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Estimates of Growth of Agricultural Sector in East Africa Pastoral Regions: Evidence from Ethiopia (Afar Regional State)

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Abstract
Employing commonly used national account estimation methodology we find livestock sub sector contributed the greatest share to the agricultural regional Real Gross Domestic Product which is 88.40 percent in 2010/11 and 87.80 percent 2011/12which is almost similar with rest of east Africa countries like in Sudan and Uganda contributing 86%and 80% respectively. Livestock sub sector is followed by crop sub sector with 6.89 and 7.44 percent in 2010/11 and 2011/12, respectively. The remaining balance was occupied by the forest sub sector. During the year 2011/12, the real growth rate of agriculture and allied activities of the region was 5.16 percent.

1. INTRODUCTION

Economists use many types of variables to measure the performance of an economy. Three macroeconomic variables are especially important namely real gross domestic product, inflation rate and unemployment rate. Real gross domestic product measures the total income of everyone in the economy (adjusted for the level of prices).The inflation rate measures how fast prices are raising. Whereas, unemployment rate measures the fraction of the labor force that is out of work. Macroeconomists study how these variables are determined; why they change over time and how they interact with one another (Mankiw, 2003).

Today gross domestic product in particular and economic growth in general is regularly referred to by leading economists, politicians, top level decision makers and the media as it represents overall progress. It is one of the primary indicators used to gauge the health of a country's Economy. Now days in any country, gross domestic product is "one of the most comprehensive and closely watched economic statistics". It is the most sensitive word in the world of economists and politicians. Economic advisors usually use gross domestic product as one of the baselines to direct government leaders and politicians while designing development policies and programs.

Until recently, the African agricultural landscape was characterized by sluggish growth, low factor productivity, declining terms of trade, and often also by practices that aggravated environmental problems. But this time many African countries have implemented macroeconomic, sectoral and institutional reforms aimed at ensuring high and sustainable economic growth, food security and poverty reduction. Some recent agricultural growth accelerations adequately address poverty, attain food security, and lead to sustained gross domestic product growth on the continent

Pastoralism in East Africa is a way of life based primarily on raising livestock, particularly small ruminants, cattle and camels. It is defined by a high reliance on livestock as a source of economic and social wellbeing, and various types of strategic mobility to access water and grazing resources in areas of high rainfall variability. Pastoral livestock production systems are mostly found in Africa's vast arid and semi-arid areas. In general, pastoralism contributes up to 44 percent of the gross domestic product of African countries.(AU,2010)
In this paper we estimate growth of the agriculture sector only, which is the dominant and leading sector in the region, as most people in the region are pastoralists where livestock is the main economic activity and means of living.

Thus, estimating growth of agriculture sector helps to monitor and evaluate the impacts of policies and strategies designed and applied so far; and devise future policies and strategies on agriculture sector. That is, it tries to address questions like:

- which sub sector contributes more to agricultural gross domestic product?
- How fast is the agriculture growing?

Estimating agriculture growth at regional level guides for resource mobilization from different sectors of the economy and for shaping the fiscal policy on regional basis.

2. DATA SOURCE AND METHODOLOGY

2.1. Crop sub-sector
Coverage
Crops produced by peasant farmers as well as commercial farmers in the given production year is covered in the

estimation process. That is, Teff,[1] barely, wheat, maize, sorghum and rice, from cereals; vetch, chick peas, and Soya beans from pulses; groundnuts, sunflower and sesame from oilseeds; tomatoes and red pepper from vegetables, onion and sweet potato from root crops; banana, water millet, mangoes and papaya from fruit crops; cotton from cash crops are covered in the sub sector estimation. Furthermore, traditional/local seeds and seedlings, improved seed and chemicals have been considered as intermediate inputs. Activities related to plant materials chiefly used for medicinal purposes, and forage crops/grasses and crop by-products (cultivated) are not covered in this estimation as it is believed to have little or no impact.

Method of estimation
From candidate approaches we have, production approach(deducting intermediate consumption from the gross value of outputs) is employed to estimate the value added of crop sub- sector: To arrive at net production of crops, 10 percent of each type of crops, which is assumed as wastage, is deducted from the actually reported quantity of production.

To determine the quantity of traditional and improved seeds, seedling rate per hectare of each crop is multiplied with area cultivated using traditional and improved seed respectively and to arrive at values of traditional and improved inputs, quantities are multiplied with producer and purchaser price respectively. Furthermore, value of chemicals input, actually available for the year 2011/12 only, are also included as an intermediate input. Eventually, the three values are added to have total value of intermediate costs in dollar.

Furthermore, in the case of commercial farm intermediate inputs such as water fee (140.40 Birr
per hectare) and cost of fuel and lubricant, chemical fertilizer, pesticides and herbicides(27% of gross value output and cost of improved seeds is also included.

The value of production (output) at current price is obtained by multiplying the respective annual quantities of crop out puts (net of wastage) by the corresponding current average prices (producers' prices). Similarly, value of intermediate consumption (such as improved seeds, other chemical inputs (only for 2011/12) and water fee per hectare (in commercial farming) actually utilized in the production process is valued by using quantities and purchaser prices of the respective units. The total cost, improved seeds, and chemicals distributed the previous year are served as intermediate consumption of this year. In the same manner, the quantities of local seeds consumed as input in the current year are valued by the respective producers' prices of the previous year. Then, gross value added at current price is obtained by deducting value of intermediate consumption from gross value of crop production (output).

Value added at constant price is calculated by double deflation method, which involves valuation of both output and input at the base year (2010/11) prices. This involves valuing quantities of outputs of all crops at base year prices and summing up to bring gross value of output at constant price. In the same manner, seeds, and other chemical inputs are valued at base year prices as well. Finally, value of intermediate consumption at constant price is deducted from gross value of output at constant prices to arrive at value added at constant prices.

N.B while using seedling rate ,as most of permanent crops give production after 3-5 years and for the next several years, seed inputs of the fruit trees, and cash crops was found difficult to estimate the seed costs. Due to this, their intermediate costs are assumed as zero.

Limitations
1. Crops produced in the region are almost totally missed from central statistics authority in any of its survey. This forced us to be only confined with bureau of pastoralists and agricultural development data on crop sub sector.

2. The seeding rates for local seeds and the assumed loss/wastage during harvesting needs updating or revision.

2.2. Livestock sub sector
Coverage
This sub-sector includes raising of domesticated animals like livestock (Cattle, Sheep, Goats, Mules, Asses, Horses, Camels…), and poultry as well as production of livestock products like milk, milk products, eggs, raw hides and skins, wool, honey, bee wax, animal dung for fuel, etc.

The gross output of livestock and livestock product during a period of account as defined in Sytem of National accounts is the sum of the value of the livestock disposed of for slaughter or exported which is off-take, the value

of the output of livestock products like milk, eggs and wool, and the value of physical change (plus or minus) in herds of livestock less imports if any.

In Afar region the livestock sub-sector includes, the raring of livestock (cattle, sheep, goats, camels, horses, donkeys and mules), poultry, and production of animal products such as, Milk, Milk products (butter & cheese) and eggs, and have been considered to estimate the gross value added of the sub-sector. In addition, the value of stock change of livestock is also included in the estimation process.

Method of Estimation

The methodology employed in estimating the value added of the sub-sector is generally production approach. In estimating the value added of this sub-sector, both primary and secondary sources of data are employed. The value added of animal products is obtained by applying different technical coefficients such as: birth rate, death rate, Slaughter rate/off take rate; over all milking cows, goats and camel; average annual milk yield per cow, camel & goat; Average lactation period per cow, camel & goat; average annual egg production per hen; and etc. The methods of estimation followed in the various components of the sub sector are described in detail as follows. The total size of milking cows, camels and goats are also derived from the total population using the regional coefficients obtained from central statistics authority reports of 2010/11 & 2011/12 on livestock of Zone one and two.

To arrive at gross value added of milk & milk products, the following technical coefficients and assumptions are taken in to consideration:

- Number of cows under milk (22 % of the total cattle population) is derived from the central statistics authority report of 2010/11 and 2011/12 on livestock of Afar region of Zone one & three.
- Regional Average annual milk yield of a cow is 300 litter per cow
- Average annual milk yield of goat is 35 litters (National coefficient).
- Milk used for butter = 50% of the total milk production (National coefficient)
- Amount of butter = Milk used for butter * 5.1% of milk used for butter* 1.031kg

(National Coefficient)

- Number of goats under milk(=31% of total goat population) is derived from the central statistics authority annual report of 2010/11 & 2011/12 on livestock of Afar region of Zone one & three.
- Price of goat milk = 50% of price of cow milk(National Coefficient)
- Number of camel under milk(12.75% of the total population) is derived from the central statistics authority annual report of 2010/11 & 2011/12 on livestock of Afar region of Zone one & three.
- Milk Production(number under milk*784lit/camel)(National Coefficient)
- Egg production(20% of population*78 eggs/pullet)
- Chicken slaughtered(98% of stock)
- The average producer prices of egg product is taken from central statistics authority (2010/11& 2011/12)

Stock change is one important element of the gross value added of the livestock sub-sector. The stock change of the current year is calculated by deducting the number of each types of livestock population of previous year from that of current year and its value is obtained by multiplying the stock change of each type of animals with their respective weighted average producers' prices. The major intermediate inputs taken in to account in the livestock sub-sector are poultry feed, animal vaccines and treatment cost, and artificial insemination. However, hay and straw as well as green fodder, which are important livestock feed, are not included due to absence of reliable source of data.

In the course of estimating the gross value of intermediate inputs of livestock sub-sector, there was lack of regionally developed coefficients for inputs use like salt for cattle. Therefore, we took national coefficients to estimate their annual consumption.

Generally, the gross value added of the livestock sub-sector at current price is obtained by deducting the value of intermediate inputs (valued at current purchasers' price) from gross value of output of the livestock sub-sector (valued at current producers' price) As this sort of estimation (gross value added at current price) is believed not to indicate the real gross domestic product growth, the value added at current price is converted in to value added at constant price through double deflation method where both output and intermediate consumptions are valued at base year producers and purchasers price respectively.

Limitations

1. There is no region specific data about some technical coefficients
2. Due to lack of data milk of sheep is not included in the estimation.
3. Hay , straw and green fodder, which are important livestock feed, are not included due to absence of reliable source of data.
4. The survey livestock population of Afar region is old and need to be up dated.

2.3. Forestry Sub Sector

Coverage

Forestry sub-sector covers production and gathering of fire wood, charcoal burning, by exploitation of natural forests, cutting and felling of trees for production of logs and timber (mainly round wood and poles) for use as intermediate input in manufacturing industry and construction, gathering of other forest products such as gum, resin, incense and myrrh. The gathering and foraging of wild berries, fruits, seeds, roots and thatching grass and straw, bamboo, and collection of medicinal herbs, are all considered to be forestry activities. On the other hand activities related to this like land clearance and afforestation, forest tree nurseries, replanting and conservation of forests are included in the construction sector.

In the case of Afar region the forestry sub sector includes, the gathering of firewood, production of charcoal and wood used for construction purposes.

Method of Estimation

To estimate the gross value added of the sub sector, both production and expenditure approaches have been used. The expenditure approach was used to value forest outputs namely fuel wood, charcoals and domestic wood consumption in construction. On the other hand, production approach has been used for the estimation of Gross Value of Output form charcoal product in combination with that of expenditure approach.

In order to calculate gross value added of fuel wood the number of household units, reported by central statistics authority of 2007, used fuel wood as a sources of energy was projected based on the average growth rate obtained between 1994 and 2007. Furthermore, to arrive at the monetary value of this product the number of household units used fuel wood as a source of energy was multiplied by consumption expenditure of household both in the rural and urban areas independently. Finally, following the national experience an assumed 20 % of the gross value of fuel wood is deducted to estimate gross value added of fuel wood at constant price.

To estimate the gross value added of fuel wood at current price we have inflated the gross value of output by the volume index and finally deducted an assumed 20 percent as an intermediate consumption. To estimate the gross value added of wood used for construction purpose both in urban and rural houses, the number of houses constructed using wood either their wall or roofing or both as reported by central statistics authority in 2007 was projected based on the average growth rate obtained between 1994 and 2007. To arrive at the total quantity of wood used for construction the number of houses constructed from wood was multiplied by number of woods needed to construct a house having two rooms.

The total number of woods required to construct a house having two rooms was obtained from the bureau of construction and town development. To arrive at the gross value of output at current price of each year of wood used for construction purpose total quantity of wood was multiplied by the producer prices of the respective year. To obtain the Gross Value Added at current price, following the national experience an assumed 20 percent of the gross value of output as an intermediate consumption was deducted.

To estimate Gross Value Added of wood used for construction purpose at constant price the total quantity of wood was valued by the base year price for each year. To obtain the Gross Value Added at constant price, an assumed 20 percent of the gross value of output as an intermediate consumption was deducted.

To estimate the gross value added from charcoal the study employed both production(direct) and expenditure(indirect) approach. This is mainly due to the fact that Afar region is the net exporter of charcoal product. Hence, considering only the expenditure aspect might under estimate the
Gross Value Added of charcoal produced in the region.

The expenditure (indirect) approach helped us to estimate gross value added of charcoal consumed in Afar Region both in rural and urban areas. The total number of housing units used charcoal as a source of energy of the year 2007 was projected based on the average annual growth rate of the 1994 &2007. In this regard, to

acquire the monetary value of charcoal the study relayed on the household income consumption expenditure survey to obtain the consumption expenditure of household on charcoal. Finally, the number of housing units was multiplied by household income consumption expenditure to obtain Gross Value of Output at Constant prices.

To estimate the gross value added of charcoal at current price we have inflated the gross value of output by the volume index and finally deducted an assumed 20(national Coefficient) percent as an intermediate consumption.

In the production approach of estimating gross value added of charcoal it has been tried to capture the total quantity of charcoal exported to the rest regions of the country. It was assumed
that about 803%(440) and 80%(480) of the heavy trucks passing through Afar region from Djibouti to the rest regions of the country took a 100kg charcoal per trip4, 2010/11 and 2011/12 respectively. Furthermore, the quantity of charcoal exported to the rest regions of the country by traders was also included in the estimation. Hence, to arrive at the gross value of charcoal at current price total quantity of charcoal sold was multiplied by the producers price at each year. Finally, it was assumed that about 20 % of the gross value of output was intermediate consumption.

To estimate the gross value out of charcoal at constant price the quantity of charcoal sold at each year was multiplied by the base year price. Finally, an assumed 20 percent of the gross value of output at constant price is deducted from the gross value of output at constant price to arrive at gross value added at constant price.

Limitations

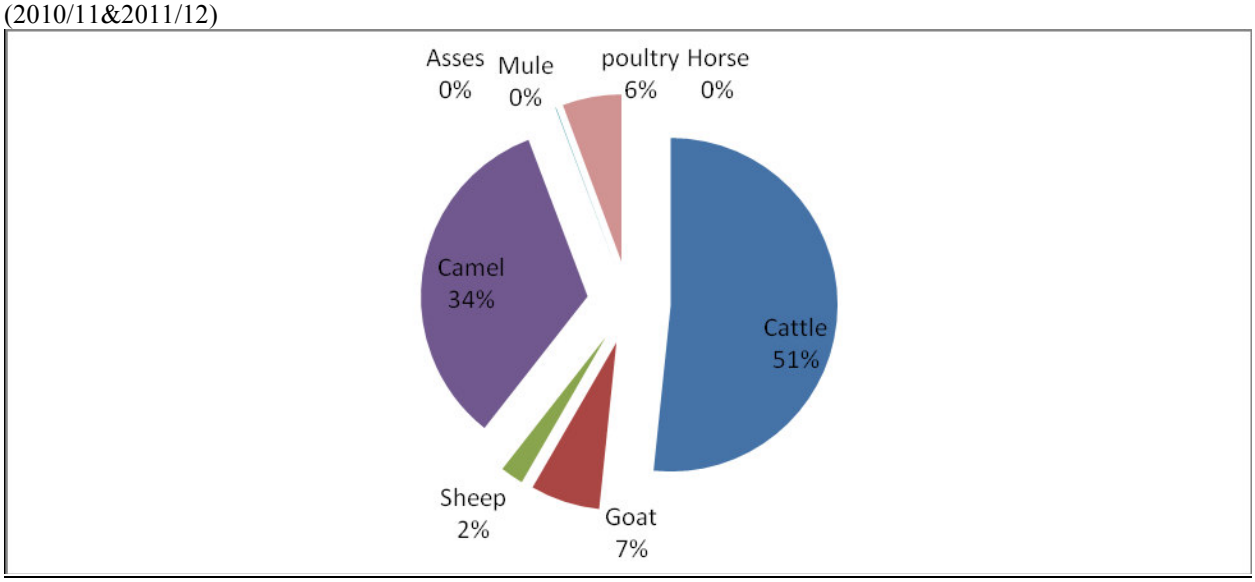
- Even thought there is huge production of charcoal in the region, it is carried out in a fragmented and disorganized manner. Hence, it is difficult to obtain reliable data on charcoal production.
- Even though Hotels, Restaurants and government organs such as Defence force consume large amount of fuel wood and charcoal, it is found to be difficult to incorporate in gross value added estimation due to lack of reliable and timely data.
- There is no regionally developed intermediate cost to gross value output ratio. Hence, we were forced to rely on the national coefficient so as to arrive at gross value added of forest product.

3. RESULTS AND DISCUSSIONS

3.1. LIVESTOCK SUB SECTOR

The GVA of livestock sub sector at constant price was $ 253.33 million and $ 264.33 million in 2010/11 and 2011/12, respectively, indicating annual growth rate of 4.44 percent. In terms of contribution to gross value added of livestock sub sector , the intra sub sector analysis of the livestock sub sector indicated that cattle population take the largest share (51 percent of livestock sub sector) followed by camel and goat, 34 and 7 percent, respectively.

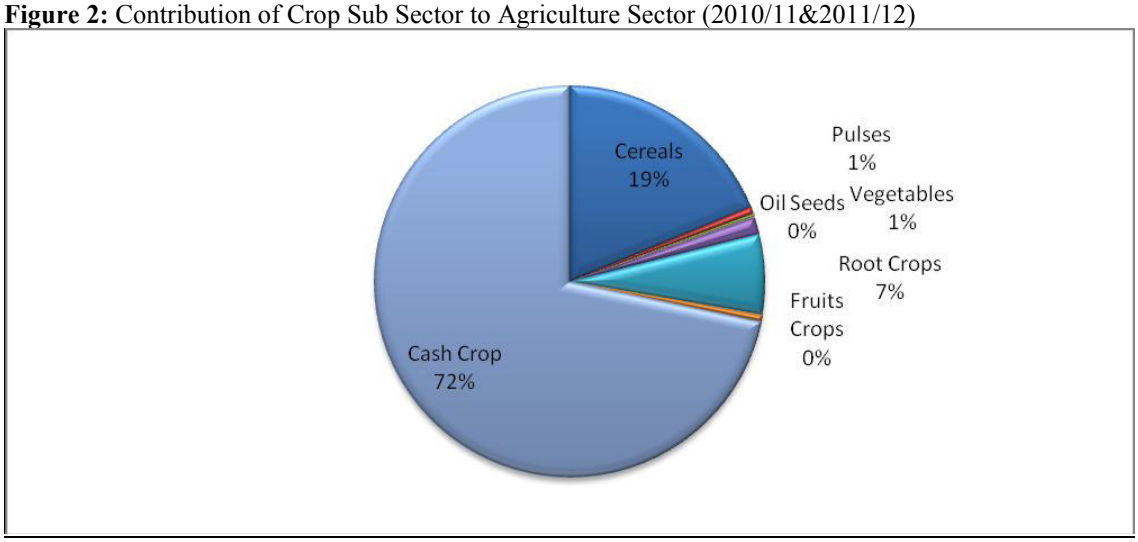
Figure 1: Average Contribution of Each Livestock Type to the gross value added of Livestock Sub Sector (2010/11&2011/12)



3.2. CROP SUB SECTOR

The gross value added of crop sub sector at constant prices was registered at $ 19.72 million and $ 22.39 million in 2010/11 and 2011/12, respectively indicating 13.55 percent growth rate per annum. In terms of contribution to the gross value added of crop sub sector, on average in 2010/11 and 2011/12, cash crop (i.e., only cotton) contributed about 72 percent followed by cereals and root crops each contributed 19 percent and 7 percent, respectively.

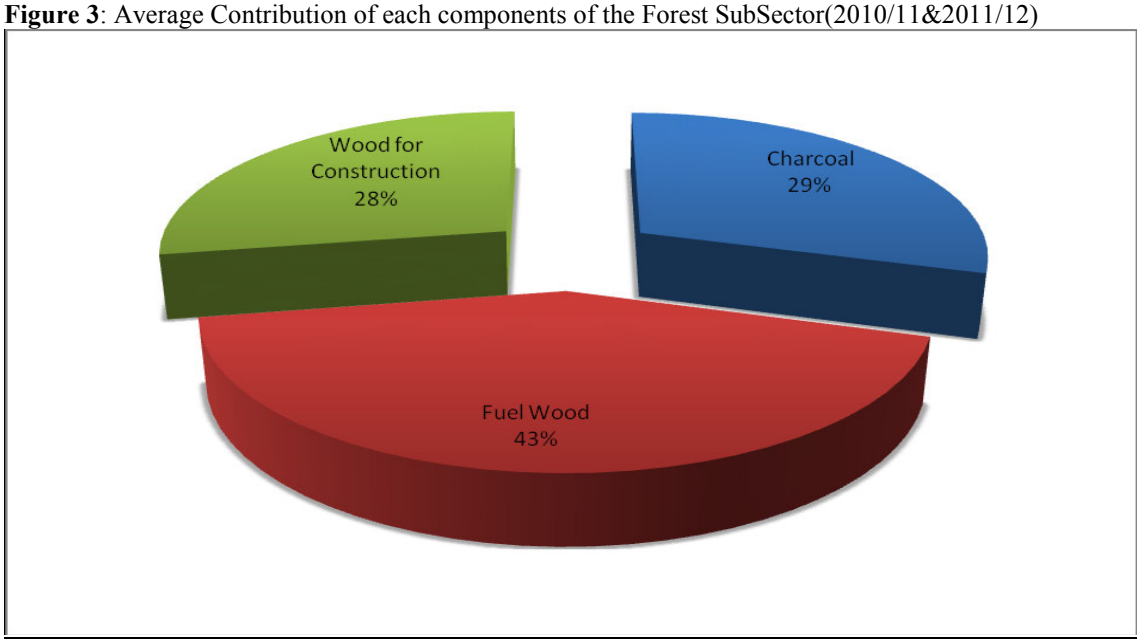
Figure 2: Contribution of Crop Sub Sector to Agriculture Sector (2010/11&2011/12)



3.3. FOREST SUB SECTOR

The gross value added of forest sub sector at constant price was $ 13.44 million and $ 14.33 million in 2010/11 and 2011/12 respectively, indicating annual growth rate of 6.46 percent. In the forest sub sector, fuel wood took the lion share in contributing to the gross value added of the forest sub sector amounting to 43 percent of gross value added followed by charcoal and wood for construction 29 and 28 percent, respectively.

Figure 3: Average Contribution of each components of the Forest SubSector(2010/11&2011/12)



Conclusions:

During the year 2011/12, the real growth rate of agriculture and allied activities of the region was 5.16 percent. Whereas, during the same fiscal year at national level the sector grew at a rate of 4.90 percent per annum. In Afar region agriculture sector comprises; livestock, crop and forestry sub sectors. The contribution of each sub sector is shown as below.

Figure 4: Average Contribution of Sub Sectors to Agricultural Sector regional gross product in % (2010/11 &2011/12)

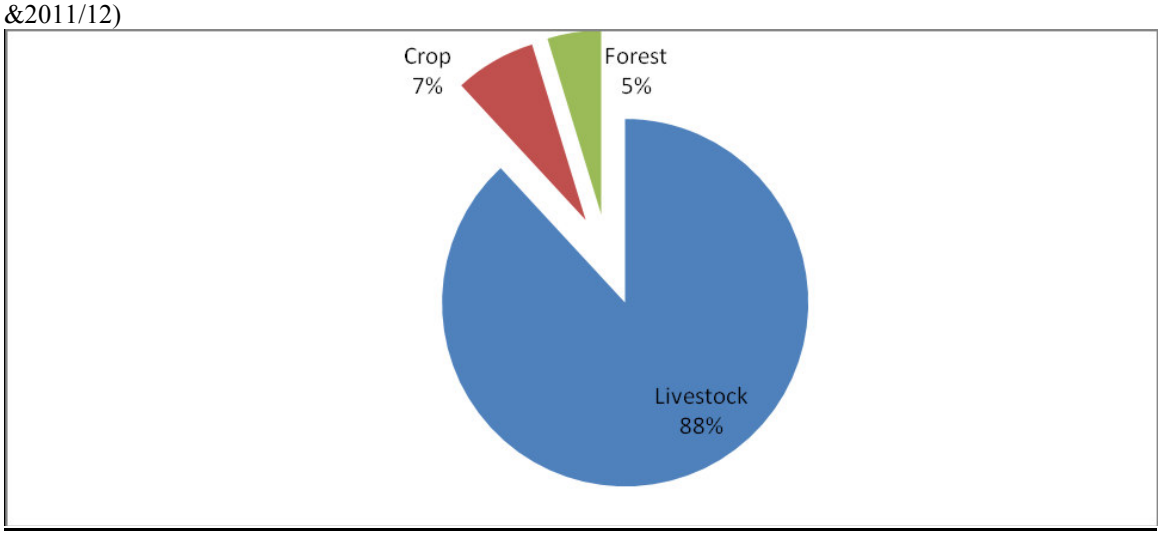


Table 1: Agriculture sub sectors contributions to total agriculture regional gross product

Economic activity	Contribution of subsectors to agriculture regional gross domestic product in %			Growth rate
	2010/11	2011/12	average	
Livestock	88.40	87.80	88.10	4.44
Crop	6.89	7.44	7.16	13.55
Forest	4.71	4.76	4.74	6.46
Total	100	100	100	5.16

In the year 2011/12, agricultural sector of Afar region had registered an annual growth rate of 5.16 percent per annum. When we look at the intra sub sector growth rates in same year, the crop sub sector had grown at 13.55 percent per annum. Whereas livestock and crop sub sectors had recorded 4.44 and 6.46 percents, respectively.

As it is clearly indicated in table 1, livestock sub sector contributed the greatest share to the agricultural regional Real Gross Domestic Product, which is 88.40 and 87.80 percent in 2010/11 and 2011/12, respectively. The crop sub sector followed livestock production with 6.89 and 7.44 percent in 2010/11 and 2011/12, respectively. The remaining balance was occupied by the forest sub sector. this result is consistent with the contribution of livestock subsector to agricultural gross domestic product in other east African countries like In Sudan, the pastoral-dominated livestock sector contributes 80 percent of the agricultural gross domestic product and contribution of livestock to agricultural gross domestic product in Uganda is 86%(IGAD,2012)

4. Sources of data

4.1. Crop sub sector

In the course of estimating the gross value added of crop sub sector, the main sources of data are:- central statistics Authority: Agricultural sample survey (2010/11-2011/12), Bureau of Pastoralist and Agricultural development and Primary data(for crops produced by commercial farmers) are the main sources of data. For retail & producers' price central statistics Authority annual report (2010, 2011 & 2012) are also used.

As almost all crops produced in the region are not incorporated in any of CSA surveys as a result, data were taken from Bureau of Pastoralist and Agricultural Development. However, following the national experience only 40 percent of the area cultivated and crop production reported by the Bureau was considered in estimating gross value added of crop sub sector. This is mainly due to the fact that data collected on area cultivated and crop produced by the Bureau, most of the time if not always, are over estimated. The Traditional/local seeds and seedlings, improved seed and chemicals have been considered as intermediate inputs.

Furthermore, seeding rates of various crop types for household farming is taken from neighboring regions and ministry of finance and economic development.

4.2. Livestock subsector

In the estimation of the gross value added of the sub-sector, the major sources of data are:

- central statistics Authority: Pastoral area livestock enumeration survey (2010/11)
- central statistics Authority reports on livestock of on Zone one and three of 2010/11 & 2011/12
- Regional Bureau of Pastoralist & Agricultural Development: report on vaccination and treatment performance (2010/11& 2011/12)

4.3. Forestry subsector

In the course of estimating the gross value added of the forestry sector, the main sources of data are:

- central statistics Authority: Population and housing census (1996GC&2007GC)
- Bureau of construction and urban development (2010/11 and 2011/12)
- Ethiopian Customs and Revenue Authority
- Wereda Office of Finance and Economic Development

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