

Addis Ababa University  
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**Commercial Off-take and Livestock Resources in Ethiopia**

**Thesis submitted as partial fulfillment of the MA Thesis Course  
(DEST 721)**

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June, 2019

Addis Ababa, Ethiopia

**DECLARATION**

I hereby declare that this thesis is my own work and has never been submitted to any university for the award of a MA degree.

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## **Abstract**

*The objective of the study is to assess the effect of commercial off-take on the livestock resources in Ethiopia. To analyze the effects, cause-effect design with a quantitative approach was applied where purely quantitative data (covered 6 years and all regions) and quantitative methods of analysis were used. Accordingly, the key results of the study at 99% confidence level were (1) increment in male cattle slaughters, female cattle slaughters, total cattle population, female cattle kept for beef and other purposes and informal trade decreased cattle population whereas increment in female and total cattle population increased sales of cattle by significant volumes; (2) increment in informal trade and male sheep 2 years aged reduced the sheep population while increment in male of sheep kept for breeding, wool and meat increased sales of sheep in volumes. (3) Increment in sales of goats increased the goats' population and vice versa; while sales of female goats reduced the goats' resource. It is concluded that, with the existing livestock production systems, the commercial off-take has significant effects on the livestock resources and vice versa in terms of volume of sales, trade channel, population size, sex, and age. The levels of effects between regions were also different for the three livestock species. The study recommends that Ethiopia those livestock resources can contribute positively if and only if the process of commercialization could be guided by researches, capacity building of the different actors and intensive investments in developments of ranches and commercial farming.*

**Keywords:** Livestock resources, Traditional production and marketing systems, Commercial off-take, Formal and Informal Trades.

### **Acknowledgements**

I would like to extend my thanks to my advisor Dr. Alemseged Gerezgiher (PhD) for giving me professional guidance starting from the proposal writing to the completion of the thesis document.

I am also thankful to my course instructors for making me capable in the field of rural livelihoods and development (RLD/CDS).

I would like also to thank senior livestock marketing experts in Ministry of Agriculture and staff of Central Statistical Agency-Ethiopia for their willingness and collaboration in providing me all the relevant secondary data/information on Livestock production and Marketing.

Finally, my special thank go to my wife Kidist Araya and her Father Feleke Araya and her mother Tiruwork Ashine and also friends of mine for being with me all the time providing me a moral support and encouragement.

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# CHAPTER ONE

## INTRODUCTION

### 1.1. Background of the Study

Ethiopia is ecologically diverse, featuring 18 distinct agro climatic zones, of which there exist two major recognized livestock production systems: highland with predominantly mixed farming and lowland pastoral and agro-pastoral systems (GebreMariam *et al.*, 2013). Cattle, Sheep, Goat, Camel, Poultry, Mule, Horse, and Donkey, Silk worm, Pigs, Fisheries and Bees are the major the livestock resources in the two recognized livestock production systems. Out of these resources, the study considered those livestock which have a national representation and their social and economic importance's are significant for the rural communities and the economy as a whole. These animals are Cattle, Sheep and Goat.

According to CSA, (2017/18) data, Ethiopia has a huge livestock resource (60.39 million cattle, 31.30 million sheep and 32.74 million goats) with 98.24% local breeds of cattle and 100% local breeds of shoats. In Ethiopia, there are about 25 breeds or types of cattle, 15 of goats and 13 of sheep (Shapiro *et al*, 2015); with features of high mortality rate 35% for camel calves, 21-26% for lambs, and 23-28% for goat kids) and low body weight at maturity (Shapiro *et al*, 2017). The cattle resource is at 5<sup>th</sup> rank out of 1.468 billion heads the world cattle populaition (Rob Cook, 2015) and at 3<sup>rd</sup> rank in sheep population out of 334.9 million Africa sheep population (Skapetas & Kalaitzidou, 2013) and the population of goats is not in the top 10 out of 352.1 million Africa goats' population (Skapetas & Bampidis, 2013).

The livestock sub-sector contributes near 20 percent of total GDP and foreign exchange earnings of the country, and some 35 to 40 percent of agricultural GDP (CIA, 2018). This contribution is in range accounted for Africa, which is 20 to 80% (average 35%) (African Union Commission, 2015). The 20% contribution to total GDP indicated that Ethiopia has not experienced significant productivity gains in the livestock sub-sector. As a result of this, the contribution of the livestock sub-sector in the economy is below expected. This can be explained by the low commercial off-take rates due to multi-faceted constraints and low per-capita consumption rates. The share of live animals and meat products were only 7% and 3% respectively out of the total export volume

(CIA, 2018). The multi-faced constraints limited both the supply (adequate and stable resource base) and the demand (commercial off-take) MoLF, (2017).

In this study, adequate livestock resource base is conceptually defined as the continuous supply of the three livestock species under consideration by herders to the market to satisfy the demand for local consumption and export to global market; whereas stable resource base is continual supply of the livestock resource to the market by herders without affecting certain age group (3-10 years for cattle and 2 years and older for shoats), sex structure and their functions (draught, breeding and milking). The stability of the resource is very much attached with the livelihoods of the rural communities on the one hand and the adequacy of the resource to the demand in the market on the other hand.

The study also considered net commercial off-take rate, sales, slaughters, formal live and meat exports and informal live animal trades as commercial off-take. ILCA, (1990) described livestock marketing which involves the sale, purchase or exchange of products such as live animals, milk, wool and hides for cash or goods in kind. At the herd or flock level, the total voluntary disposal of animals by sale, slaughter, exchange and/or giving is known as gross off-take. Sutter (1987) computes off-take rate as the total number of animals sold, slaughtered and disposed-off or non-market transaction over given period divided by total herd size. Of which, the net commercial off-take is net sales (sales minus purchase) as a percentage of average stock during the year (the average stock is a half of the sum of opening stock and ending stock over one year period) (Asfaw & Mohammad, 2008). The formal and informal trade of livestock is just to mean that the trade processes are legal (taxation) and illegal. The informal trade is usually the practice at the cross-border areas of the country.

In the existing traditional livestock production and marketing system which is characterized by low fertility rate and low level of participation of the herders in the market to sell the livestock resource, the relationship between the livestock resource and commercial off-take as defined in terms of adequacy and stability of resource need further analyses at regional and at national levels. Unless the relationship is understood well, the more the commercial off-take continues the more Ethiopia can lose its livestock resource potential which eventually affects the livelihoods of the rural communities through corresponding purposes such as draught, breeding

and milk given the existing traditional production system.

## **1.2. Statement of the Problem**

There are two contradicting issues in the livestock legend of Ethiopia, i.e, the unexploited huge livestock resources and challenges to improve the low level of participation of herders (low commercial off-take rates) in the market.

According to CSA, (2017/18) data, Ethiopia has a huge livestock resource (60.39 million cattle, 31.30 million sheep and 32.74 million goats); which is totally 124.43 million. The government of Ethiopia highlighted that despite the huge livestock resources, the country is not yet benefiting from this. The huge resource is to mean that the supply is adequate for market to satisfy the demand for local consumption and export. Considering the availability of huge resource, the GTP II plan of Ethiopia targeted 2,013 (000 tons) of meat production with objective that enhancing the contribution of livestock in food security by sustainably increasing the sector's production and productivity (National Planning Commission, 2016).

On the other hand, the Livestock Master Plan (LMP) of Ethiopia indicated there would be deficit of 53% for all meat (1.332 million tons) in 2028 unless livestock productivity is escalated through intensive investments (cattle, sheep and goats production interventions) due to exploding demand (as a result of rapid population growth and rising per capita income) (Shapiro *et al.* 2015). Study in Asfaw & Mohammad (2008) indicated low commercial off-take rates of cattle (7%), sheep (7%) and goats (8%) and argued possibility of increasing the participation level of herders to the market through improving productivity and reducing mortality rates. This indicates that without any improvement increasing commercial off-take (for domestic meat consumption and exports for earnings) of livestock can affect stability of livestock resource in terms of herd size, structure and purposes.

The CSA (2017/18) data supported the above argument where the holdings per household are small and even declining from time to time. The average holdings per household which were 3.6 for cattle, 1.99 for sheep and 1.66 for goat in 2007/08 declined to 3.36, 1.65 and 1.82 respectively in the year 2017/18. This indicates that even though there is presumably large

livestock population in Ethiopia, the size of livestock holdings at the household level is very small and does not support stable and adequate commercial off-take.

The national huge livestock resource is a misleading figure. From the CSA data one can understand that the livestock population is increasing while the holding per household is declining. The population size and owning per household depicts the livestock resources are scattered amongst herders. The scattered resource explains the supply side is facing some adequacy problems and any further increment in commercial off-take could affect the stability of resource which in turn affects the livelihoods of the rural herders.

The explained gaps indicated the existence of controversy in the livestock resources and marketing in Ethiopia. The relationship between the livestock resource and commercial off-take is not well articulated. These relationships could have either positive or negative effects on each other. This must be assessed.

Hence, this study aimed at addressing the effect of commercial off-take on livestock resource so that policy makers and other development partners would be able to consider it as a solution to maintain the livestock resource.

### **1.3. Research Questions**

The research questions are:

1. Does commercial off-take have effect on livestock resource across regions and national?
2. Does livestock resource determine the level of commercial off-take across regions and national?
3. Is the relationship between commercial off-take and livestock resource differs by regions?

### **1.4. Objectives of the Study**

The general objective of the study is to assess the effect of commercial off-take on the livestock resources in Ethiopia. The specific objectives of the research are to:

1. Analyze the effect of commercial off-take on livestock resources at national and regional levels by species (cattle, goats and sheep).
2. Analyze the effect of livestock resources on commercial off-take at national and regional levels by species (cattle, goats and sheep).
3. Compare effects of commercial off-take on livestock resources between regions by species (cattle, goats and sheep).

### 1.5. Hypothesis of the Study

The corresponding hypothesis for each specific objective was summarized below in table 1.1.

Table 1.1.Hypothesis and Corresponding Decisions

Specific Objectives	Hypothesis	Decisions
1. Analyze the effect of commercial off-take on livestock resources at national and regional levels by species (cattle, goats and sheep).	H <sub>0</sub> : Commercial off-take has no effect on the livestock resource. H <sub>1</sub> : Otherwise	Reject the H <sub>0</sub> if the effects are significant
2. Analyze the effect of livestock resources on commercial off-take at national and regional levels by species (cattle, goats and sheep).	H <sub>0</sub> : Livestock resource has no effect on the commercial off-take. H <sub>1</sub> : Otherwise	Reject the H <sub>0</sub> if the effects are significant
3. Compare effects of commercial off-take on livestock resources between regions by species (cattle, goats and sheep).	H <sub>0</sub> : The intercepts are not different across regions. H <sub>1</sub> : Otherwise	Reject the H <sub>0</sub> if the intercepts are different and significant

### 1.6. Scope of the Study

The study considered only the livestock which could represent the national base. These are cattle, goat and sheep. The resource base and commercial off-take of each region and national were studied. The study was limited only to Ethiopia case based on 6 years panel data from Central Statistical Agency (CSA) 2012/13 to 2017/18, and secondary data on livestock (live animals and

meat export) data from Ministry of Agriculture and other recognized sources on the different variables.

### **1.7. Significance of the Study**

The study can help as inputs in the following key areas:

- (a) Informs researchers to explore new mechanisms that help to accelerate the commercialization of livestock production so as tackle the challenges in the livestock legend of Ethiopia.
- (b) The results (analyzed positive and negative effects) of the study can be used as inputs for the government of Ethiopia to review its national policies and strategic plans aimed at attaining food security and development of the national economy.
- (c) Informs actors on how to attain nutrition security which is beyond food security; and
- (d) Informs the private sectors and development actors what, where and when to invest in the sub-sector to enter the global market as the global demand for livestock products is increasing from time to time.

### **1.8. Organization of the Thesis**

The thesis document is organized in five chapters. Chapter one explains the background of the study, the statement of the problem and the objectives to address the problems in specified time period and geographic scope; and its significance to actors in the sub-sector. Chapter two consists of literature review of previous studies. Chapter three describes the methods and materials used in the study. In chapter four, both results of descriptive and econometric analyses are presented, interpreted and discussed; and finally chapter five put conclusions and recommendations of the study. The references and the annexes were also put next to chapter five.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1. Theoretical Review**

It is important to understand how the livestock resources of the rural households are managed in the market as market oriented or actively taking part in market (market participation) (Gebremedhin & Jaleta, 2012).

Commercialization in the subsistence economy basically relies on the primary objective of the rural household (food self-sufficiency), not surplus production to earn additional income from sales of products in the market. The rural communities, in most cases, participate in the market to sell their livestock only to cover some of their basic household needs (household model), not for profit making (Ouma *et al.*, 2003). As economies grow, households shift away from traditional self-sufficiency goals and towards income and profit-oriented decision making, so farm output is accordingly more responsive to market trends (Pingali & Rosegrant, 1995).

The magnitude and direction of the commercial off-take (demand) on livestock resource (supply interaction in the subsistence economy of Ethiopia depends on the decisions of the rural communities in the different regions of Ethiopia. The transformation from household consumption (subsistence) to production for the market (commercialization of livestock production) is a difficult process against the traditions of the rural population (Henriksen & Rota, 2014).

This situation tells us commercialization of livestock in subsistence production system is not guided by the market demand and supply interactions. If herders are not guided by the market interactions, the herd/flock size they own could be determined by mere decisions of the household and other determining factors. The decisions and determining factors can also limit the capacity of the household to have manageable herd/flock size (usually small) and low productivity of these herds/flocks. The argument in Hurissa & Eshetu (2003) pointed out that the traditional herd management system is not supported through the introduction of improved breeding and feeding practices and the local breeds are not differentiated and improved resulting in low productivity and off-takes. Unless significant changes are made in smallholder farmers'

production systems to increase the quantity and quality of animals raised for the market, it will be difficult to obtain significant commercial off-take, both in terms of quantity and quality (Negassa *et al*, 2011).

## **2.2. Empirical Review**

The livestock herd size in the world on the one hand and the traditional production system in Africa and Ethiopia on the other hand could indicate commercialization of livestock production is very important aspect to improve the commercial off-take rate in Ethiopia. In sub-Saharan Africa cattle, sheep and goats are kept in all the traditional system in varying proportions (Otte & Chailonda, 2002). The livestock market off-take rate is low in the communal (traditional) cattle production system of Africa with the off-take rates of between 5-10%; compared to 25% in the commercial sector Musemwe *et.al* (2010). The commercial off-take rate of Ethiopia exists in the same range in African traditional systems. As explained in the African Livestock strategy document, the failure to transform the African livestock industry would adversely impact on the growth of local industries and reduces income for African livestock producers and actors in the value chains. (African Union Commission, 2015).

The nature of the livestock population figure of Ethiopia shows mismatch trend between production and consumption of meat. One year before, Ethiopia's meat production was increased by 4.6 percent, where the growth is because of the increase in the number of slaughtered animals, but not from an increase in productivity (Ministry of Livestock and Fisheries-MoLF, 2017). With such trends, the low productivity level may create gaps in the near future. The livestock master plan of Ethiopia explained that red meat production estimated to grow from 1.275 to 1.933 million tons between 2015 and 2020; which would not meet expected consumption growth of 58% by 2020 (2.008 million tons), leaving a 7% deficit (187,000 tons) (Shapiro *et al.*, 2015). This gap indicated that the total livestock population will not grantee to increase commercial off-take rates (domestic consumptions and exports).

Legese & Fadiga (2014) explained sheep and goats between six months and two years are an important source of meat for both domestic and export markets which requires animals with these characteristics-male, intact, young (1-2 years) and with a live weight of 12-30 kg. The

export market needs non castrated sheep and goats with good body fat cover. Increment in production through improving productivity is mandatory task to adequately supply to the market. As the herd/flock size increases, the probability that the household participate in cattle, sheep and goats markets as a seller only increases while the probability of non-participation in cattle, sheep and goats markets decrease (Asfaw & Mohammad, 2008). However, this associations need to be proved.

Even though there is no recent study conducted on informal livestock trade in Ethiopia, the livestock informal trade is also another challenge the country has been facing. According to the senior livestock experts' opinions in the Ministry of Agriculture, the proportion of informal trade of livestock can reach up to 10 times of the formal live animal export.

Informal livestock trade is thought to amount to four to six times that of formal exports by volume and twice formal exports by value. (GebreMariam *et al.*, 2013). Desta *et al.* (2011) as quoted in (Legese & Fadiga, 2014) reported that live animal exports from Berbera and Bosaso have often reached a peak of 3 to 3.5 million per year in which about 65% of this volume is believed to originate in Ethiopia and the volume of the informal cross border livestock trade was four times that of formal exports; however, this varies with animal species. Goats are the major species informally exported at 49% of the total, followed by cattle with 27%. About 74% of goats cross the border through Somali region, 24% through Afar region, 1% through Oromia and 1% through Southern Nations, Nationalities and People's Region (SNNPRS) to Somali land, Djibouti, and Sudan.

Contrary to the informal trade estimates, more than 1200 existing live animal exporters, 250 domestic abattoirs and 13 export abattoirs has been operating at less than 30% of their capacity due to problems of adequate supply of live animals in Ethiopia. To this effect, the trends of export volume shows declining pattern (MoA, 2018). The exports volume (in number) declined from 294,540 to 65,104 for cattle, from 355,690 to 264,480 for sheep and from 24,807 to 12,357 for Goats from year 2011/12 to 2017/18. Similarly, the values decreased from 127.6 million USD to 38.88 million USD for cattle, from 22.48 million USD to 15.61 million USD for sheep and from 1.3 million USD to 0.772 million USD for goats from year 2011/12 to 2017/18 (MoA, 2018).

### **2.3. Conceptual Framework**

The detail relationships between the commercial off-take and livestock resource were elaborated in conceptual framework as follows. The relationship between the commercial off-take and livestock resource were explained in terms of demand side and supply side interactions based on the CSA 2017/18 data.

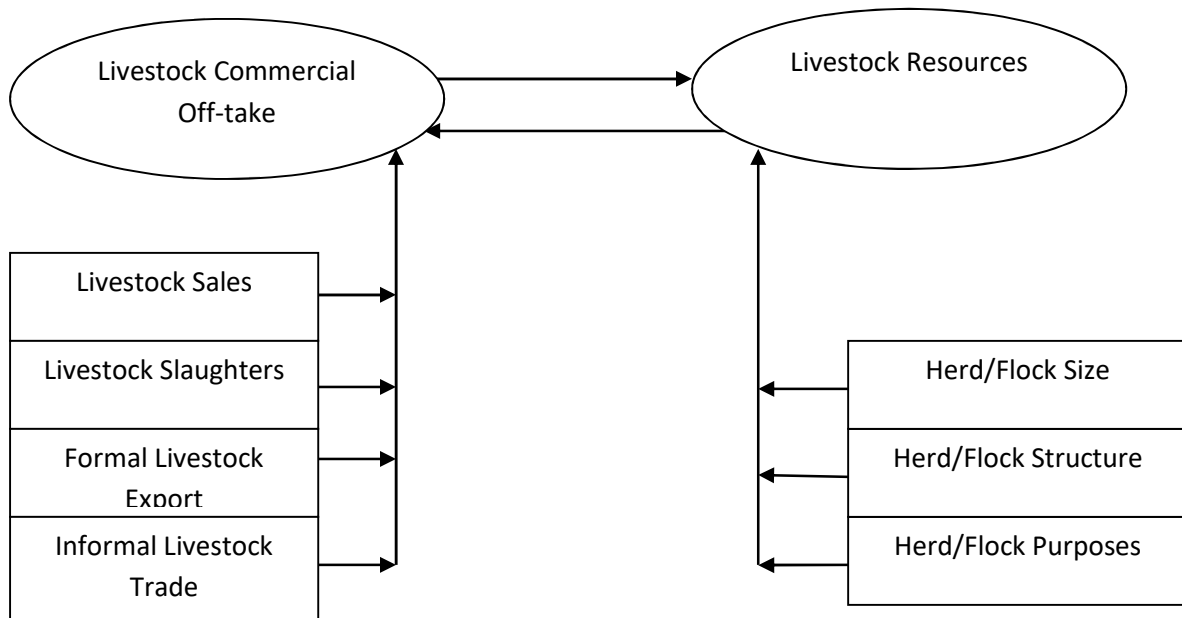
The demand side includes sales, slaughters, export and informal trade as variables of commercial off-take. The sales of livestock (could be live animal or meat) through formal or informal channel can affect the herd size, structure with corresponding purposes such as draught, breeding and milk. The more the sales of livestock are increasing, the more healthy, good body conditions and preferred age groups are coming to the market.

The supply side (livestock resource) considered the livestock herd/flock size, herd/flock structure, and purposes as key variables. The herd/flock size determines the decision of the producers to participate or not to participate in the market to sell their livestock. The 3.6 heads of cattle, 1.99 heads of sheep and 1.66 heads of goats per household are very small and do not encourage herders to sell their resources.

The age category is also very important element that can determine the commercial off-takes (export volume) whatever the channel is. Cattle age category from 3-10 years (63.09% of total cattle population) which are kept for draught (25.77%), breeding (22.76%) and milk (11.03%) and sheep and goats' age category of 2 years and older (52.21% and 50.07% respectively) were also primarily kept for breeding purposes. The purpose significantly indicates the sex structure (female). Commercial off-take from these age category can critically affect the livelihoods of the rural herders through the corresponding purposes.

If herders are forced to sell from this small size and age category to cover some of their home needs, they could face some challenges in their livelihoods which eventually affect the commercial off-take. The figure 2.1 below shows relationships diagrammatically.

Figure 2.1- Conceptual framework depicting the bi-directional relationship between Commercial Off-take and Livestock Resources



The empirical review further explained the gaps indicated in the problem of statement. The low off-take rates and projected deficits of all meats are some of the existing practices in traditional livestock production and marketing system in Ethiopia. The reviewed literatures also indicated the effect of commercial off-take and livestock resource has bi-directional relationship. The commercial off-take basically depends on the availability livestock resource. The available livestock resource can also be affected by the commercial off-take rates. The relationship between the commercial off-take and livestock resource did not show either positive or negative effects. This must be addressed to understand its nature and improve future production and marketing.

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1. Research Design and Approach

The research design is cause-effect design. This is so because of the objective of the study was designed to see the effect of commercial off-take on livestock resource and vice versa. To implement this research design, a quantitative approach was used. Purely quantitative data and quantitative methods of analysis were used.

#### 3.2. Data Type and Collection Method

The research basically focused on secondary data on livestock characteristics (production and marketing) from Central Statistical Agency (CSA) of Ethiopia and Ministry of Agriculture (MoA). The details of these data collected are annexed in Appendix 1 Table 1-21. In addition different literatures were also reviewed.

The survey data sets under considerations were collected based on the sampling procedure designed by central statistical agency (CSA) Ethiopia; i.e, the surveys applied a two stage stratified methods for clustering of the sample as enumeration areas-EAs (almost PAs) and 30 agricultural households from each EAs each year. On average 66 strata/zones out of 75 existing zones, 2129 EAs/strata, and 59350 sampling units (agricultural households)/EA were covered for each panel year during the 6 years period to collect the data. These survey reports that were used cover 6 years ranging from 2012/13 up to 2017/18.

#### 3.3. Model Specification

The model of the study was fixed effects panel data model. The model considers two equations (simultaneous equations); the first equation is to describe the livestock resource ( $Y_{it}$ ) as a function of the commercial off-take ( $X_{it}$ ) and the other is commercial off-take as a function of livestock resource. The equations of the model were described as follows.

$$Y_{it}=a_i+\beta_1X_{it}+u_{it} \dots\dots\dots (eq1)$$

Where

$a_i= (i =1 \dots n)$  is the unknown intercept for each entity (  $n$  entity-specific intercepts).

$Y_{it}$ =is the dependent variable (DV) where  $i$ = entity and  $t$ = time.

$X_{it}$  represents one independent variable (IV),

$\beta_1$  is the coefficient for that IV,

$u_{it}$  is the error term

The equation of the model by using binary variables (Dummy Variables):

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \dots + \beta_k X_{k,it} + \gamma_2 E_2 + \dots + \gamma_n E_n + u_{it} \dots \dots \dots \text{(eq2)}$$

Where

$Y_{it}$  is the dependent variable (DV) where  $i$  = entity and  $t$  = time

$\beta_k$  is the coefficient for the IVs,

$\beta_k X_{k,it}$  represents independent variables (IV),

$\gamma_2$  is the coefficient for the binary repressors (entities)

$E_n$  is the entity  $n$ . Since they are binary (dummies) you have  $n-1$  entities included in the model.

$u_i$  is the error term

The names of the variables ( $Y_{it}$  and  $X_{it}$ ) are elaborated in detail as below:

#### Dependent Variables – $Y_{it}$

Where,

- $Y_{it}$  = National Livestock Resource Base by species, region and Year
- $Y_{it1}$  = Livestock Herd/flock population by Species, region and Year
- $Y_{it2}$  = Livestock Herd/flock age Category by Species, region and Year
- $Y_{it3}$  = Livestock Herd/flock Purposes by Species, region and Year

#### Independent Variables – $X_{it}$

Where,

- $X_{it}$  = Net Livestock Commercial Off-take rate by species, region and year
- $X_{1it}$  = Volume of Livestock Sales by species, region and year
- $X_{2it}$  = Volume of Livestock Slaughters by species, region and year
- $X_{3it}$  = Volume of Formal Live Animals Export by species, region and year
- $X_{4it}$  = Volume of Informal Live Animals Trade by species, region and year

### 3.4. Organizing the Data

The secondary data collected on the variables from the two sources (Central Statistical Agency Ethiopia-CSA and the Ministry of Agriculture-MoA) were reorganized based on the following assumptions and parameters.

#### *Assumptions and Parameters*

##### *a) Delphi method to determine holding share*

The livestock resource base index is conceptually defined by considering three parameters such as herd/flock size (1-4 heads for cattle, goats and sheep), herd/flock structure (3-10 aged cattle, and 2 years and older for goats and sheep) and herd/flock purposes (for draught, breeding and milk) of the livestock. Using the DELPHI method, the senior livestock experts in the ministry of Agriculture (MoA) estimated the share of herd/flock size, herd/flock structure and herd/flock purposes from the total herd management by the Households to be 0.6, 0.2 and 0.2 respectively. Accordingly, shares were estimated as summarized below, Annex 1(annex 1h-j), for the calculation of INDEX for each species:

Holding share 1-4 heads in TLU	Structure share in TLU	Purposes share in TLU
Cattle =0.5 or 50% of holders	Cattle 3-10 years age =0.63	Cattle (draught, breeding and milk) = 0.94
Sheep =0.21 or 21% of holders	Sheep 2 years and older =0.52	Sheep (breeding) =0.93
Goats =0.15 or 15% of holders	Goats 2 years and older =0.50	Goats (breeding and milk) = 0.94

##### *b) Conversion of Number to TLU*

The Tropical livestock unit (TLU) for cattle, Sheep and Goats are 0.7, 0.1, and 0.1 respectively to convert livestock numbers to TLUs. Accordingly, the dependent variables are converted to TLUs as indicated in Annex 1(annex 1d to 1g, 1k-1n).

##### *c) Calculation of Net commercial off-take rate*

The Net commercial off-take rate (NCR) for each species, year and region were calculated using the formula applied by Asfaw & Mohammad, (2008). The formula is “the net commercial off-take rate as net sales (sales minus purchase) as a percentage of average stock during the year”. The average stock is a half of the sum of opening stock and ending stock over one year period.

$$\frac{(\text{Sales} - \text{Prurchases})}{0.5(\text{beginning stock} + \text{ending stock})}$$

Accordingly, the net commercial off-take rate (NCR) for each species, year and region was calculated and Annexed (Annex 1(annex 1o). *Sales and slaughters data are directly taken from the CSA survey reports for the 6 years. See Annex 1 (annex 1o).*

*d) Conversion of Meat to equivalent live animal*

The conversion factors meat to equivalent live animal were considered (the carcass weight for Sheep (mutton) and Goats (goat's meat) which are 10kg per head and 8.5 kg per head respectively) to convert to live animal equivalent based on the study by (Negassa *et al.*, 2011). The conversion is done only for mutton and goats meats (because of Ethiopia is not exporting cattle meat). See Annex 1 (annex 1a and 1b).

*e) Conversion of Formal trade to informal trade*

For one thing there is no formally recorded data on informal cross border trade in Ethiopia, the data on informal trade was estimated assuming the study conducted by Desta *et al.* (2011) which argued that the informal trade in Ethiopia is estimated 4 times that of the formal export. See Annex 1 (annex 1c).

The live animal and meat export data by regions were also estimated by the senior experts in the ministry of agriculture assuming the ports of exports; otherwise there is no record on live animal and meat export by region.

### **3.5. Data Analysis**

Data on the dependent ( $Y_{it}$ ) variables and independent variables ( $X_{it}$ ) were analyzed by using the Stata software version 13 (the coding of each variable was elaborated in Annex 2a, 2b and 2c). A part from other variables, the Year and the Region data were converted to dummy variables (binary variables) with IDs for Regions. While converting to dummy variables, the year and region names were coded as summarized in the table below.

Region	Year
Rg1=1 for Tigre Region; and zero otherwise.	Yr1=1 for 2013; otherwise zero.
Rg2=1 for Afar Region; and zero otherwise.	Yr2=1 for 2014; otherwise zero.
Rg3=1 for Amhara Region; and zero otherwise.	Yr3=1 for 2015; otherwise zero.
Rg4=1 for Oromia Region; and zero otherwise.	Yr4=1 for 2016; otherwise zero.
Rg5=1 for Somali Region; and zero otherwise.	Yr5=1 for 2017; otherwise zero.
Rg6=1 for B/Shangul Gumuz Region; and zero otherwise.	Yr6=1 for 2018; otherwise zero.
Rg7=1 for SNNP Region; and zero otherwise.	
Rg8=1 for Gambella Region; and zero otherwise.	
Rg9=1 for Harari Region; and zero otherwise.	
Rg10=1 for Dire Dawa Administration; and zero otherwise.	
Rg11=1 for National; and zero otherwise.	

Note: The Years 2012/13, 2013/14, 2014/15, 2015/16/ 2016/17 and 2017/18 were replaced by the years 2013, 2014, 2015, 2016, 2017, 2018 respectively to make the definition of years easy. The corresponding region numbers are used only for data analysis purposes.

Both descriptive and regression analyses were conducted. The descriptive analyses were applied just to support the econometric analyses of the study. The regression analyses on the panel data set (Annex 2 (annex 2a, 2b and 2c) were conducted using the Stata software for each livestock data sets (Cattle, Sheep and Goats) separately and the following results were obtained and discussed as per the three specific objectives of the study and the level of analysis.

## CHAPTER FOUR

### RESULTS AND DISCUSSIONS

#### 4.1. Pre-and Post-Estimation Tests

Before running the regression on the three data sets (cattle, sheep and goats), Hausman tests was conducted for model estimation between the fixed effects and random effects panel models. The Hausman hypothesis test says:

$H_0$ : Random effect model (REM) is appropriate (random effects would be consistent and efficient), versus

$H_1$ : Fixed effect model (FEM) is appropriate (random effects would be inconsistent), and the decision is to reject the null hypothesis ( $H_0$ ) if the P-value is less than 5%.

Accordingly, the estimations tests were conducted (for cattle, sheep and goats) and the P-values were less than 5% and decided to accept the Fixed Effects Model (FEM) as the appropriate model to explain the variables. The details are described in annex 3.

Following the pre-test, post estimation tests for autocorrelation problem was conducted for each dataset. As a result of this, the static values for the three species (cattle, sheep and goats) were 1.22, 0.19, and 0.35 Durbin Watsan (DW) statistic (original) respectively which indicated the existence of serial autocorrelation problem (when the DW value is close to zero). However, by running Cochrane-Orcutt procedure, the DW statistic (transformed) corrected to 1.96, 2.10, and 1.50 for cattle, sheep and goats data sets respectively so as to resolve the autocorrelation problem (no autocorrelation problem when the DW is close to 2) as annexed 3. Similarly, the regression output with 0.9987, 0.9984 and 0.9960  $R^2$  values in cattle data, sheep data and goats' data explained appropriateness of the model to explain the dummy variables.  $R^2$  values are presented in tables 4.5, 4.6, 4.12, 4.13, 4.19 and 4.20.

Based on the above tests, the analyses of commercial off-take (commercial off-take rate, sales, slaughters, formal live and meat exports and informal live animal trades) and the livestock resources (total population as herd/flock size, age and sex structure, herd/flock purposes) were conducted and results discussed by specific objective as follows:

## 4.2. Effects of Commercial Off-take on Livestock Resources

The descriptive and econometric analyses of the effects of commercial off-take on livestock resources were conducted and discussed by each species as follows.

### 4.2.1. Descriptive Analysis

#### A) Descriptive Analysis of Cattle

The commercial off-take rate trend (based on CSA data) was stagnant in the time period 2012/13 (3.23%) to 2017/18 (3.51%) as indicated in figure 4.1. This was happened because of the purposes close to the cattle populations (for draught and milking purposes) than commercialization.

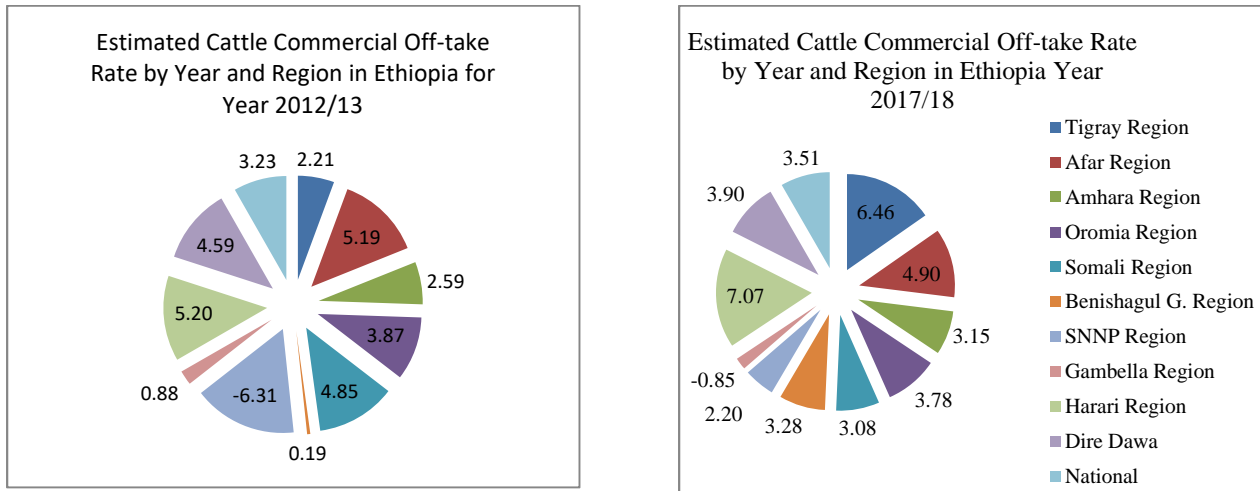


Figure 4.1 Estimated Cattle Commercial Off-take Rate in Ethiopia for the Years 2012/13 and 2017/18 based on CSA data

The figure 4.2 below indicated that the shares of cattle export were 7.62% (#183,285) in 2012/13 and changed into 2.39% (#65,104) in 2017/18 after six years. In the overall the panel years, there were continuous declined trends in cattle exports. This was happened because of the quality of the cattle (highland cattle were not exported). Ethiopia was not in a position to export cattle meat during the panel years. Transforming the traditional cattle production and marketing system to commercialization may take longer period than sheep and goats.

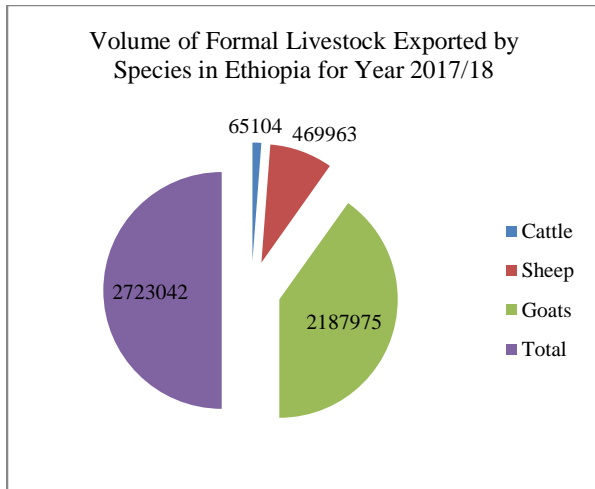


Figure 4.2. Volume of Formal Livestock Exported by Species in Ethiopia for the Years 2012/13-2017/18 based on CSA data

### B) Descriptive Analysis of Sheep

As indicated in figure 4.3 below, the overall national commercial off-take rate of sheep (based on CSA data) showed decline nature over years. The national level commercial off-take rate of sheep was 8.16% in 2012/13 and declined to 4.82% in 2017/18.

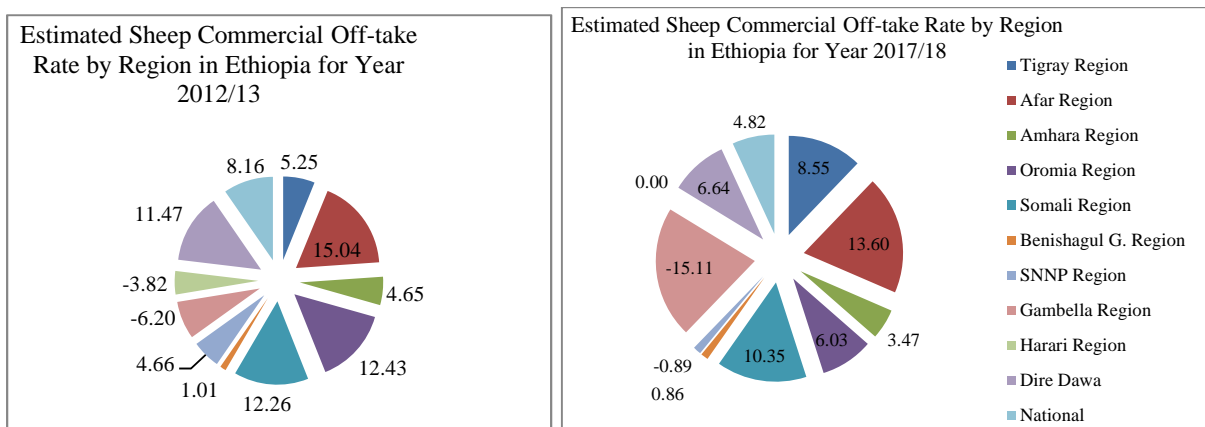


Figure 4.3 Estimated Sheep Commercial Off-take Rate in Ethiopia for the Years 2012/13 and 2017/18 based on CSA data

The volumes of sheep export were obtained by combing the volume of exported live sheep and converting the mutton to equivalent live animal. Based on this, figure 4.2 indicated the 22.6% (5434.3) shares of volume of sheep export in 2012/13 were decreased by 63,440 (11.67%) and

changed into 17.26% (469,963) in 2017/18 after six years. The overall trends showed continue declined trends in sheep exports.

**C) Descriptive Analysis of Goats**

Unlike commercial off-rate rates of cattle and sheep, as figure 4.4 indicated, the trend in the goat’s commercial off-take rate showed increment from 9.26% in 2012/13 to 11.58% in 2017/18. The increment in the rate was directly associated with the increment of the goats flock size during the panel years.

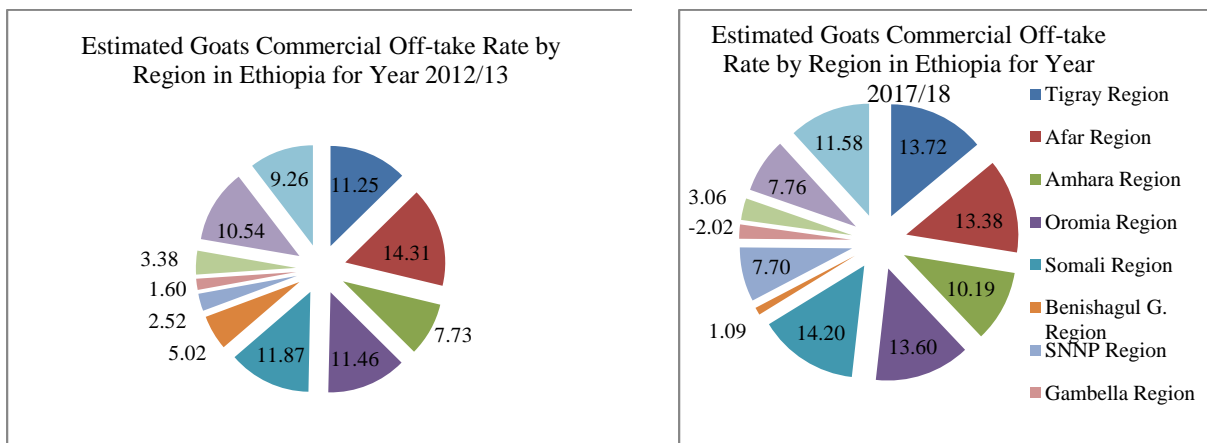


Figure 4.4 Estimated Goats Commercial Off-take Rate in Ethiopia for the Years 2012/13 and 2017/18 based on CSA data

The volumes of goats' exports were obtained by combining the live animal traded and converting the goats' meat to equivalent live animal. Accordingly, the 69.77% (1,677,534) exports shares of goats in 2012/13 were changed into 80.35% (2,187,975) in 2017/18 after six years as indicated in figure 4.2 above. The overall trends showed continuous increments of goats export. The increments in the shares of goats' exports were directly related to the high off-take rate and developments of new export abattoirs in the country.

#### 4.2.2. Econometric Analysis

Econometric regressions were conducted on three data sets (cattle, sheep and goats data sets) to estimate the fixed effects of commercial off-take on livestock resources. Accordingly, the following results were estimated and discussed per species.

##### A) *Econometric Analysis of Cattle*

Sales of cattle have significant effects on the total population of cattle at 90% confidence level (Table 4.1). A unit increase in sales of goats' population in TLU increased the total cattle population by 0.912 TLU units.

Table 4.1. Results of Fixed Effects Estimation for Sales of Cattle				
TotCatPop	Coef.	Std. Err.	t	P>t
TotCatSales	.1922766	.1157955	1.66	0.103*
TotGoaPop	.9121382	.9150548	1.00	0.323
TotShePop,	5.615584	1.137061	4.94	0.000***
_cons	3640450	255314.3	14.26	0.000***
Fixed-effects (within) regression	R-sq: within = 0.8266			
Number of obs = 66	between = 0.9856			
Prob > F = 0.0000	overall = 0.9833			
rho .99831327 (fraction of variance due to u_i)				
Robust standard errors in parentheses				
***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4a				

The sales of male cattle, total cattle slaughters, male cattle slaughters, female cattle slaughters and informal trade of cattle have significant effects on the total cattle population (in TLU) at 99% confidence level. And female cattle have significant effect at 90% confidence level. A unit increase in sales of male cattle and total cattle slaughters (in volume) increased the cattle population by 2.64 TLU and 15.06 TLU respectively. On the other hand, a unit increase in male

cattle slaughters, female cattle slaughters and informal trade of cattle (in volume) reduced the cattle population by 6.9 TLUs, 30.06 TLUs and 2.56 TLUs respectively (Table 4.2). The negative effects of commercial off-take on cattle population are more significant than the positive effects on cattle population. A unit of sales of both male cattle and slaughters encourage a household to have more stock; while the slaughters and informal trade discourage households to have less stock and it disturbs the sex structure.

Table 4.2. Results of Fixed Effects Estimation for Commercial Off-take of Cattle				
TotCatPop	Coef.	Std. Err.	t	P>t
NComCatOffTake	-5852.627	15940.6	-0.37	0.715
TotCatSales	.2497276	.1543598	1.62	0.112
MalCatSales	2.635437	.3063739	8.60	0.000***
FemCatSales	.7516781	.2995564	2.51	0.016**
TotCatSlau	15.06336	2.655295	5.67	0.000***
MalCatSlau	-6.90094	1.472049	-4.69	0.000***
FemCatSlau	-30.0642	6.087773	-4.94	0.000***
ForCatEXPORT	0 (omitted)			
InforCatTRADE	-2.561565	.3128481	-8.19	0.000***
_cons	5188497	176394.7	29.41	0.000***
Fixed-effects (within) regression	R-sq: within = 0.9582			
Number of obs = 66	between = 0.9945			
Prob > F = 0.0000	overall = 0.9830			
rho .99975705 (fraction of variance due to u_i)				
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4b				

### B) Econometric Analysis of Sheep

Table 4.3 indicated that sales of sheep have significant effects on the total sheep population. A unit increase in sales of sheep (volume) increased the sheep population by 0.153 TLU units at 99% confidence level.

Table 4.3. Results of Fixed Effects Estimation for Total Sales of Sheep				
TotShePop	Coef.	Std. Err.	t	P>t
TotSheSales	.1532379	.0206621	7.42	0.000***
TotCatPop	.0400614	.0081618	4.91	0.000***
TotGoaPop	.3031682	.0516225	5.87	0.000***
_cons	-111504.6	37928.44	-2.94	0.005***
Fixed-effects (within) regression	R-sq: within = 0.9453			
Number of obs = 66	between = 0.9958			
Prob > F = 0.0000	overall = 0.9952			
rho .99101844 (fraction of variance due to u_i)				
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4c				

The informal sheep trade (volume) has significant effects (negative) on the total sheep population (TLU) at 99% confidence level. A unit increase in informal trade of sheep (volume) reduced the sheep population by 0.208 TLU at 99% confidence level (Table 4.4).

	Coef.	Std. Err.	t	P>t
TotShePop				
NSheComOffTake	-632.7626	1467.671	-0.43	0.668
TotSheSales	29.41544	106.1579	0.28	0.783
MalSheSales	-29.08207	106.1584	-0.27	0.785
FemSheSales	-29.26011	106.1647	-0.28	0.784
TotSheSlau	-.519015	.3145505	-1.65	0.106*
MalSheSlau	.7937451	.3418081	2.32	0.025**
FemSheSlau	.2523537	.361894	0.70	0.489
ForSheEXPORT	0 (omitted)			
InforSheTRADE	-.2079265	.043129	-4.82	0.000***
_cons	213474.2	39602.46	5.39	0.000***
Fixed-effects (within) regression	R-sq: within = 0.8821			
Number of obs = 66	between = 0.9396			
Prob > F = 0.0000	overall = 0.9377			
rho .99348038 (fraction of variance due to u_i)				
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4d				

### C) Econometric Analysis of Goats

Sales of goats also have significant effects on the total goats' population (TLU). A unit increase in sales of goats (volume) increased the goats' population by 0.197 TLUs at 99% confidence level. The more the goats' stock size increased, the more it was sold in the market in the regions (Table 4.5). Such sales have the possibility of reducing the flock size.

	Coef.	Std. Err.	t	P>t
TotGoaPop				
TotGoaSales	.1974225	.0311657	6.33	0.000***
TotCatPop	-.0273193	.0176599	-1.55	0.128
TotShePop	.6744537	.1301516	5.18	0.000***
_cons	184806.4	84616.48	2.18	0.033**
Fixed-effects (within) regression	R-sq: within = 0.9110			
Number of obs = 66	between = 0.9697			
Prob > F = 0.0000	overall = 0.9665			
rho .99039583 (fraction of variance due to u_i)				
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4e				

The total sales goats and female goats' sales have significant effects on the goats' resource base index (in TLU) at 99% confidence level. A unit increase in sales of goats (volume) increased the

goats' population by 1.373 (TLUs) and sales of female goats reduced the goats' resource base by 2.245 TLU. Sales of goats have negative significant effects on the goats' resources (Table 4.6). Sales of female goat can reduce up to 3 TLU of goats.

Table 4.6. Results of Fixed Effects Estimation for Commercial Off-take of Goats				
GoalINDEX	Coef.	Std. Err.	t	P>t
NGoaComOffTake	827.0805	6428.4	0.13	0.898
TotGoaSales	1.372815	.2857244	4.80	0.000***
MalGoaSales	0 (omitted)			
FemGoaSales	-2.248674	.5849983	-3.84	0.000***
TotGoaSlau	-.0808107	.1790829	-0.45	0.654
MalGoaSlau	-.6258545	.3157392	-1.98	0.053*
FemGoaSlau	.2337748	.3013253	0.78	0.442
ForGoaEXPORT	0 (omitted)			
InforGoaTRADE	-.0528685	.0532575	-0.99	0.326
_cons	33763.98	71731.26	0.47	0.640
Fixed-effects (within) regression	R-sq: within = 0.4717			
Number of obs = 66	between = 0.3831			
Prob > F = 0.0000	overall = 0.4017			
rho .66956823 (fraction of variance due to u_i)				
Robust standard errors in parentheses				
***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4f				

#### D) Discussions

The descriptive and econometric analyses conducted on the effects of commercial off-take on livestock resources revealed that contribution of the sales of livestock (cattle, sheep and goats) was significant in its effects. A unit sale of cattle, sheep and goats contributed to the productions of livestock both negatively and positively. The descriptive figures indicated the existences of challenges for the low rates of off-take (the exports) despite the existence of huge livestock resources in the country. If the commercial off-take rate increases, there would be possibilities of reduction in herd/flock size of livestock.

As estimated in the econometric regression model, a unit increase of sales of cattle, sheep and goat were increasing the population by 0.912 TLU, 0.153 TLU and 1.373 TLU respectively. This is to mean that by the time a household sold a unit of cattle, the number of cattle replaced instead of the sold one was less than 1 TLU. In that case there was no replacement because of sales of livestock rather than maintaining the existing ones. This can be explained by the low commercial

off-take of cattle (3.51%), 4.82% for sheep and 11.58% for goats. The estimated off-take rate for cattle and sheep were very small as compared to rates (7% for cattle and sheep each) indicated in Asfaw & Mohammad, (2008) and rate in 5-10% in Musemwe *et.al* (2010). However, the rate for goats (11.58%) was a bit higher than the one indicated in the above study, which was as a result of expansions of abattoirs.

Similarly, a unit increment in slaughters of female cattle reduced the population by 30.06 TLU. Sales of female goats reduced the goats' population by 2.243 TLU; while the informal trade of cattle and sheep reduced the population by 2.56 TLU and 0.21 TLU respectively. The negative effects were more significantly affected the livestock population. such findings indicated the possibility of shortage in quality and quantity of cattle in the market (reliable and adequacy problems) as argued in Negassa *et al*, (2011) which eventually resulted in further shortage of all meat for domestic demand (Shapiro *et al*, (2017), and meat and live animal exports in line with the arguments in African Union Commission, (2015), which explained Africa will face large meat import bills. The significance level of sales of livestock was associated with the production of sheep rather than demand and supply interactions in the market. The production and marketing were not guided by the demand and supply interactions in the market. The households were managing their herd/flock to cover some their subsistence needs.

The challenges in the informal livestock trade as discussed in Desta *et al.*, (2011), Legese & Fadiga, (2014) and GebreMariam *et al*, (2013) was proved with its negative significant (reduced cattle population by 2.56 TLU and 0.21 TLU in sheep) in Ethiopia. Unlike the arguments in Desta *et al.*, (2011), Legese & Fadiga, (2014) and GebreMariam *et al.*, (2013), the informal goats' trade was not significantly impacting the goats' resources.

Supporting the argument in Legese & Fadiga, (2014), the commercial off-take significantly affected the defined age category and sex groups. This could possibly affect the breeding and milking purposes which in turn affect the livelihoods of the rural communities.

Thus, in the short run, the promotions to expand exports of livestock and its products (commercialization) could negatively affect the livelihoods of the rural communities through their corresponding purposes.

### 4.3. Effects of on Livestock Resources on Commercial Off-take

The descriptive and econometric analyses of the effects of livestock resources on commercial off-take were conducted discussed by species.

#### 4.3.1. Descriptive Analysis

In Ethiopia, the number of livestock herders in the year 2012/13 (15,479,493 herders) was increased 17,966,019 herders in the year 2017/18, which is by 16.06% (2,486,526).

##### A) Descriptive Analysis of Cattle

Based on CSA data, the overall cattle population size increased by 6.4 million heads (11.85%) in 6 years period (from 53.99 million to 60.39 million total size) in which the shares of male and female size changed from 44.52% and 55.48% in 2012/13 to 45.32% and 54.68% in 2017/18 respectively.

The % share of herders with no cattle was increased by 2% (from 22 to 24) while share of those herders with greater than 4 heads of cattle remained constant (26%). The national shares of livestock herders with 1-4 heads of cattle were declined from 52% in 2012/13 out of 15,479,493 to 50% in 2017/18 out of 17,966,019. See figure 4.5 below.

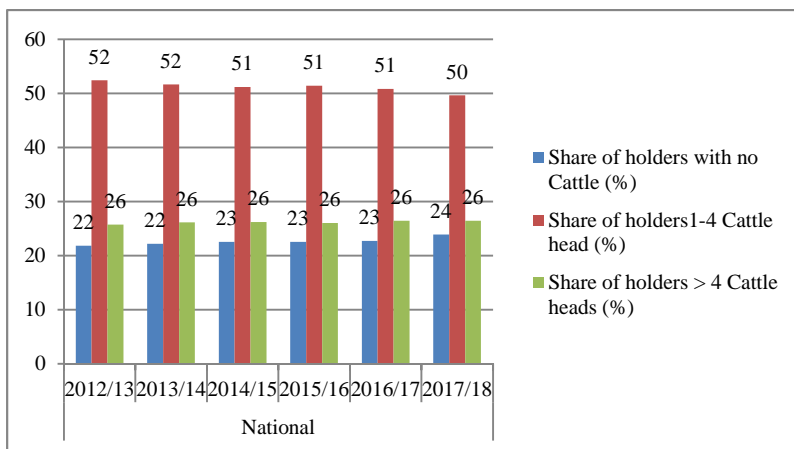


Figure 4.5 Share of cattle holders in Ethiopia from Year 2012/13-2017/18 based on CSA data

The increment of 6.4 million heads of cattle (11.85%) with the increment of 16% herders (2,486,526) showed that the number of cattle was increased because of increment by numbers of herders than due to improvements in productivity, which shows the cattle resources were more scattered by the number of owners than a household owning more stock. This is to mean that the system of production is still traditional (subsistence) than commercials.

**B) Descriptive Analysis of Sheep**

According to CSA data, 5.81 million heads of sheep population (22.79%) were increased from 2012/13 (25.49 million) to 2017/18 (31.30 million) at national level in which the shares of male and female size changed from 26.43% and 73.57% in 2012/13 to 28.18% and 71.82% in 2017/18 respectively.

The national shares of livestock herders with 1-4 heads of sheep were declined from 22% and in 2012/13 to 21% 2017/18 and almost remained constant over 6 years under consideration (figure 4.6). The 22.79% increment in sheep population together with the 16.06% increment of herders showed slightly more flocks to sell in the sheep market.

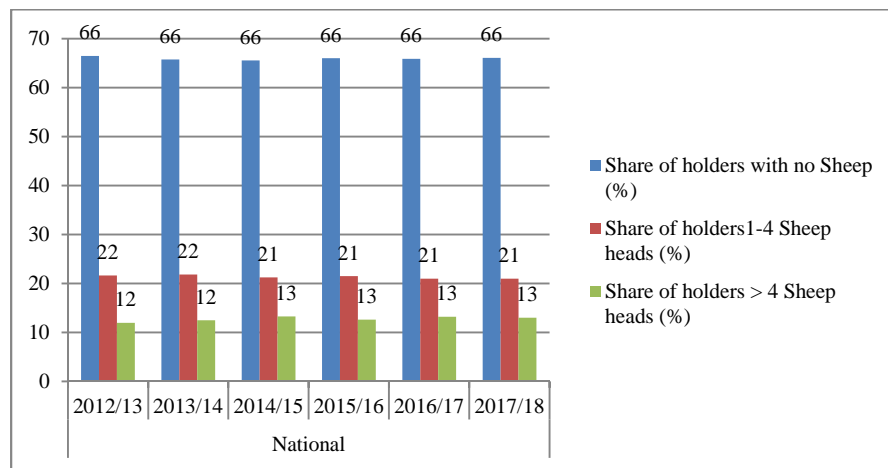


Figure 4.6 Share of Sheep holders in Ethiopia from Year 2012/13-2017/18 based on CSA data

**C) Descriptive Analysis of Goats**

The national flock size of goats were 24.06 million in 2012/13 and increased by 8.74 million heads (34.91%) and became 32.74 million heads in 2017/18 (CSA data) in which the shares of

male and female size changed from 28.94% and 71.06% in 2012/13 to 29.51% and 70.49% in 2017/18 respectively.

The national shares of livestock herders with 1-4 heads of goats were declined from 16% in 2012/13 out of 15,479,493 to 15% in 2017/18 out of 17,966,019. The shares of herders of with 1-4 heads almost remained constant over 6 years under consideration. See figure 4.7. The 33.91% and 16.06% increments in goats' population and herders also contributed to the increments of herders with more than 4 heads of goats by 2 %.

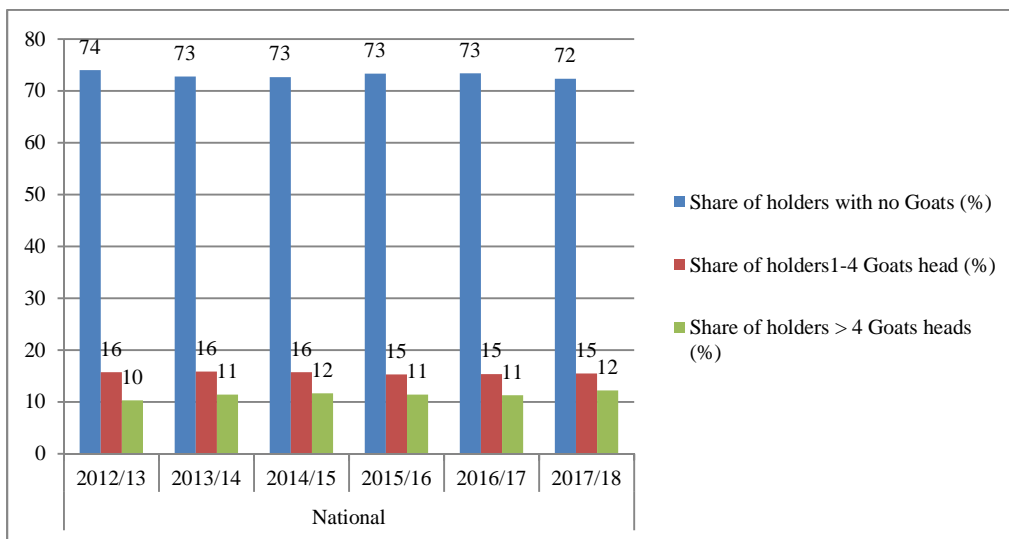


Figure 4.7 Share of Goats holders in Ethiopia from Year 2012/13-2017/18 based on CSA data

The declining or stagnant trends in owning of herds/flocks showed that decision of a household to sell his/her livestock in the market was very critical and contributed to the low off-take rate of livestock.

#### 4.3.2. Econometric Analysis

##### A) *Econometric Analysis of Cattle*

A unit increase in cattle population (TLU) increased sales of the cattle by 0.344 (in volumes) at 99% confidence level (Table 4.7). This is to mean that whenever a household increase his cattle stock by one unit, the volume decided by the household to be sold is 0.344, which is less than

one volume. Accordingly, herd size was not responsive for the volume of cattle to be sold by household in the market.

TotCatSales	Coef.	Std. Err.	t	P>t
TotCatPop	.3442611	.0676215	5.09	0.000***
_cons	-1371003	494011.8	-2.78	0.008***
Fixed-effects (within) regression	R-sq: within = 0.3243			
Number of obs = 66	between = 0.9991			
Prob > F = 0.0000	overall = 0.9746			
rho .98256139 (fraction of variance due to u_i)				
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4g				

In addition, a unit increase in sheep TLU increased the cattle population by 5.616 TLU at 99% confidence level (Table 4.1) and a unit increase in sheep TLU increased the cattle resource base index by 14.4 TLU at 99% confidence level as indicated in Table 4.8. The figures shows production of sheep by the household was significantly contributed to the increment of cattle herd size.

CatINDEX	Coef.	Std. Err.	t	P>t
NComCatOffTake	-10024.26	13696.21	-0.73	0.468
GoalINDEX	2.931389	2.62662	1.12	0.270
SheINDEX	14.41981	2.507103	5.75	0.000***
_cons	1121309	79157.34	14.17	0.000***
Fixed-effects (within) regression	R-sq: within = 0.9749			
Number of obs = 66	between = 0.9822			
Prob > F = 0.0000	overall = 0.9448			
rho .97864935 (fraction of variance due to u_i)				
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4h				

Table 4.9 below, also indicated that the total cattle population, male cattle population, cattle resource base index and female cattle kept for beef and other purposes (in TLU) have significant effects on the total sales of cattle (in volume) at 99% confidence level. A unit increase in total

cattle population and female cattle (in TLU) kept for beef and other purposes reduced the total cattle sales by 1.7 units (volume) and 7.18 units (volume) respectively. However, a unit increase in cattle resource base increases the sales of cattle by 0.89 volumes. The results indicated that increasing of resource base has positive contribution to the increment of cattle sales; while the sex (female) has negative effects on the sales.

Table 4.9. Results of Fixed Effects Estimation for Cattle Resources				
	Coef.	Std. Err.	t	P>t
TotCatSales				
TotCatPop	-1.701373	.4954157	-3.43	0.001***
MalCatPop	5.671086	1.84865	3.07	0.004***
FemCatPop	-1.680741	1.650772	-1.02	0.314
CatINDEX	.0891816	.0224192	3.98	0.000***
MalCatLes3YrsA~d	-.8594466	1.541236	-0.56	0.580
FemCatLes3YrsA~d	2.199602	1.604806	1.37	0.178
MalCat3to10Yrs~d	-.2367679	8.743444	-0.03	0.979
FemCat3to10Yrs~d	4.48626	2.805022	1.60	0.117
MalCatAb10YrsA~d	0 (omitted)			
FemCatAb10YrsA~d	0 (omitted)			
MalCatPurDB	-3.94358	8.329871	-0.47	0.638
FemCatPurDMB	-1.745673	2.099505	-0.83	0.410
MalCatPurBeOt	-5.357052	8.378278	-0.64	0.526
FemCatPurBeOt	-7.180559	2.342504	-3.07	0.004***
_cons	1873026	923362.7	2.03	0.049**
Fixed-effects (within) regression	R-sq: within = 0.9424			
Number of obs = 66	between = 0.8387			
Prob > F = 0.0001	overall = 0.6921			
rho .99905008 (fraction of variance due to u_i)				
Robust standard errors in parentheses				
***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4i				

### ***B) Econometric Analysis of Sheep***

As indicated in the Table 4.10, the male sheep 2 years aged has significant effect on the total sales of sheep at 99% confidence level. A unit increase in male sheep 2 years aged (TLU) reduced the sales of sheep by 13.714 units (volume). A unit increment in sheep from this age group reduces the possibility sheep to be sold in the market by 13.714 volumes which eventually reduce the overall sales volume of sheep. On the other hand, male sheep kept for breeding and wool, meat and others increased sales of sheep by 0.62 volumes and 13.62 volumes respectively at 95% confidence level. It is the male sheep that has significant effects on the sales of sheep. In this case, age category and sex structure were affecting the sales volume of sheep. This indicated that commercial farming of sheep can boost sales of the sheep very significantly.

Table 4.10. Results of Fixed Effects Estimation for Sheep Resources				
TotSheSales	Coef.	Std. Err.	t	P>t
TotShePop	-.5526215	228.5699	-0.00	0.998
MalShePop	-5.636717	228.5744	-0.02	0.980
FemShePop	0 (omitted)			
MalSheLes2YrsAged	0 (omitted)			
FemSheLes2YrsAged	5.331548	228.5838	0.02	0.981
MalShe2YrsAged	-13.71415	4.047356	-3.39	0.001***
FemShe2YrsAged	0 (omitted)			
MalShePurB	.623743	2.104437	2.20	0.033**
FemShePurB	8.98233	228.5717	0.04	0.969
MalShePurWMO	13.62272	5.218708	2.61	0.012**
FemShePurWMO	1.030117	228.635	0.00	0.996
_cons	-412754.5	90576.34	-4.56	0.000 ***
Fixed-effects (within) regression Number of obs = 66 Prob > F = 0.0000 rho .99417932 (fraction of variance due to u_i)	R-sq: within = 0.9265 between = 0.9938 overall = 0.9930			
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4j				

Table 4.11 below indicated that sheep resources have significant effects on the sales of sheep. A unit increase in sheep population (in TLU) increased the sales of sheep by 3.35 volumes at 99% confidence level. This is to mean that a unit increases in flock size in the household increase the sales of sheep by 3.35 volumes. The more the sheep stock size increased, the more it was sold in the market. In addition, a unit increase in goats' population (in TLU) increased the sheep population (in TLU) by 0.65 volumes at 95% confidence level.

Table 4.11. Results of Fixed Effects Estimation for Total Sheep Population				
TotSheSales	Coef.	Std. Err.	t	P>t
TotShePop	3.354454	.4523048	7.42	0.000***
TotCatPop	-.0867278	.0446004	-1.94	0.057*
TotGoaPop	-.6458275	.2983395	-2.16	0.035**
_cons	415536	182768.7	2.27	0.027**
Fixed-effects (within) regression Number of obs = 66 Prob > F = 0.0000 rho .98641302 (fraction of variance due to u_i)	R-sq: within = 0.7757 between = 0.9905 overall = 0.9877			
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4k				

On the other hand, the cattle and goats resources (in TLU) increased the sheep resource base index by 0.267 TLU units and 0.560 TLU units respectively at 99% confidence level (Table 4.12). Productions of goats and cattle have the possibility of increasing the flock size of sheep in a household by the amount specified.

SheINDEX	Coef.	Std. Err.	t	P>t
NSheComOffTake	419.3902	592.3631	0.71	0.482
CatINDEX	.0266807	.004654	5.73	0.000***
GoaINDEX	.5602514	.085051	6.59	0.000***
_cons	-20890.93	7147.808	-2.92	0.005***
Fixed-effects (within) regression Number of obs = 66 Prob > F = 0.0000 rho .90003326 (fraction of variance due to u_i)	R-sq: within = 0.9859 between = 0.9845 overall = 0.9799			
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4l				

### C) Econometric Analysis of Goats

Table 4.13 below depicted that total goats population (TLU) has significant effects on the sales of goats (volume). A unit increase in goat population (TLU) increased the sales of goat by 2.21 units (volumes) at 99% confidence level. A unit increase in cattle population (in TLU) also increased the sales of goats by 0.022 units (volumes) at 99% confidence level. In addition, a unit increase in sheep population (in TLU) increased the goats' resource by 0.674 TLU at 99% confidence level. The more the goats' stock size increased, the more it was sold in the market in the regions (Table 4.5).

TotGoaSales	Coef.	Std. Err.	t	P>t
TotGoaPop	2.20625	.3482851	6.33	0.000***
TotCatPop	.2204598	.0520671	4.23	0.000***
TotShePop	-.6550088	.5280262	-1.24	0.220
_cons	-1474824	213366.4	-6.91	0.000***
Fixed-effects (within) regression Number of obs = 66 Prob > F = 0.0000 rho .99833567 (fraction of variance due to u_i)	R-sq: within = 0.8991 between = 0.9802 overall = 0.9656			
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4m				

The sheep resources index (in TLU) increased the goats' resource base index by 0.81 TLU at 99% confidence level (Table 4.14). The production of one sheep resource in a household can increase the production of goats by the species volume.

GoaINDEX	Coef.	Std. Err.	t	P>t
NGoaComOffTake	178.635	1081.12	0.17	0.869
CatINDEX	.0077868	.00712	1.09	0.279
SheINDEX	.8086914	.1240349	6.52	0.000***
_cons	-23550.57	11360.47	-2.07	0.043**
Fixed-effects (within) regression Number of obs = 66 Prob > F = 0.0000 rho .91405546 (fraction of variance due to u_i)	R-sq: within = 0.9773 between = 0.9733 overall = 0.9574			
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4n				

#### D) Discussions

The results of the descriptive and econometric analyses of the effects livestock resources on commercial off-take indicated that the livestock population size and herd size by holders were stagnant over panel years and which contributed to the low commercial off-take rates and small portion of export volumes in agricultural sector. In years' time, the cattle, sheep and goats populations were increased by 11.85%, 22.79% and 34.9% respectively. This increment per year was 2.67% for cattle, 3.8% for sheep and 5.82% for goats. The percentage increments of livestock populations were less than the annual off-take rates. On the other hand, the percent increment of herders was 2.67% per year. The population and herders increments were the reflections of the low commercial off-take rates.

A unit increase in cattle population increased the sales of cattle by 1.7 volumes, sheep by 3.35 volumes and by 2.21 volumes. These increments were almost similar to the percent increments of each species. In this case, the households were selling their livestock resources to cover some of the household needs from the existing stocks. These results were in line with household model argument in Ouma *et al.*, (2003) which argued that the sales of livestock were decided by the

households to sell their livestock to cover some of their households need, not for profit. The findings indicated that the production systems were operating in traditional management system with low productivity and low commercial off-take rate as explained in Hurissa & Eshetu, (2003) and also in line with the arguments of Negassa *et al*, (2011) that explained the herd size positively associated with households' participation in the market.

In line with argument in Legese & Fadiga, (2014), the commercial off-take of cattle and sheep were significantly affected the defined age category and sex group. A unit increase in female cattle (in TLU) and male sheep (in TLU) and male sheep 2 years and older reduced the sales of cattle by 7.18 volumes and sheep by 13.714 volumes. Both sex and age category had more significant effects on the sales of livestock. This could have the possibly of affecting the female of the same age group and younger ones which in turn affects the breeding and replacement of these species. Improvements in the productivity of livestock could help the country to accelerate the process of transforming the livestock sector to commercialization in a short period of time.

#### **4.4. Comparing Effects of Commercial Off-take on Livestock Resources and the Reverse Between Regions**

The descriptive and econometric analyses of the effects of commercial off-take on livestock resources and the reverse between regions were conducted and discussed by each species as follow.

##### **4.4.1. Descriptive Analysis**

###### ***A) Descriptive Analysis of Cattle***

Out of 60.39 million total sizes of cattle resource, Oromia, Amhara and SNNP regions totally accounted 87.4% share in 2012/13. This share was decreased to 86.87% in 2017/18. See figure 4.8 below.

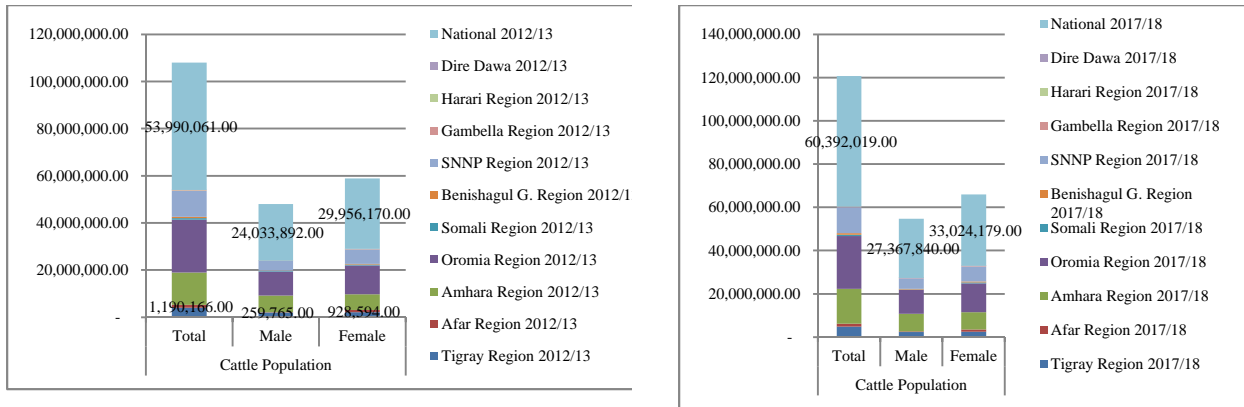


Figure 4.8 Cattle population in Ethiopia for the Years 2012/13 and 2017/18 based on CSA data

However, the commercial off-take rate and the herd size were inversely related in the regions. Figure 4.1 above indicated that the cattle commercial off-take rates were higher in Harari (7.07% and Tigray (6.46%) and lower in Gambella (-0.85%) as compared to the national rate (3.51%) in 2017/18. This was happened because of the fact that the livestock were kept for subsistence purposes such as draught, breeding and milking purposes than commercial off-take.

### B) Descriptive Analysis of Sheep

In year 2012/13, out of the total size of sheep, 85.13% were in Amhara, Oromia, and SNNP regions which were reduced to 80.26% in 2017/18. See figure 4.9. The reason could be competing demand for domestic meat consumption due to population pressure.

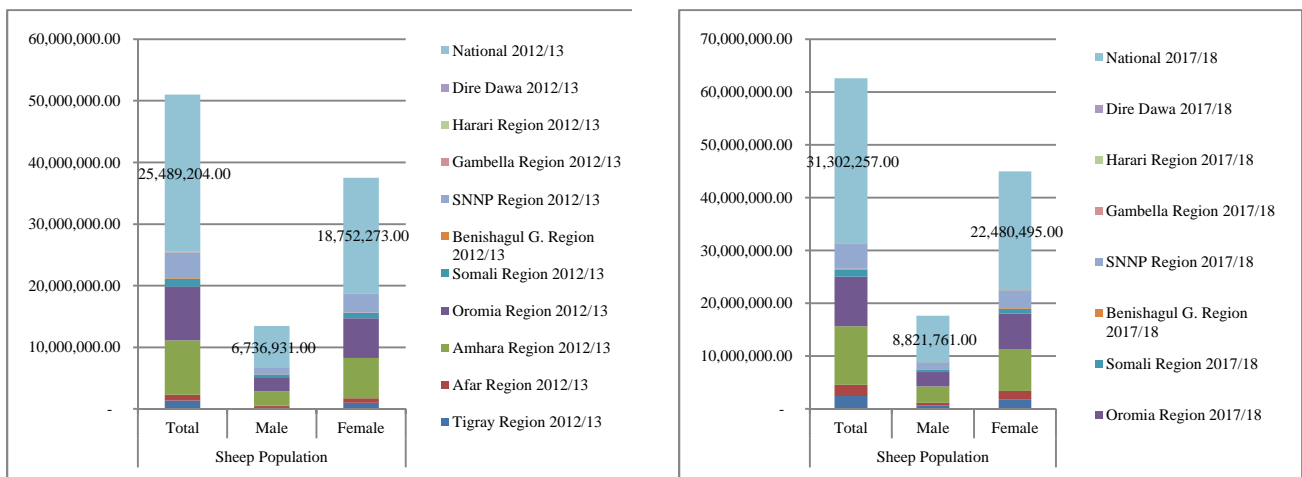


Figure 4.9 Sheep population in Ethiopia for the Years 2012/13 and 2017/18 based on CSA data

In terms of commercial off-take, figure 4.3 above indicated that Gambella (-15.11%), SNNP (-0.89%) and Afar (0%) accounted lowest rates of commercial off-take of sheep on one hand and Somali (10.35%), Afar (13.60%) and Tigray (8.55%) accounted highest rates as compared to the national rates (4.82%) in 2017/18 on the other hand. The figures of the regions could indicate the link between the commercial off-take rate and the informal trade routes at cross borders in Ethiopia, regardless of the existing flock sizes in the regional states.

**C) Descriptive Analysis of Goats**

Oromia, Amhara, SNNP and Tigray regions accounted 82.09% out of the 32.74 million total heads of goats in 2012/13 and after 6 years (in 2017/18), 88.24% share were accounted by Oromia, Amhara, SNNP, Tigray and Afar regions. See figure 4.10.

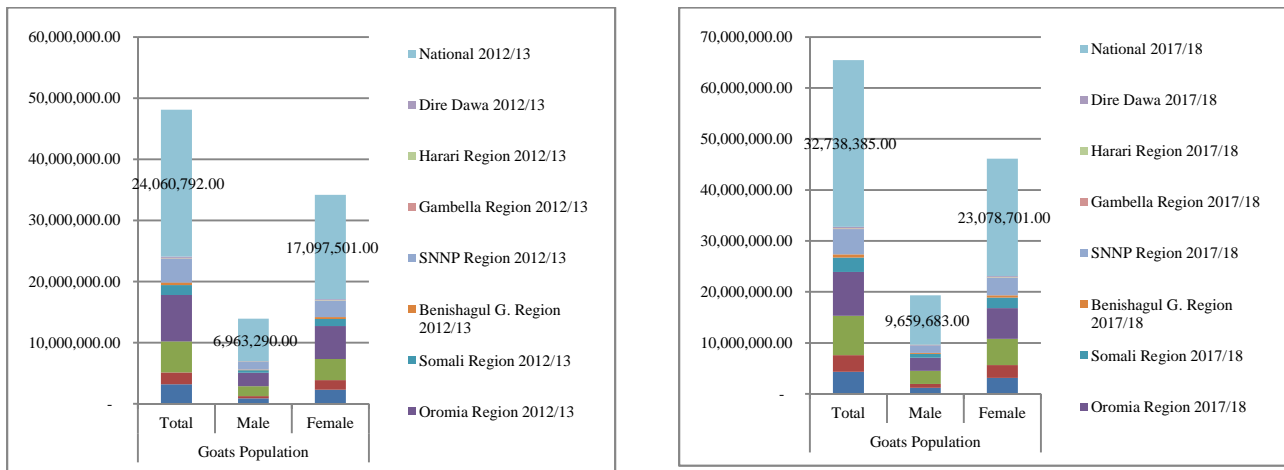


Figure 4.10 Goats Population in Ethiopia for the Years 2012/13 and 2017/18 based on CSA data

Figure 4.4 above indicated that Somali, Tigray, Oromia, Afar, and Amhara accounted higher off-take rate of 14.2%, 13.06%, 13.38% and 10.19% respectively while lowest in Gambella (-2.02%) and Benishangul Gumuz (1.09%) as compared to the national rate (11.58%) in 2017/18. The households in the regions were favored to sell their goats with the improvements in exports markets. The informal trade also contributed to the higher rates in Somali, Tigray, Oromia, Afar, and Amhara.

#### 4.4.2. Econometric Analysis

##### A) *Econometric Analysis of Cattle*

Regarding the effects between the regions (Table 4.15), sales of cattle have significant effects on cattle total population in all regions including national at 99% confidence level. The effects are positive in Afar, Amhara, Oormia, Somali, B/Gumuz, SNNP, and at national level. On the other, it has negative impact in Gambella region, Harari region and Dire Dawa Administration as compared to base region (Tigray region=2594161) at 95 % confidence level. A unit increase sales of cattle (in volume) reduced the cattle resource by the negative intercepts TLU of regions and increased by the positive intercepts TLU of the regions. The intercepts of Afar, Amhara, Oromia, Somali, Benishangul Gumuz, SNNP, Gambella, Harari, Dire Dawa Administration, and at national level are  $2594161+(-1985384)$ ,  $2594161+6352267$ ,  $2594161+1.15e+07$ ,  $2594161+(-2465709)$ ,  $2594161+(-2445850)$ ,  $2594161+4151547$ ,  $2594161+(-2692663)$ ,  $2594161+(-2833823)$ ,  $2594161+3.26e+07$  respectively. The heterogeneity amongst the regions is highly significant.

The year dummy variables were significant for the year 2017 and 2018 indicating that a unit increase in sales (volumes) of cattle increased cattle resources for the significant years by  $2594161+514713.1$ TLU and  $2594161+533935.9$  respectively as compared to base year 2013 at 95% confidence level. However, it was insignificant for the year 2014-2016 as compared to base year 2013 as indicated below in Table 4.15.

Table 4.15. Results of Fixed Effects Estimation for Total Sales of Cattle by Regions and Years				
TotCatPop	Coef.	Std. Err.	t	P>t
TotCatSales	.7389449	.2033086	3.63	0.001***
Rg				
Afar Region	-1985384	283454.5	-7.00	0.000***
Amhara Region	6352267	392782.5	16.17	0.000 ***
Oromia Region	1.15e+07	530472.9	21.65	0.000***
Somali Region	-2465709	287162.1	-8.59	0.000***
Benishangul Gu.	-2445850	284818.2	-8.59	0.000***
SNNP Region	4151547	322210.5	12.88	0.000 ***
Gambella Region	-2692663	287449	-9.37	0.000***
Harari Region	-2833823	288227.4	-9.83	0.000***
Dire Dawa Region	-2841978	288337.6	-9.86	0.000***
National	3.26e+07	1225283	26.57	0.000***
Yr				
2014	139029.1	204518	0.68	0.500
2015	270053.2	205565.6	1.31	0.195
2016	219132	217543.6	1.01	0.319
2017	514713.1	210738.2	2.44	0.018**
2018	533935.9	218620.9	2.44	0.018**
_cons	2594161	240286.2	10.80	0.000***
Number of obs = 66	R-squared = 0.9987			
Prob > F = 0.0000	Adj R-squared = 0.9983			
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4o				

### ***B) Econometric Analysis of Sheep***

According to Table 16, the total sheep resource has significant effects on sales of sheep resource (in TLU) in Amhara (99%) (Positive) and Oromia (95%) (Positive) and SNNP (99%) (Positive) and Somali (95%) (Negative), given other regions remain constant, as compared to base region (Tigray region=11813.34) at 99% confidence level for Amhara and SNNP and at 95% confidence level for Oromia and Somali. The intercepts of Amhara, SNNP, Oromia and Somali are  $11813.34+799597.3$ ,  $11813.34+(-292889.8)$ ,  $11813.34+354499.5$  and  $-109563.4+11813.34$  respectively. The heterogeneity amongst regions is highly significant. A unit increase sales of sheep (in volume) reduced the cattle resource by the negative intercepts TLU of regions and increased by the positive intercepts TLU of the regions.

Regarding the year, the year dummy variables are insignificant indicating the sheep resources has not changed over time as indicated in Table 4.16.

Table 4.16. Results of Fixed Effects Estimation for Total Population of Sheep by Regions and Years				
TotSheSales	Coef.	Std. Err.	t	P>t
TotShePop	2.03982	.1887802	10.81	0.000***
Rg				
Afar Region	-19050.83	52232.81	-0.36	0.717
Amhara Region	799597.3	160210.9	4.99	0.000***
Oromia Region	354499.5	153439.9	2.31	0.025**
Somali Region	-109563.4	53018.72	-2.07	0.044 **
Benishangul Gu.	-3374.809	61170.98	-0.06	0.956
SNNP Region	-292889.8	74759.88	-3.92	0.000***
Gambella Region	-3639.984	61814.32	-0.06	0.953
Harari Region	-1862.029	62173.41	-0.03	0.976
Dire Dawa Admi.	-6489.405	61517.63	-0.11	0.916
National	733349.7	513077.5	1.43	0.159
Yr				
2014	-37635.85	38995.31	-0.97	0.339
2015	13404.38	40668.65	0.33	0.743
2016	30618.86	40204.18	0.76	0.450
2017	-22706.99	42421.28	-0.54	0.595
2018	-49736.79	43336.3	-1.15	0.257
_cons	11813.34	49826.74	0.24	0.814
Number of obs = 66		R-squared = 0.9984		
Prob > F = 0.0000		Adj R-squared = 0.9979		
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4p				

As indicated below in Table 4.17, sales of sheep has significant effects on sheep resources in SNNP region (positive) at 99 % confidence level and in Benishangu G. (positive), Gambella (positive), Harari (positive), Dire Dawa (positive) and at national at national (positive) at 90% confidence level, given other regions remain constant, as compared to base region (Tigray region=31266.02). A unit increase in sales of sheep (volume) increased the sheep resources (in TLU) by the positive intercepts (TLU) of the regions at corresponding confidence level. The intercepts of SNNP, Benishangu G., Gambella, Harari, Dire Dawa and at national at national are 31266.02+185115.8, -49059.25+185115.8, -50863.43+185115.8, -52514.41+185115.8, -49011.47+

185115.8 and 31266.02+546062.8 respectively. The heterogeneity amongst regions is highly significant.

Regarding the year, the year dummy variables of 3 years (2014-2016) were insignificant indicating the sheep resources have not changed over time; However, years 2017 and 2018 which is significant at 90% and 99% confidence level respectively as compared to base year 2013 (Table 4.17). A unit increase in sales of increased for the significant years by 31266.02+35837.5 TLU and 31266.02+48419.42 TLU respectively.

Table 4.17. Results of Fixed Effects Estimation for Total Sales of Sheep by Regions and Years				
TotShePop	Coef.	Std. Err.	t	P>t
TotSheSales	.3453151	.031958	10.81	0.000***
Rg				
Afar Region	501.8183	21519.97	0.02	0.981
Amhara Region	-38861.76	80766.51	-0.48	0.633
Oromia Region	103595.7	64813.64	1.60	0.116
Somali Region	22349.53	22519.81	0.99	0.326
Benishangul G.	-49059.25	24173.83	-2.03	0.048**
SNNP Region	185115.8	23306.2	7.94	0.000***
Gambella Region	-50863.43	24374.08	-2.09	0.042**
Harari Region	-52514.41	24456.4	-2.15	0.037 **
Dire Dawa Adm.	-49011.47	24326.44	-2.01	0.049 **
National	546062.8	200841.2	2.72	0.009**
Yr				
2014	22986.7	15859.82	1.45	0.154
2015	16027.95	16594.23	0.97	0.339
2016	7718.567	16602.85	0.46	0.644
2017	35837.5	16739.58	2.14	0.037**
2018	48419.42	16692.15	2.90	0.006***
_cons	31266.02	20020.53	1.56	0.125
Number of obs = 66		R-squared = 0.9985		
Prob > F = 0.0000		Adj R-squared = 0.9980		
Robust standard errors in parentheses				
***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4q				

### C) Econometric Analysis of Goats

The total goats resource has significant effects on sales of goats resource in Oromia (negative), Benishagul Gumuz (negative), SNNP (negative), Gambella (positive), Harari (positive), Dire Dawa Administration (positive), and at national (negative) given other regions remain constant,

as compared to base region (Tigray region=-372846.4) at 99 % confidence level. A unit increase in sales of goats (volume) increased the goats' resources (in TLU) by the positive and reduced by the negative intercepts (TLU) of the regions at 99% confidence level. The intercepts of Oromia, Benishagul Gumuz, SNNP, Gambella, Harari, Dire Dawa Administration, and at national are (-372846.4+-295341), (-372846.4+363772.5), (-372846.4+-509312.4), (-372846.4+393272.2), (-372846.4+398684.1), (-372846.4+380187.7) and (-372846.4+-2698333) respectively. The heterogeneity amongst regions is highly significant (Table 18).

Regarding the year, the year dummy variables are insignificant indicating the goats resources has not changed over time as compared to base year 2013 (Table 4.18).

Table 4.18. Results of Fixed Effects Estimation for Total Population of Goats by Regions and Years				
TotGoaSales	Coef.	Std. Err.	t	P>t
TotGoaPop	2.87598	.1807506	15.91	0.000***
Rg				
Afar Region	75573.97	65688.06	1.15	0.256
Amhara Region	116418.5	73342.47	1.59	0.119
Oromia Region	-295341	96744.28	-3.05	0.004***
Somali region	80120.38	73423.58	1.09	0.281
Benishangul Gu.	363772.5	90409.61	4.02	0.000***
SNNP Region	-509312.4	64937.56	-7.84	0.000***
Gambella Region	393272.2	95251.63	4.13	0.000***
Harari Region	398684.1	95672	4.17	0.000***
Dire Dawa Admi.	380187.7	93753.32	4.06	0.000***
National	-2698333	455351.7	-5.93	0.000***
Yr				
2014	-90879.46	48436.61	-1.88	0.067*
2015	-64233.54	49396.34	-1.30	0.200
2016	-53205	50083.81	-1.06	0.293
2017	-58853.4	50709.16	-1.16	0.251
2018	36443.65	54567.34	0.67	0.507
_cons	-372846.4	78269.01	-4.76	0.000***
Number of obs = 66		R-squared = 0.9960		
Prob > F = 0.0000		Adj R-squared = 0.9947		
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4r				

Sales of goats has significant effects (positive) on goats resources in Oromia, Somali, SNNP, and at national level and negative effects on goats resources in Benishangul Gumuz, Gambella, Harari, and Dire Dawa Administration at 99% confidence level (except Somali which is at 95%), given other regions remain constant, as compared to base region (Tigray region=159687.6). A unit increase sales of goats (volume) increased by the positive intercepts of Oromia, Somali, SNNP and at national level at corresponding confidence level. Also a unit increase in the sales of goats (volume) reduced goats' resource (in TLU) in Benishangul Gumuz, Gambella, Harari, and Dire Dawa Administration by the intercepts of the regions at 99% confidence level. The intercepts of Oromia, Somali, Benishangul G., SNNP, Gambella, Harari, Dire Dawa and at national level are  $159687.6+151914.7$ ,  $159687.6+-57184.86$ ,  $159687.6+-164158.6$ ,  $159687.6+162529.9$ ,  $159687.6+-178669.7$ ,  $159687.6+-180748.5$ ,  $159687.6+-173054.5$  and  $159687.6+ 1190678$  respectively. The heterogeneity amongst regions is highly significant (Table 4.19).

The year dummy variables were significant (positively) for the year 2014-2017 as compared to base year 2013 at 95% confidence level indicating that a unit increase in sales (volumes) of goats increased goats resources for the significant years by  $159687.6+38571.1$  TLU,  $159687.6+33608.39$  TLU,  $159687.6+32140.95$  TLU and  $159687.6 +35246.69$  TLU respectively. However, it was insignificant for the year 2018 as compared to base year 2013 as indicated below in Table 4.19.

Table 4.19. Results of Fixed Effects Estimation for Total Sales of Goats by Regions and Years				
TotGoaPop	Coef.	Std. Err.	t	P>t
TotGoaSales	.2913232	.0183092	15.91	0.000***
Rg				
Afar Region	-38728.19	20451.86	-1.89	0.064*
Amhara Region	-213.3214	23935.26	-0.01	0.993
Oromia Region	151914.7	25639.94	5.92	0.000***
Somali region	-57184.86	22195.01	-2.58	0.013**
Benishangul Gu.	-164158.6	23485.69	-6.99	0.000***
SNNP Region	162529.9	20598.35	7.89	0.000***
Gambella Region	-178669.7	24233.86	-7.37	0.000***
Harari Region	-180748.2	24269.81	-7.45	0.000***
Dire Dawa Admi.	-173054.5	24041.19	-7.20	0.000***
National	1190678	84390.77	14.11	0.000***
Yr				
2014	38571.1	14978.69	2.58	0.013**
2015	33608.39	15252.48	2.20	0.032**
2016	32140.95	15455.01	2.08	0.043**
2017	35246.69	15565.32	2.26	0.028 **
2018	14967.89	17314.44	0.86	0.392
_cons	159687.6	19685.17	8.11	0.000***
Number of obs = 66		R-squared = 0.9986		
Prob > F = 0.0000		Adj R-squared = 0.9981		
Robust standard errors in parentheses ***P<0.01, **P<0.05, *P<0.1				
Source: Annex 4s				

#### ***D) Discussions***

The production and marketing of cattle, sheep and goats in the regions (especially regions with large cattle population) were not guided by the demand and supply interactions in the market. The households in those regions were raising cattle and sheep not for the market and their participation were remaining very minimal. The regions with larger herd/flock size attained lower off-take rate (relatively) as compared to the national rate for cattle and sheep species and relatively higher for goats. The findings indicated it was in line with household model argument in Ouma *et al.*, (2003) which argued that the sales of livestock were decided by the households to sell their livestock to cover some of their households need, not for profit.

Similarly, the effects of livestock population on sales were positive in regions with larger size of livestock resources (cattle and sheep) and negative in those regions with larger livestock herds for goats. The effects on goats were due to the preferences of the export abattoirs. The results in

one or another depicted that the adequate herd/flock sizes were directly (positively) associated with the sales as argued in Negassa, *et al*, 2011.

## **CHAPTER FIVE**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1. Conclusions**

The positive and negative effects of commercial off-take on livestock resources (aged groups and sex category) or the inverse informs commercialization of livestock should pay attention to the stability and adequacy of the resources despite the huge resources available in the different regions.

The results indicated that there was mismatch between the supply of livestock resources and the demand for it. The extension services provided by the government and other actors were insignificant to transform the system from traditional production and marketing system (which is not guided by interactions in the market) to commercial one. The question of quality and quantity standard remain unanswered.

Therefore, it can be concluded that with the existing livestock production systems, the commercial off-take has significant effects on the livestock resources and vice versa in terms of volume of sales, trade channel, population size, sex, and age. The more the commercial off-take increases, the more it could have significant effects on the resources and the inverse holds true. The levels of effects between regions were also different for the three livestock species. Thus, all null ( $H_0$ ) hypotheses (indicated in table 1.1) were rejected and the alternative ones accepted ( $H_1$ ).

#### **5.2. Recommendations**

The existing traditional livestock production and marketing systems in Ethiopia (with those livestock resources under consideration) can contribute positively if and only if the process of commercialization could be guided by researches, capacity building of the different actors in the sub-sector and intensive investments in developments of ranches and commercial farming; otherwise, The accelerated increment of consumer demand (per-capita income of the households) and expanding volume of livestock export may not grantee the positive effects of commercial off-take.

Therefore, this study strongly recommends the following 4 key points. These are:

- a. The researchers and policy makers need to conduct further studies on relationship and its effects between commercial off-take and livestock resources continually prior to merely making decision on market participation of the herders to improve commercial off-take (especially exports) with existing huge livestock resources.
- b. Building the capacity of youths and smallholders to actively engage in the value chains development through establishments of cooperatives.
- c. Intensive investments to develop ranches and livestock commercial farming in the different regions that could be the best solution to address the projected meat deficits in the economy; otherwise, the focus of the government on the traditional farming system could help only the food self sufficiency of rural communities; and
- d. Creation of enabling environments that would ensure the active engagement of the stakeholders in the sub-sector.

### **5.3. Limitations of the Study and Implications for Future Research**

The study mainly relied on secondary data obtained from CSA-Ethiopia and the Ministry of Agriculture (MoA). The level of analysis was at regional level, not at household level. Besides, the secondary data on informal trade was estimated based on the secondary data on formal trade of livestock.

Commercial off-take rate was increased for the goat but declined for cattle and sheep over years. This could be due to expanding of abattoirs and/or the practices in the informal trade at cross borders of the country. This needs further research.

The significance level of the informal livestock trade informs the need to assess the effects of informal livestock trade on formal trade and resources at household level and regions. Future studies need to focus on relationships and corresponding effects between commercial off-take and livestock resources at household and regional level.

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## Annex 1: Secondary Data Collected and Organized on Livestock Resources and Commercial Off-take in Ethiopia

### Annex 1a: Volume of Formal Livestock (Live Animals) Exported by Year and Region in Ethiopia

No	Region	Year	Exported Live Cattle in Number	Exported Live Sheep in Number	Exported Live Goats in Number	Converted Cattle meat to live cattle	Converted Mutton meat to Live animal based on 10kg/head	Converted goat meat to Live animal based on 8.5kg/head	Total exported Cattle	Total exported Sheep	Total exported Goats
0	1	2	3	4	5	6	7	8	9=3+6	10=4+7	11=5+8
1	Tigray Region	2012/13	5499	38819	0	0	15521	0	5499	54340	0
		2013/14	6148	34638	0	0	15704	0	6148	50342	0
		2014/15	4284	30008	0	0	19052	0	4284	49060	0
		2015/16	4592	39833	0	0	19037	0	4592	58870	0
		2016/17	2425	16532	0	0	19779	0	2425	36311	0
		2017/18	1953	26449	0	0	20548	0	1953	46997	0
2	Afar Region	2012/13	0	0	8524	0	0	410860	0	0	419384
		2013/14	0	0	10446	0	0	415697	0	0	426143
		2014/15	0	0	6996	0	0	504307	0	0	511303
		2015/16	0	0	20681	0	0	503921	0	0	524602
		2016/17	0	0	5241	0	0	523567	0	0	528808
		2017/18	0	0	3089	0	0	543904	0	0	546993
3	Amhara Region	2012/13	5499	38819	2046	0	15521	98606	5499	54340	100652
		2013/14	6148	34638	2507	0	15704	99767	6148	50342	102274
		2014/15	4283	30008	1679	0	19052	121034	4283	49060	122713
		2015/16	4592	39833	4963	0	19037	120941	4592	58870	125904
		2016/17	2425	16532	1258	0	19779	125656	2425	36311	126914
		2017/18	1953	26449	741	0	20548	130537	1953	46997	131278
4	Oromia Region	2012/13	155792	77638	4773	0	31044	230081	155792	108682	234854
		2013/14	174182	69276	5850	0	31408	232790	174182	100684	238640
		2014/15	121370	60015	3918	0	38102	282412	121370	98117	286330
		2015/16	130092	79667	11581	0	38074	282196	130092	117741	293777
		2016/17	68720	33064	2935	0	39559	293198	68720	72623	296133



10	Dire Dawa	2012/13	0	0	0	0	0	0	0	0	0
		2013/14	0	0	0	0	0	0	0	0	0
		2014/15	0	0	0	0	0	0	0	0	0
		2015/16	0	0	0	0	0	0	0	0	0
		2016/17	0	0	0	0	0	0	0	0	0
		2017/18	0	0	0	0	0	0	0	0	0
11	National	2012/13	183285	388189	34096	0	155214	1643438	183285	543403	1677534
		2013/14	204921	346382	41784	0	157041	1662787	204921	503423	1704571
		2014/15	142788	300077	27982	0	190516	2017228	142788	490593	2045210
		2015/16	153051	398333	82724	0	190370	2015682	153051	588703	2098406
		2016/17	80847	165320	20962	0	197792	2094268	80847	363112	2115230
		2017/18	65104	264488	12357	0	205475	2175618	65104	469963	2187975

Source: MoA 2019, Unpublished report

Note:

- There is no compiled data by region, but the livestock experts' estimated the regional export volume
- Share by source (region) is also estimated as indicated by %
- The export of meat (goat and mutton) is increasing from time to time; however, the volume of exported live animals is decreasing from time to time which in turn decreases the income from export. On the other hand the informal trade is increasing even though not verified with study. (up to 10% experts' judgment)

Annex 1b: Volume of Exported Meat by Year and Region in Ethiopia

No	Region	Year	Exported Cattle Meat (beef) in Tons	Exported Mutton in Tons	Exported Goats meat in Tons	Total meat export in Tons	converted Mutton meat to Live animal based on 10kg/head	converted goat meat to Live animal based on 8.5kg/head
1	Tigray Region	2012/13	-	155.21	-	155.21	15521	0
		2013/14	-	157.04	-	157.04	15704	0
		2014/15	-	190.52	-	190.52	19052	0
		2015/16	-	190.37	-	190.37	19037	0
		2016/17	-	197.79	-	197.79	19779	0
		2017/18	-	205.48	-	205.48	20548	0
2	Afar Region	2012/13	-	-	3,492.31	3,492.31	0	410860
		2013/14	-	-	3,533.42	3,533.42	0	415697
		2014/15	-	-	4,286.61	4,286.61	0	504307
		2015/16	-	-	4,283.33	4,283.33	0	503921
		2016/17	-	-	4,450.32	4,450.32	0	523567
		2017/18	-	-	4,623.19	4,623.19	0	543904
3	Amhara Region	2012/13	-	155.21	838.15	993.37	15521	98606
		2013/14	-	157.04	848.02	1,005.06	15704	99767
		2014/15	-	190.52	1,028.79	1,219.30	19052	121034
		2015/16	-	190.37	1,028.00	1,218.37	19037	120941
		2016/17	-	197.79	1,068.08	1,265.87	19779	125656
		2017/18	-	205.48	1,109.57	1,315.04	20548	130537
4	Oromia Region	2012/13	-	310.43	1,955.69	2,266.12	31044	230081
		2013/14	-	314.08	1,978.72	2,292.80	31408	232790
		2014/15	-	381.03	2,400.50	2,781.53	38102	282412
		2015/16	-	380.74	2,398.66	2,779.40	38074	282196
		2016/17	-	395.58	2,492.18	2,887.76	39559	293198
		2017/18	-	410.95	2,588.99	2,999.94	41094	304587
5	Somali Region	2012/13	-	931.28	6,984.61	7,915.89	93128	821719
		2013/14	-	942.25	7,066.85	8,009.09	94225	831394
		2014/15	-	1,143.10	8,573.22	9,716.32	114310	1008614
		2015/16	-	1,142.22	8,566.65	9,708.87	114222	1007840
		2016/17	-	1,186.75	8,900.64	10,087.39	118675	1047134
		2017/18	-	1,232.85	9,246.38	10,479.23	123285	1087809
6	Benishagul G. Region	2012/13	-	-	-	-	0	0
		2013/14	-	-	-	-	0	0
		2014/15	-	-	-	-	0	0
		2015/16	-	-	-	-	0	0
		2016/17	-	-	-	-	0	0
		2017/18	-	-	-	-	0	0
7	SNNP Region	2012/13	-	-	698.46	698.46	0	82172
		2013/14	-	-	706.68	706.68	0	83139
		2014/15	-	-	857.32	857.32	0	100861
		2015/16	-	-	856.67	856.67	0	100784
		2016/17	-	-	890.06	890.06	0	104713
		2017/18	-	-	924.64	924.64	0	108781

8	Gambella Region	2012/13	-	-	-	-	0	0
		2013/14	-	-	-	-	0	0
		2014/15	-	-	-	-	0	0
		2015/16	-	-	-	-	0	0
		2016/17	-	-	-	-	0	0
		2017/18	-	-	-	-	0	0
9	Harari Region	2012/13	-	-	-	-	0	0
		2013/14					0	0
		2014/15					0	0
		2015/16					0	0
		2016/17					0	0
		2017/18	-	-	-	-	0	0
10	Dire Dawa	2012/13	-	-	-	-	0	0
		2013/14	-	-	-	-	0	0
		2014/15	-	-	-	-	0	0
		2015/16	-	-	-	-	0	0
		2016/17	-	-	-	-	0	0
		2017/18	-	-	-	-	0	0
11	National	2012/13	-	1,552.14	13,969.22	15,521.36	155214	1643438
		2013/14	-	1,570.41	14,133.69	15,704.10	157041	1662787
		2014/15	-	1,905.16	17,146.44	19,051.60	190516	2017228
		2015/16	-	1,903.70	17,133.30	19,037.00	190370	2015682
		2016/17	-	1,977.92	17,801.28	19,779.20	197792	2094268
		2017/18	-	2,054.75	18,492.75	20,547.50	205475	2175618

Source: MoA 2019, unpublished report

Note:

- There was no compiled data by region, but the livestock experts in the MoA estimated the regional export volume
- Estimated share of export were 90% goat meat exports and the rest (10%) sheep.
- share by source (region) is also estimated as indicated by %
- cattle meat is not exported so far
- meat to live animal is converted 8.5kg/head for goat, 10kg/head for sheep, and 108kg/head for cattle according to Negassa, A. et al 2011
- trend shows meat export is increasing

Annex 1c: Estimated Volume of Informal Livestock Traded by Year and Region in Ethiopia

No	Region	Year	Volume of Formal Livestock (Live Animals) Exported			Estimated Volume Informal Livestock Trade		
			Cattle	Sheep	Goats	Cattle	Sheep	Goats
1	Tigray Region	2012/13	5499	54340	0	21996	217360	0
		2013/14	6148	50342	0	24592	201368	0
		2014/15	4284	49060	0	17136	196240	0
		2015/16	4592	58870	0	18368	235480	0
		2016/17	2425	36311	0	9700	145244	0
		2017/18	1953	46997	0	7812	187988	0
2	Afar Region	2012/13	0	0	419384	0	0	1677536
		2013/14	0	0	426143	0	0	1704572
		2014/15	0	0	511303	0	0	2045212
		2015/16	0	0	524602	0	0	2098408
		2016/17	0	0	528808	0	0	2115232
		2017/18	0	0	546993	0	0	2187972
3	Amhara Region	2012/13	5499	54340	100652	21996	217360	402608
		2013/14	6148	50342	102274	24592	201368	409096
		2014/15	4283	49060	122713	17132	196240	490852
		2015/16	4592	58870	125904	18368	235480	503616
		2016/17	2425	36311	126914	9700	145244	507656
		2017/18	1953	46997	131278	7812	187988	525112
4	Oromia Region	2012/13	155792	108682	234854	623168	434728	939416
		2013/14	174182	100684	238640	696728	402736	954560
		2014/15	121370	98117	286330	485480	392468	1145320
		2015/16	130092	117741	293777	520368	470964	1175108
		2016/17	68720	72623	296133	274880	290492	1184532

		2017/18	55338	93992	306317	221352	375968	1225268
5	Somali Region	2012/13	7331	326041	838767	29324	1304164	3355068
		2013/14	8197	302055	852286	32788	1208220	3409144
		2014/15	5712	294356	1022604	22848	1177424	4090416
		2015/16	6122	353222	1049202	24488	1412888	4196808
		2016/17	3235	217867	1057615	12940	871468	4230460
		2017/18	2605	281977	1093988	10420	1127908	4375952
6	Benishagul G. Region	2012/13	0	0	0	0	0	0
		2013/14	0	0	0	0	0	0
		2014/15	0	0	0	0	0	0
		2015/16	0	0	0	0	0	0
		2016/17	0	0	0	0	0	0
		2017/18	0	0	0	0	0	0
7	SNNP Region	2012/13	9164	0	83877	36656	0	335508
		2013/14	10246	0	85228	40984	0	340912
		2014/15	7139	0	102260	28556	0	409040
		2015/16	7653	0	104921	30612	0	419684
		2016/17	4042	0	105760	16168	0	423040
		2017/18	3255	0	109399	13020	0	437596
8	Gambella Region	2012/13	0	0	0	0	0	0
		2013/14	0	0	0	0	0	0
		2014/15	0	0	0	0	0	0
		2015/16	0	0	0	0	0	0
		2016/17	0	0	0	0	0	0
		2017/18	0	0	0	0	0	0
9	Harari Region	2012/13	0	0	0	0	0	0
		2013/14	0	0	0	0	0	0

		2014/15	0	0	0	0	0	0
		2015/16	0	0	0	0	0	0
		2016/17	0	0	0	0	0	0
		2017/18	0	0	0	0	0	0
10	Dire Dawa	2012/13	0	0	0	0	0	0
		2013/14	0	0	0	0	0	0
		2014/15	0	0	0	0	0	0
		2015/16	0	0	0	0	0	0
		2016/17	0	0	0	0	0	0
		2017/18	0	0	0	0	0	0
11	National	2012/13	183285	543403	1677534	733140	2173612	6710136
		2013/14	204921	503423	1704571	819684	2013692	6818284
		2014/15	142788	490593	2045210	571152	1962372	8180840
		2015/16	153051	588703	2098406	612204	2354812	8393624
		2016/17	80847	363112	2115230	323388	1452448	8460920
		2017/18	65104	469963	2187975	260416	1879852	8751900
Source: MoA 2019, Unpublished report								

Note:

- There is no compiled data by region, but the livestock experts estimated the regional export volume
- Share by source (region) is also estimated as indicated by %
- The export of meat (goat and mutton) is increasing from time to time; however, the volume of exported live animals is decreasing from time to time which in turn decreases the income from export. On the other hand the informal trade is increasing (up to 10% experts' judgment) even though not verified with study.

### Annex 1d: Age and Sex Category of Cattle by Year and Region in Ethiopia

No	Region	Year	Cattle Number						Cattle in TLU					
			Male Cattle 3-10 years age	Female Cattle 3-10 years age	Male Cattle less than 3 years age	Female Cattle less than 3 years age	Male Cattle above 10 years age	Female Cattle above 10 years age	Male Cattle 3-10 years age	Female Cattle 3-10 years age	Male Cattle less than 3 years age	Female Cattle less than 3 years age	Male Cattle above 10 years age	Female Cattle above 10 years age
1	Tigre Region	2012/13	1207819	1337327	632834	718105	93253	75744	845,473.30	936,128.90	442,983.80	502,673.50	65,277.10	53,020.80
		2013/14	1296942	1367592	664496	766792	119615	82587	907,859.40	957,314.40	465,147.20	536,754.40	83,730.50	57,810.90
		2014/15	1394104	1492171	719402	807379	98366	66759	975,872.80	1,044,519.70	503,581.40	565,165.30	68,856.20	46,731.30
		2015/16	1381093	1469486	735129	809651	128183	89933	966,765.10	1,028,640.20	514,590.30	566,755.70	89,728.10	62,953.10
		2016/17	1482613	1553735	735884	784432	131734	102942	1,037,829.10	1,087,614.50	515,118.80	549,102.40	92,213.80	72,059.40
		2017/18	1446640	1518580	763224	899767	108106	80786	1,012,648.00	1,063,006.00	534,256.80	629,836.90	75,674.20	56,550.20
2	Afar Region	2012/13	103588	585432	156177	336845	0	6317	72,511.60	409,802.40	109,323.90	235,791.50	-	4,421.90
		2013/14	106333	676247	191006	366162	3370	16790	74,433.10	473,372.90	133,704.20	256,313.40	2,359.00	11,753.00
		2014/15	109005	805549	206335	435722	0	18928	76,303.50	563,884.30	144,434.50	305,005.40	-	13,249.60
		2015/16	118632	753935	195279	406460	3555	17192	83,042.40	527,754.50	136,695.30	284,522.00	2,488.50	12,034.40
		2016/17	96703	665915	161761	352996	5925	0	67,692.10	466,140.50	113,232.70	247,097.20	4,147.50	-
		2017/18	83520	665551	195320	343512	0	0	58,464.00	465,885.70	136,724.00	240,458.40	-	-
3	Amhara Region	2012/13	4692609	4397253	2044507	2105936	321049	205569	3,284,826.30	3,078,077.10	1,431,154.90	1,474,155.20	224,734.30	143,898.30
		2013/14	4829625	4528320	2071350	2203108	357985	235600	3,380,737.50	3,169,824.00	1,449,945.00	1,542,175.60	250,589.50	164,920.00
		2014/15	5124564	4684774	2146699	2274378	279703	200792	3,587,194.80	3,279,341.80	1,502,689.30	1,592,064.60	195,792.10	140,554.40
		2015/16	5222137	4926375	2391433	2506246	235390	173340	3,655,495.90	3,448,462.50	1,674,003.10	1,754,372.20	164,773.00	121,338.00
		2016/17	5365997	5037070	2432319	2635747	288075	223332	3,756,197.90	3,525,949.00	1,702,623.30	1,845,022.90	201,652.50	156,332.40
		2017/18	5442020	5096560	2517881	2604628	257361	229939	3,809,414.00	3,567,592.00	1,762,516.70	1,823,239.60	180,152.70	160,957.30
4	Oromia Region	2012/13	6321578	7954647	3587413	4031026	235794	223595	4,425,104.60	5,568,252.90	2,511,189.10	2,821,718.20	165,055.80	156,516.50
		2013/14	6419462	7935813	3700832	4015319	199517	234276	4,493,623.40	5,555,069.10	2,590,582.40	2,810,723.30	139,661.90	163,993.20
		2014/15	6418428	8081170	3772875	4261855	189148	202254	4,492,899.60	5,656,819.00	2,641,012.50	2,983,298.50	132,403.60	141,577.80
		2015/16	6659184	8192377	3813445	4240709	225386	205410	4,661,428.80	5,734,663.90	2,669,411.50	2,968,496.30	157,770.20	143,787.00
		2016/17	6773596	8493876	3866956	4595946	207837	206149	4,741,517.20	5,945,713.20	2,706,869.20	3,217,162.20	145,485.90	144,304.30
		2017/18	6811830	8589929	3982521	4644415	186168	218112	4,768,281.00	6,012,950.30	2,787,764.70	3,251,090.50	130,317.60	152,678.40
5	Somali Region	2012/13	77695	273334	109384	132855	0	3793	54,386.50	191,333.80	76,568.80	92,998.50	-	2,655.10
		2013/14	77266	267437	124202	139606	0	1805	54,086.20	187,205.90	86,941.40	97,724.20	-	1,263.50
		2014/15	75072	286797	127905	152162	0	0	52,550.40	200,757.90	89,533.50	106,513.40	-	-
		2015/16	90028	262554	123885	153119	0	1117	63,019.60	183,787.80	86,719.50	107,183.30	-	781.90
		2016/17	82870	259509	101293	139051	0	1965	58,009.00	181,656.30	70,905.10	97,335.70	-	1,375.50
		2017/18	90961	251256	120516	125243	0	0	63,672.70	175,879.20	84,361.20	87,670.10	-	-
6	Benishagul G. Region	2012/13	157887	203781	93614	94987	4111	4172	110,520.90	142,646.70	65,529.80	66,490.90	2,877.70	2,920.40

		2013/14	144603	251165	94038	105559	3642	5556	101,222.10	175,815.50	65,826.60	73,891.30	2,549.40	3,889.20
		2014/15	182802	230531	116555	116840	6286	6574	127,961.40	161,371.70	81,588.50	81,788.00	4,400.20	4,601.80
		2015/16	190860	257073	126444	130948	11817	9124	133,602.00	179,951.10	88,510.80	91,663.60	8,271.90	6,386.80
		2016/17	204555	277459	131103	145393	9816	9588	143,188.50	194,221.30	91,772.10	101,775.10	6,871.20	6,711.60
		2017/18	203912	273556	150921	157704	3452	5480	142,738.40	191,489.20	105,644.70	110,392.80	2,416.40	3,836.00
7	SNNP Region	2012/13	2238331	4593487	1797322	1265414	40285	145985	1,566,831.70	3,215,440.90	1,258,125.40	885,789.80	28,199.50	102,189.50
		2013/14	2199166	4656146	1795025	1241700	39697	112412	1,539,416.20	3,259,302.20	1,256,517.50	869,190.00	27,787.90	78,688.40
		2014/15	2291713	4615173	1843636	1268603	35569	60941	1,604,199.10	3,230,621.10	1,290,545.20	888,022.10	24,898.30	42,658.70
		2015/16	2266571	4847614	1719688	1210891	38468	87920	1,586,599.70	3,393,329.80	1,203,781.60	847,623.70	26,927.60	61,544.00
		2016/17	2284223	4625892	1957992	2000571	31039	85431	1,598,956.10	3,238,124.40	1,370,594.40	1,400,399.70	21,727.30	59,801.70
		2017/18	2873069	4518027	1969411	2425721	35261	62060	2,011,148.30	3,162,618.90	1,378,587.70	1,698,004.70	24,682.70	43,442.00
8	Gambella Region	2012/13	33309	125129	45760	68438	1062	3353	23,316.30	87,590.30	32,032.00	47,906.60	743.40	2,347.10
		2013/14	33630	130139	45562	64398	315	2202	23,541.00	91,097.30	31,893.40	45,078.60	220.50	1,541.40
		2014/15	35642	131704	43761	66127	0	1062	24,949.40	92,192.80	30,632.70	46,288.90	-	743.40
		2015/16	36856	123879	47073	71611	0	1114	25,799.20	86,715.30	32,951.10	50,127.70	-	779.80
		2016/17	36207	138256	45901	59890	0	1961	25,344.90	96,779.20	32,130.70	41,923.00	-	1,372.70
		2017/18	34381	142645	43827	59943	0	3113	24,066.70	99,851.50	30,678.90	41,960.10	-	2,179.10
9	Harari Region	2012/13	7898	21845	10457	11896	0	736	5,528.60	15,291.50	7,319.90	8,327.20	-	515.20
		2013/14	7582	23799	12994	12349	0	533	5,307.40	16,659.30	9,095.80	8,644.30	-	373.10
		2014/15	7708	24463	14563	15066	0	0	5,395.60	17,124.10	10,194.10	10,546.20	-	-
		2015/16	10669	27339	14411	15361	0	461	7,468.30	19,137.30	10,087.70	10,752.70	-	322.70
		2016/17	8815	27698	15583	16754	0	503	6,170.50	19,388.60	10,908.10	11,727.80	-	352.10
		2017/18	8804	26715	16353	18754	0	0	6,162.80	18,700.50	11,447.10	13,127.80	-	-
10	Dire Dawa	2012/13	7807	17026	10176	11525	0	620	5,464.90	11,918.20	7,123.20	8,067.50	-	434.00
		2013/14	6944	16585	9754	11090	0	621	4,860.80	11,609.50	6,827.80	7,763.00	-	434.70
		2014/15	7119	19296	10648	12241	0	575	4,983.30	13,507.20	7,453.60	8,568.70	-	402.50
		2015/16	7546	19869	12213	11987	0	994	5,282.20	13,908.30	8,549.10	8,390.90	-	695.80
		2016/17	8572	21469	10207	11809	0	0	6,000.40	15,028.30	7,144.90	8,266.30	-	-
		2017/18	6583	19306	12437	13008	0	0	4,608.10	13,514.20	8,705.90	9,105.60	-	-
11	National	2012/13	14848521	19509262	8487644	9777025	697727	669883	10,393,964.70	13,656,483.40	5,941,350.80	6,843,917.50	488,408.90	468,918.10
		2013/14	15121553	19853243	8709261	9926085	724758	692382	10,585,087.10	13,897,270.10	6,096,482.70	6,948,259.50	507,330.60	484,667.40
		2014/15	15646158	20371628	9002379	10510373	614453	561399	10,952,310.60	14,260,139.60	6,301,665.30	7,357,261.10	430,117.10	392,979.30
		2015/16	15983576	20880503	9179000	10556979	643290	586604	11,188,503.20	14,616,352.10	6,425,300.00	7,389,885.30	450,303.00	410,622.80
		2016/17	16344151	21100880	9459001	11242588	675225	664822	11,440,905.70	14,770,616.00	6,621,300.70	7,869,811.60	472,657.50	465,375.40
		2017/18	17001719	21102125	9772413	11292693	593708	629361	11,901,203.30	14,771,487.50	6,840,689.10	7,904,885.10	415,595.60	440,552.70

Source: CSA-Ethiopia



		2012/13	5242	39027	22752	26111	524.20	3,902.70	2,275.20	2,611.10
		2013/14	3020	36410	21258	23136	302.00	3,641.00	2,125.80	2,313.60
		2014/15	7292	43407	28867	24980	729.20	4,340.70	2,886.70	2,498.00
		2015/16	4997	38744	25947	28247	499.70	3,874.40	2,594.70	2,824.70
		2016/17	3940	37933	25600	32541	394.00	3,793.30	2,560.00	3,254.10
		2017/18	4721	62233	38508	54568	472.10	6,223.30	3,850.80	5,456.80
7	SNNP Region									
		2012/13	286133	1915008	839338	1077904	28,613.30	191,500.80	83,933.80	107,790.40
		2013/14	368386	2144490	997240	1238560	36,838.60	214,449.00	99,724.00	123,856.00
		2014/15	383404	2079608	926351	1190857	38,340.40	207,960.80	92,635.10	119,085.70
		2015/16	408274	2284350	907418	1103516	40,827.40	228,435.00	90,741.80	110,351.60
		2016/17	413398	2251741	1085903	1335966	41,339.80	225,174.10	108,590.30	133,596.60
		2017/18	337203	2108045	1018863	1175494	33,720.30	210,804.50	101,886.30	117,549.40
8	Gambella Region									
		2012/13	3595	20128	10815	15396	359.50	2,012.80	1,081.50	1,539.60
		2013/14	3887	18170	11000	12373	388.70	1,817.00	1,100.00	1,237.30
		2014/15	2253	12885	8731	11607	225.30	1,288.50	873.10	1,160.70
		2015/16	4528	17383	8008	14366	452.80	1,738.30	800.80	1,436.60
		2016/17	4349	15965	11345	12644	434.90	1,596.50	1,134.50	1,264.40
		2017/18	5147	14142	7414	8584	514.70	1,414.20	741.40	858.40
9	Harari Region									
		2012/13	339	2955	1366	1735	33.90	295.50	136.60	173.50
		2013/14	0	4184	1744	2153	-	418.40	174.40	215.30
		2014/15	231	2922	1802	1332	23.10	292.20	180.20	133.20
		2015/16	419	4257	1977	2501	41.90	425.70	197.70	250.10
		2016/17	295	3677	1623	1505	29.50	367.70	162.30	150.50
		2017/18	0	2939	497	967	-	293.90	49.70	96.70
10	Dire Dawa									
		2012/13	1995	32707	13872	19216	199.50	3,270.70	1,387.20	1,921.60
		2013/14	2422	30409	16726	23008	242.20	3,040.90	1,672.60	2,300.80
		2014/15	2368	36650	19563	27963	236.80	3,665.00	1,956.30	2,796.30
		2015/16	3569	32448	14276	25127	356.90	3,244.80	1,427.60	2,512.70
		2016/17	2645	31806	12138	17645	264.50	3,180.60	1,213.80	1,764.50
		2017/18	4199	30730	11872	17531	419.90	3,073.00	1,187.20	1,753.10
11	National									
		2012/13	1444710	12011928	5292221	6740345	144,471.00	1,201,192.80	529,222.10	674,034.50
		2013/14	1679201	12751326	5781508	7135897	167,920.10	1,275,132.60	578,150.80	713,589.70
		2014/15	1730596	13519667	6256514	7825604	173,059.60	1,351,966.70	625,651.40	782,560.40
		2015/16	1834319	13603713	6012386	7441963	183,431.90	1,360,371.30	601,238.60	744,196.30
		2016/17	1940878	14023721	6611406	8121937	194,087.80	1,402,372.10	661,140.60	812,193.70
		2017/18	2040538	14302918	6781223	8177577	204,053.80	1,430,291.80	678,122.30	817,757.70

Source: CSA-Ethiopia



		2017/18	25013	229851	143559	204417	2,501.30	22,985.10	14,355.90	20,441.70
7	SNNP Region									
		2012/13	492441	1697371	751942	970377	49,244.10	169,737.10	75,194.20	97,037.70
		2013/14	550105	2161593	1025063	1216828	55,010.50	216,159.30	102,506.30	121,682.80
		2014/15	616603	2055728	996897	1423400	61,660.30	205,572.80	99,689.70	142,340.00
		2015/16	630621	2502626	981324	1228502	63,062.10	250,262.60	98,132.40	122,850.20
		2016/17	738388	2076532	1060690	1382640	73,838.80	207,653.20	106,069.00	138,264.00
		2017/18	481967	2152114	1045703	1278472	48,196.70	215,211.40	104,570.30	127,847.20
8	Gambella Region									
		2012/13	5640	32754	18138	27698	564.00	3,275.40	1,813.80	2,769.80
		2013/14	3988	36479	21071	28323	398.80	3,647.90	2,107.10	2,832.30
		2014/15	4550	37339	19332	27388	455.00	3,733.90	1,933.20	2,738.80
		2015/16	6633	39207	19348	28996	663.30	3,920.70	1,934.80	2,899.60
		2016/17	6015	40587	20933	31482	601.50	4,058.70	2,093.30	3,148.20
		2017/18	4655	45401	25832	31195	465.50	4,540.10	2,583.20	3,119.50
9	Harari Region									
		2012/13	3028	22631	11632	13748	302.80	2,263.10	1,163.20	1,374.80
		2013/14	3764	24856	13546	16265	376.40	2,485.60	1,354.60	1,626.50
		2014/15	3196	25289	15093	14047	319.60	2,528.90	1,509.30	1,404.70
		2015/16	5153	31817	15037	15715	515.30	3,181.70	1,503.70	1,571.50
		2016/17	3703	30361	18508	19983	370.30	3,036.10	1,850.80	1,998.30
		2017/18	4531	28610	17248	19513	453.10	2,861.00	1,724.80	1,951.30
10	Dire Dawa									
		2012/13	9324	79860	36146	53237	932.40	7,986.00	3,614.60	5,323.70
		2013/14	9390	74779	38975	60612	939.00	7,477.90	3,897.50	6,061.20
		2014/15	9485	88651	42627	69219	948.50	8,865.10	4,262.70	6,921.90
		2015/16	9960	87203	42357	63186	996.00	8,720.30	4,235.70	6,318.60
		2016/17	14461	95486	39318	56539	1,446.10	9,548.60	3,931.80	5,653.90
		2017/18	15665	106243	52455	75031	1,566.50	10,624.30	5,245.50	7,503.10
11	National									
		2012/13	1948077	10428645	5015213	6668856	194,807.70	1,042,864.50	501,521.30	666,885.60
		2013/14	2249990	12203307	5922052	7787982	224,999.00	1,220,330.70	592,205.20	778,798.20
		2014/15	2294890	12285914	6125042	8407116	229,489.00	1,228,591.40	612,504.20	840,711.60
		2015/16	2297051	3081463	6147178	18179266	229,705.10	308,146.30	614,717.80	1,817,926.60
		2016/17	2494672	12743870	6379794	8581890	249,467.20	1,274,387.00	637,979.40	858,189.00
		2017/18	2426212	13964515	7233471	9114186	242,621.20	1,396,451.50	723,347.10	911,418.60

Source: CSA-Ethiopia

## Annex 1g: Livestock Population by Year and Region in Ethiopia

No	Region	Year	Cattle Number			Cattle in TLU			Sheep Number			Sheep in TLU			Goats Number			Goats in TLU		
			Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
1	Tigray Region																			
		2012/13	4065082	1933906	2131176	2,845,557.40	1,353,734.20	1,491,823.20	1381622	351641	1029980	138,162.20	35,164.10	102,998.00	3191184	880181	2311003	319,118.40	88,018.10	231,100.30
		2013/14	4298023	2081053	2216971	3,008,616.10	1,456,737.10	1,551,879.70	1481963	378434	1103528	148,196.30	37,843.40	110,352.80	4000252	1060964	2939289	400,025.20	106,096.40	293,928.90
		2014/15	4578181	2211872	2366309	3,204,726.70	1,548,310.40	1,656,416.30	1817305	472813	1344492	181,730.50	47,281.30	134,449.20	4255290	1152053	3103238	425,529.00	115,205.30	310,323.80
		2015/16	4613475	2244405	2369070	3,229,432.50	1,571,083.50	1,658,349.00	1637697	406370	1231327	163,769.70	40,637.00	123,132.70	3948276	1047566	2900708	394,827.60	104,756.60	290,070.80
		2016/17	4791341	2350231	2441109	3,353,938.70	1,645,161.70	1,708,776.30	2041731	495368	1546365	204,173.10	49,536.80	154,636.50	4584138	1109518	3474619	458,413.80	110,951.80	347,461.90
		2017/18	4817104	2317970	2499133	3,371,972.80	1,622,579.00	1,749,393.10	2472938	629739	1843197	247,293.80	62,973.90	184,319.70	4301221	1175973	3125247	430,122.10	117,597.30	312,524.70
2	Afar Region																			
		2012/13	1190166	259765	928594	833,116.20	181,835.50	650,015.80	916353	198527	717826	91,635.30	19,852.70	71,782.60	1935611	375210	1560400	193,561.10	37,521.00	156,040.00
		2013/14	1359908	300709	1059199	951,935.60	210,496.30	741,439.30	1474618	350885	1123733	147,461.80	35,088.50	112,373.30	2984271	649611	2334660	298,427.10	64,961.10	233,466.00
		2014/15	1580313	315340	1260199	1,106,219.10	220,738.00	882,139.30	1665727	373143	1292585	166,572.70	37,314.30	129,258.50	3149351	650749	2498602	314,935.10	65,074.90	249,860.20
		2015/16	1495054	317466	1177587	1,046,537.80	222,226.20	824,310.90	1732090	375119	1356972	173,209.00	37,511.90	135,697.20	3301056	643407	2657649	330,105.60	64,340.70	265,764.90
		2016/17	1315917	264389	1018911	921,141.90	185,072.30	713,237.70	1729159	449350	1279808	172,915.90	44,935.00	127,980.80	3461260	754269	2706991	346,126.00	75,426.90	270,699.10
		2017/18	1317139	278840	1009063	921,997.30	195,188.00	706,344.10	2081955	520803	1561150	208,195.50	52,080.30	156,115.00	3265403	736707	2528696	326,540.30	73,670.70	252,869.60
3	Amhara Region																			
		2012/13	13766923	7058165	6708758	9,636,846.10	4,940,715.50	4,696,130.60	8825061	2314596	6510465	882,506.10	231,459.60	651,046.50	5102580	1647363	3455215	510,258.00	164,736.30	345,521.50
		2013/14	14225988	7258960	6967028	9,958,191.60	5,081,272.00	4,876,919.60	8518066	2269988	6248077	851,806.60	226,998.80	624,807.70	5291571	1690676	3600895	529,157.10	169,067.60	360,089.50
		2014/15	14710911	7550966	7159944	10,297,637.70	5,285,676.20	5,011,960.80	10024277	2689196	7335081	1,002,427.70	268,919.60	733,508.10	6064944	1982001	4082942	606,494.40	198,200.10	408,294.20
		2015/16	15454923	7848960	7605961	10,818,446.10	5,494,272.00	5,324,172.70	9797248	2695221	7102027	979,724.80	269,522.10	710,202.70	6085912	1958220	4127692	608,591.20	195,822.00	412,769.20
		2016/17	15982541	8086391	7896149	11,187,778.70	5,660,473.70	5,527,304.30	10735926	2928847	7807079	1,073,592.60	292,884.70	780,707.90	6438600	2112496	4326103	643,860.00	211,249.60	432,610.30
		2017/18	16148390	8217262	7931127	11,303,873.00	5,752,083.40	5,551,788.90	11086083	3111769	7974312	1,108,608.30	311,176.90	797,431.20	7766661	2630517	5136143	776,666.10	263,051.70	513,614.30
4	Oromia Region																			
		2012/13	22354053	10144785	12209268	15,647,837.10	7,101,349.50	8,546,487.60	8748537	2307402	6441135	874,853.70	230,740.20	644,113.50	7554869	2164339	5390530	755,486.90	216,433.90	539,053.00
		2013/14	22505219	10319811	12185408	15,753,653.30	7,223,867.70	8,529,785.60	9493622	2572937	6920684	949,362.20	257,293.70	692,068.40	8151014	2352362	5798651	815,101.40	235,236.20	579,865.10
		2014/15	22925730	10380451	12545279	16,048,011.00	7,266,315.70	8,781,695.30	9715587	2651794	7063792	971,558.70	265,179.40	706,379.20	7849924	2218873	5631050	784,992.40	221,887.30	563,105.00
		2015/16	23336510	10698015	12638496	16,335,557.00	7,488,610.50	8,846,947.20	9486687	2587028	6899658	948,668.70	258,702.80	689,965.80	8377584	2435882	5941703	837,758.40	243,588.20	594,170.30
		2016/17	24144361	10848389	13295971	16,901,052.70	7,593,872.30	9,307,179.70	9866172	2822246	7043925	986,617.20	282,224.60	704,392.50	8129784	2459145	5670641	812,978.40	245,914.50	567,064.10
		2017/18	24432974	10980519	13452456	17,103,081.80	7,686,363.30	9,416,719.20	9394430	2721123	6673307	939,443.00	272,112.30	667,330.70	8591204	2572915	6018288	859,120.40	257,291.50	601,828.80

5	Somali Region																			
		2012/13	597427	187079	409982	418,198.90	130,955.30	286,987.40	1281998	379320	902679	128,199.80	37,932.00	90,267.90	1639080	457215	1181864	163,908.00	45,721.50	118,186.40
		2013/14	610898	201468	408848	427,628.60	141,027.60	286,193.60	1420767	462460	958306	142,076.70	46,246.00	95,830.60	2033165	634122	1399044	203,316.50	63,412.20	139,904.40
		2014/15	645166	202977	438959	451,616.20	142,083.90	307,271.30	1296412	419303	877109	129,641.20	41,930.30	87,710.90	1903891	583119	1320773	190,389.10	58,311.90	132,077.30
		2015/16	631059	213913	416790	441,741.30	149,739.10	291,753.00	1308309	403555	904753	130,830.90	40,355.50	90,475.30	1835811	521285	1314525	183,581.10	52,128.50	131,452.50
		2016/17	584983	184163	400525	409,488.10	128,914.10	280,367.50	1022298	295240	727059	102,229.80	29,524.00	72,705.90	1519602	416044	1103559	151,960.20	41,604.40	110,355.90
		2017/18	589503	211477	376499	412,652.10	148,033.90	263,549.30	1360703	409148	951555	136,070.30	40,914.80	95,155.50	2826424	726943	2099481	282,642.40	72,694.30	209,948.10
6	Benishagul G. Region																			
		2012/13	558551	255612	302940	390,985.70	178,928.40	212,058.00	93131	27994	65138	9,313.10	2,799.40	6,513.80	411503	110691	300811	41,150.30	11,069.10	30,081.10
		2013/14	604563	242283	362280	423,194.10	169,598.10	253,596.00	83825	24278	59546	8,382.50	2,427.80	5,954.60	417424	118407	299017	41,742.40	11,840.70	29,901.70
		2014/15	659587	305643	353945	461,710.90	213,950.10	247,761.50	104547	36159	68387	10,454.70	3,615.90	6,838.70	440719	125354	315366	44,071.90	12,535.40	31,536.60
		2015/16	726265	329121	397145	508,385.50	230,384.70	278,001.50	97934	30944	66991	9,793.40	3,094.40	6,699.10	448635	127434	321202	44,863.50	12,743.40	32,120.20
		2016/17	777915	345474	432440	544,540.50	241,831.80	302,708.00	100013	29540	70474	10,001.30	2,954.00	7,047.40	431216	120979	310237	43,121.60	12,097.90	31,023.70
		2017/18	795024	358285	436740	556,516.80	250,799.50	305,718.00	160029	43229	116801	16,002.90	4,322.90	11,680.10	602840	168572	434268	60,284.00	16,857.20	43,426.80
7	SNNP Region																			
		2012/13	11080824	4075938	6004886	7,756,576.80	2,853,156.60	4,203,420.20	4118382	1125471	2992912	411,838.20	112,547.10	299,291.20	3912131	1244383	2667748	391,213.10	124,438.30	266,774.80
		2013/14	11044147	4033888	6010258	7,730,902.90	2,823,721.60	4,207,180.60	4748676	1365626	3383050	474,867.60	136,562.60	338,305.00	4953588	1575168	3378421	495,358.80	157,516.80	337,842.10
		2014/15	11215636	4170918	5944717	7,850,945.20	2,919,642.60	4,161,301.90	4580220	1309755	3270465	458,022.00	130,975.50	327,046.50	5092628	1613500	3479128	509,262.80	161,350.00	347,912.80
		2015/16	11171151	4024727	6146425	7,819,805.70	2,817,308.90	4,302,497.50	4703558	1315692	3387866	470,355.80	131,569.20	338,786.60	5343072	1611945	3731128	534,307.20	161,194.50	373,112.80
		2016/17	11485147	4273254	6711894	8,039,602.90	2,991,277.80	4,698,325.80	5087007	1499301	3587707	508,700.70	149,930.10	358,770.70	5258250	1799078	3459172	525,825.00	179,907.80	345,917.20
		2017/18	11883548	4877741	7005808	8,318,483.60	3,414,418.70	4,904,065.60	4639606	1356066	3283539	463,960.60	135,606.60	328,353.90	4958255	1527670	3430586	495,825.50	152,767.00	343,058.60
8	Gambella Region																			
		2012/13	277050	80131	196920	193,935.00	56,091.70	137,844.00	49934	14410	35524	4,993.40	1,441.00	3,552.40	84229	23778	60452	8,422.90	2,377.80	6,045.20
		2013/14	276246	79507	196739	193,372.20	55,654.90	137,717.30	45428	14887	30543	4,542.80	1,488.70	3,054.30	89860	25059	64802	8,986.00	2,505.90	6,480.20
		2014/15	278584	79403	198893	195,008.80	55,582.10	139,225.10	35476	10984	24492	3,547.60	1,098.40	2,449.20	88610	23882	64727	8,861.00	2,388.20	6,472.70
		2015/16	280561	83929	196604	196,392.70	58,750.30	137,622.80	44285	12536	31749	4,428.50	1,253.60	3,174.90	94184	25981	68203	9,418.40	2,598.10	6,820.30
		2016/17	282654	82108	200107	197,857.80	57,475.60	140,074.90	44302	15694	28609	4,430.20	1,569.40	2,860.90	99018	26948	72069	9,901.80	2,694.80	7,206.90
		2017/18	285102	78208	205701	199,571.40	54,745.60	143,990.70	35285	12561	22726	3,528.50	1,256.10	2,272.60	107083	30487	76596	10,708.30	3,048.70	7,659.60
9	Harari Region																			
		2012/13	52832	18355	34477	36,982.40	12,848.50	24,133.90	6395	1705	4690	639.50	170.50	469.00	51039	14660	36379	5,103.90	1,466.00	3,637.90
		2013/14	57258	20576	36681	40,080.60	14,403.20	25,676.70	8401	1744	6337	840.10	174.40	633.70	58432	17310	41121	5,843.20	1,731.00	4,112.10

		2014/15	62401	22271	39529	43,680.70	15,589.70	27,670.30	6287	2033	4254	628.70	203.30	425.40	57624	18289	39336	5,762.40	1,828.90	3,933.60
		2015/16	68240	25080	43161	47,768.00	17,556.00	30,212.70	9153	2396	6758	915.30	239.60	675.80	67721	20190	47532	6,772.10	2,019.00	4,753.20
		2016/17	69387	24398	44955	48,570.90	17,078.60	31,468.50	7100	1918	5182	710.00	191.80	518.20	72555	22211	50344	7,255.50	2,221.10	5,034.40
		2017/18	71277	25157	45469	49,893.90	17,609.90	31,828.30	6896	497	3906	689.60	49.70	390.60	69901	21779	48123	6,990.10	2,177.90	4,812.30
10	Dire Dawa	2012/13	47153	17983	29171	33,007.10	12,588.10	20,419.70	67790	15867	51923	6,779.00	1,586.70	5,192.30	178567	45470	133097	17,856.70	4,547.00	13,309.70
		2013/14	45030	16698	28296	31,521.00	11,688.60	19,807.20	72565	19148	53417	7,256.50	1,914.80	5,341.70	183755	48365	135391	18,375.50	4,836.50	13,539.10
		2014/15	49880	17767	32112	34,916.00	12,436.90	22,478.40	86545	21931	64613	8,654.50	2,193.10	6,461.30	209982	52112	157870	20,998.20	5,211.20	15,787.00
		2015/16	52716	19759	32850	36,901.20	13,831.30	22,995.00	75419	17845	57575	7,541.90	1,784.50	5,757.50	202707	52317	150389	20,270.70	5,231.70	15,038.90
		2016/17	52421	18779	33278	36,694.70	13,145.30	23,294.60	64234	14783	49451	6,423.40	1,478.30	4,945.10	205804	53779	152025	20,580.40	5,377.90	15,202.50
		2017/18	51958	19020	32314	36,370.60	13,314.00	22,619.80	64332	16071	48261	6,433.20	1,607.10	4,826.10	249393	68120	181274	24,939.30	6,812.00	18,127.40
11	National	2012/13	53990061	24033892	29956170	37,793,042.70	16,823,724.40	20,969,319.00	25489204	6736931	18752273	2,548,920.40	673,693.10	1,875,227.30	24060792	6963290	17097501	2,406,079.20	696,329.00	1,709,750.10
		2013/14	55027280	24555572	30471710	38,519,096.00	17,188,900.40	21,330,197.00	27347933	7460709	19887223	2,734,793.30	746,070.90	1,988,722.30	28163332	8172042	19991289	2,816,333.20	817,204.20	1,999,128.90
		2014/15	56706389	25262990	31443400	39,694,472.30	17,684,093.00	22,010,380.00	29332382	7987110	21345271	2,933,238.20	798,711.00	2,134,527.10	29112963	8419932	20693030	2,911,296.30	841,993.20	2,069,303.00
		2015/16	57829953	25805866	32024086	40,480,967.10	18,064,106.20	22,416,860.20	28892380	7846705	21045676	2,889,238.00	784,670.50	2,104,567.60	29704958	8444229	21260729	2,970,495.80	844,422.90	2,126,072.90
		2016/17	59486667	26478377	33008290	41,640,666.90	18,534,863.90	23,105,803.00	30697942	8552284	22145658	3,069,794.20	855,228.40	2,214,565.80	30200226	8874466	21325760	3,020,022.60	887,446.60	2,132,576.00
		2017/18	60392019	27367840	33024179	42,274,413.30	19,157,488.00	23,116,925.30	31302257	8821761	22480495	3,130,225.70	882,176.10	2,248,049.50	32738385	9659683	23078701	3,273,838.50	965,968.30	2,307,870.10

Source: CSA-Ethiopia

### Annex 1h: Estimated Cattle Resource Base by Year and Region in Ethiopia

No	Region	Year	Cattle Resource Base Index as a function of:			
			0.6 Cattle Population as herd size 1-4 head owning (A) in TLU	0.2 Cattle age Category 3-10 years (B) in TLU	0.2 Cattle kept for Draught milk and breeding © in TLU	Cattle R. Base Index =0.6A+0.2B+0.2C in TLU
		2012/13	853,667	358,540	334513	1,546,720.18
		2013/14	902,585	-	0	902,584.83
		2014/15	961,418	-	0	961,418.01
		2015/16	968,830	-	0	968,829.75
		2016/17	1,006,182	-	0	1,006,181.61
		2017/18	1,011,592	424,868	389844	1,826,304.01
2	Afar Region	2012/13	249,935	104,813	90415	445,163.38
		2013/14	285,581	-	0	285,580.68
		2014/15	331,866	-	0	331,865.73
		2015/16	313,961	-	0	313,961.34
		2016/17	276,343	-	0	276,342.57
		2017/18	276,599	113,593	97582	487,773.77
3	Amhara Region	2012/13	2,891,054	1,214,243	1196226	5,301,522.28
		2013/14	2,987,457	-	0	2,987,457.48
		2014/15	3,089,291	-	0	3,089,291.31
		2015/16	3,245,534	-	0	3,245,533.83
		2016/17	3,356,334	-	0	3,356,333.61
		2017/18	3,391,162	1,424,288	1386877	6,202,326.94
4	Oromia Region	2012/13	4,694,351	1,971,627	1878751	8,544,729.81
		2013/14	4,726,096	-	0	4,726,095.99
		2014/15	4,814,403	-	0	4,814,403.30
		2015/16	4,900,667	-	0	4,900,667.10
		2016/17	5,070,316	-	0	5,070,315.81
		2017/18	5,130,925	2,154,988	2026871	9,312,784.42
5	Somali Region	2012/13	125,460	52,661	46084	224,204.66
		2013/14	128,289	-	0	128,288.58
		2014/15	135,485	-	0	135,484.86
		2015/16	132,522	-	0	132,522.39
		2016/17	122,846	-	0	122,846.43
		2017/18	123,796	51,859	44891	220,546.24
6	Benishagul G. Region	2012/13	117,296	49,264	47481	214,041.28
		2013/14	126,958	-	0	126,958.23
		2014/15	138,513	-	0	138,513.27
		2015/16	152,516	-	0	152,515.65
		2016/17	163,362	-	0	163,362.15
		2017/18	166,955	70,121	58990	296,065.95

7	SNNP Region	2012/13	2,326,973	889,129	899067	4,115,169.10
		2013/14	2,319,271	-	0	2,319,270.87
		2014/15	2,355,284	-	0	2,355,283.56
		2015/16	2,345,942	-	0	2,345,941.71
		2016/17	2,411,881	-	0	2,411,880.87
		2017/18	2,495,545	1,048,129	972668	4,516,342.20
8	Gambella Region	2012/13	58,181	24,436	20818	103,434.73
		2013/14	58,012	-	0	58,011.66
		2014/15	58,503	-	0	58,502.64
		2015/16	58,918	-	0	58,917.81
		2016/17	59,357	-	0	59,357.34
		2017/18	59,871	25,041	23204	108,116.43
9	Harari Region	2012/13	11,095	4,660	3875	19,629.20
		2013/14	12,024	-	0	12,024.18
		2014/15	13,104	-	0	13,104.21
		2015/16	14,330	-	0	14,330.40
		2016/17	14,571	-	0	14,571.27
		2017/18	14,968	6,229	4096	25,293.83
10	Dire Dawa	2012/13	9,902	4,159	3247	17,308.61
		2013/14	9,456	-	0	9,456.30
		2014/15	10,475	-	0	10,474.80
		2015/16	11,070	-	0	11,070.36
		2016/17	11,008	-	0	11,008.41
		2017/18	10,911	4,528	3274	18,712.92
11	National	2012/13	11,337,913	4,761,923	4521484	20,621,320.52
		2013/14	11,555,729	-	0	11,555,728.80
		2014/15	11,908,342	-	0	11,908,341.69
		2015/16	12,144,290	-	0	12,144,290.13
		2016/17	12,492,200	-	0	12,492,200.07
		2017/18	12,682,324	5,326,576	5014466	23,023,365.94

Source: Based on data collected from CSA-Ethiopia

### Annex 1i: Estimated Sheep Resource Base by Year and Region in Ethiopia

No	Region	Year	Sheep Resource Base Index as a function of:			
			0.6 Sheep Population as herd size 1-4 head owning (A) in TLU	0.2 Sheep age Category 2 Years and older (B) in TLU	0.2 Sheep kept for breeding © in TLU	Sheep R. Base Index =0.6A+0.2B+0.2C in TLU
1	Tigray Region	2012/13	17,408	14,369	13702	45,479
		2013/14	18,673	-	0	18,673
		2014/15	22,898	-	0	22,898
		2015/16	20,635	-	0	20,635
		2016/17	25,726	-	0	25,726
		2017/18	31,159	25,719	22990	79,867
2	Afar Region	2012/13	11,546	9,530	9070	30,146
		2013/14	18,580	-	0	18,580
		2014/15	20,988	-	0	20,988
		2015/16	21,824	-	0	21,824
		2016/17	21,787	-	0	21,787
		2017/18	26,233	21,652	21089	68,974
3	Amhara Region	2012/13	111,196	91,781	90172	293,148
		2013/14	107,328	-	0	107,328
		2014/15	126,306	-	0	126,306
		2015/16	123,445	-	0	123,445
		2016/17	135,273	-	0	135,273
		2017/18	139,685	115,295	108907	363,887
4	Oromia Region	2012/13	110,232	90,985	81469	282,685
		2013/14	119,620	-	0	119,620
		2014/15	122,416	-	0	122,416
		2015/16	119,532	-	0	119,532
		2016/17	124,314	-	0	124,314
		2017/18	118,370	97,702	88990	305,062
5	Somali Region	2012/13	16,153	13,333	12934	42,420
		2013/14	17,902	-	0	17,902
		2014/15	16,335	-	0	16,335
		2015/16	16,485	-	0	16,485
		2016/17	12,881	-	0	12,881
		2017/18	17,145	14,151	13651	44,947
6	Benishagul G. Region	2012/13	1,173	969	822	2,964
		2013/14	1,056	-	0	1,056

		2014/15	1,317	-	0	1,317
		2015/16	1,234	-	0	1,234
		2016/17	1,260	-	0	1,260
		2017/18	2,016	1,664	1242	4,923
7	SNNP Region	2012/13	51,892	42,831	40938	135,661
		2013/14	59,833	-	0	59,833
		2014/15	57,711	-	0	57,711
		2015/16	59,265	-	0	59,265
		2016/17	64,096	-	0	64,096
		2017/18	58,459	48,252	45459	152,170
8	Gambella Region	2012/13	629	519	437	1,586
		2013/14	572	-	0	572
		2014/15	447	-	0	447
		2015/16	558	-	0	558
		2016/17	558	-	0	558
		2017/18	445	367	295	1,107
9	Harari Region	2012/13	81	67	58	205
		2013/14	106	-	0	106
		2014/15	79	-	0	79
		2015/16	115	-	0	115
		2016/17	89	-	0	89
		2017/18	87	46	55	187
10	Dire Dawa	2012/13	854	705	630	2,189
		2013/14	914	-	0	914
		2014/15	1,090	-	0	1,090
		2015/16	950	-	0	950
		2016/17	809	-	0	809
		2017/18	811	669	572	2,051
11	National	2012/13	321,164	265,088	250293	836,545
		2013/14	344,584	-	0	344,584
		2014/15	369,588	-	0	369,588
		2015/16	364,044	-	0	364,044
		2016/17	386,794	-	0	386,794
		2017/18	394,408	325,543	303988	1,023,940

Source: Based on data collected from CSA-Ethiopia

Annex 1j: Estimated Goats Resource Base by Year and Region in Ethiopia

No	Region	Year	Goat Resource Base Index as a function of:			
			0.6 Goats Population as herd size 1-4 head owning (A) in TLU	0.2 Goats age Category 2 Years and older (B) in TLU	0.2 Goats kept for milk and breeding © in TLU	Goat R. Base Index =0.6A+0.2B+0.2C in TLU
1	Tigray Region	2012/13	28,721	31,912	30460	91,093
		2013/14	36,002	-	0	36,002
		2014/15	38,298	-	0	38,298
		2015/16	35,534	-	0	35,534
		2016/17	41,257	-	0	41,257
		2017/18	38,711	43,012	37632	119,355
2	Afar Region	2012/13	17,420	19,356	19137	55,913
		2013/14	26,858	-	0	26,858
		2014/15	28,344	-	0	28,344
		2015/16	29,710	-	0	29,710
		2016/17	31,151	-	0	31,151
		2017/18	29,389	32,654	33499	95,542
3	Amhara Region	2012/13	45,923	51,026	48059	145,008
		2013/14	47,624	-	0	47,624
		2014/15	54,584	-	0	54,584
		2015/16	54,773	-	0	54,773
		2016/17	57,947	-	0	57,947
		2017/18	69,900	77,667	69366	216,932
4	Oromia Region	2012/13	67,994	75,549	69572	213,114
		2013/14	73,359	-	0	73,359
		2014/15	70,649	-	0	70,649
		2015/16	75,398	-	0	75,398
		2016/17	73,168	-	0	73,168
		2017/18	77,321	85,912	79229	242,462
5	Somali Region	2012/13	14,752	16,391	17347	48,489
		2013/14	18,298	-	0	18,298
		2014/15	17,135	-	0	17,135
		2015/16	16,522	-	0	16,522
		2016/17	13,676	-	0	13,676
		2017/18	25,438	28,264	28028	81,730
6	Benishagul G. Region	2012/13	3,704	4,115	3568	11,386
		2013/14	3,757	-	0	3,757
		2014/15	3,966	-	0	3,966
		2015/16	4,038	-	0	4,038
		2016/17	3,881	-	0	3,881

		2017/18	5,426	6,028	4666	16,120
7	SNNP Region					
		2012/13	35,209	39,121	41168	115,499
		2013/14	44,582	-	0	44,582
		2014/15	45,834	-	0	45,834
		2015/16	48,088	-	0	48,088
		2016/17	47,324	-	0	47,324
		2017/18	44,624	49,583	49281	143,488
8	Gambella Region					
		2012/13	758	842	712	2,312
		2013/14	809	-	0	809
		2014/15	797	-	0	797
		2015/16	848	-	0	848
		2016/17	891	-	0	891
		2017/18	964	1,071	915	2,950
9	Harari Region					
		2012/13	459	510	470	1,440
		2013/14	526	-	0	526
		2014/15	519	-	0	519
		2015/16	609	-	0	609
		2016/17	653	-	0	653
		2017/18	629	699	605	1,933
10	Dire Dawa					
		2012/13	1,607	1,786	1663	5,055
		2013/14	1,654	-	0	1,654
		2014/15	1,890	-	0	1,890
		2015/16	1,824	-	0	1,824
		2016/17	1,852	-	0	1,852
		2017/18	2,245	2,494	2182	6,921
11	National					
		2012/13	216,547	240,608	232682	689,837
		2013/14	253,470	-	0	253,470
		2014/15	262,017	-	0	262,017
		2015/16	267,345	-	0	267,345
		2016/17	271,802	-	0	271,802
		2017/18	294,645	327,384	308146	930,175

Source: Based on data collected from CSA-Ethiopia

### Annex 1k: Livestock Holders by Year and Region in Ethiopia

No	Region	Year	Cattle Holders Number				Sheep Holders Number				Goats Holders Number			
			Cattle				Sheep				Goats			
			Holdings with no Cattle	1-4 head	> 4 heads	Total	Holdings with no Cattle	1-4 head	> 4 heads	Total	Holdings with no Cattle	1-4 head	> 4 heads	Total
1	Tigray Region	2012/13	242532	527755	297728	1068015	845435	91011	131569	1068015	693986	129704	244325	1068015
		2013/14	268011	528326	338025	1134362	895879	108313	130170	1134362	715202	135807	283353	1134362
		2014/15	287353	598590	353518	1239461	965226	110850	163385	1239461	781198	141233	317030	1239461
		2015/16	292377	602016	359624	1254017	984901	121746	147370	1254017	804377	147116	302524	1254017
		2016/17	305569	648966	372909	1327444	1038559	120363	168522	1327444	853479	154170	319795	1327444
		2017/18	442607	726712	343402	1512721	1133088	146439	233194	1512721	1057122	162880	292719	1512721
2	Afar Region	2012/13	35601	21655	59817	117073	51297	14000	51776	117073	27167	12476	77430	117073
		2013/14	79181	45912	93984	219077	97457	33248	88372	219077	54700	25046	139331	219077
		2014/15	87705	61436	109617	258758	124926	40550	93282	258758	80644	37712	140402	258758
		2015/16	76376	49769	106470	232615	87695	42429	102491	232615	62476	26283	143856	232615
		2016/17	93612	58076	101292	252980	99956	35033	117991	252980	66138	27898	158944	252980
		2017/18	49143	48579	87263	184985	62029	25952	97004	184985	47404	15871	121710	184985
3	Amhara Region	2012/13	907520	2567038	1019168	4493726	2879159	886339	728228	4493726	3464271	615186	414269	4493726
		2013/14	914619	2600870	1067401	4582890	2944065	927202	711623	4582890	3521954	627093	433843	4582890
		2014/15	1003187	2736754	1099041	4838982	3075710	911541	851731	4838982	3717356	615115	506511	4838982
		2015/16	1046735	2779365	1177141	5003241	3201762	970563	830916	5003241	3887313	598862	517066	5003241
		2016/17	1125773	2821871	1226882	5174526	3280231	976592	917703	5174526	4015833	642585	516108	5174526
		2017/18	1218998	2923234	1227262	5369494	3487779	955294	926421	5369494	4083562	671957	613975	5369494
4	Oromia Region	2012/13	1284768	2767556	1799483	5851807	3869638	1331097	651072	5851807	4282659	1013328	555820	5851807
		2013/14	1338738	2790661	1853152	5982551	3871379	1384564	726608	5982551	4286121	1089843	606587	5982551
		2014/15	1355894	2823993	1902603	6082490	3948210	1384835	749445	6082490	4370634	1116809	595047	6082490
		2015/16	1411018	2960423	1920265	6291706	4163522	1415006	713178	6291706	4548477	1130035	613194	6291706
		2016/17	1328732	2930657	1979577	6238966	4114551	1378403	746012	6238966	4552965	1076190	609811	6238966
		2017/18	1435448	2782233	2105190	6322871	4205775	1410228	706868	6322871	4615739	1043490	663642	6322871
5	Somali Region	2012/13	49578	50900	45654	146132	68915	21095	56122	146132	41431	23667	81034	146132
		2013/14	55542	60383	51053	166978	67817	24534	74627	166978	41422	22655	102901	166978
		2014/15	48097	50596	50006	148699	64656	18819	65224	148699	37412	20924	90363	148699
		2015/16	54752	44343	53493	152588	57552	23718	71318	152588	38205	22330	92053	152588
		2016/17	43627	53485	49476	146588	66385	24933	55270	146588	43385	24961	78242	146588
		2017/18	62935	72504	52195	187634	75980	31332	80322	187634	44214	26281	117139	187634
6	Benishagul G. Region	2012/13	122401	53753	42126	218280	194681	16469	7130	218280	142301	42287	33692	218280
		2013/14	111707	55816	41342	208865	190097	12011	6757	208865	134525	40604	33736	208865
		2014/15	127592	58653	48933	235178	211018	15719	8441	235178	157655	42423	35100	235178
		2015/16	129772	60535	56930	247237	222776	16094	8367	247237	167195	43936	36106	247237
		2016/17	127292	63487	57421	248200	224242	16331	7627	248200	169054	45882	33264	248200
		2017/18	186311	74485	62712	323508	285757	23317	14434	323508	215677	61526	46305	323508
7	SNNP Region	2012/13	700187	2101801	679149	3481137	2299370	970837	210930	3481137	2745344	569031	166762	3481137
		2013/14	728847	2118082	717525	3564454	2343055	978885	242514	3564454	2802360	563377	198717	3564454
		2014/15	772980	2084851	753072	3610903	2355047	1004203	251653	3610903	2804702	596072	210129	3610903

		2015/16	728016	2100931	681340	3510287	2276333	1002238	231716	3510287	2748523	570119	191645	3510287
		2016/17	814418	2091690	736779	3642887	2373628	1032303	236956	3642887	2817598	632604	192685	3642887
		2017/18	839871	2233921	853970	3927762	2507760	1148987	271015	3927762	2861389	759017	307356	3927762
8	Gambella Region	2012/13	27182	12299	14396	53877	46491	3958	3428	53877	41038	5986	6853	53877
		2013/14	33665	13776	15363	62804	55385	4409	3010	62804	48718	6716	7370	62804
		2014/15	34299	13022	14142	61463	54977	3738	2748	61463	48672	6021	6770	61463
		2015/16	40374	14133	14383	68890	62529	3911	2450	68890	55361	7577	5952	68890
		2016/17	44811	16668	15431	76910	68350	5553	3007	76910	59976	9757	7177	76910
		2017/18	40653	15905	15450	72008	64040	5631	2337	72008	54473	8520	9015	72008
9	Harari Region	2012/13	4862	16078	2281	23221	20503	2513	205	23221	8762	11175	3284	23221
		2013/14	5601	15754	3322	24677	21509	2743	425	24677	8701	11729	4247	24677
		2014/15	5904	16845	3383	26132	23752	2067	313	26132	10035	12135	3962	26132
		2015/16	6022	17743	3972	27737	24043	3257	437	27737	10180	12553	5004	27737
		2016/17	6653	18890	3700	29243	26387	2580	276	29243	10094	13966	5183	29243
		2017/18	8461	21085	3606	33152	31123	1629	400	33152	11455	17162	4535	33152
10	Dire Dawa	2012/13	7708	16708	1809	26225	10528	10650	5047	26225	3573	8995	13657	26225
		2013/14	7975	16758	1565	26298	10947	9770	5581	26298	4131	8702	13465	26298
		2014/15	8822	17198	1862	27882	9966	10931	6985	27882	2787	9144	15951	27882
		2015/16	9196	17991	1964	29151	12772	10825	5554	29151	4322	10448	14381	29151
		2016/17	6584	19071	1793	27448	11802	10975	4671	27448	3635	10044	13769	27448
		2017/18	12160	17919	1805	31884	15580	11791	4513	31884	3855	10541	17488	31884
11	National	2012/13	3382337	8108829	3988327	15479493	10286017	3347969	1845507	15479493	11450532	2431836	1597125	15479493
		2013/14	3543881	8246338	4182737	15972956	10497593	3485678	1989685	15972956	11617832	2531572	1823552	15972956
		2014/15	3731838	8461935	4336176	16529949	10833489	3503252	2193208	16529949	12011096	2597587	1921266	16529949
		2015/16	3794635	8647249	4375586	16817470	11093885	3609788	2113797	16817470	12326428	2569259	1921783	16817470
		2016/17	3897068	8722862	4545261	17165191	11304092	3603065	2258034	17165191	12592153	2638059	1934979	17165191
		2017/18	4296584	8916579	4752856	17966019	11868912	3760600	2336507	17966019	12994889	2777244	2193886	17966019

Source: CSA-Ethiopia

## Annex 11: Volume of Cattle by Purposes, Year and Region in Ethiopia

No	Region	Year	Cattle Number				Cattle in TLU			
			Male Cattle's Purposes (Draught and Breeding)	Female Cattle's Purposes (Draught milk and breeding)	Male Cattle's Purposes (Beef and other)	Female Cattle's Purposes (beef and other)	Male Cattle's Purposes ( Draught and Breeding)	Female Cattle's Purposes (Draught milk and breeding)	Male Cattle's Purposes (Beef and other)	Female Cattle's Purposes (beef and other)
1	Tigray Region	2012/13	1192465	1322795	15353	11277	834,725.50	925,956.50	10,747.10	7,893.90
		2013/14	1282442	1354295	14501	13297	897,709.40	948,006.50	10,150.70	9,307.90
		2014/15	1374320	1477539	19784	14633	962,024.00	1,034,277.30	13,848.80	10,243.10
		2015/16	1367226	1453560	13867	15926	957,058.20	1,017,492.00	9,706.90	11,148.20
		2016/17	1474541	1540614	7012	13121	1,032,178.70	1,078,429.80	4,908.40	9,184.70
		2017/18	1424218	1504933	19539	13648	996,952.60	1,053,453.10	13,677.30	9,553.60
2	Afar Region	2012/13	100247	583514	3285	0	70,172.90	408,459.80	2,299.50	-
		2013/14	104787	655924	0	0	73,350.90	459,146.80	-	-
		2014/15	103488	788878	0	0	72,441.60	552,214.60	-	-
		2015/16	110115	753250	8518	0	77,080.50	527,275.00	5,962.60	-
		2016/17	88848	658205	0	0	62,193.60	460,743.50	-	-
		2017/18	83163	658338	0	0	58,214.10	460,836.60	-	-
3	Amhara Region	2012/13	4492653	4059802	199956	337451	3,144,857.10	2,841,861.40	139,969.20	236,215.70
		2013/14	4629488	4227813	200136	300507	3,240,641.60	2,959,469.10	140,095.20	210,354.90
		2014/15	4950593	4399589	173970	285185	3,465,415.10	3,079,712.30	121,779.00	199,629.50
		2015/16	5013866	4699210	208271	227166	3,509,706.20	3,289,447.00	145,789.70	159,016.20
		2016/17	5184314	4840380	181683	196690	3,629,019.80	3,388,266.00	127,178.10	137,683.00
		2017/18	5218567	4899017	223453	197543	3,652,996.90	3,429,311.90	156,417.10	138,280.10
4	Oromia Region	2012/13	5835991	7486815	485587	467832	4,085,193.70	5,240,770.50	339,910.90	327,482.40
		2013/14	5957486	7507873	461976	427940	4,170,240.20	5,255,511.10	323,383.20	299,558.00
		2014/15	5969739	7699042	448690	382129	4,178,817.30	5,389,329.40	314,083.00	267,490.30
		2015/16	6218937	7820179	440248	372198	4,353,255.90	5,474,125.30	308,173.60	260,538.60
		2016/17	6323189	8182610	450407	311266	4,426,232.30	5,727,827.00	315,284.90	217,886.20
		2017/18	6344104	8189374	467726	400555	4,440,872.80	5,732,561.80	327,408.20	280,388.50
5	Somali Region	2012/13	73587	270203	3628	2766	51,510.90	189,142.10	2,539.60	1,936.20
		2013/14	72466	265629	4653	0	50,726.20	185,940.30	3,257.10	-
		2014/15	66709	282049	0	0	46,696.30	197,434.30	-	-
		2015/16	81483	259395	7058	3028	57,038.10	181,576.50	4,940.60	2,119.60
		2016/17	74761	256860	8059	1517	52,332.70	179,802.00	5,641.30	1,061.90
		2017/18	79263	250924	10931	0	55,484.10	175,646.80	7,651.70	-
6	Benishagul G. Region	2012/13	149523	197497	8364	5416	104,666.10	138,247.90	5,854.80	3,791.20
		2013/14	134833	238193	9770	6841	94,383.10	166,735.10	6,839.00	4,788.70
		2014/15	177416	228230	5386	2302	124,191.20	159,761.00	3,770.20	1,611.40
		2015/16	184508	249032	1962	8041	129,155.60	174,322.40	1,373.40	5,628.70
		2016/17	198403	276296	2873	0	138,882.10	193,407.20	2,011.10	-
		2017/18	186941	261309	0	0	130,858.70	182,916.30	-	-
7	SNNP Region	2012/13	1948427	4018906	289905	574581	1,363,898.90	2,813,234.20	202,933.50	402,206.70
		2013/14	1943143	4144370	256023	511777	1,360,200.10	2,901,059.00	179,216.10	358,243.90

		2014/15	2024057	4153599	267657	461575	1,416,839.90	2,907,519.30	187,359.90	323,102.50
		2015/16	1715329	3224113	258678	450663	1,200,730.30	2,256,879.10	181,074.60	315,464.10
		2016/17	2034644	4184972	249579	440920	1,424,250.80	2,929,480.40	174,705.30	308,644.00
		2017/18	2567751	4047507	305317	470520	1,797,425.70	2,833,254.90	213,721.90	329,364.00
8	Gambella Region	2012/13	32505	124671	804	214	22,753.50	87,269.70	562.80	149.80
		2013/14	33261	128851	0	0	23,282.70	90,195.70	-	-
		2014/15	34992	130668	0	0	24,494.40	91,467.60	-	-
		2015/16	32802	123160	4053	0	22,961.40	86,212.00	2,837.10	-
		2016/17	34967	137997	0	0	24,476.90	96,597.90	-	-
		2017/18	30952	142040	3332	0	21,666.40	99,428.00	2,332.40	-
9	Harari Region	2012/13	5991	20605	1696	1151	4,193.70	14,423.50	1,187.20	805.70
		2013/14	5572	22788	1591	734	3,900.40	15,951.60	1,113.70	513.80
		2014/15	5496	23787	2145	573	3,847.20	16,650.90	1,501.50	401.10
		2015/16	6533	23098	2761	389	4,573.10	16,168.60	1,932.70	272.30
		2016/17	6955	27406	1860	0	4,868.50	19,184.20	1,302.00	-
		2017/18	4413	26715	0	0	3,089.10	18,700.50	-	-
10	Dire Dawa	2012/13	6306	16031	1345	995	4,414.20	11,221.70	941.50	696.50
		2013/14	5503	15853	1264	666	3,852.10	11,097.10	884.80	466.20
		2014/15	5331	18205	1696	1021	3,731.70	12,743.50	1,187.20	714.70
		2015/16	0	17257	1388	537	-	12,079.90	971.60	375.90
		2016/17	5752	21078	2781	269	4,026.40	14,754.60	1,946.70	188.30
		2017/18	3715	18806	2358	0	2,600.50	13,164.20	1,650.60	-
11	National	2012/13	13837696	18101324	1010825	1407938	9,686,387.20	12,670,926.80	707,577.50	985,556.60
		2013/14	14169367	18570386	952185	1282857	9,918,556.90	12,999,270.20	666,529.50	897,999.90
		2014/15	14712232	19205875	933925	1165753	10,298,562.40	13,444,112.50	653,747.50	816,027.10
		2015/16	15030803	19801052	952773	1079451	10,521,562.10	13,860,736.40	666,941.10	755,615.70
		2016/17	15426376	20127734	917775	973146	10,798,463.20	14,089,413.80	642,442.50	681,202.20
		2017/18	15952120	20012229	1049599	1089896	11,166,484.00	14,008,560.30	734,719.30	762,927.20

Source: CSA-Ethiopia

Annex 1m: Volume of Sheep by Purposes, Year and Region in Ethiopia

No	Region	Year	Sheep Number				Sheep in TLU			
			Male Sheep's Purposes (Breeding)	Female Sheep's Purposes (Breeding)	Male Sheep's Purposes (Mutton wool and other)	Female Sheep's Purposes (Mutton wool and other)	Male Sheep's Purposes (Breeding)	Female Sheep's Purposes (Breeding)	Male Sheep's Purposes (Mutton wool and other)	Female Sheep's Purposes (Mutton wool and other)
1	Tigray Region									
		2012/13	64788	652249	12584	7046	6,478.80	65,224.90	1,258.40	704.60
		2013/14	64004	672886	26155	12885	6,400.40	67,288.60	2,615.50	1,288.50
		2014/15	86453	833764	12059	18213	8,645.30	83,376.40	1,205.90	1,821.30
		2015/16	75655	791344	8669	8031	7,565.50	79,134.40	866.90	803.10
		2016/17	59856	997047	7478	14104	5,985.60	99,704.70	747.80	1,410.40
		2017/18	76912	1151087	0	8015	7,691.20	115,108.70	-	801.50
2	Afar Region									
		2012/13	46360	428023	7039	6215	4,636.00	42,802.30	703.90	621.50
		2013/14	84088	653555	7278	21515	8,408.80	65,355.50	727.80	2,151.50
		2014/15	91756	766490	8987	10807	9,175.60	76,649.00	898.70	1,080.70
		2015/16	91915	860067	0	4684	9,191.50	86,006.70	-	468.40
		2016/17	113739	691512	14970	77110	11,373.90	69,151.20	1,497.00	7,711.00
		2017/18	145082	932049	8413	48277	14,508.20	93,204.90	841.30	4,827.70
3	Amhara Region									
		2012/13	225612	4255398	288731	78201	22,561.20	425,539.80	28,873.10	7,820.10
		2013/14	219368	4139568	291410	87161	21,936.80	413,956.80	29,141.00	8,716.10
		2014/15	179960	4687345	344515	58980	17,996.00	468,734.50	34,451.50	5,898.00
		2015/16	248243	4590304	322185	92936	24,824.30	459,030.40	32,218.50	9,293.60
		2016/17	255284	5032016	307285	58889	25,528.40	503,201.60	30,728.50	5,888.90
		2017/18	279856	5117974	397554	59857	27,985.60	511,797.40	39,755.40	5,985.70
4	Oromia Region									
		2012/13	165828	3988608	182832	42770	16,582.80	398,860.80	18,283.20	4,277.00
		2013/14	210217	4296777	220877	59614	21,021.70	429,677.70	22,087.70	5,961.40
		2014/15	198843	4357658	250706	62669	19,884.30	435,765.80	25,070.60	6,266.90
		2015/16	212469	4292344	261574	65834	21,246.90	429,234.40	26,157.40	6,583.40
		2016/17	317551	4298646	325898	72362	31,755.10	429,864.60	32,589.80	7,236.20
		2017/18	322593	4137988	267546	56301	32,259.30	413,798.80	26,754.60	5,630.10
5	Somali Region									
		2012/13	123035	539428	28745	4166	12,303.50	53,942.80	2,874.50	416.60
		2013/14	131578	570788	35842	2944	13,157.80	57,078.80	3,584.20	294.40
		2014/15	96002	545147	46385	3124	9,600.20	54,514.70	4,638.50	312.40
		2015/16	103077	504424	49622	16563	10,307.70	50,442.40	4,962.20	1,656.30
		2016/17	67691	437330	28329	3582	6,769.10	43,733.00	2,832.90	358.20
		2017/18	97876	565584	62776	7698	9,787.60	56,558.40	6,277.60	769.80
6	Benishagul G. Region									
		2012/13	4498	38743	651	284	449.80	3,874.30	65.10	28.40
		2013/14	1793	36378	1226	32	179.30	3,637.80	122.60	3.20
		2014/15	4360	42984	2813	423	436.00	4,298.40	281.30	42.30
		2015/16	2728	37715	1656	1029	272.80	3,771.50	165.60	102.90

		2016/17	2730	37782	1130	151	273.00	3,778.20	113.00	15.10
		2017/18	4567	61677	0	556	456.70	6,167.70	-	55.60
7	SNNP Region	2012/13	204582	1894846	81368	20162	20,458.20	189,484.60	8,136.80	2,016.20
		2013/14	244514	2097427	123528	47063	24,451.40	209,742.70	12,352.80	4,706.30
		2014/15	267794	2044058	112312	35549	26,779.40	204,405.80	11,231.20	3,554.90
		2015/16	0	2271073	96672	13277	-	227,107.30	9,667.20	1,327.70
		2016/17	310321	2226053	102552	25688	31,032.10	222,605.30	10,255.20	2,568.80
		2017/18	218490	2089398	117483	18648	21,849.00	208,939.80	11,748.30	1,864.80
8	Gambella Region	2012/13	3368	19957	0	171	336.80	1,995.70	-	17.10
		2013/14	3211	17836	0	334	321.10	1,783.60	-	33.40
		2014/15	1465	12758	0	127	146.50	1,275.80	-	12.70
		2015/16	2789	17155	1704	228	278.90	1,715.50	170.40	22.80
		2016/17	2154	15932	0	33	215.40	1,593.20	-	3.30
		2017/18	1716	14043	0	98	171.60	1,404.30	-	9.80
9	Harari Region	2012/13	0	2955	180	0	-	295.50	18.00	-
		2013/14	0	4184	0	0	-	418.40	-	-
		2014/15	0	2922	0	0	-	292.20	-	-
		2015/16	0	4257	0	0	-	425.70	-	-
		2016/17	0	3677	0	0	-	367.70	-	-
		2017/18	0	2939	0	0	-	293.90	-	-
10	Dire Dawa	2012/13	0	32545	1178	162	-	3,254.50	117.80	16.20
		2013/14	622	30048	1800	361	62.20	3,004.80	180.00	36.10
		2014/15	702	36352	1636	299	70.20	3,635.20	163.60	29.90
		2015/16	690	32448	2840	0	69.00	3,244.80	284.00	-
		2016/17	273	31806	2372	0	27.30	3,180.60	237.20	-
		2017/18	0	30730	0	0	-	3,073.00	-	-
11	National	2012/13	838981	11852753	605729	159175	83,898.10	1,185,275.30	60,572.90	15,917.50
		2013/14	959541	12519446	719660	231880	95,954.10	1,251,944.60	71,966.00	23,188.00
		2014/15	927384	13329478	803211	190189	92,738.40	1,332,947.80	80,321.10	19,018.90
		2015/16	1048719	13401132	785601	202582	104,871.90	1,340,113.20	78,560.10	20,258.20
		2016/17	1129683	13771801	811195	251920	112,968.30	1,377,180.10	81,119.50	25,192.00
		2017/18	1148509	14103468	892029	199450	114,850.90	1,410,346.80	89,202.90	19,945.00

Source: CSA-Ethiopia

## Annex 1n: Volume of Goats by Purposes, Year and Region in Ethiopia

No	Region	Year	Goats Number				Goats in TLU			
			Male Goats' Purposes (breeding)	Female Goats' Purposes ( milk and breeding)	Male Goats' Purposes (meat and other)	Female Goats' Purposes ( meat and other)	Male Goats' Purposes (breeding)	Female Goats' Purposes (milk and breeding)	Male Goats' Purposes (meat and other)	Female Goats' Purposes (meat and other)
1	Tigray Region	2012/13	206430	1373446	35475	4874	20,643.00	137,344.60	3,547.50	487.40
		2013/14	253896	1747902	50760	6634	25,389.60	174,790.20	5,076.00	663.40
		2014/15	197567	1763777	55978	17962	19,756.70	176,377.70	5,597.80	1,796.20
		2015/16	194934	1732535	44018	3019	19,493.40	173,253.50	4,401.80	301.90
		2016/17	204475	2147295	45587	4995	20,447.50	214,729.50	4,558.70	499.50
		2017/18	199928	1786598	15171	0	19,992.80	178,659.80	1,517.10	-
2	Afar Region	2012/13	87214	919476	11210	0	8,721.40	91,947.60	1,121.00	-
		2013/14	180594	1380358	16674	13581	18,059.40	138,035.80	1,667.40	1,358.10
		2014/15	184736	1500265	17949	4758	18,473.60	150,026.50	1,794.90	475.80
		2015/16	144714	1650626	26354	3528	14,471.40	165,062.60	2,635.40	352.80
		2016/17	202631	1602015	25542	11592	20,263.10	160,201.50	2,554.20	1,159.20
		2017/18	201196	1580679	0	0	20,119.60	158,067.90	-	-
3	Amhara Region	2012/13	161473	2064580	303040	27251	16,147.30	206,458.00	30,304.00	2,725.10
		2013/14	202479	2195497	275800	19336	20,247.90	219,549.70	27,580.00	1,933.60
		2014/15	204204	2347322	328581	27550	20,420.40	234,732.20	32,858.10	2,755.00
		2015/16	189351	2434482	318156	20462	18,935.10	243,448.20	31,815.60	2,046.20
		2016/17	202185	2517245	325612	16320	20,218.50	251,724.50	32,561.20	1,632.00
		2017/18	291440	3042371	339206	16646	29,144.00	304,237.10	33,920.60	1,664.60
4	Oromia Region	2012/13	251626	3257491	179856	11663	25,162.60	325,749.10	17,985.60	1,166.30
		2013/14	252511	3463994	196672	20453	25,251.10	346,399.40	19,667.20	2,045.30
		2014/15	223328	3357475	213973	22646	22,332.80	335,747.50	21,397.30	2,264.60
		2015/16	298256	3613934	200974	18618	29,825.60	361,393.40	20,097.40	1,861.80
		2016/17	326629	3347455	237008	26991	32,662.90	334,745.50	23,700.80	2,699.10
		2017/18	326984	3634514	231185	21608	32,698.40	363,451.40	23,118.50	2,160.80
5	Somali Region	2012/13	142226	742101	37844	520	14,222.60	74,210.10	3,784.40	52.00
		2013/14	185387	859047	44780	4192	18,538.70	85,904.70	4,478.00	419.20
		2014/15	171932	824558	39143	0	17,193.20	82,455.80	3,914.30	-
		2015/16	152252	750909	36697	9465	15,225.20	75,090.90	3,669.70	946.50
		2016/17	111740	641830	27037	5269	11,174.00	64,183.00	2,703.70	526.90
		2017/18	122812	1252177	115881	0	12,281.20	125,217.70	11,588.10	-
6	Benishagul G. Region	2012/13	14742	170923	4117	0	1,474.20	17,092.30	411.70	-
		2013/14	15857	168846	3565	0	1,585.70	16,884.60	356.50	-

		2014/15	16974	185987	3640	0	1,697.40	18,598.70	364.00	-
		2015/16	11436	167401	6503	1148	1,143.60	16,740.10	650.30	114.80
		2016/17	14756	160559	3054	1505	1,475.60	16,055.90	305.40	150.50
		2017/18	21689	223160	3323	0	2,168.90	22,316.00	332.30	-
7	SNNP Region									
		2012/13	395717	1688772	96725	8599	39,571.70	168,877.20	9,672.50	859.90
		2013/14	430146	2099568	5608	2725	43,014.60	209,956.80	560.80	272.50
		2014/15	495156	2035088	103994	20640	49,515.60	203,508.80	10,399.40	2,064.00
		2015/16	527973	2483565	102647	10761	52,797.30	248,356.50	10,264.70	1,076.10
		2016/17	625782	2068218	112606	8314	62,578.20	206,821.80	11,260.60	831.40
		2017/18	400354	2140421	75052	5514	40,035.40	214,042.10	7,505.20	551.40
8	Gambella Region									
		2012/13	5179	32681	0	0	517.90	3,268.10	-	-
		2013/14	3598	33692	182	0	359.80	3,369.20	18.20	-
		2014/15	4242	34911	0	0	424.20	3,491.10	-	-
		2015/16	6199	38831	0	0	619.90	3,883.10	-	-
		2016/17	4419	39568	0	0	441.90	3,956.80	-	-
		2017/18	3269	45401	0	0	326.90	4,540.10	-	-
9	Harari Region									
		2012/13	1012	22036	1956	0	101.20	2,203.60	195.60	-
		2013/14	594	24560	3171	0	59.40	2,456.00	317.10	-
		2014/15	758	25197	2437	0	75.80	2,519.70	243.70	-
		2015/16	937	31691	4216	0	93.70	3,169.10	421.60	-
		2016/17	1185	30318	2480	0	118.50	3,031.80	248.00	-
		2017/18	2429	27933	1808	0	242.90	2,793.30	180.80	-
10	Dire Dawa									
		2012/13	2739	79117	6585	0	273.90	7,911.70	658.50	-
		2013/14	3044	69568	6216	195	304.40	6,956.80	621.60	19.50
		2014/15	2283	88345	7202	0	228.30	8,834.50	720.20	-
		2015/16	1776	84025	8084	0	177.60	8,402.50	808.40	-
		2016/17	1208	93705	13253	0	120.80	9,370.50	1,325.30	-
		2017/18	0	104526	11549	0	-	10,452.60	1,154.90	-
11	National									
		2012/13	1268357	10350956	679720	77689	126,835.70	1,035,095.60	67,972.00	7,768.90
		2013/14	1528104	12051439	721885	45803	152,810.40	1,205,143.90	72,188.50	4,580.30
		2014/15	1501180	12187644	793710	98270	150,118.00	1,218,764.40	79,371.00	9,827.00
		2015/16	1527827	12992033	769224	89429	152,782.70	1,299,203.30	76,922.40	8,942.90
		2016/17	1695011	12664577	799660	79293	169,501.10	1,266,457.70	79,966.00	7,929.30
		2017/18	1574217	13851773	851995	112742	157,421.70	1,385,177.30	85,199.50	11,274.20

Source: CSA-Ethiopia

**Annex 1o: Volume of Livestock Sales and Slaughters and Estimated Livestock Commercial Off-take Rate by Region in Ethiopia**

No	Region	Livestock Type	Panel Year	Net Com off-take Rate	Number of sales			Number of Slaughters		
					Total	Male	Female	Total	Male	Female
1	Tigray Region	A. Cattle	2012/13	2.21	256089	165241	90848	33714	17084	16630
			2013/14	2.83	291575	186874	104701	48800	26510	22290
			2014/15	2.61	317200	200691	116509	56367	33482	22885
			2015/16	5.03	411668	262363	149305	46781	26470	20310
			2016/17	5.54	518518	345804	172714	62094	36781	25313
		B. Sheep	2012/13	5.25	207204	114555	92649	204321	150410	53911
			2013/14	3.65	272146	148421	123725	249251	190277	58974
			2014/15	7.56	322153	175038	147114	261869	196068	65801
			2015/16	12.37	444741	264782	179959	296096	208274	87822
			2016/17	8.17	377352	199690	177662	314281	238652	75629
		C. Goat	2012/13	8.55	591017	289422	301595	500243	363687	136556
			2013/14	11.25	489135	280923	208211	321448	226073	95375
			2014/15	10.71	622183	338871	283312	451988	312415	139574
			2015/16	11.30	693348	408479	284869	497868	344099	153769
			2016/17	13.93	799474	468238	331236	510222	334743	175479
			2016/17	15.81	954412	514895	439518	597370	398343	99026
			2017/18	13.72	956624	506178	450447	574099	388910	185189
2	Afar Region	A. Cattle	2012/13	5.19	63300	32219	31081	6564	3729	2835
			2013/14	6.17	95757	46367	49390	5913	1678	4236
			2014/15	6.21	104049	59725	44324	15885	6153	9732
			2015/16	6.19	132707	61506	71202	15602	6479	9122
			2016/17	7.33	127619	69277	58342	13382	7737	5645
		B. Sheep	2017/18	4.90	87473	47393	40080	14044	8662	0
			2012/13	15.04	157796	100692	57105	43379	25712	17666
			2013/14	20.88	294308	168740	125568	66941	44529	22412
			2014/15	16.80	331123	198023	133100	80638	54262	26376
			2015/16	20.49	429471	224923	204548	66809	45697	21112
		C. Goat	2016/17	14.66	328910	193860	135050	88158	65160	22998
			2017/18	13.60	307118	209684	97434	95659	59713	35947
			2012/13	14.31	283342	165871	117471	77150	51643	25507
			2013/14	18.22	517231	269465	247766	95869	63632	32237
			2014/15	15.06	571451	314034	257417	159780	109131	50648
			2015/16	19.80	743764	343122	400643	104637	68879	35759
			2016/17	12.80	527658	291592	236066	153706	110047	43659
			2017/18	13.38	546838	336478	210360	137717	85103	52614
3	Amhara Region	A. Cattle	2012/13	2.59	1503650	973798	529852	81382	37477	43905
			2013/14	2.96	1404128	859594	544535	64901	34823	30078
			2014/15	2.56	1624049	1073668	550381	111114	57938	53177
			2015/16	2.32	1921923	1285623	636300	149210	71600	77610
			2016/17	3.06	1983536	1284553	698983	121974	68385	53589

			2017/18	3.15	2182377	1455890	726487	124043	56938	67106
		B. Sheep	2012/13	4.65	2467083	1280055	1187027	1923611	1393592	530019
			2013/14	6.65	2399363	1266497	1132866	1728517	1248431	480086
			2014/15	3.38	2974467	1618997	1355470	2024739	1456339	568400
			2015/16	3.23	2771319	1485970	1285349	2208216	1608536	599680
			2016/17	3.26	3132576	2662769	469807	490554	468088	22466
			2017/18	3.47	3089817	1564742	1525075	2795024	1983337	811686
		C. Goat	2012/13	7.73	1164989	577380	587610	797883	562546	235337
			2013/14	9.00	1214125	614958	599167	793477	543438	250039
			2014/15	9.17	1483575	726808	756767	1065196	723524	341672
			2015/16	5.72	1424790	709079	715711	1153391	747373	406018
			2016/17	5.34	1522177	767509	754668	207459	793194	14265
			2017/18	10.19	1990351	1001601	988749	1316139	836467	479672
4	Oromia Region	A. Cattle	2012/13	3.87	2569427	1586377	983050	132356	68152	64204
			2013/14	4.33	2544329	1618290	926038	100727	50961	49765
			2014/15	3.72	2557093	1681357	875736	139768	66319	73449
			2015/16	3.98	2710852	1723962	986890	164995	88711	76284
			2016/17	3.56	2553544	1653119	900426	130824	67758	63066
			2017/18	3.78	2816376	1784281	1032095	116317	54602	61715
		B. Sheep	2012/13	12.43	2301124	1299858	1001266	685829	515861	169969
			2013/14	11.91	2341768	1304043	1037725	655898	491871	164028
			2014/15	12.13	2412312	1362899	1049414	689053	512347	176706
			2015/16	10.92	2419608	1435656	983953	725674	554196	171479
			2016/17	7.81	2222509	1333370	889139	734710	655638	79072
			2017/18	6.03	2001307	1166205	835102	729545	563522	166023
		C. Goat	2012/13	11.46	1415465	767767	647698	359186	259184	100002
			2013/14	12.27	1611113	842604	768509	361530	250492	111038
			2014/15	10.74	1569080	816173	752907	443132	308206	134926
			2015/16	11.67	1674604	853068	821536	385991	267376	118615
			2016/17	9.97	1563827	835432	728395	417038	300528	16510
			2017/18	13.60	1918959	1025180	893780	416071	309294	106777
5	Somali Region	A. Cattle	2012/13	4.85	30356	19373	10983	2653	0	768
			2013/14	2.53	18881	13065	5816	1214	0	0
			2014/15	3.39	25129	17494	7634	2403	1595	0
			2015/16	3.82	33254	20993	12261	2422	1748	674
			2016/17	1.74	21973	12311	9662	2004	1419	585
			2017/18	3.08	24349	16154	8195	2174	0	0
		B. Sheep	2012/13	12.26	157353	115356	41997	36193	26588	9604
			2013/14	11.92	177658	133692	43966	61343	49166	12177
			2014/15	11.73	170062	124483	45579	62228	44093	18135
			2015/16	11.09	160286	109734	50552	63092	44259	18833
			2016/17	7.51	105277	69609	35668	44739	32980	11759
			2017/18	10.35	145528	96343	49185	91039	71510	19529
		C. Goat	2012/13	11.87	199513	141640	57873	63813	47956	15858
			2013/14	10.72	216742	155052	61690	79627	63912	15716

			2014/15	10.61	225176	156441	68734	74672	49735	24936
			2015/16	11.02	229917	146938	82979	74462	52018	22444
			2016/17	8.85	175319	99397	75922	64092	40271	23821
			2017/18	14.20	347818	219210	128608	134917	97095	37821
6	Benishagul G. Region	A. Cattle	2012/13	0.19	43340	26466	16874	2997	1681	1316
			2013/14	-0.84	47493	26880	20614	4256	2401	1855
			2014/15	2.27	62292	37515	24777	5554	3477	2077
			2015/16	0.49	77348	46655	30693	10909	0	4315
			2016/17	4.88	87973	53623	34350	7229	4092	3137
		2017/18	3.28	112716	69375	43341	4110	2900	1210	
		B. Sheep	2012/13	1.01	16951	7526	9425	14806	11843	2963
			2013/14	3.57	16711	8817	7895	10010	8622	1388
			2014/15	7.77	7319	3257	4062	14293	11050	3243
			2015/16	-5.76	19127	7993	11134	18145	15338	2806
			2016/17	-2.45	21716	11215	10500	16264	12376	3887
		2017/18	0.86	33193	18574	14618	20931	15514	5418	
		C. Goat	2012/13	5.02	66955	33152	33803	35600	22441	13159
			2013/14	2.86	78457	39082	39376	43646	28205	15441
2014/15	3.91		83389	42603	40786	51400	32430	18970		
2015/16	1.55		88106	45165	42941	55608	36720	18888		
2016/17	2.98		85013	41388	43625	46178	28250	17928		
2017/18	1.09	104475	49811	54663	57654	32947	24707			
7	SNNP Region	A. Cattle	2012/13	-6.31	260824	665884	594940	75716	46383	29334
			2013/14	-6.35	270981	684103	586877	101253	69584	31669
			2014/15	1.63	1100462	599406	501056	64250	38473	25777
			2015/16	16.85	2840292	556998	493612	108908	67574	41334
			2016/17	3.20	1306705	705028	601677	111647	69525	42122
		2017/18	2.20	1481374	870095	611279	115369	69892	45477	
		B. Sheep	2012/13	4.66	666939	313475	353464	159417	123804	35613
			2013/14	3.25	642690	308938	333752	177006	146355	30651
			2014/15	0.90	586494	290429	296066	175468	145048	30420
			2015/16	1.98	593736	294838	298898	150399	123292	27106
			2016/17	1.71	724941	360707	364234	12865	80446	32420
		2017/18	-0.89	719183	371511	347672	274985	233029	41956	
		C. Goat	2012/13	2.52	365629	175754	189875	105639	81369	24270
			2013/14	2.52	402792	204491	198301	141106	109176	31930
2014/15	2.47		447180	250824	196356	142592	103579	39013		
2015/16	0.80		351605	185935	165670	122048	86882	35165		
2016/17	3.29		593251	330639	262612	95012	38388	56624		
2017/18	7.70	805157	426062	379095	168447	120255	48191			
8	Gambella Region	A. Cattle	2012/13	0.88	19037	9856	9181	2434	0	650
			2013/14	1.62	20266	11179	9087	1081	427	654
			2014/15	1.22	19100	10448	8651	1095	595	500
			2015/16	-0.52	19388	11465	7923	617	324	293

			2016/17	0.91	19701	12616	7084	662	474	188
			2017/18	-0.85	24698	16516	8182	818	489	328
		B. Sheep	2012/13	-6.20	4842	2642	2200	4732	3919	0
			2013/14	-4.92	7735	5015	2720	4306	3571	735
			2014/15	-4.61	5667	3953	1715	3678	3124	554
			2015/16	-9.82	3248	2300	948	3325	2817	508
			2016/17	-12.70	6319	4398	1921	2944	2576	368
			2017/18	-15.11	7129	4263	2866	3488	2891	0
		C. Goat	2012/13	1.60	7894	4196	3698	1655	831	824
			2013/14	-1.03	7255	3755	3500	1953	1205	747
			2014/15	3.48	12639	6440	6199	2198	1386	812
			2015/16	-1.66	4050	2261	1788	2484	1966	0
			2016/17	-2.22	10116	6249	3867	3526	2720	806
			2017/18	-2.02	11786	5769	6017	3414	2216	1197
9	Harari Region	A. Cattle	2012/13	5.20	5075	3349	1726	186	129	0
			2013/14	6.91	6410	4319	2091	0	0	0
			2014/15	3.69	5172	3217	1955	480	381	0
			2015/16	2.71	5562	3712	1850	218	218	0
			2016/17	5.00	7725	4511	3215	504	469	0
			2017/18	7.07	8071	4173	3898	0	0	0
		B. Sheep	2012/13	-3.82	374	0	241	658	557	0
			2013/14	-1.72	720	345	374	612	612	0
			2014/15	-6.06	470	266	0	787	758	0
			2015/16	-3.20	588	286	0	943	797	145
			2016/17	-0.57	522	447	0	783	742	0
			2017/18	0.00	0	0	0	2691	2343	0
		C. Goat	2012/13	3.38	4100	2520	1580	4420	4031	388
			2013/14	5.79	5969	3384	2585	5232	4572	659
			2014/15	3.00	4629	2617	2012	4868	4317	551
			2015/16	3.81	5642	3208	2434	5803	5113	690
			2016/17	-0.08	4704	3194	1509	7798	6721	1077
			2017/18	3.06	7757	3864	3893	10428	9553	875
10	Dire Dawa	A. Cattle	2012/13	4.59	4645	2658	1987	0	0	0
			2013/14	3.91	3678	2249	1428	0	0	0
			2014/15	3.49	4348	3147	1201	0	0	0
			2015/16	2.02	4098	2771	1327	180	0	0
			2016/17	4.47	4332	2354	1978	0	0	0
			2017/18	3.90	5224	3337	1888	0	0	0
		B. Sheep	2012/13	11.47	9935	7015	2920	4420	4206	0
			2013/14	5.32	8651	6117	2534	4307	4123	184
			2014/15	9.83	11190	8629	2562	5667	5268	399
			2015/16	7.86	10067	5938	4129	6578	6159	420
			2016/17	7.12	7079	4729	2350	5014	4602	412
			2017/18	6.64	6858	5282	1576	6688	6049	0
		C. Goat	2012/13	10.54	24679	15399	9280	4733	4033	701

			2013/14	10.69	25878	15238	10640	5601	4896	705
			2014/15	11.44	30944	19569	11375	6429	5653	776
			2015/16	10.83	30372	19645	10727	6931	5471	1460
			2016/17	10.54	27218	17766	9452	6362	4673	1689
			2017/18	7.76	28034	20063	7971	9676	9102	0
11	National	A. Cattle	2012/13	3.23	5755743	3485221	2270523	338150	78411	159739
			2013/14	3.49	5703497	3452921	2250576	328538	87386	141152
			2014/15	2.95	5818893	3686670	2132223	396986	8449	188537
			2015/16	3.01	6367410	3976047	2391363	499841	69830	230011
			2016/17	3.59	6631627	4143196	488431	450357	356676	93681
		2017/18	3.51	7346188	4680510	2665678	434514	222050	212464	
		B. Sheep	2012/13	8.16	5989600	3241306	2748294	3077367	2256494	820873
			2013/14	8.61	6161751	3350625	2811126	2958191	2187556	770635
			2014/15	7.31	6873271	3820755	3052516	3318420	2428358	890062
			2015/16	7.43	6852191	3832420	3019771	3539278	2609365	929913
			2016/17	5.58	6927201	4840796	2086331	910312	861260	49052
		2017/18	4.82	6902463	3726452	3176011	4520293	3301596	1218697	
		C. Goat	2012/13	9.26	4021701	2164603	1857098	1771527	1260107	511421
			2013/14	9.98	4701747	2486901	2214846	1980029	1381944	598085
			2014/15	9.38	5121410	2743989	2377421	2448134	1682060	766074
			2015/16	9.46	5352324	2776659	2575665	2421576	1606541	815035
			2016/17	8.75	5463697	2908061	2555636	1598540	1823134	75406
2017/18	11.58	6717799	3594216	3123582	2828561	1890944	937617			

Source: CSA-Ethiopia and NCR is calculated figure based on CSA data





9	9	2014	40080.60	14403.20	25676.70	5843.20	840.10	12024.18	525.89	105.85	9095.80	8644.30	5307.40	16659.30	0.00	373.10	3900.40	15951.60	1113.70	513.80	6.91	6410.00	4319.00	2091.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	9	2015	43680.70	15589.70	27670.30	5762.40	628.70	13104.21	518.62	79.22	10194.10	10546.20	5395.60	17124.10	0.00	0.00	3847.20	16650.90	1501.50	401.10	3.69	5172.00	3217.00	1955.00	480.00	381.00	0.00	0.00	0.00	0.00	0.00	
9	9	2016	47768.00	17556.00	30212.70	6772.10	915.30	14330.40	609.49	115.33	10087.70	10752.70	7468.30	19137.30	0.00	322.70	4573.10	16168.60	1932.70	272.30	2.71	5562.00	3712.00	1850.00	218.00	218.00	0.00	0.00	0.00	0.00	0.00	
9	9	2017	48570.90	17076.00	31468.50	7255.50	710.00	14571.27	653.00	89.46	10908.10	11727.80	6170.50	19388.60	0.00	352.10	4868.50	19184.20	1302.00	0.00	5.00	7725.00	4511.00	3215.00	504.00	469.00	0.00	0.00	0.00	0.00	0.00	
9	9	2018	49893.90	17609.90	31828.30	6990.10	689.60	25293.83	1932.93	187.35	11447.10	13127.80	6162.80	18700.50	0.00	0.00	3089.10	1870.50	0.00	0.00	7.07	8071.00	4173.00	3898.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10	10	2013	33007.10	12588.10	20419.70	17856.70	6779.00	17308.61	5055.46	2189.43	7123.20	8067.50	5464.90	11918.20	0.00	434.00	4414.20	11221.70	941.50	696.50	4.59	4645.00	2658.00	1987.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10	10	2014	31521.00	11688.60	19807.20	18375.50	7256.50	9456.30	1653.80	914.32	6827.80	7763.00	4860.80	11609.50	0.00	434.70	3852.10	11097.10	884.80	466.20	3.91	3678.00	2249.00	1428.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10	10	2015	34916.00	12436.90	22478.40	20998.20	8654.50	10474.80	1889.84	1090.47	7453.60	8568.70	4983.30	13507.20	0.00	402.50	3731.70	12743.50	1187.20	714.70	3.49	4348.00	3147.00	1201.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10	10	2016	36901.20	13831.30	22995.00	20270.70	7541.90	11070.36	1824.36	950.28	8549.10	8390.90	5282.20	13908.30	0.00	695.80	0.00	12079.90	971.60	375.90	2.02	4098.00	2771.00	1327.00	180.00	0.00	0.00	0.00	0.00	0.00	0.00	
10	10	2017	36694.70	13145.30	23294.60	20580.40	6423.40	11008.41	1852.24	809.35	7144.90	8266.30	6000.40	15028.30	0.00	0.00	4026.40	14754.60	1946.70	188.30	4.47	4332.00	2354.00	1978.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10	10	2018	36370.60	13314.00	22619.80	24939.30	6433.20	18719.30	6920.69	2051.21	8705.90	9105.60	4608.10	13514.20	0.00	0.00	2600.50	13164.20	1650.60	0.00	3.90	5224.00	3337.00	1888.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11	11	2013	37793042.70	16823724.40	20969319.00	2406079.20	25489204.0	206252.41	689837.41	836545.16	5941350.80	6843917.50	10393964.70	13656483.40	488408.90	468918.10	9686387.20	12670926.80	707577.50	985556.60	3.23	5755743.00	3485221.00	2270523.00	338150.00	78411.00	159739.00	183285.00	733140.00			
11	11	2014	38519096.00	17188900.40	21330197.00	2816333.20	2734793.30	11555728.80	253469.99	344583.96	6096482.70	6948259.50	10585087.10	13897270.10	507330.60	48467.40	9918556.90	12999270.20	666529.50	897999.90	3.49	5703497.00	3452921.00	2250576.00	328538.00	87386.00	141152.00	204921.00	819684.00			
11	11	2015	39694472.30	17684093.00	22010380.00	2911296.30	2933238.20	11908341.016.69	262016.67	369588.01	6301665.30	7357261.10	10952310.60	14260139.60	430117.10	392979.30	10298562.40	411250.50	653747.50	816027.10	2.95	5818893.00	3686670.00	213223.00	396986.00	8449.00	188537.00	142788.00	571152.00			
11	11	2016	40480967.10	18064106.00	22416860.00	2970495.80	2889238.00	12144290.13	267344.62	364043.99	6425300.00	7389885.30	11188503.20	14616352.10	450303.00	410622.80	10521562.10	13860736.40	666941.10	755615.70	3.01	6367410.00	3976047.00	2391363.00	499841.00	69830.00	23001.00	153051.00	612204.00			
11	11	2017	41640666.90	18534863.00	23105803.00	3020022.60	3069794.20	12492200.07	271802.03	386794.07	6621300.70	7869811.60	11440905.70	14770616.00	472657.50	465375.40	10798463.20	14089413.80	642442.50	681202.20	3.59	6631627.00	4143196.00	488431.00	57.00	76.00	93681.00	80847.00	323388.00			
11	11	2018	42274413.30	19157488.00	23116925.30	3273838.50	3130225.70	23023365.94	93027.97	1023940.18	6840689.10	7904885.10	11901203.30	14771487.50	415595.60	440552.70	11166484.00	856030.30	734719.30	762927.20	3.51	7346188.00	4680510.00	2665678.00	434514.00	222050.00	212464.00	65104.00	260416.00			

Remark: Definitions of Variables in Annex 2a

ID	Region ID
Rg	Regional State
Yr	Year
TotCatPop	Total Cattle Population in TLU
MalCatPop	Male Cattle Population in TLU
FemCatPop	Female Cattle Population in TLU
TotGoaPop	Total Goats Population in TLU
TotShePop	Total Sheep Population in TLU
CatINDEX	Cattle Resource Base Index in TLU
GoaINDEX	Goats Resource Base Index in TLU
SheINDEX	Sheep Resource Base Index in TLU
MalCatLes3YrsAged	Male Cattle Less than 3 Years age in TLU
FemCatLes3YrsAged	Female Cattle Less than 3 Years age in TLU
MalCat3to10YrsAged	Male Cattle Aged 3 to 10 Years age in TLU
FemCat3to10YrsAged	Female Cattle Aged 3 to 10 Years age in TLU
MalCatAb10YrsAged	Male Cattle Aged above 10 Years age in TLU
FemCatAb10YrsAged	Female Cattle Aged Above 10 Years age in TLU
MalCatPurDB	Male Cattle Kept for Draught and Breeding in TLU
FemCatPurDMB	Female Cattle Kept for Draught Milk and Breeding in TLU
MalCatPurBeOt	Male Cattle Kept for Beef and Other in TLU
FemCatPurBeOt	Female Cattle Kept for Beef and Other in TLU
NComCatOffTake	Net Commercial Off-take Cattle (Rate)
TotCatSales	Total Cattle Sales (Volume)
MalCatSales	Male Cattle Sales (Volume)
FemCatSales	Female Cattle Sales (Volume)
TotCatSlau	Total Cattle Slaughters (Volume)
MalCatSlau	Male Cattle Slaughters (Volume)
FemCatSlau	Female cattle Slaughters (Volume)
ForCatEXPORT	Formal Cattle Export (Volume)
InforCatTRADE	Informal Cattle Trade (Volume)



5	5	2015	1296 41.20	4193 0.30	87710 .90	45161 6.20	19038 9.10	16334 .79	13548 4.86	1713 5.02	27655.90	32883.90	14274.40	54827. 00	9600.20	54514.70	4638.5 0	312.40	11.73	17006 2.00	12448 3.00	4557 9.00	6222 8.00	44093. 00	18135. 00	29435 6.00	1177424.00
5	5	2016	1308 30.90	4035 5.50	90475 .30	44174 1.30	18358 1.10	16484 .69	13252 2.39	1652 2.30	24923.30	38376.70	15432.20	52098. 60	10307.70	50442.40	4962.2 0	1656.3 0	11.09	16028 6.00	10973 4.00	5055 2.00	6309 2.00	44259. 00	18833. 00	35322 2.00	1412888.00
5	5	2017	1022 29.80	2952 4.00	72705 .90	40948 8.10	15196 0.20	12880 .95	12284 6.43	1367 6.42	19756.10	28614.70	9767.90	44091. 20	6769.10	43733.00	2832.9 0	358.20	7.51	10527 7.00	69609 .00	3566 8.00	4473 9.00	32980. 00	11759. 00	21786 7.00	871468.00
5	5	2018	1360 70.30	4091 4.80	95155 .50	41265 2.10	28264 2.40	44947 .34	22054 6.24	8173 0.41	24487.40	37827.40	16427.40	57328. 10	9787.60	56558.40	6277.6 0	769.80	10.35	14552 8.00	96343 .00	4918 5.00	9103 9.00	71510. 00	19529. 00	28197 7.00	1127908.00
6	6	2013	9313. 10	2799. 40	6513. 80	39098 5.70	41150 .30	2963. 70	21404 1.28	1138 6.45	2275.20	2611.10	524.20	3902.7 0	449.80	3874.30	65.10	28.40	1.01	16951. 00	7526. 00	9425. 00	1480 6.00	11843. 00	2963.0 0	0.00	0.00
6	6	2014	8382. 50	2427. 80	5954. 60	42319 4.10	41742 .40	1056. 20	12695 8.23	3756 .82	2125.80	2313.60	302.00	3641.0 0	179.30	3637.80	122.60	3.20	3.57	16711. 00	8817. 00	7895. 00	1001 0.00	8622.0 0	1388.0 0	0.00	0.00
6	6	2015	1045 4.70	3615 90	6838. 70	46171 0.90	44071 .90	1317. 29	13851 3.27	3966 .47	2886.70	2498.00	729.20	4340.7 0	436.00	4298.40	281.30	42.30	7.77	7319.0 0	3257. 00	4062. 00	1429 3.00	11050. 00	3243.0 0	0.00	0.00
6	6	2016	9793. 40	3094. 40	6699. 10	50838 5.50	44863 .50	1233. 97	15251 5.65	4037 .72	2594.70	2824.70	499.70	3874.4 0	272.80	3771.50	165.60	102.90	-5.76	19127. 00	7993. 00	1113 4.00	1814 5.00	15338. 00	2806.0 0	0.00	0.00
6	6	2017	1000 1.30	2954. 00	7047. 40	54454 0.50	43121 .60	1260. 16	16336 2.15	3880 .94	2560.00	3254.10	394.00	3793.3 0	273.00	3778.20	113.00	15.10	-2.45	21716. 00	11215 .00	1050 0.00	1626 4.00	12376. 00	3887.0 0	0.00	0.00
6	6	2018	1600 2.90	4322. 90	11680 .10	55651 6.80	60284 .00	4923. 16	29606 5.95	1611 9.59	3850.80	5456.80	472.10	6223.3 0	456.70	6167.70	0.00	55.60	0.86	33193. 00	18574 .00	1461 8.00	2093 1.00	15514. 00	5418.0 0	0.00	0.00
7	7	2013	4118 38.20	1125 47.10	29929 1.20	77565 76.80	39121 3.10	13566 0.62	41151 69.10	1154 98.9 7	83933.80	107790.4 0	28613.30	191500 .80	20458.20	189484.60	8136.8 0	2016.2 0	4.66	66693 9.00	31347 5.00	3534 64.00	1594 17.00	123804 00	35613. 00	0.00	0.00
7	7	2014	4748 67.60	1365 62.60	33830 5.00	77309 02.90	49535 8.80	59833 .32	23192 70.87	4458 2.29	99724.00	123856.0 0	36838.60	214449 .00	24451.40	209742.70	12352. 80	4706.3 0	3.25	64269 0.00	30893 8.00	3337 52.00	1770 06.00	146355 .00	30651. 00	0.00	0.00
7	7	2015	4580 22.00	1309 75.50	32704 6.50	78509 45.20	50926 2.80	57710 .77	23552 83.56	4583 3.65	92635.10	119085.7 0	38340.40	207960 .80	26779.40	204405.80	11231. 20	3554.9 0	0.90	58649 4.00	29042 9.00	2960 66.00	1754 68.00	145048 .00	30420. 00	0.00	0.00
7	7	2016	4703 55.80	1315 49.20	33878 6.60	78198 05.70	53430 7.20	59264 .83	23459 41.71	4808 7.65	90741.80	110351.6 0	40827.40	228435 .00	0.00	227107.30	9667.2 0	1327.7 0	1.98	59373 6.00	29483 8.00	2988 98.00	1503 99.00	123292 .00	27106. 00	0.00	0.00
7	7	2017	5087 00.70	1499 30.10	35877 0.70	80396 02.90	52582 5.00	64096 .29	24118 80.87	4732 4.25	108590.30	133596.6 0	41339.80	225174 .10	31032.10	222605.30	10255. 20	2568.8 0	1.71	72494 1.00	36070 7.00	3642 34.00	1286 5.00	80446. 00	32420. 00	0.00	0.00
7	7	2018	4639 60.60	1356 06.60	32835 3.90	83184 83.60	49582 5.50	15216 9.68	45163 42.20	88.0 7	101886.30	117549.4 0	33720.30	210804 .50	21849.00	208939.80	11748. 30	1864.8 0	-0.89	71918 3.00	37151 1.00	3476 72.00	2749 85.00	233029 .00	41956. 00	0.00	0.00
8	8	2013	4993. 40	1441. 00	3552. 40	19393 5.00	8422. 90	1585. 51	10343 4.73	2312 .13	1081.50	1539.60	359.50	2012.8 0	336.80	1995.70	0.00	17.10	-6.20	4842.0 0	2642. 00	2200. 00	4732. 00	3919.0 0	0.00	0.00	0.00
8	8	2014	4542. 80	1488. 70	3054. 30	19337 2.20	8986. 00	572.3 9	58011. 66	808. 74	1100.00	1237.30	388.70	1817.0 0	321.10	1783.60	0.00	33.40	-4.92	7735.0 0	5015. 00	2720. 00	4306. 00	3571.0 0	735.00	0.00	0.00
8	8	2015	3547. 60	1098. 40	2449. 20	19500 8.80	8861. 00	447.0 0	58502. 64	797. 49	873.10	1160.70	225.30	1288.5 0	146.50	1275.80	0.00	12.70	-4.61	5667.0 0	3953. 00	1715. 00	3678. 00	3124.0 0	554.00	0.00	0.00
8	8	2016	4428. 50	1253. 60	3174. 90	19639 2.70	9418. 40	557.9 9	58917. 81	847. 66	800.80	1436.60	452.80	1738.3 0	278.90	1715.50	170.40	22.80	-9.82	3248.0 0	2300. 00	948.0 0	3325. 00	2817.0 0	508.00	0.00	0.00
8	8	2017	4430. 20	1569. 40	2860. 90	19785 7.80	9901. 80	558.2 1	59357. 34	891. 16	1134.50	1264.40	434.90	1596.5 0	215.40	1593.20	0.00	3.30	12.70	6319.0 0	4398. 00	1921. 00	2944. 00	2576.0 0	368.00	0.00	0.00
8	8	2018	3528. 50	1256. 10	2272. 60	19957 1.40	10708 .30	1106. 52	10811 6.43	2949 .57	741.40	858.40	514.70	1414.2 0	171.60	1404.30	0.00	9.80	15.11	7129.0 0	4263. 00	2866. 00	3488. 00	2891.0 0	0.00	0.00	0.00
9	9	2013	639.5 0	170.5 0	469.0 0	36982. 40	5103. 90	205.4 0	19629. 20	1439 .82	136.60	173.50	33.90	295.50	0.00	295.50	18.00	0.00	-3.82	374.00	0.00	241.0 0	658.0 0	557.00	0.00	0.00	0.00
9	9	2014	840.1 0	174.4 0	633.7 0	40080. 60	5843. 20	105.8 5	12024. 18	525. 89	174.40	215.30	0.00	418.40	0.00	418.40	0.00	0.00	-1.72	720.00	345.0 0	374.0 0	612.0 0	612.00	0.00	0.00	0.00
9	9	2015	628.7 0	203.3 0	425.4 0	43680. 70	5762. 40	79.22	13104. 21	518. 62	180.20	133.20	23.10	292.20	0.00	292.20	0.00	0.00	-6.06	470.00	266.0 0	0.00	787.0 0	758.00	0.00	0.00	0.00
9	9	2016	915.3 0	239.6 0	675.8 0	47768. 00	6772. 10	115.3 3	14330. 40	609. 49	197.70	250.10	41.90	425.70	0.00	425.70	0.00	0.00	-3.20	588.00	286.0 0	0.00	943.0 0	797.00	145.00	0.00	0.00
9	9	2017	710.0 0	191.8 0	518.2 0	48570. 90	7255. 50	89.46	14571. 27	653. 00	162.30	150.50	29.50	367.70	0.00	367.70	0.00	0.00	-0.57	522.00	447.0 0	0.00	783.0 0	742.00	0.00	0.00	0.00
9	9	2018	689.6 0	49.70	390.6 0	49893. 90	6990. 10	187.3 5	25293. 83	1932 .93	49.70	96.70	0.00	293.90	0.00	293.90	0.00	0.00	0.00	0.00	0.00	0.00	2691. 00	2343.0 0	0.00	0.00	0.00
10	10	2013	6779. 00	1586. 70	5192. 30	33007. 10	17856 .70	2189. 43	17308. 61	5055 .46	1387.20	1921.60	199.50	3270.7 0	0.00	3254.50	117.80	16.20	11.47	9935.0 0	7015. 00	2920. 00	4420. 00	4206.0 0	0.00	0.00	0.00

10	10	2014	7256.50	1914.80	5341.70	31521.00	18375.50	914.32	9456.30	1653.80	1672.60	2300.80	242.20	3040.90	62.20	3004.80	180.00	36.10	5.32	8651.00	6117.00	2534.00	4307.00	4123.00	184.00	0.00	0.00
10	10	2015	8654.50	2193.10	6461.30	34916.00	20998.20	1090.47	10474.80	1889.84	1956.30	2796.30	236.80	3665.00	70.20	3635.20	163.60	29.90	9.83	11190.00	8629.00	2562.00	5667.00	5268.00	399.00	0.00	0.00
10	10	2016	7541.90	1784.50	5757.50	36901.20	20270.70	950.28	11070.36	1824.36	1427.60	2512.70	356.90	3244.80	69.00	3244.80	284.00	0.00	7.86	10067.00	5938.00	4129.00	6578.00	6159.00	420.00	0.00	0.00
10	10	2017	6423.40	1478.30	4945.10	36694.70	20580.40	809.35	11008.41	1852.24	1213.80	1764.50	264.50	3180.60	27.30	3180.60	237.20	0.00	7.12	7079.00	4729.00	2350.00	5014.00	4602.00	412.00	0.00	0.00
10	10	2018	6433.20	1607.10	4826.10	36370.60	24939.30	2051.21	18712.92	6920.69	1187.20	1753.10	419.90	3073.00	0.00	3073.00	0.00	0.00	6.64	6858.00	5282.00	1576.00	6688.00	6049.00	0.00	0.00	0.00
11	11	2013	2548920.40	673693.10	1875227.30	37793042.70	2406079.20	836545.16	20621320.52	689837.41	529222.10	674034.50	144471.00	1201192.80	83898.10	1185275.30	60572.90	15917.50	8.16	5989600.00	3241306.00	2748294.00	3077367.00	2256494.00	820873.00	543403.00	2173612.00
11	11	2014	2734793.30	746070.90	1988722.30	38519096.00	2816333.20	344583.96	11555728.80	253469.99	578150.80	713589.70	167920.10	1275132.60	95954.10	1251944.60	71966.00	23188.00	8.61	6161751.00	3350625.00	2811126.00	2958191.00	2187556.00	770635.00	503423.00	2013692.00
11	11	2015	2933238.20	798711.00	2134527.10	39694472.30	2911296.30	369588.01	11908341.69	262016.67	625651.40	782560.40	173059.60	1351966.70	92738.40	1332947.80	80321.10	19018.90	7.31	6873271.00	3820755.00	3052516.00	3318420.00	2428358.00	890062.00	490593.00	1962372.00
11	11	2016	2889238.00	784670.50	2104567.60	40480967.10	2970495.80	364043.99	12144290.13	267344.62	601238.60	744196.30	183431.90	1360371.30	104871.90	1340113.20	78560.10	20258.20	7.43	6852191.00	3832420.00	3019771.00	3539278.00	2609365.00	929913.00	588703.00	2354812.00
11	11	2017	3069794.20	855228.40	2214565.80	41640666.90	3020022.60	386794.07	12492200.07	271802.03	661140.60	812193.70	194087.80	1402372.10	112968.30	1377180.10	81119.50	25192.00	5.58	6927201.00	4840796.00	2086331.00	910312.00	861260.00	49052.00	363112.00	1452448.00
11	11	2018	3130225.70	882176.10	2248049.50	42274413.30	3273838.50	1023940.18	23023365.94	930174.97	678122.30	817757.70	204053.80	1430291.80	114850.90	1410346.80	89202.90	19945.00	4.82	6902463.00	3726452.00	3176011.00	4520293.00	3301596.00	1218697.00	469963.00	1879852.00

Remark: Definitions of Variables in Annex 2b

ID	Region ID
Rg	Region
Yr	Year
TotShePop	Total Sheep Population in TLU
MalShePop	Male Sheep Population in TLU
FemShePop	Female Sheep Population in TLU
TotCatPop	Total Cattle Population in TLU
TotGoaPop	Total Goats Population in TLU
SheINDEX	Sheep Resource Base Index in TLU
CatINDEX	Cattle Resource Base Index in TLU
GoaINDEX	Goats Resource Base Index in TLU
MalSheLes2YrsAged	Male Sheep Aged Less than 2 Years age in TLU
FemSheLes2YrsAged	Female Sheep Aged less than 2 Years age in TLU
MalShe2YrsAged	Male Sheep Aged 2 Years and Older in TLU
FemShe2YrsAged	Female Sheep Aged 2 Years and Older in TLU
MalShePurB	Male Sheep Kept for Breeding in TLU
FemShePurB	Female Sheep kept for Breeding in TLU
MalShePurWMO	Male Sheep kept for Wool Mutton and Other in TLU
FemShePurWMO	Female Sheep kept for Wool Mutton and Other in TLU
NSheComOffTake	Net Commercial Off-take Sheep (Rate)
TotSheSales	Total Sheep Sales (Volume)
MalSheSales	Male Sheep Sales (Volume)
FemSheSales	Female Sheep Sales (Volume)
TotSheSlau	Total Sheep Slaughters (Volume)
MalSheSlau	Male Sheep Slaughters (Volume)
FemSheSlau	Female Sheep Slaughters (Volume)
ForSheEXPORT	Formal Sheep Export (Volume)
InforSheTRADE	Informal Sheep Trade (Volume)





10	10	2015	20998.20	5211.20	15787.00	34916.00	8654.50	1889.84	10474.80	1090.47	4262.70	6921.90	948.50	8865.10	228.30	8834.50	720.20	0.00	11.44	30944.00	19569.00	11375.00	6429.00	5653.00	776.00	0.00	0.00
10	10	2016	20270.70	5231.70	15038.90	36901.20	7541.90	1824.36	11070.36	950.28	4235.70	6318.60	996.00	8720.30	177.60	8402.50	808.40	0.00	10.83	30372.00	19645.00	10727.00	6931.00	5471.00	1460.00	0.00	0.00
10	10	2017	20580.40	5377.90	15202.50	36694.70	6423.40	1852.24	11008.41	809.35	3931.80	5653.90	1446.10	9548.60	120.80	9370.50	1325.30	0.00	10.54	27218.00	17766.00	9452.00	6362.00	4673.00	1689.00	0.00	0.00
10	10	2018	24939.30	6812.00	18127.40	36370.60	6433.20	6920.69	18712.92	2051.21	5245.50	7503.10	1566.50	10624.30	0.00	10452.60	1154.90	0.00	7.76	28034.00	20063.00	7971.00	9676.00	9102.00	0.00	0.00	0.00
11	11	2013	2406079.20	696329.00	1709750.10	37793042.70	2548920.40	689837.41	20621320.52	836545.16	501521.30	666885.60	194807.70	1042864.50	126835.70	1035095.60	67972.00	7768.90	9.26	4021701.00	2164603.00	1857098.00	1771527.00	1260107.00	511421.00	1677534.00	6710136.00
11	11	2014	2816333.20	817204.20	1999750.10	38519096.00	2734793.30	253469.99	11555728.80	344583.96	592205.20	778798.20	224999.00	1220330.70	152810.40	1205143.90	72188.50	4580.30	9.98	4701747.00	2486901.00	2214846.00	1980029.00	1381944.00	598085.00	1704571.00	6818284.00
11	11	2015	2911296.30	841993.20	2069303.00	39694472.30	2933238.20	262016.67	11908341.69	369588.01	612504.20	840711.60	229489.00	1228591.40	150118.00	1218764.40	79371.00	9827.00	9.38	5121410.00	2743989.00	2377421.00	2448134.00	1682060.00	766074.00	2045210.00	8180840.00
11	11	2016	2970495.80	844422.90	2126072.90	40480967.10	2889238.00	267344.62	12144290.13	364043.99	614717.80	1817926.60	229705.10	308146.30	152782.70	1299203.30	76922.40	8942.90	9.46	5352324.00	2776659.00	2575665.00	2421576.00	1606541.00	815035.00	2098406.00	8393624.00
11	11	2017	3020022.60	887446.60	2132576.00	41640666.90	3069794.00	271802.03	12492200.70	386794.07	637979.40	858189.00	249467.20	1274387.00	169501.10	1266457.70	79966.00	7929.30	8.75	5463697.00	2908061.00	2555636.00	1598540.00	1823134.00	75406.00	2115230.00	8460920.00
11	11	2018	3273838.50	965968.30	2307870.10	42274413.30	3130225.70	930174.97	23023365.94	1023940.18	723347.10	911418.60	242621.20	1396451.50	157421.70	1385177.30	85199.50	11274.20	11.58	6717799.00	3594216.00	3123582.00	2828561.00	1890944.00	937617.00	2187975.00	8751900.00

Remark: Definitions of Variables in Annex 2c

ID	Region ID
Rg	Region
Yr	Year
TotGoaPop	Total Goats Population in TLU
MalGoaPop	Male Goats Population in TLU
FemGoaPop	Female Goats Population in TLU
TotCatPop	Total Cattle Population in TLU
TotShePop	Total Sheep Population in TLU
GoaINDEX	Goats Resource Base Index in TLU
CatINDEX	Cattle Resource Base Index in TLU
SheINDEX	Sheep Resource Base Index in TLU
MalGoaLes2YrsAged	Male Goat Less than 2 Years age in TLU
FemGoales2YrsAged	Female Goat Less than 2 Years age in TLU
MalGoa2YrsAged	Male Goats Aged 2 Years and Older in TLU
FemGoa2YrsAged	Female Goats Aged 2 Years and Older in TLU
MalGoaPurB	Male Goats Kept for Breeding in TLU
FemGoaPurMB	Female Goats kept for Milk and Breeding in TLU
MalGoaPurBO	Male Goats kept for Meat and Other in TLU
FemGoaPurBO	Female Goats Kept for Meat and Other in TLU
NGoaComOffTake	Net Commercial Off-take Goats (Rate)
TotGoaSales	Total Goats Sales (Volume)
MalGoaSales	Male Goats Sales (Volume)
FemGoaSales	Female Goats Sales (Volume)
TotGoaSlau	Total Goats Slaughters (Volume)
MalGoaSlau	Male Goats Slaughters (Volume)
FemGoaSlau	Female Goats Slaughters (Volume)
ForGoaEXPORT	Formal Goats Export (Volume)
InforGoaTRADE	Informal Goats Trade (Volume)

### Annex 3: Pre and Post Estimations Tests

. hausman fe re

	—— Coefficients ——		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
TotCatSales	.1922766	2.579165	-2.386888	.
TotGoaPop	.9121382	2.039838	-1.1277	.
TotShePop	5.615584	6.263327	-.6477431	.

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
 = 100.25  
 Prob>chi2 = 0.0000  
 (V\_b-V\_B is not positive definite)

. hausman fe re

	—— Coefficients ——		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
TotSheSales	.1532379	.1784561	-.0252182	.0094969
TotCatPop	.0400614	.0178031	.0222583	.0072895
TotGoaPop	.3031682	.3554031	-.0522349	.0339542

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
 = 20.57  
 Prob>chi2 = 0.0001

. hausman fe re

	Coefficients			sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re	(b-B) Difference	
TotGoaPop	2.20625	2.261739	-.0554897	.1225523
TotCatPop	.2204598	-.0782281	.2986879	.0446567
TotShePop	-.6550088	.7727702	-1.427779	.1987449

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
 = 59.31  
 Prob>chi2 = 0.0000  
 (V\_b-V\_B is not positive definite)

Cochrane-Orcutt AR(1) regression -- iterated estimates

Source	SS	df	MS	Number of obs =	55
Model	9.8803e+13	1	9.8803e+13	F( 1, 53) =	1212.91
Residual	4.3173e+12	53	8.1459e+10	Prob > F =	0.0000
Total	1.0312e+14	54	1.9096e+12	R-squared =	0.9581
				Adj R-squared =	0.9573
				Root MSE =	2.9e+05

TotCatSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotCatPop	.1607	.0046143	34.83	0.000	.151445	.169955
_cons	9939.124	64399.8	0.15	0.878	-119230.5	139108.8
rho	.2938557					

Durbin-Watson statistic (original) 1.222231  
 Durbin-Watson statistic (transformed) 1.960071

Cochrane-Orcutt AR(1) regression -- iterated estimates

Source	SS	df	MS	Number of obs =	55
Model	2.2040e+12	1	2.2040e+12	F( 1, 53) =	197.00
Residual	5.9296e+11	53	1.1188e+10	Prob > F =	0.0000
				R-squared =	0.7880
				Adj R-squared =	0.7840
Total	2.7970e+12	54	5.1796e+10	Root MSE =	1.1e+05

TotSheSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotShePop	2.094934	.149257	14.04	0.000	1.795562	2.394306
_cons	-50012.71	241574.1	-0.21	0.837	-534549.1	434523.7
rho	.9314144					

Durbin-Watson statistic (original) 0.191190

Durbin-Watson statistic (transformed) 2.101392

Cochrane-Orcutt AR(1) regression -- iterated estimates

Source	SS	df	MS	Number of obs =	55
Model	5.1373e+12	1	5.1373e+12	F( 1, 53) =	300.59
Residual	9.0580e+11	53	1.7090e+10	Prob > F =	0.0000
				R-squared =	0.8501
				Adj R-squared =	0.8473
Total	6.0431e+12	54	1.1191e+11	Root MSE =	1.3e+05

TotGoaSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotGoaPop	2.235543	.1289414	17.34	0.000	1.976919	2.494166
_cons	11346.62	198560	0.06	0.955	-386914.4	409607.6
rho	.895359					

Durbin-Watson statistic (original) 0.358645

Durbin-Watson statistic (transformed) 1.502766

## Annex 4: Computed Regression Estimations by Species

### Annex 4a- Results of Fixed Effects Estimation for Sales of Cattle

```
. xtreg TotCatPop TotCatSales TotGoaPop TotShePop, fe

Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.8266                 Obs per group:  min =      6
        between = 0.9856                avg           =     6.0
        overall = 0.9833                max           =      6

corr(u_i, Xb) = 0.9688                 F(3,52)         =     82.63
                                                Prob > F        =     0.0000
```

TotCatPop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotCatSales	.1922766	.1157955	1.66	0.103	-.0400842	.4246374
TotGoaPop	.9121382	.9150548	1.00	0.323	-.9240535	2.74833
TotShePop	5.615584	1.137061	4.94	0.000	3.333905	7.897264
_cons	3640450	255314.3	14.26	0.000	3128125	4152776
sigma_u	6258528.3					
sigma_e	257253.93					
rho	.99831327	(fraction of variance due to u_i)				

F test that all u\_i=0: F(10, 52) = 152.14 Prob > F = 0.0000

### Annex 4b- Results of Fixed Effects Estimation for Commercial Off-take of Cattle

```
. xtreg TotCatPop NComCatOffTake TotCatSales MalCatSales FemCatSales TotCatSlau MalCatSlau FemCatSlau For
> CatEXPORT InforCatTRADE, fe
note: ForCatEXPORT omitted because of collinearity
```

```
Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.9582                 Obs per group:  min =      6
        between = 0.9945                avg           =     6.0
        overall = 0.9830                max           =      6

corr(u_i, Xb) = 0.9827                 F(8,47)         =    134.71
                                                Prob > F        =     0.0000
```

TotCatPop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
NComCatOffTake	-5852.627	15940.6	-0.37	0.715	-37920.99	26215.73
TotCatSales	.2497276	.1543598	1.62	0.112	-.0608042	.5602594
MalCatSales	2.635437	.3063739	8.60	0.000	2.019092	3.251782
FemCatSales	.7516781	.2995564	2.51	0.016	.1490483	1.354308
TotCatSlau	15.06336	2.655295	5.67	0.000	9.721596	20.40513
MalCatSlau	-6.90094	1.472049	-4.69	0.000	-9.86232	-3.93956
FemCatSlau	-30.0642	6.087773	-4.94	0.000	-42.31122	-17.81718
ForCatEXPORT	0	(omitted)				
InforCatTRADE	-2.561565	.3128481	-8.19	0.000	-3.190935	-1.932196
_cons	5188497	176394.7	29.41	0.000	4833637	5543358
sigma_u	8521553.3					
sigma_e	132841.16					
rho	.99975705	(fraction of variance due to u_i)				

F test that all u\_i=0: F(10, 47) = 120.21 Prob > F = 0.0000

## Annex 4c- Results of Fixed Effects Estimation for Total Sales of Sheep

```
. xtreg TotShePop TotSheSales TotCatPop TotGoaPop, fe
```

```
Fixed-effects (within) regression      Number of obs      =      66
Group variable: ID                    Number of groups   =      11

R-sq:  within = 0.9453                Obs per group: min =      6
      between = 0.9958                    avg =      6.0
      overall = 0.9952                    max =      6

                                          F(3,52)           =      299.31
corr(u_i, Xb) = -0.9539                Prob > F           =      0.0000
```

TotShePop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotSheSales	.1532379	.0206621	7.42	0.000	.1117762	.1946995
TotCatPop	.0400614	.0081618	4.91	0.000	.0236837	.0564392
TotGoaPop	.3031682	.0516225	5.87	0.000	.1995801	.4067563
_cons	-111504.6	37928.44	-2.94	0.005	-187613.6	-35395.62
sigma_u	190615.67					
sigma_e	18146.53					
rho	.99101844	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(10, 52) =      22.57      Prob > F = 0.0000
```

## Annex 4d- Results of Fixed Effects Estimation for Commercial Off-take of Sheep

```
. xtreg TotShePop NSheComOffTake TotSheSales MalSheSales FemSheSales TotSheSlau MalSheSlau FemSheSlau For
> SheEXPORT InforSheTRADE, fe
```

note: ForSheEXPORT omitted because of collinearity

```
Fixed-effects (within) regression          Number of obs   =       66
Group variable: ID                        Number of groups =       11

R-sq:  within = 0.8821                    Obs per group:  min =        6
        between = 0.9396                  avg =           6.0
        overall = 0.9377                  max =           6

                                          F(8,47)         =       43.95
corr(u_i, Xb) = 0.7841                    Prob > F        =       0.0000
```

TotShePop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
NSheComOffTake	-632.7626	1467.671	-0.43	0.668	-3585.336	2319.811
TotSheSales	29.41544	106.1579	0.28	0.783	-184.1467	242.9776
MalSheSales	-29.08207	106.1584	-0.27	0.785	-242.6453	184.4811
FemSheSales	-29.26011	106.1647	-0.28	0.784	-242.836	184.3157
TotSheSlau	-.519015	.3145505	-1.65	0.106	-1.151809	.113779
MalSheSlau	.7937451	.3418081	2.32	0.025	.1061158	1.481374
FemSheSlau	.2523537	.361894	0.70	0.489	-.4756831	.9803906
ForSheEXPORT	0	(omitted)				
InforSheTRADE	-.2079265	.043129	-4.82	0.000	-.2946909	-.1211622
_cons	213474.2	39602.46	5.39	0.000	133804.3	293144.1
sigma_u	345800.49					
sigma_e	28012.839					
rho	.99348038	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(10, 47) =      34.33      Prob > F = 0.0000
```

## Annex 4e- Results of Fixed Effects Estimation for Total Sales of Goats

```
. xtreg TotGoaPop TotGoaSales TotCatPop TotShePop, fe

Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.9110                Obs per group: min =      6
      between = 0.9697                avg =          6.0
      overall  = 0.9665                max =          6

                                          F(3,52)        =    177.39
corr(u_i, Xb) = 0.8658                Prob > F        =    0.0000
```

TotGoaPop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotGoaSales	.1974225	.0311657	6.33	0.000	.1348839	.2599611
TotCatPop	-.0273193	.0176599	-1.55	0.128	-.0627565	.0081178
TotShePop	.6744537	.1301516	5.18	0.000	.4132854	.9356221
_cons	184806.4	84616.48	2.18	0.033	15010.98	354601.7
sigma_u	301086.42					
sigma_e	29649.454					
rho	.99039583	(fraction of variance due to u_i)				

F test that all u\_i=0: F(10, 52) = 71.99 Prob > F = 0.0000

## Annex 4f- Results of Fixed Effects Estimation for Commercial Off-take of Goats

```
. xtreg GoaINDEX NGoaComOffTake TotGoaSales FemGoaSales TotGoaSlau MalGoaSlau FemGoaSlau ForGoaEXPORT Inf
> orGoaTRADE, fe
note: ForGoaEXPORT omitted because of collinearity
```

```
Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.4717                Obs per group: min =      6
      between = 0.3831                avg =          6.0
      overall  = 0.4017                max =          6

                                          F(7,48)        =      6.12
corr(u_i, Xb) = -0.2877                Prob > F        =    0.0000
```

GoaINDEX	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
NGoaComOffTake	827.0805	6428.473	0.13	0.898	-12098.23	13752.39
TotGoaSales	1.372815	.2857244	4.80	0.000	.7983277	1.947303
FemGoaSales	-2.248674	.5849983	-3.84	0.000	-3.424892	-1.072456
TotGoaSlau	-.0808107	.1790829	-0.45	0.654	-.440881	.2792595
MalGoaSlau	-.6258545	.3157392	-1.98	0.053	-1.260691	.0089816
FemGoaSlau	.2337748	.3013253	0.78	0.442	-.3720803	.8396299
ForGoaEXPORT	0	(omitted)				
InforGoaTRADE	-.0528685	.0532575	-0.99	0.326	-.15995	.054213
_cons	33763.98	71731.26	0.47	0.640	-110461.4	177989.4
sigma_u	106372.04					
sigma_e	74725.868					
rho	.66956823	(fraction of variance due to u_i)				

F test that all u\_i=0: F(10, 48) = 1.16 Prob > F = 0.3406

## Annex 4g- Results of Fixed Effects Estimation for Total Cattle Population

```
. xtreg TotCatSales TotCatPop, fe
```

```
Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.3243                Obs per group: min =      6
      between = 0.9991                    avg =      6.0
      overall = 0.9746                    max =      6

F(1,54) = 25.92
corr(u_i, Xb) = -0.9986                Prob > F = 0.0000
```

TotCatSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotCatPop	.3442611	.0676215	5.09	0.000	.2086881	.4798342
_cons	-1371003	494011.8	-2.78	0.008	-2361437	-380568.9
sigma_u	2261296.2					
sigma_e	301254.46					
rho	.98256139 (fraction of variance due to u_i)					

```
F test that all u_i=0:      F(10, 54) = 0.96      Prob > F = 0.4841
```

## Annex 4h- Results of Fixed Effects Estimation for Net Commercial Off-take of Cattle

```
. xtreg CatINDEX NComCatOffTake GoaINDEX SheINDEX, fe
```

```
Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.9749                Obs per group: min =      6
      between = 0.9822                    avg =      6.0
      overall = 0.9448                    max =      6

F(3,52) = 674.13
corr(u_i, Xb) = 0.8123                Prob > F = 0.0000
```

CatINDEX	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
NComCatOffTake	-10024.26	13696.21	-0.73	0.468	-37507.71	17459.19
GoaINDEX	2.931389	2.62662	1.12	0.270	-2.33931	8.202087
SheINDEX	14.41981	2.507103	5.75	0.000	9.388937	19.45068
_cons	1121309	79157.34	14.17	0.000	962468.1	1280150
sigma_u	1932243.7					
sigma_e	285399.98					
rho	.97864935 (fraction of variance due to u_i)					

```
F test that all u_i=0:      F(10, 52) = 81.06      Prob > F = 0.0000
```

## Annex 4i- Results of Fixed Effects Estimation for Cattle Resources

```
. xtreg TotCatSales TotCatPop MalCatPop FemCatPop CatINDEX MalCatLes3YrsAged FemCatLes3YrsAged MalCat3to1
> 0YrsAged FemCat3to10YrsAged MalCatAb10YrsAged FemCatAb10YrsAged MalCatPurDB FemCatPurDMB MalCatPurBeOt
> FemCatPurBeOt, fe
```

note: MalCatAb10YrsAged omitted because of collinearity

note: FemCatAb10YrsAged omitted because of collinearity

```
Fixed-effects (within) regression          Number of obs   =       66
Group variable: ID                       Number of groups =       11
```

```
R-sq:  within = 0.9424                    Obs per group:  min =       6
        between = 0.8387                  avg   =       6.0
        overall = 0.6921                  max   =       6
```

```
corr(u_i, Xb) = -0.9414                  F(12,43)       =      58.66
                                                Prob > F       =      0.0000
```

TotCatSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotCatPop	-1.701373	.4954157	-3.43	0.001	-2.700474	-.7022721
MalCatPop	5.671086	1.84865	3.07	0.004	1.942929	9.399244
FemCatPop	-1.680741	1.650772	-1.02	0.314	-5.009839	1.648358
CatINDEX	.0891816	.0224192	3.98	0.000	.043969	.1343941
MalCatLes3YrsAged	-.8594466	1.541236	-0.56	0.580	-3.967645	2.248752
FemCatLes3YrsAged	2.199602	1.604806	1.37	0.178	-1.036798	5.436001
MalCat3to10YrsAged	-.2367679	8.743444	-0.03	0.979	-17.8696	17.39607
FemCat3to10YrsAged	4.48626	2.805022	1.60	0.117	-1.170606	10.14313
MalCatAb10YrsAged	0	(omitted)				
FemCatAb10YrsAged	0	(omitted)				
MalCatPurDB	-3.94358	8.329871	-0.47	0.638	-20.74237	12.85521
FemCatPurDMB	-1.745673	2.099505	-0.83	0.410	-5.979728	2.488382
MalCatPurBeOt	-5.357052	8.378278	-0.64	0.526	-22.25346	11.53936
FemCatPurBeOt	-7.180559	2.342504	-3.07	0.004	-11.90467	-2.45645
_cons	1873026	923362.7	2.03	0.049	10887.39	3735164
sigma_u	3195836.5					
sigma_e	98544.741					
rho	.99905008	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(10, 43) =      5.15          Prob > F = 0.0001
```

## Annex 4j- Results of Fixed Effects Estimation for Sheep Resources

```
. xtreg TotSheSales TotShePop MalShePop FemShePop MalSheLes2YrsAged FemSheLes2YrsAged MalShe2YrsAged FemS
> he2YrsAged MalShePurB FemShePurB MalShePurWMO FemShePurWMO, fe
note: FemShePop omitted because of collinearity
note: MalSheLes2YrsAged omitted because of collinearity
note: FemShe2YrsAged omitted because of collinearity
```

```
Fixed-effects (within) regression           Number of obs   =       66
Group variable: ID                         Number of groups =       11

R-sq:  within = 0.9265                      Obs per group:  min =        6
        between = 0.9938                      avg =           6.0
        overall = 0.9930                      max =           6

                                           F(8,47)         =       74.11
corr(u_i, Xb) = -0.9689                     Prob > F         =       0.0000
```

TotSheSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotShePop	-.5526215	228.5699	-0.00	0.998	-460.3759	459.2706
MalShePop	-5.636717	228.5744	-0.02	0.980	-465.469	454.1956
FemShePop	0	(omitted)				
MalSheLes2YrsAged	0	(omitted)				
FemSheLes2YrsAged	5.331548	228.5838	0.02	0.981	-454.5197	465.1828
MalShe2YrsAged	-13.71415	4.047356	-3.39	0.001	-21.85638	-5.571914
FemShe2YrsAged	0	(omitted)				
MalShePurB	4.623743	2.104437	2.20	0.033	.3901621	8.857323
FemShePurB	8.98233	228.5717	0.04	0.969	-450.8445	468.8092
MalShePurWMO	13.62272	5.218708	2.61	0.012	3.124037	24.12141
FemShePurWMO	1.030117	228.635	0.00	0.996	-458.9242	460.9844
_cons	-412754.5	90576.34	-4.56	0.000	-594970.6	-230538.4
sigma_u	667971.31					
sigma_e	51110.754					
rho	.99417932	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(10, 47) =      12.57      Prob > F = 0.0000
```

## Annex 4k- Results of Fixed Effects Estimation for Total Sheep Population

```
. xtreg TotSheSales TotShePop TotCatPop TotGoaPop, fe
```

```
Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.7757                Obs per group:  min =      6
      between = 0.9905                  avg =           6.0
      overall  = 0.9877                  max =           6

                                          F(3,52)        =      59.96
corr(u_i, Xb) = 0.9556                 Prob > F        =      0.0000
```

TotSheSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotShePop	3.354454	.4523048	7.42	0.000	2.446838	4.26207
TotCatPop	-.0867278	.0446004	-1.94	0.057	-.1762251	.0027694
TotGoaPop	-.6458275	.2983395	-2.16	0.035	-1.244489	-.0471656
_cons	415536	182768.7	2.27	0.027	48783.71	782288.3
sigma_u	723418.1					
sigma_e	84902.691					
rho	.98641302	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(10, 52) =      16.01          Prob > F = 0.0000
```

## Annex 4l- Results of Fixed Effects Estimation for Net Commercial Off-take of Sheep

```
. xtreg SheINDEX NSheComOffTake CatINDEX GoaINDEX, fe
```

```
Fixed-effects (within) regression      Number of obs   =      66
Group variable: ID                    Number of groups =      11

R-sq:  within = 0.9859                Obs per group:  min =      6
      between = 0.9845                  avg =           6.0
      overall  = 0.9799                  max =           6

                                          F(3,52)        =     1210.76
corr(u_i, Xb) = -0.7437                 Prob > F        =      0.0000
```

SheINDEX	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
NSheComOffTake	419.3902	592.3631	0.71	0.482	-769.2732	1608.054
CatINDEX	.0266807	.004654	5.73	0.000	.0173416	.0360197
GoaINDEX	.5602514	.085051	6.59	0.000	.389584	.7309188
_cons	-20890.93	7147.808	-2.92	0.005	-35234.05	-6547.801
sigma_u	36890.529					
sigma_e	12294.571					
rho	.90003326	(fraction of variance due to u_i)				

```
F test that all u_i=0:      F(10, 52) =      18.64          Prob > F = 0.0000
```

## Annex 4m- Results of Fixed Effects Estimation for Total Goats Population

```
. xtreg TotGoaSales TotGoaPop TotCatPop TotShePop, fe

Fixed-effects (within) regression      Number of obs   =       66
Group variable: ID                    Number of groups =       11

R-sq:  within = 0.8991                Obs per group:  min =       6
      between = 0.9802                    avg =       6.0
      overall = 0.9656                    max =       6

                                          F(3,52)        =    154.48
corr(u_i, Xb) = -0.9936                Prob > F        =    0.0000
```

TotGoaSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotGoaPop	2.20625	.3482851	6.33	0.000	1.507364	2.905135
TotCatPop	.2204598	.0520671	4.23	0.000	.1159796	.32494
TotShePop	-.6550088	.5280262	-1.24	0.220	-1.714571	.4045532
_cons	-1474824	213366.4	-6.91	0.000	-1902975	-1046673
sigma_u	2427527.1					
sigma_e	99116.439					
rho	.99833567 (fraction of variance due to u_i)					

F test that all u\_i=0: F(10, 52) = 20.49 Prob > F = 0.0000

## Annex 4n- Results of Fixed Effects Estimation for Net Commercial Off-take of Goats

```
. xtreg GoaINDEX NGoaComOffTake CatINDEX SheINDEX, fe

Fixed-effects (within) regression      Number of obs   =       66
Group variable: ID                    Number of groups =       11

R-sq:  within = 0.9773                Obs per group:  min =       6
      between = 0.9733                    avg =       6.0
      overall = 0.9574                    max =       6

                                          F(3,52)        =    744.73
corr(u_i, Xb) = -0.7961                Prob > F        =    0.0000
```

GoaINDEX	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
NGoaComOffTake	178.635	1081.12	0.17	0.869	-1990.791	2348.061
CatINDEX	.0077868	.00712	1.09	0.279	-.0065005	.022074
SheINDEX	.8086914	.1240349	6.52	0.000	.5597971	1.057586
_cons	-23550.57	11360.47	-2.07	0.043	-46347.03	-754.1223
sigma_u	48579.547					
sigma_e	14896.228					
rho	.91405546 (fraction of variance due to u_i)					

F test that all u\_i=0: F(10, 52) = 17.09 Prob > F = 0.0000

## Annex 4o- Results of Fixed Effects Estimation for Total Sales of Cattle by Regions and Years

```
. reg TotCatPop TotCatSales i.Rg i.Yr
```

Source	SS	df	MS	Number of obs =	66
Model	8.8426e+15	16	5.5266e+14	F( 16, 49) =	2402.55
Residual	1.1272e+13	49	2.3003e+11	Prob > F =	0.0000
				R-squared =	0.9987
				Adj R-squared =	0.9983
Total	8.8539e+15	65	1.3621e+14	Root MSE =	4.8e+05

TotCatPop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotCatSales	.7389449	.2033086	3.63	0.001	.3303809	1.147509
Rg						
Afar Region	-1985384	283454.5	-7.00	0.000	-2555007	-1415761
Amhara Region	6352267	392782.5	16.17	0.000	5562941	7141593
Oromia Region	1.15e+07	530472.9	21.65	0.000	1.04e+07	1.26e+07
Somali Region	-2465709	287162.1	-8.59	0.000	-3042783	-1888635
Benishangul Gumuz Region	-2445850	284818.2	-8.59	0.000	-3018213	-1873486
SNNP Region	4151547	322210.5	12.88	0.000	3504040	4799053
Gambella Region	-2692663	287449	-9.37	0.000	-3270314	-2115013
Harari Region	-2833823	288227.4	-9.83	0.000	-3413038	-2254609
Dire Dawa Region	-2841978	288337.6	-9.86	0.000	-3421414	-2262542
National	3.26e+07	1225283	26.57	0.000	3.01e+07	3.50e+07
Yr						
2014	139029.1	204518	0.68	0.500	-271965.2	550023.4
2015	270053.2	205565.6	1.31	0.195	-143046.4	683152.8
2016	219132	217543.6	1.01	0.319	-218038.2	656302.2
2017	514713.1	210738.2	2.44	0.018	91218.78	938207.4
2018	533935.9	218620.9	2.44	0.018	94600.67	973271
_cons	2594161	240286.2	10.80	0.000	2111287	3077034

## Annex 4p- Results of Fixed Effects Estimation for Total Population of Sheep by Regions and Years

```
. reg TotSheSales TotShePop i.Rg i.Yr
```

Source	SS	df	MS			
Model	2.5124e+14	16	1.5702e+13	Number of obs =	66	
Residual	3.9884e+11	49	8.1396e+09	F( 16, 49) =	1929.11	
Total	2.5163e+14	65	3.8713e+12	Prob > F =	0.0000	
				R-squared =	0.9984	
				Adj R-squared =	0.9979	
				Root MSE =	90220	

TotSheSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotShePop	2.03982	.1887802	10.81	0.000	1.660452	2.419188
Rg						
Afar Region	-19050.83	52232.81	-0.36	0.717	-124016.6	85914.94
Amhara Region	799597.3	160210.9	4.99	0.000	477641.4	1121553
Oromia Region	354499.5	153439.9	2.31	0.025	46150.52	662848.5
Somali Region	-109563.4	53018.72	-2.07	0.044	-216108.5	-3018.337
Benishangul Gumuz Region	-3374.809	61170.98	-0.06	0.956	-126302.5	119552.9
SNNP Region	-292889.8	74759.88	-3.92	0.000	-443125.4	-142654.2
Gambella Region	-3639.984	61814.32	-0.06	0.953	-127860.5	120580.6
Harari Region	-1862.029	62173.41	-0.03	0.976	-126804.2	123080.1
Dire Dawa Administration	-6489.405	61517.63	-0.11	0.916	-130113.7	117134.9
National	733349.7	513077.5	1.43	0.159	-297718.1	1764418
Yr						
2014	-37635.85	38995.31	-0.97	0.339	-115999.9	40728.15
2015	13404.38	40668.65	0.33	0.743	-68322.34	95131.1
2016	30618.86	40204.18	0.76	0.450	-50174.47	111412.2
2017	-22706.99	42421.28	-0.54	0.595	-107955.8	62541.77
2018	-49736.79	43336.3	-1.15	0.257	-136824.4	37350.77
_cons	11813.34	49826.74	0.24	0.814	-88317.25	111943.9

## Annex 4q- Results of Fixed Effects Estimation for Total Sales of Sheep by Regions and Years

```
. reg TotShePop TotSheSales i.Rg i.Yr
```

Source	SS	df	MS	Number of obs =	66
Model	4.4913e+13	16	2.8071e+12	F( 16, 49) =	2037.17
Residual	6.7519e+10	49	1.3779e+09	Prob > F =	0.0000
				R-squared =	0.9985
				Adj R-squared =	0.9980
Total	4.4981e+13	65	6.9201e+11	Root MSE =	37121

TotShePop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotSheSales	.3453151	.031958	10.81	0.000	.281093 .4095372	
Rg						
Afar Region	501.8183	21519.97	0.02	0.981	-42744.17 43747.81	
Amhara Region	-38861.76	80766.51	-0.48	0.633	-201168.1 123444.6	
Oromia Region	103595.7	64813.64	1.60	0.116	-26652.22 233843.6	
Somali Region	22349.53	22519.81	0.99	0.326	-22905.72 67604.77	
Benishangul Gumuz Region	-49059.25	24173.83	-2.03	0.048	-97638.38 -480.1144	
SNNP Region	185115.8	23306.2	7.94	0.000	138280.2 231951.4	
Gambella Region	-50863.43	24374.08	-2.09	0.042	-99844.97 -1881.888	
Harari Region	-52514.41	24456.4	-2.15	0.037	-101661.4 -3367.425	
Dire Dawa Administration	-49011.47	24326.44	-2.01	0.049	-97897.28 -125.6576	
National	546062.8	200841.2	2.72	0.009	142457.4 949668.3	
Yr						
2014	22986.7	15859.82	1.45	0.154	-8884.796 54858.2	
2015	16027.95	16594.23	0.97	0.339	-17319.4 49375.31	
2016	7718.567	16602.85	0.46	0.644	-25646.11 41083.25	
2017	35837.5	16739.58	2.14	0.037	2198.041 69476.95	
2018	48419.42	16692.15	2.90	0.006	14875.3 81963.55	
_cons	31266.02	20020.53	1.56	0.125	-8966.734 71498.78	

## Annex 4r- Results of Fixed Effects Estimation for Total Population of Goats by Regions and Years

```
. reg TotGoaSales TotGoaPop i.Rg i.Yr
```

Source	SS	df	MS	Number of obs =	66
Model	1.4460e+14	16	9.0377e+12	F( 16, 49) =	759.22
Residual	5.8329e+11	49	1.1904e+10	Prob > F =	0.0000
				R-squared =	0.9960
				Adj R-squared =	0.9947
Total	1.4519e+14	65	2.2336e+12	Root MSE =	1.1e+05

TotGoaSales	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotGoaPop	2.87598	.1807506	15.91	0.000	2.512748 3.239212	
Rg						
Afar Region	75573.97	65688.06	1.15	0.256	-56431.14 207579.1	
Amhara Region	116418.5	73342.47	1.59	0.119	-30968.7 263805.7	
Oromia Region	-295341	96744.28	-3.05	0.004	-489755.9 -100926.1	
Somali region	80120.38	73423.58	1.09	0.281	-67429.82 227670.6	
Benishangul Gumuz Region	363772.5	90409.61	4.02	0.000	182087.6 545457.4	
SNNP Region	-509312.4	64937.56	-7.84	0.000	-639809.3 -378815.5	
Gambella Region	393272.2	95251.63	4.13	0.000	201856.9 584687.5	
Harari Region	398684.1	95672	4.17	0.000	206424 590944.2	
Dire Dawa Administration	380187.7	93753.32	4.06	0.000	191783.3 568592	
National	-2698333	455351.7	-5.93	0.000	-3613397 -1783269	
Yr						
2014	-90879.46	48436.61	-1.88	0.067	-188216.5 6457.564	
2015	-64233.54	49396.34	-1.30	0.200	-163499.2 35032.13	
2016	-53205	50083.81	-1.06	0.293	-153852.2 47442.18	
2017	-58853.4	50709.16	-1.16	0.251	-160757.3 43050.46	
2018	36443.65	54567.34	0.67	0.507	-73213.52 146100.8	
_cons	-372846.4	78269.01	-4.76	0.000	-530133.9 -215559	

## Annex 4s- Results of Fixed Effects Estimation for Total Sales of Goats by Regions and Years

```
. reg TotGoaPop TotGoaSales i.Rg i.Yr
```

Source	SS	df	MS			
Model	4.1981e+13	16	2.6238e+12	Number of obs =	66	
Residual	5.9084e+10	49	1.2058e+09	F( 16, 49) =	2176.02	
Total	4.2041e+13	65	6.4678e+11	Prob > F =	0.0000	
				R-squared =	0.9986	
				Adj R-squared =	0.9981	
				Root MSE =	34725	

TotGoaPop	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TotGoaSales	.2913232	.0183092	15.91	0.000	.2545295	.3281169
Rg						
Afar Region	-38728.19	20451.86	-1.89	0.064	-79827.74	2371.361
Amhara Region	-213.3214	23935.26	-0.01	0.993	-48313.02	47886.38
Oromia Region	151914.7	25639.94	5.92	0.000	100389.3	203440.1
Somali region	-57184.86	22195.01	-2.58	0.013	-101787.4	-12582.32
Benishangul Gumuz Region	-164158.6	23485.69	-6.99	0.000	-211354.8	-116962.3
SNNP Region	162529.9	20598.35	7.89	0.000	121136	203923.9
Gambella Region	-178669.7	24233.86	-7.37	0.000	-227369.4	-129969.9
Harari Region	-180748.2	24269.81	-7.45	0.000	-229520.2	-131976.2
Dire Dawa Administration	-173054.5	24041.19	-7.20	0.000	-221367.1	-124742
National	1190678	84390.77	14.11	0.000	1021088	1360268
Yr						
2014	38571.1	14978.69	2.58	0.013	8470.298	68671.91
2015	33608.39	15252.48	2.20	0.032	2957.384	64259.41
2016	32140.95	15455.01	2.08	0.043	1082.944	63198.95
2017	35246.69	15565.32	2.26	0.028	3967.005	66526.38
2018	14967.89	17314.44	0.86	0.392	-19826.77	49762.55
_cons	159687.6	19685.17	8.11	0.000	120128.8	199246.4