.470796	1896.796998	3288.26779
1984/85	4078.946077	1284.751357	1404.479503	1966.514765	3370.99427
1985/86	4732.448466	1369.111541	1452.884113	2042.867438	3495.75155
1986/87	5620.224091	1478.536659	1671.431485	2178.542034	3849.97352
1987/88	5464.737242	1422.393702	1727.754725	2332.960727	4060.71545
1988/89	5521.051485	1328.084352	1633.163374	2504.081954	4137.24533
1989/90	5814.23851	1265.192685	1705.665356	2647.628607	4353.29396
1990/91	6114.876729	1024.039223	1304.865604	2494.334079	3799.19968
1991/92	5947.561791	951.2227787	1272.06285	2363.72477	3635.78762
1992/93	6308.266111	1221.948551	1554.782684	2713.742337	4268.52502
1993/94	6077.992415	1307.15673	1650.908652	2963.287583	4614.19624
1994/95	6284.00617	1412.5	1757.3	3190.5	4947.8
1995/96	7206.2	1434.8	1914.7	3375.2	5289.9
1996/97	7453.9	1530.539413	2062.076	3593.6995	5655.7755
1997/98	6620.55398	1566.474759	2177.905172	4064.042322	6241.94749
1998/99	6873.459142	1700.850602	2253.930721	4465.787854	6719.71857
1999/2000	7024.675243	1731.253785	2423.095615	4933.303453	7356.39907
2000/01	7831.107961	1818.11549	2550.123103	5155.016321	7705.13942
2001/02	7651	1923.505628	2663.348682	5394.507838	8057.85652
2002/03	6687	2012.308546	2748.88682	5493.302614	8242.18943
2003/04	7952.1	2150.736727	2956.855723	5841.208443	8798.06417
2004/05	8480.8	2302.2	3169.2	6179.7	9348.9
2005/06	9083	2478.3	3396.7	6536.9	9933.6

Appendix 11: Sectoral share and growth comparison of GDP

	sectoral Share of GDP			growth of sectoral GDP		
years	AGRICULTURE	INDUSTR	Services	agriculture	industry	services
1980/81	57.74876	10.85094	31.4003			
1981/82	55.36248	11.70814	32.92938	-3.623632	8.472189	5.425934
1982/83	57.08831	11.25467	31.65702	13.59506	5.894271	5.90446
1983/84	53.28537	12.73014	33.98449	-12.54311	5.982434	0.587485
1984/85	46.69823	14.70861	38.59317	-20.88597	4.303613	2.515807
1985/86	49.31015	14.26557	36.42428	16.02135	6.566265	3.700905
1986/87	51.33218	13.50418	35.16364	18.75933	7.992418	10.13293
1987/88	49.91609	12.99245	37.09145	-2.76656	-3.797197	5.473854
1988/89	50.25359	12.08846	37.65794	1.030502	-6.630327	1.88464
1989/90	50.8561	11.06641	38.07748	5.310348	-4.735518	5.222041
1990/91	55.9043	9.362117	34.73358	5.170724	-19.06061	-12.72816
1991/92	56.45755	9.029534	34.51291	-2.736195	-7.110708	-4.301223
1992/93	53.46559	10.3566	36.1778	6.064743	28.46082	17.40304
1993/94	50.6527	10.89357	38.45373	-3.650348	6.97314	8.098142
1994/95	49.69831	11.17104	39.13066	3.389503	8.058962	7.229943
1995/96	51.72817	10.29941	37.97242	14.67525	1.578761	6.914184
1996/97	50.91387	10.45435	38.63178	3.437318	6.672666	6.916492
1997/98	45.88374	10.85645	43.25981	-11.18	2.347888	10.36413
1998/99	44.94211	11.12101	43.93688	3.82	8.578232	7.654199
1999/00	43.59814	10.7449	45.65696	2.2	1.787528	9.474809
2000/01	45.12472	10.47642	44.39886	11.48	5.017272	4.740639
2001/02	43.39182	10.90895	45.69927	-2.299904	5.796669	4.577686
2002/03	39.4712	11.87801	48.65098	-12.59966	4.616723	2.287617
2003/04	42.0725	11.37899	46.54828	18.9188	6.879073	6.744261
2004/05	42.12618	11.43558	46.43824	6.648558	7.04239	6.260875
2005/06	42.25673	11.52977	46.21397	7.100745	7.649205	6.254212

Declaration

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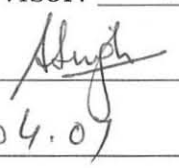
Signature: 

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