ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

INSTITUTE OF AGRICULTURE AND DEVELOPMENT STUDIES

THE EFFECT OF GOVERNMENT EXPENDITURE ON LIVESTOCK SECTOR DEVELOPMENT IN ETHIOPIAN

BY:
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A Thesis Submitted to the School of Graduate Studies St. Mary's University, in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Agricultural Economics

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As members of the Board of Examining of the final MSc thesis open defense, we certify that we have read and evaluated the thesis prepared by Dereje Tadesse under the title "**The Effect of Government Expenditure on Livestock Sector Development in Ethiopian**" We recommend that the thesis be accepted as fulfilling the thesis requirement for the Degree of Master of Science in Agricultural Economics.

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I declare that, this Msc. thesis is my original work, has never been presented for a degree in this or any other university and all source of materials used for the thesis have been duly acknowledged.

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ENDORSEMENT

This thesis has been submitted to St. Mary's University, school of Graduate Studies for examination with my approval as a University advisor.

Dr. Wondimagegne Chekol (PhD)	_____	_____
Advisor	**Signature**	**Date**

TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS

First and for most, I would like to express my deepest gratitude to the almighty GOD for his blessing me throughout of my journey. Next, my deepest thanks go to my advisor Dr. Wondimagegne Chekol (PhD) for his valuable advice, guidance and concrete comment through out of my journey on the preparation of this paper. I also express my gratitude to the author of articles, thesis, journals, books and working document, like reports used during the review and cited in this paper as source document. Also, forward may thanks to those support me by providing data and information from Ministry of Agriculture.

At the end, I would like also to express my sincere gratitude to my family and classmates for their understand and support me to finalize this paper by sharing their time, skill, knowledge and information in every direction.

ACRONYMS AND ABBREVIATIONS

ACGSF	Agri Credit Guarantee Scheme Fund
ADF	Augmented Dickey–Fuller
AIC	Akaiki Information Criteria
ARDL	Auto Regressive Distributed Lagged
CPI	Consumer Price Index
D.W	Durbin - Watson
DF	Dickey Fuller
E.C	Ethiopian Calendar
ECM	Error Correction Method
ETB	Ethiopia Birr.
FAOSTAT	Food and Agriculture Organization Statistics Database
FPE	Final Prediction Error
GDP	Growth Domestic
HQ	Hannan Quinn Information Criteria
ILCA	International Livestock Centre for Africa
LM	Lagrange Multiplier
MoA	Ministry of Agriculture
MoFED	Ministry of Finance and Economic Development
NBE	National Bank of Ethiopia
OLS	Ordinary Least Square
PPI	Producer Price Index
SIC	Schwarz (Bayesian) Information Criteria
STATA	Statistics and Data (Application)
TLU	Tropical Livestock Unit
USD	United State of America Dollar
VAR	Vector Auto Regression
VECM	Vector Error Correction Model

LIST OF TABLES

Page

LIST OF FIGURES

Page

ABSTRACT

Livestock play multiple critical role in the Ethiopian economy by providing food, input for crop production and soil fertility management, raw material for industry, cash income as well as in promoting saving, fuel, social functions, and employment. Despite of owning the largest livestock resources in the country. The sector not yet reached the desired stage of development due to several factors and constraints. The main objective of this study is to investigate the effect of livestock government expenditure on livestock development in Ethiopia using a time series data from 1980 – 2019, also the study identifies the contribution of sector to the economic development and expenditure adequacy. A secondary data collected from published and unpublished source of MoA, MoFAD, CST, NBE, and FAOSTAT used on the variables of livestock GDP share, government livestock expenditure, livestock export value, livestock population, livestock production index, animal health service coverage, change in cattle death rate and control variables (inflation and exchange rate). The long-run and the short-run interaction among the variables identified using Johansson cointegration and Vector Error Correction methods. The long-run analysis indicates that livestock expenditure, livestock population and production index have a significant positive impact on the development of the livestock sector at 1% significant level, while the control variables have negative effect. Also, change in cattle death rate has positive effect at 5% significant. The long-run elasticity of the government expenditure has 0.998% impact on the sectoral development. In short-run the current year sectoral development has negative 1.6% effect on next year development while current year expenditure has 1.7% positive impact. The descriptive analysis deployed to identify the adequacy of expenditure and its contribution on economic development and the result show that highly inadequate spending and tangible contribution to national economy. In general, the government spending shows the commitment of the government and its role to support the sector and the study identify that the livestock sector has significant importance on the economy but less government expenditure, that need improvement by expanding livestock related revenue collection and proper resource allocation with utilization.

***Key words**: Livestock development; Livestock expenditure; Johansen co-integration; Vector Error Correction; Expenditure adequacy*

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Globally, the livelihood of more people depends on agriculture than any other industry. Growth in agricultural production and productivity is necessary in order to raise rural incomes, to support the increasing numbers of people dependent on this industry and to meet the food and raw material needs of fast-growing urban populations. Enhancing agricultural productivity contributes to industrial growth by providing cheap labour, capital investment, foreign currency and markets for manufactured consumer goods. Agriculture plays a key role in reducing poverty because most of the world's poor live in rural areas that are largely dependent on agriculture; food prices also determine the cost of living for the urban poor. Livestock as part of the agriculture sector provides over half of the value of global agricultural output and it is one of third income generating component in developing countries (Upton, 2004).

Increased livestock production and higher self-sufficiency would reduce the need for foreign aid and increase gross domestic product as a result of the export of livestock and their products. Livestock production contributes to rural livelihoods, employment and poverty relief, integrating with and complementing crop production, acting as a savings bank and providing a buffer against risks (Sen & Chander 2003; Upton, 2004). Hassen, 2014) Livestock system represents a potential pathway out of poverty for many smallholders in the developing world. The majority the world's rural poor, and a significant proportion of the urban poor, keep livestock and use them in a variety of ways that extend beyond income generation. In many cases, livestock are central component of smallholder risk management strategies.

In Ethiopia, the agricultural sector is the basic determinate corner stone of the economic and social life of the people. The sector employs 80-85 percent of the population and contributes 40 percent to the total GDP. The Ethiopian economy is highly dependent on agriculture. The sector share of agriculture, for instance in 1996, was 52% to the Gross Domestic Product, 90% of the foreign exchange and 75% source of raw material. Agriculture in Ethiopia is a non-monetized and highly

traditional sector, production based on small scale fragmented pieces of land oriented to satisfy daily needs. Livestock production, as one component of agriculture, covers 40 percent of agricultural output, excluding the values of draught power, manure and transport of people and products and it also plays an important role in the national economy as it contributes 13-16 percent of the total GDP and provides livelihood for 65% of the population (Seifu, 2000; Aleme et al., 2015)

Livestock serve for Ethiopian economy as sources of food traction, manure, raw materials, investment, cash income, security, foreign exchange earnings and social and cultural identity. The livestock sector provides employment to over 30% of the agricultural labor force. Livestock and livestock by products generate export income, the sector still remains under exploited (Trade Bulletin, 2010)

Despite its large population size, the contribution of livestock production to agriculture and the overall economy of the country is low. Available data show that all functions of the sector have a declined trend of development. Low production level of the sector is attributed to inefficient productivity of the livestock as a result of the traditional method of production, poor feeding, inferior health care, poor breeds and services, and low capital investment in human and fixed assets. Along the various factors constraining livestock development (including inadequate resources, lack of suitable institutions and technological problems), inappropriate development policies are becoming major factors of the poor performance of the sector. However, none of these were finalized for proper enactment by the government (Aleme et al., 2015)

Government expenditures are strong instruments introduced to remove market failure (tendency for an economy to produce too much of some goods and an insufficient amount) and can launch an economy into achieving economic growth. Government Expenditures are the expenses which a government incurs for its own maintenance, society and the economy (Bhatia, 2002). Government expenditure represents the total government spending to attain the predetermined macro-economic objectives (Anthony et al., 2018)

The size of government expenditures and its effect on economic growth, and vice versa is a center of debate among scholars. The relationship between government expenditure and economic growth has continued to generate series of debate among scholars. Government performs two major functions- protection (and security) and provisions of certain public good (Al-Yousif, 2000). Scholars argue that increase in government expenditure on socioeconomic and physical infrastructures encourage economic growth. For example, government expenditure on health and education raises the productivity of labour and increase the growth of national output. Similarly, expenditure on infrastructures such as roads, communications, power, etc. reduces production costs, increases private sector investment and profitability of firms, thus fostering economic growth. There are important sectors of the economy of which Government expenditure could channel to promote economic growth. The sectors like defense, Agriculture, transportation and communication, health and education could have essential potential to move an economy forward (Anthony et al. (2018).

The economic theory does not automatically generate strong conclusions about the effect of government agriculture expenditure on agriculture growth. Indeed, most economists would agree that there are circumstances in which lower levels of government agriculture spending would enhance agriculture growth and other circumstance in which higher level of government spending would be desirable. By proxy the expenditure to livestock sector has a similar fate with the agriculture, because livestock is the subsector of agriculture. There is a continuous interest to investigate the commitment of the government to the livestock sector up to the contribution of the sector to the national economic growth. In Ethiopia the livestock sector has untouched potential and has a great share for economic development, but from time to time the share of the sector not show any change or there is a change to the negative or to the positive is not clearly indicated by the researchers in relation to the government attention to the sector. So, the level of the sectoral contribution and the level of the government commitment should be known, to benefit from the sector. This study was done to identify the effect of the government expenditure in the livestock sector and its contribution to sectoral development, as well as economic growth to the national economy.

1.2. Statement of the Problem

Livestock sector play significant role in the development of national economy and household livelihood improvement. Livestock contribute 15 to17 percent of GDP and 35 to 49 percent of agricultural GDP, and 37 to 87 percent of the household incomes. Livestock have multiple uses aside from income generation, including cash storage for those beyond the reach of the banking system, draught and pack services, milk and meat for household consumption, and manure for fuel and fertilizer. In addition to these non-market values, a thriving informal export trade in live animals further emphasizes the significance, albeit unrecognized by official statistics, of livestock and particularly cattle in the Ethiopian economy. This importance is pronounced in pastoral regions, and women's crucial role is widely acknowledged: both directly in primary production, and indirectly through the contribution of livestock to household assets and food security (Ayele et al., 2003). Ethiopia has a large population of livestock with untouched potential to contribute to the national economy if adequate attention is given to the development of the sector. To use the maximum potential of the sector, it needs a change in attitude of policy makers and development practitioners that livestock development programs are relatively expensive require continuous commitment. (Azage et al., 2006).

The constraints mitigating successful animal production development revolve around the absence of clear livestock sector development policy and strategy. Specific constraints prone to the efficient development of the sector include lack of proper statistics or inadequate knowledge of the livestock resource, under and mal nutrition of the existing livestock, prevalence of animal diseases, poor market development and low genetic potential of indigenous animals for specific product. Less attention given to develop known local breeds of animals in the utilization of adaptive characteristics should also be considered important draw back. Negligence of the government the role of the private sector in development of the sub sector, absence of user's participation in the designing and planning of livestock development projects and inability of the previous livestock sector development projects to be sustained after their completion (either by government fund or community participation).

The government agriculture expenditure is one of the important determinants of agriculture growth. However, the growth of an economy depends on the size, spending capacity, and effective

use of the expenditure in the development process There have been few numbers of studies that attempt to measure the impact of components of government Livestock sector expenditure and way of financing the sector on the development of the livestock sector and maximizing its contribution to the national economy. This issue has continued to generate a series of scholar's debates. Some scholars argued that increase in government agriculture/livestock expenditure on socioeconomic and physical infrastructure boosts agriculture/livestock growth. However, some scholars do not support the claim that increasing government agriculture/livestock expenditure encourages agriculture/livestock growth, instead they assert that higher public expenditure may slow down overall performance of the economy by crowding out private investment (Sharma, 2012).

In Ethiopia, fiscal policy is a key element of macroeconomic policy given the importance of government expenditures in financing investment and consumption activities and their role in meeting the growing need for public social services. In recent year the composition of agriculture government expenditure has been attracting the attention of economists due to its effect on the overall economic development. Government agriculture/livestock expenditure is expected to be means of reducing the negative impacts of market failure on the economy. This study, therefore, attempted to examine the long run and short run relationship between livestock sectoral government expenditure on livestock sector development and to measure livestock sectoral contribution to the economy of the country in Ethiopia using an error correction model.

1.3. Objective of the Study

The objective of this study is discussed in the following manner:

1.3.1. General Objective

- The main objective of the study is to investigate the impact of government expenditure on livestock sector development in Ethiopia.

1.3.2. Specific Objectives

- To identify the level of the government commitment through government livestock spending.
- To assess the overall contribution the livestock sector to the economic development.

- To identify the effect of government expenditure to the livestock sector development
- To identify the long- run and short- run interaction of livestock sector expenditure with livestock development, other determinate factors
- To identify the adequacy of financing the livestock sector at national level and related issues.

1.4. Research Questions

- How much is the livestock sector contribution to the overall economic growth in the case of Ethiopia?
- What is the effect of government livestock spending on the development of the livestock sector?
- What is the long and short-run impact of government livestock expenditure on the development of the sector and related effects?
- What it seems the way of financing the livestock sector and its adequacy compared to the economical contribution of the sector?

1.5. Research Hypothesis

i. The effect of livestock sectoral expenditure to livestock development

H_0: Livestock government expenditure has no effect to the development of livestock sector and its contribution to Ethiopia economic growth.

H_1: Livestock government expenditure has effect to the development of livestock sector and its contribution to Ethiopia economic growth.

ii. Government contribution through government spending

H_0: The government of Ethiopia is highly less committed to spend adequate amount to the livestock sector.

H_1: The government of Ethiopia is less committed to spend adequate amount to the livestock sector.

iii. **The contribution of livestock sector to the overall economic development.**

H_0: The livestock sector not significantly contribute to Ethiopia economic development**.**

H_1: The livestock sector significantly contribute to Ethiopia economic development**.**

iv. **The long-run & short-run effect of livestock expenditure to livestock development.**

H_0: The livestock expenditure hasn't both long-run & short-run effect to livestock development.

H_1: The livestock expenditure has both long-run & short-run effect to livestock development.

v. **The adequacy of financing livestock sector.**

H_0: Financing livestock sector is not adequate in the case of Ethiopia economy.

H_1: Financing livestock sector is adequate in the case of Ethiopia economy.

1.6. Significance of the Study

Worldwide a number of studies done on the impact of governmental sectoral expenditure of agriculture, defense, education and health on economic growth. In similar way in Ethiopia the same studies done by different researchers to identify their long-run and short run interaction between sectoral expenditure and economic growth. Based on those studies report, different countries have different result for the impact of sectoral expenditure on the economic growth. Hence, to identify the impact of each and every sector to the economic development and to design intervention approach, it needs a clear sectoral specific study to capture the different marginal effect of each sector's expenditure on economic growth. In the case of Ethiopia some number of studies done on the impact of agricultural expenditure on the development of the sector as well as economic growth of the country. But those studies not clearly indicate the impact of the livestock sector expenditure to the development of the sector and its contribution to economic growth.

In livestock sector, there is one study that indicate the financing of the livestock sector compared with east African countries. This study has a limitation on the way of analysis, usage of a limited data, not UpToDate (In 1983 by Addis as a working document for ILCA) and the focus only on the way financing and its adequacy compared to other East African countries. So, this study aimed

to contribute the body of knowledge which exists on different literature and empirical finding on related sectoral contribution and specifically to show the effect of livestock government expenditure to the development of the sector and its contribution to economic growth in the case of Ethiopia.

1.7. Scope and Limitation of the Study

The focus of this study is to show the long and short run effect of Livestock sector government expenditure on the development of the livestock sector and its contribution to economic growth in Ethiopia using the time series data from 1997/80 – 2018/19 (from 1972 – 2011 E.C). The data analysis focus only to show the long-run and short-run relationship of sectoral government expenditure on sectoral development using a limited variables such as: Livestock growth development production (LGDP), Growth Development production (GDP), Agricultural growth development production (AGDP), Livestock government expenditure, livestock export, inflation, livestock TLU, Livestock Production Index and livestock health service coverage. Also study briefly discussed the financing of the livestock sector and its adequacy using a limited data due the limitation of data for long period of time. The main problem was lack well organized disaggregated data for the livestock sector.

1.8. Organization of the Study

The paper is structured as follows: chapter one deals with the background of the role of Agriculture and livestock to the economic growth, also the effect of the Livestock government expenditure to the development of the sector in the case of Ethiopia, Introduction, problem of the statement, objective of the study, significance of the study. Chapter two: discuss literature review includes theoretical and empirical review. Chapter three: methodology and approach of the study. Chapter four: deal with Result and discussion; and chapter five: deals with conclusion and recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Literature

The importance of the governmental intervention through public expenditure is a controversial issue on its importance, way of implementation, distribution and funding, even if its definition. In developing country, the public sector forms a large portion of their economy, and public expenditure to the sector has a major impact on the National macro-economy, also affect the household livening standard. A lot of economic theories drawn different views on the impact of public expenditure, some of them have argued that increasing in public spending exercises a negative effect on the privet sectors, and some other argued that it has positive impact on economic growth (Wendwesen, 2012).

The Neoclassical theory: In this model increasing in public expenditure induce a negative effect on household income, increasing in public expenditure means higher in taxation in household level. The decreasing in household income lead to increasing labor supply and fail to real wage. By the fiscal policy in neoclassical model lump-sum tax increased due to increasing in government expenditure then the household income reduced and increasing labor supply. This initiate constant labor demand, marginal labor productivity and real wages decline. As a result, the household consumption reduced while the output rises. The situation persists for some periods, expenditure of private sector increased, and at some point, it turns to the normal level. The result may be differing from this due to intra-temporal and inter- temporal substitution effect in labor supply. The effect is determined by the taxation procedure, that designed to cover the public expenditure. The change in the government expenditure have a direct effect on output, household consumption and employment. In revers to this the private consumption, investment, and output shows a negative effect (Baxter and King, 1993).

Keynesian theory of Government expenditure as a Fiscal policy: John Maynard Keynes was the first Economist that proposed the government expenditure as fiscal policy instrument in 1936. The Keynesian concept state that Government must play a positive role in order to regulate the overall economy by applying government spending and taxation. This school of thought is the

opposite of the classical theory, the supply creates its own demand then it creates full employment without the government interference. Keynes believes that the propensity to consume reduces as income increase and the propensity to save increase as income increase. This will bring about disequilibrium in the economy as consumptions (aggregate demands) do not grow proportionally with savings when income is rising. To maintain the balance of income, employment and economic growth, it needs government intervention to reduce the effect of outputs demand by a corresponding increase in public expenditure. When economical disbalance occur due to the gap between the income and expenditure must be filled either by increasing propensity to consume in the economy or by increasing government expenditure. So, in this condition the government intervention through expenditure play economic maintenance and regulatory role (Carvalho, 2009).

The Keynesian model indicates that during recession a policy of budgetary expansion should be undertaken to increase the aggregate demand in the economy thus boosting the Gross Domestic Product (GDP). In new Keynesian model argue that an increasing in government expenditure have a multiplier effect on demand creation and economic activity. Increasing in government spending may increase the productivity of goods and service that lead to increasing the demand for labor. Consequently, the labor demand shifts outward thereby, increasing the real wage One of the greatest limitations of the Keynesian theory is that it fails to adequately consider the problem of inflation which might be brought about by increase in government spending (Devereux et al., 1996).

The New Keynesian Theory: According to this model, increasing in governmental expenditure has effect to increase demand and economic growth, those have a multiplication effect to the overall macro-economy. Increasing returns where government spending may increase the equilibrium number of firms in intermediate goods characterized by increasing returns to specialization. In this case increasing in productivity of enforce the firms to increase labor, that lead to labor demand increment with the increment of labor wage. This effect has direct impact on goods price elasticity and inelastic component. An increase in demand via higher government spending increases the weight of the elastic component and induces producers to lower their price mark-up. The consumers, those consume their entire disposable income. In developing country there is high number of the consumer have such behavior, in increase the productivity that enforce the producers

to increase labor force. This condition lead to increase labor demand and have a negative wealth effect in the return. One of greatest limitation of Keynesian theory is that it fails to adequately consider the problem of inflation which might be brought about by the increasing governmental expenditure (Kaldor, 1954).

Non-Keynesian Effects: this effect refers to the situation where financial consolidation (reduction in government spending and/or increase in tax) causes a rise in output. This negative multiplier effect occurs as a result of reduction or elimination of cost of fiscal consolidation due to favorable expectation effects driving inter- temporal saving choices. These expectations directly influence the two non-mutually exclusive channels namely, consumption and investment channel. The privet consumption faced three effects due to fiscal changes, such as: Pure expectation effects, wealth effects and substitution effects. The pure expectation effect implies that households expect lower tax burden in the future when taxes are higher and/or spending's are lower today. The wealth effect, on the other hand, increases private consumption through lower interest rate that increases the market value of the asset held by households and increases the opportunity cost of private saving. These two effects have their own negative effect of fiscal consolidation due to lower disposable income. The third effect relates to the substitution of public consumption by which is largely a function of private willingness and ability to provide social services like education, health and so on. Interest rate reduction and the labor market effect are two ways through which higher investment and hence output results (Carvalho, 2009).

Both Neo-classical and New Keynesian theory predict positive response on output due to increasing the government expenditure, while the non- Keynesian effect acknowledges the possibility of negative multiplier. The neo-classical model typically predicts negative response in private consumption that is the neo-classical growth models argue that government fiscal policy does not have any effect on the growth of national output. However, it has been argued that government fiscal policy or intervention helps to improve failure that might arise from the inefficiencies of the market, while New Keynesian models yields the opposite result for a positive shock in government spending.

The Keynesian macroeconomic thought, public spending can contribute positively to economic growth. Increasing the public expenditure lead to an increase in employment, profitability and

investment through multiplier effects on aggregate demand, which provokes an increased output depending on expenditure multipliers. Opposite to this approach discussed in different studies to show the out come of investment, hampers economic growth in the short run and diminishes capital accumulation in the long run (Diamond, 1989).

Agriculture is one of the important factors that determine the quality of economical capital. Moreover, Hartshorne (1985) suggests that agriculture plays an important positive role in economic growth. The former is considered to be an independent factor of production that is indispensable to achieve high and sustainable economic growth rates. Livestock sector is sub component of agriculture, so that any economic theory applied for agriculture by proxy it is applicable for Livestock sectors.

In addition, several theories explain government expenditure as follows:

Theory of Increasing Public Expenditure (Wagnerian Law of Increasing State Activities): Wagner law viewed public expenditure as a behavioral variable that positively responded to the dictates of a growing economy, Wagner (1977). A German economist, Adolph Wagner propounds the law of increasing state activities. The theory emphasized the functional relation between the economic growth and government activities with the effect that government sector grows rapidly relative to the economy. According to Wagner the reasons for the increasing for public expenditure are categorized in to Administrative and protective Obligations. Administrative roles kept increasing in coverage and intensity. Justice, law and order, maintenance of state machinery and social overheads continue to be expansive and expensive. Welfare and equitable income distribution roles: this cover the activities involve in enrichment of cultural life of the masses and provision of social security to people. Old age pension, subsidies payments direct provision of merit goods items and services feature prominently here with the tendency of expanding and expensive as the economy grows. These above roles bring about distributive justice by mitigating the harsh effects of wealth and income inequalities in the society (Bhatia, 2002).

Musgrave Rostow's Theory Public Goods & Privet Goods interaction: This theory asserts that in early stages of economic growth, public expenditure in the economy should be encouraged, Musgrave (1959). Musgrave made attempt to explain the growing public expenditure on the basis

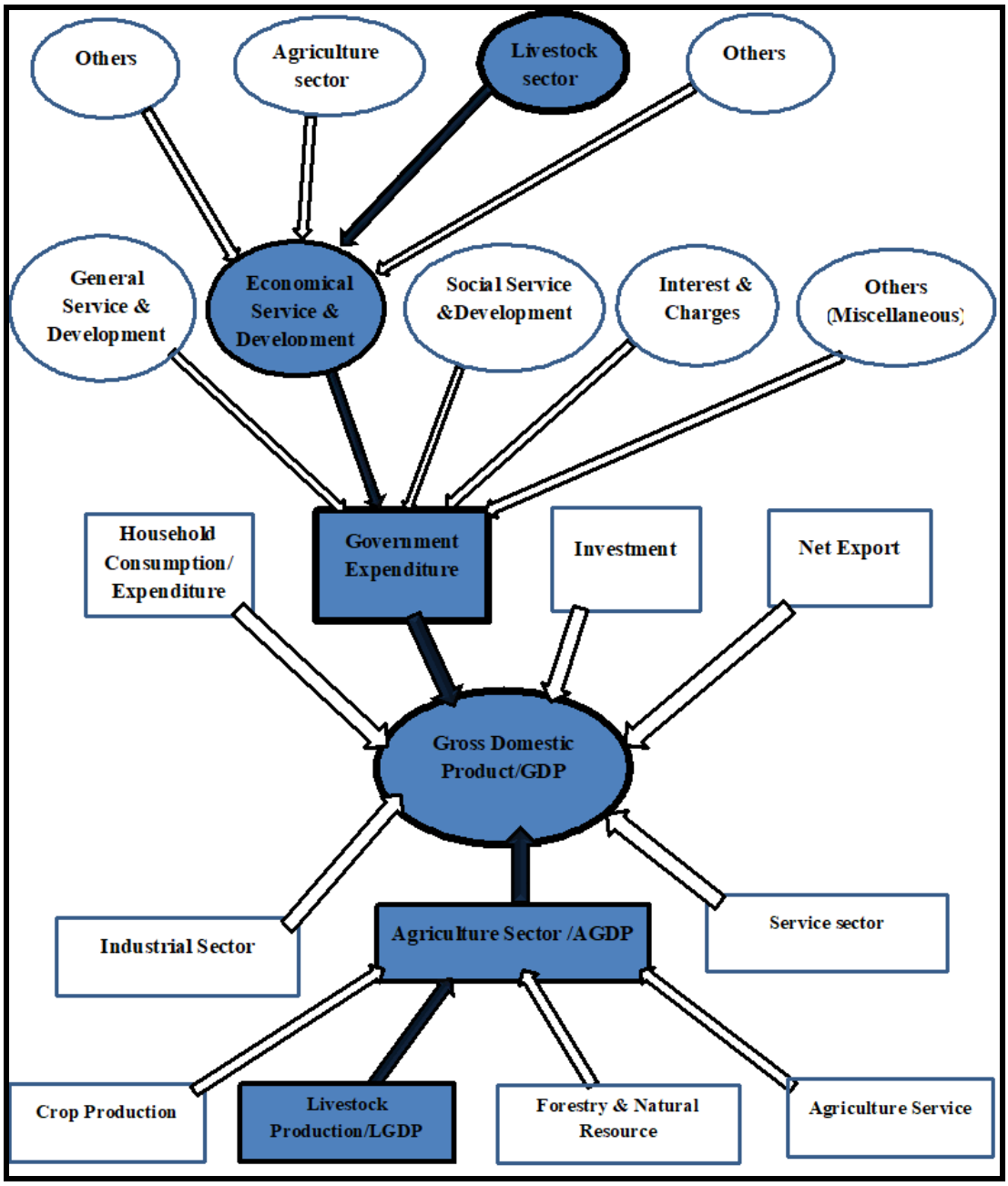
of private goods that required public goods in order to be able to put into use. Meanwhile, the private acquired goods depend on the level of per capital income. The theory further states during the early stages of growth there exists market failures and hence there should be robust government involvement to deal with these market failures. This theory is faulted because it ignores the contribution to development by the private sector by assuming the government expenditure is the only driver of economic growth.

Peacock - Wiseman (Displacement) Theory: This theory was advanced by peacock and Wiseman in a study of public expenditure in the UK for the period 1890 – 1955. The quest for increase public expenditure resulting from the unanticipated social disturbance and inadequacy of the available revenue brings about new level of government expenditure which necessitates higher taxation. The phenomenon is known as displacement effect. Comparison of inadequate available revenue and public expenditure required to carry out government activities brings about Inspection effect. The adaptation of the citizens to this higher level of revenue obtained through taxation to carry out the required public spending is view as Tax tolerance. The combination of macro factors like population upsurge, urbanization, administration, welfare rolls, defense expenditure and ever-increasing awareness of government responsibilities and the micro factors resulting from increasing in price level which tends to increase the cost of public activities in one hand is the cause of ever increase public expenditure (Kivuva, 2016).

Ernst Engel's Theory of Public Expenditure: Ernst Engel was also a German economist writing almost the same time as Adolph Wagner in the 19th century. Engel pointed out over a century ago that the composition of the consumer budget changes as family income increases, Zimmerman (1932). A smaller share comes to be spent on certain goods such as work clothing and a larger share on others, such as for coats, expensive jewelries etc. As average income increase, smaller charges in the consumption pattern for the economy may occur. At the earlier stages of national development, there is need for overhead capital such as roads, harbors, power installations, pipe-borne water etc. But as the economy developed, one would expect the public share in capital formation to decline over time. Individual expenditure pattern is thus compared to national expenditure and Engel finding is referred to as the declining portion of outlays on foods.

Most of the above economic theory have their own application effect on Ethiopia economy in different level in differ approach based on economic development and living standard. Ethiopia is one of developing nation in the world. As per the findings of the studies which have been conducted in the country, the various civil wars that faced at the country level in 1970s and 1980s, and the frequent droughts that occurred since the 1960s up to the present are believed to be the reasons behind the underdevelopment of the country The country main economy depends on agriculture sector that directly determine the economic development of the country. (Tsegay, 2008).

According to theoretical economic concept and economical variables recording in Ethiopia context by financial institutions like National Bank of Ethiopia and Finance & Economic Ministers of Ethiopia categorized as per the chart in the Figure 2.1. The shaded variables in the chart indicate the links between the main variables of the study, Livestock sectoral expenditure and livestock development (Livestock GDP). The livestock sectoral expenditure category from the total expenditure allocation classification at the national level and the classification of national economic growth, GDP. The livestock sector development category in the national economy classification and link with other economic variables with their interaction. As per the chart the center of the concept began from economic growth, GDP and branched to both to the expenditure classification and economic growth category.



Source: own contracted based on economic concept and national economical categories.

Figure 2.1: Conceptual Framework

2.2. Empirical Literature

2.2.1. The Effect of Government Expenditure on Agriculture Growth

Several studies on the effect of governmental expenditure to indicate different impact on different sectoral development and the overall economic growth of the national economy. Those studies indicate that the study on the relationship between in governmental spending and its impact to understand the economical flow and play a crucial role for police makers and economist to sustain economic development. However, there is no common ground or evidence to clearly state the relationship between public agricultural expenditure with agriculture growth by proxy it is similar to Livestock expenditure and livestock growth.

The study in Indonesia on the effect of public expenditure on Indonesia agriculture growth, by Enrique et al. (2012). The study used the time series data from 1076-2006 and analysis done using ordinary least squares and generalized method. The study used the variables like public expenditure on irrigation and agriculture; fertilizer subsidies and agricultural gross domestic product per capita growth. The result of the study indicates that, the public expenditure of irrigation and agriculture had a positive impact but agriculture impact was not significant.

In Zimbabwe the study using a time series data from 1980-2005 to identify the impact of agricultural expenditure on economic performance of the country, by Talknice and Mufaro (2014). On the study the variables like: Gross Domestic Product, agriculture exports, money supply, agricultural expenditure, total government expenditure (less agriculture expenditure), subsidies to the agriculture sector and dummy for drought. Ordinary Least Square (OLS) model deployed to analyze the data. The fining of the study indicate that the agriculture expenditure has a positive significant effect to determine economic growth.

The impact of government expenditure on agricultural and economic growth in Pakistan examined using a time series data from 1983-201, by Abbas et al. (2016). The variables like: Government expenditure on agriculture, agricultural outputs and GDP. They employed the Augmented Dickey–Fuller (ADF), Johansen Co-integration test and Ordinary Least Square (OLS) technique as analytical tools. This study indicates that there is a long-run relationship among governmental

expenditure on agriculture, agriculture outputs and economic growth. On the study agriculture output and government expenditure had significantly affect the GDP of the country.

The Nigeria researcher Comfort and review the effect of agricultural productivity and on economic growth using time series data from 2000 – 2014. The Ordinary Least Square (OLS) method used to analyze the data and variables like: agricultural sector contribution to GDP, gross expenditure on agriculture and gross access to bank (agricultural) loans and credit. The result of the study indicates that access to credit and loans did not significant impact to economic growth. Another study in Nigeria, to identify factors that influenced the agricultural output and productivity using a time series data 1077-2011. In this study regression casual technique was applied by using a variable like: food import value, interest rate, commercial banks' loans on Agriculture, GDP growth rate and foreign direct investment. The result of the study indicates that around ninety five percent of the variables like: foreign direct investment; commercial bank loan, interest rate and food import value had positive and significant impact on agricultural output (Ndubuaku et al., 2019)

The Nigerians also studied the effect of commercial banks' credit advances to the agricultural sector and its effect of on agricultural output using the data from 1970 - 2014, by Udoka et al. (2016). The study concluded that there was a positive and significant relationship between Agric Credit Guarantee Scheme Fund, commercial banks credit to the agricultural sector, government expenditure on agriculture and agricultural production in Nigeria respectively. The study deploys ordinary least squares regression technique to estimate variables. Additional another study in the same country also the effect of agricultural credit on three agricultural subsectors (crop production, livestock and fisheries). The study used time series data from 1978-2008, by Onwumere et al. (2012). The deploy two- variable regression model for data analysis. The result indicate that the agriculture credit has a positive impact on three agricultural subsectors (crop production, Livestock and fisheries) and on overall agricultural productivity.

The study in Nigeria on the impact of agricultural financing on agricultural sector contribution to GDP in Nigeria. The used a time series data from1981-2016 and variables like: Agricultural GDP (AGDP) with independent variables such as government funding (Capital Expenditure on

Agriculture and Recurrent Expenditure on Agriculture), Agric Credit Guarantee scheme Fund and Commercial Banks' Credit, Loans and Advances to the Agricultural Sector. The Auto Regressive Distributed Lagged regression model (ARDL) was used to estimate the data. The result of the study shows that government funding to agriculture and Agric Credit Guarantee scheme Fund (ACGSF) had a non-significant impact on Agricultural Contribution to GDP (AGDP). Jambo (2017) conduct a study to indicate the effect of sectoral expenditure to economic growth of Zambia, Malawi, South Africa and Tanzania using a data between 2000 and 2014.

2.2.2. The Application VECM Model to Identify the Effect of Government Expenditure

In Saudi Arabia, the effect of governmental expenditure on agriculture growth discussed by Alshahrani and Alsadiq (2014) using VECM model. The finding in this study indicate that agricultural expenditure and export had a positive impact to agriculture growth both in short run and long run causality. Export of agricultural product had significant effect. The related study on the impact of institutional funding on agricultural labour productivity in Nigeria studied by Edet et al. (2016) using co-integration and error correction model to analyses the variables. The result showed that there was a significant impact of government capital expenditure on agricultural sector, real amount of loan guaranteed by Agric Credit Guarantee scheme Fund, past value of loan guaranteed by Agric Credit Guarantee Scheme Fund and policy shift on agricultural labour productivity respectively. However, Commercial Bank's Credit to Agricultural Sector had not significantly impacted on agricultural labour productivity in Nigeria during the period. The time series data 1978-2012 used for this study.

The effect of public agricultural expenditure to agricultural output studied by Matthew and Mordecai (2016) using a time series data 1981 – 2014. Analytical tools employed included the granger causality diagnostic test, augmented dickey-fuller test, error correction method (ECM) and Johansen cointegration test. The study result show that the public agricultural expenditure had a negative and significant impact on agricultural output. Also, in similar procedure Andrew (2015) analyzed agricultural financing and its effect on output for sustainable economic development in Nigeria (GDP) using multiple regression technique. The study found a nonsignificant relationship between agricultural financing and GDP. Another Nigerian study on the effect of government

expenditure on the agricultural output using data from 1975 to 2010 by Idoko et al. (2012) indicate that the relationship that existed between the two variables had significant and positive impact. The variables for this study included foreign direct investment on agricultural sector, annual rainfall, government expenditure on agricultural sector, Agric Credit Guarantee scheme Fund, and commercial bank loans and advances to the agricultural sector. The OLS model was used to estimate the result.

2.2.3. The Studies on the Effect of Government Expenditure on Agriculture Growth in the case of Ethiopia

In Ethiopia several studies were conducted to indicate the relationship between governmental expenditure and economic growth using different approaches. Some of them are discussed in the following by focusing on those have technical similarity and supportive idea with this study. Endale (2007) assessed the effect of defense expenditure on economic growth based on the test of random effect estimator in Ethiopia. This study indicate that the defense expenditure had a distractive burden to the overall real GDP growth. Another study on the effect of governmental expenditure on different sectors education on economic development using vector error correction model by Wendwesen (2012) and Fitsum (2013. The study indicates that, the public expenditure on education and road construction the sector had a positive short -run significant impact on economic growth, but the expenditure on health, agriculture sectors had a negative and significant effect on GDP growth.

The vector error correction model (VECM) is used to test the impact of public expenditure, private investment and net trade on agricultural GDP growth. Seida (2016) also conduct a study on the effects of government expenditure and tax on economic growth in Ethiopia using Co-integrated Vector Error Correction approach is applied to analyze time series data from1980/81 to 2013/14.

Teshome (2006) studied the impact of sectoral governmental expenditure (Investment, consumption and human capital) on economic growth. The study shows that only human capital (education and health) had long run significant positive impact on economic growth. In the same way Salih (2012) conduct a similar study and show that the public spending on physical investment

and human capital development had positive contribution to economic growth while spending on consumption affects growth negatively.

Bayew (2015) show the impact of public sector spending on the economic growth in Ethiopia. The empirical analysis found that public spending on social sectors has positive long run effect on the growth of real per capita income while spending on general services has suppressing its growth. From the selected infrastructure sector components, while public expenditure on electric power sector has significant positive effect, road sector development has insignificant effect on the growth of real per capita income growth. The study used a time series data1983 – 2005 Ethiopia finical years. Similar study done by Bazezew (2014) using a time series data from 1975 to 2013 and by estimating a multivariate co-integration and error correction model to examine the marginal effect of expenditure on each sector on economic growth. The result also shows that government spending on education had a positive impact on economic growth in the long-run but an insignificant impact in the short-run; Spending on defense had a negative and significant impact on economic growth both in the long-run and in the short-run; Government spending on agriculture is negatively correlated to growth in the long-run but is insignificant in the short-run; and Spending on health and the effect of consumer price index is found to be insignificant both in the long-run and the short-run.

2.2.4. The Studies on the Effect of Government Expenditure on Livestock Development in the case of Ethiopia

The study on the impact of Livestock government expenditure on economic development and Livestock sectoral development not advanced as per the required level due to its contribution to the national economy. Addis (1983) reviewed financing animal health services in some African countries to discuss and identify the contribution of the livestock sector to economic growth of different African countries. In addition, Addis (1985) Financing livestock services in some countries of East and southern Africa reviewed the role of livestock to economic development, the way of financing the livestock sector and the adequacy of financing the livestock sectors using regression model for East Africa countries including Ethiopia. The study show that the livestock sector had a significant effect on economic growth and the financing of the sector comparatively less than others and inefficient. The related literature by Aleme et al. (2015) reviewed the

contribution of livestock sector in Ethiopian economy in descriptive manner to identify the level of livestock contribution to the economy and the main challenge to the sector. In this study one of identified constraining to the sector is low commitment of the government, it may be manifested by government expenditure.

The importance of this study is to contribute a significant input to the livestock sector based on the gap of different studies. Most of the studied discussed in the above show the government expenditure impact on economic growth. The other researcher indicts the effect of agricultural government expenditure on the development of agriculture development and economic growth. The study of Addis in 1985 also indicate that a limited information on the effect of Livestock on economic development, using a limited data and analyzing approach because the document is a working document for other studies. So, this study aimed to review the impact of the livestock sector expenditure to the development of the sector and its contribution to economic growth.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Research Approach and Design

The approach of this study is initiated defining the objective of the study, and to evaluate the contribution of livestock government expenditure on the development of the livestock sectors and its contribution to economic growth in the case of Ethiopia. The study identified the determinate variables have interaction with livestock expenditure and livestock growth. A time series data form 1979/80 up to 2018/19 those explain the livestock expenditure and economic development.

The study also defined the variables used in this study, the source of the data explained and the diagnostic test applied in the study. The specific analyzing model deployed to measure the long-run and short-run relationship of livestock sector government expenditure on livestock development and its effect on economical growth. The period considered in this study is adequate as compared with the number of years that are taken by similar studies and the incorporated explanatory variables. So, the study employed descriptive and ex-post facto research design using a time series secondary data, it is a quantitative data.

3.2. Description of Data Source

To investigate how the livestock sector government expenditure could affect the livestock sector development and its contribution to economic growth in Ethiopia, a number of variables have been taken into consideration in this study. The study also used secondary time series data collected from different international and national economic data source, both published and unpublished document for the period from 1979/80 up to 2018/19 (1972 – 2011 E.C). the reason for the use of 1979/80 as a cutoff point is because of the availability of data from source. The main source of data for the study were National Bank of Ethiopia (NBE), Ministry of Finance and Economic development (MoFED), Ministry of Agriculture (MoA) and FAOSTAT for most variables used in this particular study.

3.3. Theoretical Framework

The theoretical framework that the study is based on is an Augmented Solow Growth Model. Such a model is basically a log transformation of the Cobb-Douglas production function. The log form of this model allows including any relevant variable which affects economic growth. In this study the researcher specified an Augmented Solow Growth Model where the production function of the economy is given by:

$$Y_t = Af\,(L_t, K_t, G_t, X_t) \ldots \ldots (3.1)$$

In the model, the level of output (Y) is assumed to be a function of two factors of production, capital (K) and labor (L) and components of government expenditure (G). A represents level of technology; t represents time dimension and X_t represents a vector including other factors affecting economic growth. Moreover, some authors focused on the components of government expenditure that are productive or unproductive, while others submitted that composition of government expenditure might exert more influence compared to the level of government expenditure (Bazezew, 2014).

3.4. Model Specification

Model specification section describe the econometric model which has relevancy with this study. The econometric model applied for this study, the relationship between livestock sectors government expenditure and livestock development with its effect on economic growth in Ethiopia with a particular focus on sectoral expenditures and development.

The econometrics model applied by a related study like Wendwesen (2012), Fitsum (2013) and Bazezew (2013) to analysis the relationship between sectoral expenditure and sectoral development/ economic growth. In addition to this the relevance of the model for such study allow to use this model. This study used additional more variables than those studies, such as Livestock growth domestic product share, Livestock sectoral expenditure, livestock export share, inflation rate as consumer price index, livestock production index, Livestock population and Animal health coverage. Also, the study data covers from 1979/80 – 2018/19 (1972-2011E.C).

The empirical framework of this study is focused on evaluating the relationship between livestock sector government expenditure and livestock development with its impact to economic growth using the VAR approach in Ethiopia. The reason for using VAR approach is due to the presence of two-way relationships between livestock sector government expenditure and livestock development with the its contribution to economic growth. The evidence remains whether the supply of public goods and services in the livestock sector leads to the development of the livestock sector that significantly contribute to economic growth or economic growth drives the demand for goods and services in the livestock sector.

According to the theoretical and empirical finding and discussion indicate that the livestock sector development and its contribution to economic growth determine by a lot of factors, for this study the six variables included. In the study the model expresses the livestock sector development in relation to economic growth contribution, the share of Livestock sector to economic growth (LIVGDP) as a function of Livestock expenditure (LIVEXP), inflation (INF), Livestock Population (LIVPOP), Livestock export share (LIVEXPO), Livestock production Index (LIVPROI), Animal health service coverage (ANHEAS).

This study estimated by the growth model is specified as follow:

LIVGDP = f (LIVEXP, LIVPOP, LIVEXPO, LIVPROI, ANHEAS, INF, U) …… (3.2)

⇨ At time t:

$LIVGDP_t$ = f (LIVEXP, LIVPOP, LIVEXPO, LIVPROI, ANHEAS, INF, U) $_t$ ……. (3.3)

⇨ These can be written in a regression form as:

$LIVGDP_t = \square_{0+} \square_1 LIVEXP_t + \square_2 LIVPOP_t + \square_3 LIVEXPO_t + \square_4 LIVPROI_t + \square_5 ANHEAS_t + \square_6 INF_t + U$

…… (3.4)

⇨ Where:

$LIVGDP_t$ = Livestock development (Livestock GDP share) at time t

$LIVEXP_t$ = Livestock Sector Government Expenditure at time t

$LIVPOP_t$ = Livestock population (TLU=Tropical Livestock Unit) at time t

$LIVEXPO_t$ = Livestock Export at time t

$LIVPROI_t$ = Livestock Productivity Index at time t

$ANHEAS_t$ = Animal Health Service coverage at time t

INF = Inflation at time t

U_t = stochastic error term

$\square_0$ = Intercept/Constant term

$\square_1$ to $\square_6$ = Regression coefficient/Coefficient of the explanatory variable (slope)

t = time in the year

To make the interpretation of the results of the variables easier and also to get the stationarity of the variables in lower order of integration we will take the natural logarithmic form for the above equations. Therefore, the letter "Ln" represents logarithmic terms of the variables. Logarithms help to resolve the problem of heteroscedasticity. The logarithmic form of the regressions and the final models to be estimated in the study are specified as follows:

$$Log(LIVGDP_t)=\square_{0+}\square_1 Log(LIVEXP_t)+\square_2 Log(LIVPOP_t)+\square_3 Log(LIVEXPO_t)+\square_4 Log(LIVPROI_t)+\square_5 \; Log(ANHEAS_t)+\square_6 Log(INF_t)+U_t \quad (3.5)$$

$$\mathbf{Ln}(LIVGDP_t)=\square_{0+}\square_1 \mathbf{Ln}(LIVEXP_t)+\square_2 \mathbf{Ln}(LIVPOP_t)+\square_3 \mathbf{Ln}(LIVEXPO_t)+\square_4 \mathbf{Ln}(LIVPROI_t)+\square_5 \mathbf{Ln}(ANHEAS_t)+\square_6 \mathbf{Ln}(INF_t)+U_t \quad (3.6)$$

Prior to estimation of the growth model above, standard econometric tests like stationarity and co-integration tests were conducted in order to avoid the generation of spurious regression results. For the study Vector Error Correction Model (VECM) to analyze both the short and long run relationship among variables. Also, another important assumption of this model suggested that Livestock Sector Government expenditure on Livestock GDP (livestock development) had a positive sign and coefficients, which implied a positive relationship between the variables. Thus, the following is the a priori expectation of the model: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6>0$; $\mu=0$.

3.5. Definition and Measurement of Variables

Livestock Development (Livestock GDP/LIVGDP): This is the share value of livestock sector from the total gross domestic product. In this study it captures the value of goods and services produced in a given economy specially by livestock sector for a specified period of time. It is compared with agriculture or the total economic growth (LGDP/AGDP or LGDP/GDP).

Livestock Sector Government Expenditure (LIVEXP): This is the share livestock sector expenditure from the total government expenditure. It includes expenses such as buying livestock production equipment, livestock inputs such as improved animal breed, trained and hiring a number of livestock development agents, animal health facilities, animal health supplies and so on.

Livestock Population (TLU=Tropical Livestock Unit) (LIVPOP): the livestock population mean that the total number of livestock. In this study livestock population include: the number of cattle per year, number of sheep per year, number of goats per year, number of chickens per year and number of camels per year. The livestock population calculated by Tropical Livestock Unit (TLU). For this study the conversion factor applied are: cattle conversion factors - 1cattle= 0.70TLU; Sheep conversion factors – 1sheep = 0.10TLU; Goat conversion factors – 1goat = 0.10TLU; Chickens conversion factors – 1chickens = 0.01TLU; and Camels conversion factors – 1 camel = 1.40TLU.

Livestock Export Value (LIVEXPOVA): according to this study the livestock export means that the share of the livestock sector from the overall total export value. Livestock export include: the export value of meat and meat product, the export value of skin and hide, and the export of live animal.

Livestock Productivity Index (LIVPROIND): the production index is the rate that used to measure the capacity of the production. In this study the rate of production includes: the production and productivity of the livestock sectors like, milk production, meat production, egg and live animal. The production index calculated as per FAO standard and procedure.

Animal Health Service coverage (ANIHESECO): animal health service coverage is the service coverage of animal health, according to this study the coverage includes the coverage of Vaccination for major endemic disease those have social and economic importance, the coverage

of treatment from diseased animals and the rate of reducing animal death (Mortality rate). The focus and the way of recording is to indicate the coverage of the service both for treatment, prevention and control. Its measurement is in number of animals not in money value.

Inflation (INF): is defined as the general rise in the price level of goods and service in the economy. General rise in the level indicates the net change in the price of all baskets of commodity produced and services provided in the economy. That means there may be an increase or decrease in the price of basket of some commodity in the economy. The net effect gives us the general rise in the price level or decrease in the price level. If the net change is a rise in the price level, we can call it inflation otherwise deflation. There are various methods used to measure inflation. The common methods that are used to measure inflation are:

- Consumer Price Index (CPI): Take the change in the price of consumer goods and services (applied for this study)
- Producer Price Index (PPI): Take the change in price of raw material or produce used by the producers.
- GDP-Deflator: It is the ratio of nominal and real gross domestic product.

Exchange Rate (EXCHRAT): it is the change in local currency to USD, it means that ETB to USD. It is collected every year rate.

Change in Cattle Death Rate (CHCATDERA): It the change in the rate of cattle death in this year from last year. It is expressed in change in percentage, it may be increasing or decreasing.

3.6. Properties of the Time Series Data

In view of the fact that this study used time series data and inherently it might exhibit some strong trends, the non- random disposition of the series might undermine the use of some of the econometric tests such as F and t tests. This is because they can cause rejection of a hypothesis which would have otherwise not been rejected. This study intends to conduct stationarity and co-integration tests to mitigate such situations.

3.7. Estimation Technique and Tests

3.7.1. Unit Root Test

All economics data are mostly non-stationary. Undertaking regression on non-stationary time series may give a spurious result in which estimators and test statistics are misleading. Even if there is no real relation between variables the result may show a high R^2 and a significant relationship between variables. So, checking for the stationarity of the data is mandatory before regressions are undertaken.

A variable is stationary means its mean and variance are time invariant. If the mean and variance are dependent over time, then the series is called non-stationary. There are different methods to identify whether the series is stationary or not. The emphasis here is on using the most common test that is unit root test. There are also different ways to test for the presence of unit root. Here Augmented Dickey fuller (ADF) test is used to test for the stationarity of the variables.

Let Y be any time series variable and it is given as:

$$Y_t = Y_{t-1}+U_t \quad \ldots\ldots (3.7)$$

Where: Y_{t-1} is the value of Y at time t-1

U_t is white noise error term

Equation (3.7) is simply a random walk model without drift that means it is non-stationary. If we rewrite equation (3.7) as:

$$Y_t = \rho Y_{t-1}+U_t \;\; ; \;\; -1 \leq \rho \leq 1 \quad \ldots\ldots (3.8)$$

If $\rho=1$ it will be the same with equation and therefore it becomes non stationary. So simply by regressing Y_t on it lagged value of Y_{t-1}, we can estimate the value of ρ. If the estimated value of ρ is 1 the series Y_t is said to be non-stationary. So here the null hypothesis will be $\rho=1$, i.e. the time series is stationary.

Or alternatively we can rewrite equation (3.9) as:

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1}+U_t \quad \ldots\ldots (3.9)$$

(Subtracting Yt-1 from both sides of equation (3.9))

$$\Delta Yt = (\rho-1)\, Yt-1 + Ut \quad \ldots\ldots (3.10)$$

To simplify the equation (3.10) it can be rewritten as:

$$\Delta Yt = \delta Yt-1 + Ut \quad \ldots\ldots (3.11)$$

Where: $\delta = (\rho-1)$

Δ indicates the first difference operator

Now the null hypothesis is $\delta = 0$. I.e. $\delta = 0$ means the value of $\rho=1$, in this case the time series is non stationary or there is a unit root against the alternative that is $\delta < 0$. To test the null hypothesis, $\rho = 1$, the τ (tau) statistic is used. Dickey Fuller test can be estimated as follow:

$$\Delta Yt = \delta Yt-1 + Ut \quad \ldots\ldots (3.12)$$

$$\Delta Yt = \beta 1 + \delta Yt-1 + Ut \quad \ldots\ldots (3.13)$$

$$\Delta Yt = \beta 1 + \beta 2t + \delta Yt-1 + Ut \quad \ldots\ldots (3.14)$$

Equation (3.12) represents an equation with no constant term and time trend. Equation (3.13) is an equation with constant term but no time trend. On the other hand, equation (3.14) represents an equation with both constant term and time trend. The null hypothesis is the same for three of the equations, which means the null hypothesis is given as the series is nonstationary or it contains a unit root.

Dickey Fuller (DF) test is based on the assumption that the error term is uncorrelated. However Augmented Dickey Fuller (ADF) test is an extension of DF test that augment preceding three DF equations by lagged values of the dependent variable in order to manage autocorrelation problem (Gujarati, 2003). Therefore, in this paper ADF test is used to identify whether the variables are stationary or not, while all tests and the hypothesis for ADF test are the same with DF test. It is estimated as:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + a_i \sum_{i=1}^{m} (\Delta Y_{t-i}) + u_t \quad \ldots\ldots (3.15)$$

As I mentioned above regressing a non-stationary variable on another non-stationary variable may give false relationship between variables or it may produce a spurious regression. To avoid the spurious regression problem between variables we have to transform non-stationary variable in to stationary variables. In other words, if a time series has a unit root, we have to transfer it into a stationary time series before regression is undertaken. To do so, the researcher uses differenced method. According to Verbeek (2000), if a series becomes stationary after first differencing it is called integrated of order one, denoted by I (1). In some case taking first difference may not transform the series into stationary. In that case a series must be differenced twice, to make it stationary, then it is said to be integrated of order two, denoted by I (2). In general, if a series becomes stationary after differencing d times, it is called integrated of order d, denoted by I(d).

3.7.2. Co-integration Test

Having tested the variables for stationarity, the next step of time series analysis is testing for co-integration, which is whether the linear combination of the variables is also stationary or not. Even though the variables are individually non-stationary at level, liner combination of these non-stationary variables can be stationary. Co-integration of the time series variables tells us the existence of a long run or equilibrium relationship among them. If the time series variables are co-integrated, the regression at level of the two variables is meaningful i.e., the regression is not spurious because of their individual non-stationarity.

For the existence of such relationship, the error term of the model should be stationary, since it is a linear combination of the variables in the model. If we put our model as:

$$Y_t = \beta_0 + \beta_1 X_t + U_t \quad \text{……} \quad (3.16)$$

The linear combination will be

$$U_t = Y_t - \beta_0 - \beta_1 X_t \quad \text{……} \quad (3.17)$$

If the error term or the linear combination of the variables is stationary or it is I (0) then the variables Y_t and X_t are called co-integrated and therefore they have an equilibrium relationship. Co-integration analysis can be applied by using either the Engle-Granger two step procedures or the Johansen maximum likelihood estimation approach.

Since the Engle-Granger approach is based on a single equation, it has limitations on identifying the existence of multiple co-integrating vectors. The Engle-Granger approach is also focused on only residual term; however, the residual-based test tends to lack power because it does not exploit all the available information about the dynamic interactions of the variables. An alternative approach that does not suffer from these drawbacks was proposed by Johansen (1988), who developed a maximum likelihood estimation procedure, which also allows one to test for the number of co-integrating relations. Therefore, the Johansen approach is preferred and it is possible to test for the presence of more than one cointegrating vectors with this approach. It also allows estimating the model without priority restriction of the variables as endogenous and exogenous. To identify the number of cointegrations the Johansen approach relies heavily on the relationship between the rank of a matrix and its characteristic roots. In this procedure determining the rank of the long run matrix provides the number of co-integrating vector between the variables (Verbeek, 2008). Therefore, this study used the Johansen maximum likelihood estimation approach to test the existence of co-integration among variables.

3.7.3. Vector Error Correction Model

Having tested the stationarity of the error term, the next step will be depending on the stationarity test. If the error term is stationary then the Vector error correction model (VECM) will be estimated by using the error term from the equilibrium regression. This VECM helps us to reconcile the short run behaviour of the variables to its long run behaviour, with disequilibrium as a process of adjustment to the long run model.

Defining a vector Zt = {Yt, X1t, X2t,.,,, Xnt}' of n potentially endogenous variables, it is possible to specify the following unrestricted vector auto regression (VAR) model involving up to K-lags of Zti :

$$Z_t = A1Zt\text{-}1 + \ldots\ldots + Ak\, Z_{t-k} + U_t \quad \text{..... (3.18)}$$

Where Z_t is (nx1) and each of the Ai is an (n x n) matrix of parameters. Equation (3.18) can be reformulated in to a vector error-correction (VECM) form:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \ldots\ldots + \Gamma_k\, \Delta Z_{t-k}+1 + \Pi Z_{t-k} + U_t \quad \text{.....(3.19)}$$

Where, ΔZ_t represents the first differences of the variables; $\Gamma i = -(I-A_1 -\ldots-A_i)$ is the coefficient matrix in the error correction term that represents the short run parameters; $\Pi = (IA_1- \ldots..-A_k)$ is matrix of long run responses, which contains information about the long-run relationships and (i=1,…, k-1).

Since the co-integration result may be sensitive to the number of lags included in the VAR model determination of the appropriate lag length is important to estimate the VECM. Thus, before testing the co-integration analysis and also estimating the VECM, the appropriate lag length that fits the model should be decided. Therefore, the lag length can be determined using different model selection criteria. The Akaiki Information Criteria (AIC), the Schwarz (Bayesian) Information Criteria (SIC), the Final Prediction Error (FPE) and the Hannan Quinn Information Criteria (HQ) is used to determine the optimal numbers of lags.

In the Johansen (1988) procedure the decision criteria on determining the existence and the number of existent co-integrating vector depend on the rank(r) of the long run matrix (Π). In general, there are three cases that may occur. The first case is when all variables are stationary in this case the rank (r) of the long run matrix (Π) is equal to n (r=n). The implication of this result is that there is no problem of spurious regression, thus estimating unrestricted vector auto regression (VAR) model is an appropriate modelling strategy. The second case is when there is no co-integration relation at all which means the system is nonstationary, in this case the rank (r) of the long run matrix (Π) is equal to zero (r = 0). The implication of this result is that there are no linear combinations of the variables at I (0), thus the appropriate model is a VAR in first-differences involving no long-run elements. The third case is when there is up to (n-1) co-integrating vectors, in this case the rank (r) of the long run matrix Π) is in between zero and n ($0 < r < n$). The implication of this result is that the system is non-stationary, but there are r co-integrating relationships that are stationary. Therefore, Π has reduced rank and gives information about the long-run equilibrium. To determine the rank of the long-run matrix and hence the number of co-integrating vectors, Trace (λ_{trace}) and Maximum Eigenvalue (λ_{max}) statistics are used. (Harries and Robert, 2003). These statistics are given by

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \log(1-\hat{\lambda}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.20)$$

$$\lambda_{max}(r, r+1) = -T \log(1 - \hat{\lambda}_{r+1}) \quad \text{..... (3.21)}$$

Where r is the number of co-integrating vectors, λ is the estimated characteristic root (eigen values) from the matrix, and T is the number of observations. For Trace (λ_{trace}) statistics the null hypothesis is there is at most r co-integrating vectors against the alternative more than r co-integrating vectors. On the other hand, for Maximum Eigenvalue (λ_{max}) statistics the null hypothesis is that there are r co-integrating vectors against the alternative that r + 1 exist.

3.7.4. Granger Causality Test

Granger causality test in time series analysis is useful to identify which variable granger causes another variable. In a time, series analysis if the variables are stationary at first difference and also, they are co-integrated then either the first variable granger causes the second or vice versa. However, the number of lagged terms to be included in the model during causality test is an important part of the test. i.e. the direction of granger causality may depend on the number of lagged terms involved in the model. Given two variables X and Y, X is said to Granger causes Y if lagged values of X predict Y well. The same is true if the lagged values of Y predict X well, and then Y is said to Granger causes X. If lagged values of X predict Y and, at the same time, lagged values of Y predict X, then there is a bi-directional granger causality between X and Y. In general, a time series X is said to Granger causes another time series Y if it can be shown that the series X values provide statistically significant information about the future values of series Y; if not, X does not Granger causes Y (Alemayehu et al, 2011).

3.7.5. Diagnostic tests

Diagnostic tests are utilized to check the validity of the fitted model. Since high R square, no heteroskedacity, normality of residual distribution, no serial correlation in the residual are features of the best regression model, checking these diagnostic tests are important. Therefore, residual normality test, error vector autocorrelation test, heteroskedacity test and stability test are applied to identify whether the regressed model is suitable.

The residual normality test is carried out in order to investigate whether residuals are normally distributed or not. In order to diagnose this normality, test the multivariate extension of the Jarque-

Bera (JB) normality test which compares the third and the fourth moments of the residuals to those from the normal distribution is applied. This test is a joint asymptotic test in which the statistic is calculated from the skewness and kurtosis of the residuals as follows.

$$JB = \frac{N}{6}[S^2 + \frac{(\beta_3 - 3)^2)}{4}] \quad \ldots\ldots (3.22)$$

Where T is the number of observations; S is the coefficient of skewness, β_3 is a measure of kurtosis; and the test statistic is χ^2 distributed. The null hypothesis is that residuals are normally distributed thus the null hypothesis is desirably.

The residual serial correlation test is applied to investigate whether the residual is serially correlated with its lagged orders. In order to test the possibility of serial correlation in the residuals the residual serial correlation Lagrangian Multiplier test is used, that uses Breusch-Godfrey Lagrange multiplier (LM) test which is a multivariate test for residual serial correlation up to some specific lag order. The LM test is given as:

$$LM = (N-q) \quad \ldots\ldots (3.23)$$

Where q is the degrees of freedom and $R_{\hat{E}}^2$ is the coefficient of determination obtained from the auxiliary regression, and the LM test statistic is χ^2 distributed. The null hypothesis is given as residual is not serially correlated, thus here also the null hypothesis is desirably.

Heteroskedacity test is carried out to investigate whether the error term in the model are constant. To analyses this test the White's test is applied in which the null hypothesis represents that the residuals are both homoscedastic and that there is no problem of misspecification. Here also the null hypothesis is desirable in the diagnostic process.

Stability test is undertaken to determine whether the regressed model is stable. In order to test this, test the inverse characteristic roots is applied. If the characteristic roots of the variables lie within the circle, then the estimated parameters are considered as stable.

3.8. Adequacy Measurement for Livestock Government Expenditure

The quality and quantity of the livestock service determined by effectiveness utilization and management of resource. The adequacy of the finance for the livestock sector measured by proxies from generally accepted standards. Such as: (1) the expenditure to GDP ratio, (2) the proportion and ratio of staff to non-staff expenditure, (3) the number and proportion of technical staff of different categories. For this study it is difficult to measure using the second and the third techniques, because of lack enough information and data on the number of staffs in the sector. other measurements like measuring the unit expenditure per livestock unit and the sectoral contribution of the livestock to economic growth (GDP).

1) <u>The Relative expenditure rations</u>

$$R = \left(\frac{ARE\,(x_1)}{AGDP\,(y_1)}\right) \div \left(\frac{LRE\,(x_2)}{LGDP\,(y_2)}\right) \quad \text{..... (3.24)}$$

Where: ARE(X_1) = agriculture expenditure

AGDP (Y_1) = agriculture GDP

LRE (X_2) = Livestock recurrent expenditure

LGDP (Y_2) = Livestock GD

R can thus express as:

$$R = \left(\frac{x_1}{y_1} \div \frac{x_2}{y_2}\right) \quad \text{..... (3.25)}$$

The ratio basically tells us the intensity of input expenditure in the livestock sector relative to the intensity in the agricultural sector as a whole

R can also express as:

$$R = \left(\frac{x_1}{x_2} \cdot \frac{y_2}{y_1}\right) = r_1 \cdot r_2 \quad \text{..... (3.26)}$$

A ratio of more than 1 means that proportionately less is being allocated to livestock services than to other agricultural services in relation to their economic importance. The reverse will be true for values of less than 1(Addis, 1985).

2) *The Ratio of Unit Expenditure to Livestock Unit*

The ratio of unit expenditure to livestock unit is the government spending to every year for a single livestock. It is calculated that the total expenditure per year divided by a total livestock population the measured by TLU (Tropical Livestock Unit).

Ratio = (Expenditure for a single livestock unit / Livestock unit)

R = Expenditure in USD / 1 TLU ..... (2.27)

It also expressed as:

R= Expenditure in X year (USD) / No. Livestock in X year (TLU) ..... (2.28)

Interpretation for the result with it is adequate or not is based on intranational standard for the livestock expenditure: for one livestock unit (TLU) the expected expenditure of 0.75USD up 0.90USD.

3) *Compering the share of the Livestock sector to GDP*

This is used to indicate economical contribution the livestock sector by computing the GDP share of the livestock sector from the GDP share of Agriculture sector and also computing the GDP share of the Livestock sector with the GDP at national level. It is used to compere by proxy the sectoral contribution to the national economy and the government commitment. It is expired in the following way:

R_1= AGDP/ GDP; R_2 = LIVGDP / AGDP; R_3 = LIVGDP / GDP .....(2.29)

CHAPTER FOUR

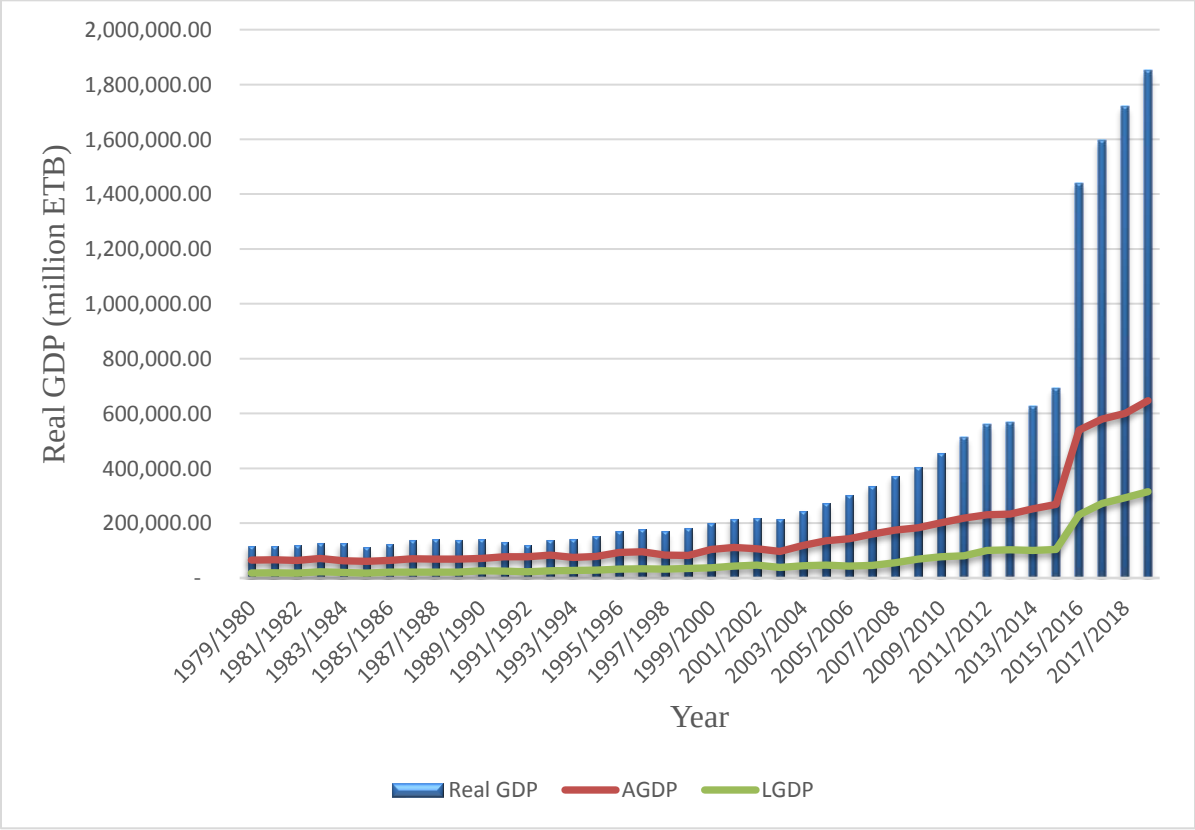
RESULTS AND DISCUSSIONS

This section discussed the economic analysis of the data on livestock expenditure and growth based on the relevant variables. The analysis focusses to identify the effect of livestock expenditure and related factors have direct interaction with livestock sectoral development such as: livestock and product export, livestock number, livestock production performance, Animal health service coverage, and other variables those have indirect interaction used as a control like: inflation and local currency exchange rate. The analysis section draws a conclusion and give insight on the interaction of livestock spending and livestock development in the case of Ethiopia using a data form 1980 - 2019. To achieve the major objective of the paper, the existence of a statistical relationship among the variables is carried out in different stages. Initially the order of integration of the variables is investigated using standard tests for the presence of unit roots and the second step involves the static or levels' regression to find the long-run values (coefficients) for the variables and interpret the results. In the third step involves testing for cointegration using the Augmented Engle- Granger co-integration procedure is used.

In general, the analysis pass four main steps involves the utilization of Error Correction modeling, causality test, co-integration, there always exists a corresponding error correction representation. This implies that changes in dependent variable are as a function of independent variable disequilibrium in the co-integrating relationship that captured by the error correction term (ECT) the relationship may be bidirectional.

4.1. Descriptive Analysis Result

The data collected from the relevant organization indicate that agriculture play a significant to economy of the county, also livestock sector play main role to the agriculture sector. so, by proxy livestock sector have significant role in the economy by creating income, social value, food security, transportation, farm power and saving. For this study different variables were identified to discussed the contribution of livestock sector to the economy of the country. The variables under consideration are livestock gross domestic product (LIVGDP) and public expenditure of the livestock sector (LIVEXP), livestock export value (LIVEXPOVA), livestock population measured by Tropical Livestock value (LIVPOP), Livestock production Index (LIVPROIND), Animal health service (ANIHESECO), Change in Cattle death rate (CHCATDERA). In addition, Inflation (INF) and Rate of exchange currency (EXCHRAT) were considered as a control variable.



Source: Calculations from own study

Figure 4.1: The Contribution of Livestock to Economic Growth

The livestock development (LIVGDP) is a dependent variable, whereas, the other variables are determinant factors for livestock sector development. All variables are measured in real terms, deflated using the consumer price index, CPI. They are all expressed in logarithm form for the sake of econometric analysis. The Figure 4.1 indicate that the relationship and the pattern among the economic development (GDP), Agriculture development (AGDP) and Livestock development (LIVGDP). The contribution of agriculture to national economy and livestock contribution both for agriculture and national economy are significant. The pattern of change for the three variables from 1980 up 2004 are increasing to the positive direction very slowly, after 2005 up to 2014 and 2016 up to 2019 increasing in increasing rate. The change from 2014 to the year of 2015 is very for all three variables. But relatively the rate of increasing of agriculture development and livestock development ware less compared to the aggregate national economic development, GDP. This is highly manifested between the year 2015 and 2016, the change in national GDP very high compared to both agricultural GDP and livestock GDP, and the livestock GDP shows very small change comparatively.

4.2. Unit Root Tests

Before specified the model for analysis a time series data the stationery of the data check at the beginning. The stationery of the variables determined by the presence of the unit root, that is identified by different tests. The non-stationarity of the series can be tested by using an Augmented Dickey-Fuller test. The hypothesis to be tested is: H0: the series is non-stationary or has a unit root against the alternative hypothesis; H1: the series is stationary or has no unit root. The study carried out Unit Root testing using the ADF test for each variable in STATA before proceeding to the Johansen test of co-integration. The rule of thumb of the distraction of stationarity: If the absolute value of t-statics less than the absolute value of critical value (especially at 5%), the we reject the null hypostasis - Ho: the variable has unit root or not stationary and accept the Alternative one, H1: the variable is stationery. Also, we confirm the presence of spurious regression by performing regression among dependent variable and independent variable and check for R^2 against Durbin-Watson d-statistics. when there is spurious regression, $R^2 > D.W$. To make the variable stationary, we should go for first differencing. Based on Augmented Dickey Fuller Unit root test using STATA the result of the variables deployed for this study indicated in the below table.

Table 4.1: Augmented Dickey Fuller Unit root test results at level

Variable	With Tend and Intercept			Lag	Variable Regression		Variable status at level -I (0)
	(ADF) t-statistic	Critical Value at 1%, 5% & 10%			R^2	D.W	
ln(LIVGDP)	1.333	1%	- 4.288	4	1.0000	2.02179	Non-Stationary at level
		5%	- 3.560				
		10%	- 3.216				
ln(LIVEXP)	1.347	1%	- 4.288	4	1.0000	2.02179	Non-Stationary at level
		5%	- 3.560				
		10%	- 3.216				
ln(LIVEXPOVA)	- 1.725	1%	- 4.260	1	0.8631	0.4575624	Non-Stationary at level
		5%	- 3.548				
		10%	- 3.209				
ln(INF)	- 4.602	1%	- 4.260	1	0.0840	0.025332	Non-Stationary at level
		5%	- 3.548				
		10%	- 3.209				
ln(EXCHRAT)	- 2.831	1%	- 4.270	2	0.8400	0.2784991	Non-Stationary at level
		5%	- 3.552				
		10%	- 3.211				
ln(LIVPOP)	- 2.189	1%	- 4.279	3	0.5884	0.2090887	Non-Stationary at level
		5%	- 3.556				
		10%	- 3.214				
ln(LIVPROIND)	- 1.663	1%	- 4.260	1	0.7551	0.2662014	Non-Stationary at level
		5%	- 3.548				
		10%	- 3.209				
ln(ANIHESECO)	- 1.164	1%	- 4.260	1	0.9291	0.6213419	Non-Stationary at level
		5%	- 3.548				
		10%	- 3.209				
ln(CHCATDERA)	- 5.947	1%	- 2.431	0	0.0038	0.056662	Stationary at level
		5%	- 1.687				
		10%	- 1.305				

Source: Calculations from own study -STATA

To convert the variables not stationery at a level by differencing the variable the first integral or more, because to apply Johansen test of co-integration the variable should be converted to stationery at the first difference. The result of the first difference indicated as below. In the study the log form of the variable applied.

Table 4.2: Augmented Dickey Fuller Unit root test results at First Difference

Variable	With Tend and Intercept			Lag	Variable Regression		Variable status at order -I (1)
	(ADF) t-statistic	Critical Value at 1%, 5% & 10%			R^2	D.W	
Dln(LIVGDP)	- 6.693	1%	- 4.260	0	1.0000	2.04625	Stationary at first order
		5%	- 3.548				
		10%	- 3.209				
Dln(LIVEXP)	- 6.693	1%	- 4.260	0	1.0000	2.04625	Stationary at first order
		5%	- 3.548				
		10%	- 3.209				
Dln(LIVEXPOVA)	- 4.959	1%	- 4.260	0	0.1040	2.051231	Stationary at first order
		5%	- 3.548				
		10%	- 3.209				
Dln(INF)	- 4.856	1%	- 4.279	2	0.0567	1.987739	Stationary at first order
		5%	- 3.556				
		10%	- 3.214				
Dln(EXCHRAT)	- 3.595	1%	- 2.441	1	0.0075	2.026796	Stationary at first order
		5%	- 1.691				
		10%	- 1.307				
Dln(LIVPOP)	- 2.676	1%	- 2.441	1	0.0003	2.017649	Stationary at first order
		5%	- 1.691				
		10%	- 1.307				
Dln(LIVPROIND)	- 7.456	1%	- 4.260	0	0.0006	2.028939	Stationary at first order
		5%	- 3.548				
		10%	- 3.204				
Dln(ANIHESECO)	- 6.570	1%	- 4.260	0	0.0055	2.001183	Stationary at first order
		5%	- 3.548				
		10%	- 3.209				
Dln(CHCATDERA)	- 5.915	1%	- 4.270	1	0.0257	2.086368	Stationary at first order
		5%	- 3.552				
		10%	- 3.221				

Source: Calculations from own study -STATA

4.3. Co-integration Test Analysis

Next to the stationary test for variables, followed by step of time series analysis is testing for co-integration, which is whether the linear combination of the variables is also stationary or not. However, since the Johansen co-integration test needs the prior decision on lag length, deciding the optimal lag length of the model is an important input to undertake this test. The lag length selection undertakes by applying Unrestricted VAR test in order to determine the optimal lag length that should be included in the model. The optimal lag length is determined with the

sequential modified Likelihood Ratio test statistics (LR), the Akaiki Information Criteria (AIC), the Schwarz (Bayesian) Information Criteria (SIC), the Final Prediction Error (FPE) and the Hannan-Quinn Information Criterions (HQ). The following table shows the optimal lag length test at 5% significant level based on different information criterions.

Table 4.3: Optimal lag length Criteria

Selection-order criteria
Sample: 1982 - 2019 Number of obs = 38

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	9.00121				8.1e-12	-.000064	.13793	.387786
1	286.512	555.02	81	0.000	2.9e-16	-10.3427	-8.96279	-6.46423*
2	424.917	276.81*	81	0.000	3.1e-17*	-13.3641*	-10.7422*	-5.99492

Endogenous: lnlivgdp lnlivexp lnlivexpova lninf lnexchrat lnlivpop lnlivproind lnaniheseco lnchcatdera
Exogenous: _cons

Source: Calculations from own study -STATA

Table 4.4: Optimal Lag Length Criteria for each Variables

Variable	ln(LIVGDP)	ln(LIVEXP)	ln(LIVEXPOVA)	ln(INF)	ln(EXCHRAT)	ln(LIVPOP)	ln(LIVPROIND)	ln(ANIHESECO)	ln(CHCATDERA)
Lag	4	4	1	3	2	3	1	1	0
P- Value	0.0400	0.0430	0.0000	0.0170	0.0030	0.0080	0.0000	0.0000	0.000

Source: Calculations from own study

To identify the best optimal lag from the identified by applying Lag exclusion test to select the best lag among the suggested by different information criterions. This test used to differentiate other lags from the optimal lag that have significant effect in the models. In this study uses VAR Wald Lag-Exclusion test in order to identify the lags which have significant effect in the models.

Based on the information criterions propose the optimal lag length of 2, identified as per the VAR Wald Lag-Exclusion test result.

After the stationary of the variables identified at first difference and the optimal lag length selected, the next step is the analysis of co-integration test using Johansen Tests. The presence and the number of co-integrating relationships are evaluated with the Trace and Maximum Eigenvalue statistics based on the decision criteria. The results of Trace and Maximum Eigen value statistics are presented in the following tables.

Table 4.5: Johansen Tests for Cointegration

Maximum rank	Eigenvalue	Trace statistic	5% Critical Value	Max statistic	5% Critical Value	Conclusion	Number Cointegration
0	-	371.4661	192.89	105.80050	57.12	H0: Accept	0
1	0.93822	265.6656	156.00	81.16560	51.42	H0: Reject	1
2	0.88187	184.5001	124.24	55.92300	45.28	H0: Reject	2
3	0.77046	128.5771	94.15	38.66120	39.37	H0: Reject	3
4	0.63847	89.9159	68.52	28.77950	33.46	H0: Reject	4
5	0.53109	61.1365	47.21	24.73870	27.07	H0: Reject	5
6	0.47849	36.3977	29.68	21.99070	20.97	H0: Reject	6
7	0.43937	14.4070	15.41*	14.09120	14.07	H0: Reject	7
8	0.30983	0.3158	3.76	0.31580	3.76		0
9	0.00828						0
Null Hypothesis – H0: there is no cointegration among variables							
Alt. Hypothesis – H1: there is cointegration among variables							

Source: Calculations from own study -STATA

In this study there is two out come from the cointegration analysis test have trace statistic and max statistic and based on the result the conclusion forwarded according to the guideline. The guideline is: when trace statistic more than 5 % critical value – we reject null hypothesis and accept alternative hypothesis, but if trace statistic is less than 5% critical value, we accept the null hypothesis. The interpretation for max statistic similar to the trance statistic. In this study at zero rank the null hypothesis accepted. The rank from 1 up to 7 the null- hypothesis rejected, that indicate the is cointegration. So, in the study there is seven (7) cointegration or long run relationship or the variable move long run together. When the variables are cointegrated we run VECM, if the variable are not cointegrated we run unrealistic VAR. so we run VECM.

4.4. Vector Error Correction Model Estimation

On the co-integration test depict that the variables are cointegrated and have long run relationship. Hence the dynamic or short run relationship can be evaluated by using Error Correction Model (ECM). The ECM involves using the lagged residuals to correct for short run deviations from equilibrium. The lagged residual in the ECM model plays as error correction in the model. The error correction coefficient has to be negatively signed or near to zero and have to be statistically significant to best play its role. The negative sign indicates the convergence of the variables to equilibrium point. The absolute value of the coefficient of the lagged residual shows the speed of adjustment that indicates how fast the equilibrium is restored in the system for temporary shocks. Accordingly, the VECM has two parts: the long run and short run dynamics with co-integrating and short run coefficients that are used for further analysis including the speed of adjustment (ECTt-1).

4.4.1. Long Run Analysis

The result from the Johansen co-integration result provides more than one cointegration among the involved variables. However, the main objective of this study is to examine the impact of government livestock sector expenditure on the development of livestock sector and other related variables implication on the livestock sector. The equation is solved through ad-hoc normalization and Johansen test was used to confirm the appropriateness of the selected equation. To investigate the long-run effects in this model, we presented the estimated normalized co-integration coefficient vectors in the Table 4.6. The Table 4.6 indicate that the interaction of dependent variables and independent variables result from Vector Error Correction econometrics model. The table also indicate the magnitude on interaction among the variables using coefficient, standard error, T-value and P - value, those indicate level influence and significance.

Table 4.6: The Estimated Long-Run Model for Livestock GDP

Long run Impact to Ln(LIVEGDP) =1				
Variable	**Coefficient**	**Std.Err.**	**T-statistic**	**P-Value**
Ln(LIVEXP)	-0.9980112	0.0017623	-566.32	0.000***
Ln(LIVEXPOVA)	0.0005376	0.0006046	0.89	0.347
Ln(INF)	0.0038786	0.0002305	16.83	0.000***
Ln(EXCHRAT)	0.0083221	0.0010668	7.80	0.000***
Ln(LIVPOP)	-0.0140779	0.0022582	-6.23	0.000***
Ln(LIVPROIND)	-0.0884500	0.0024903	-3.55	0.000***
Ln(ANIHESECO)	-0.0101275	0.0043459	-2.33	0.020**
Ln(CHCATDERA)	-0.0007645	0.0001397	-5.47	0.000***
_Cons	-6.1255540	.	.	.
ECT_{t-1}	-0.814256	0.3937080	-2.068172	0.089*
R-squared = 0.4791; Chi2 = 1.19e +07; P > Chi2 = 0.000				

*Source: Calculations from own study -STATA; *indicates significant (*** = significant at 1% , ** = significant at 5 % , and * = significant at 10%)*

The result from the table indicate that variables LIVEXP, INF, EXCHRAT, LIVPOP, LIVPROIND, CHCATDERA) have significant effect at 1% on the long run LIVGDP as measured by p-value. Other variables, LIVEEXPOVA has insignificant effect and ANIHESECO has significant effect at 5% level. Therefore, the long run equilibrium model of the LIVGDP for livestock sectoral expenditure model can be written in equation form after reversing the signs of the coefficients as follow:

The economic model results indicate that in the long-run, spending on the livestock sector has a positive impact on the development of the livestock sector, this result support the finding of different researchers by proxy with the agriculture, the researcher such as Wendwesen, 2012; Teshome, 2006 and Ndubuaku, 2019. The spending on the agriculture sector has positive impact to sectoral development, which promote economic growth in the long-run. This supports on the one hand Keynesian view that government investments on social sectors are causes of growth.

According to the above long-run equation the government livestock expenditure positively affects the development of the livestock sector (LIVEGDP) in Ethiopia in the long run. As the government increases the livestock sector expenditure by 1% then in the long run the livestock developed (LIVEGDP) in Ethiopia will increased by 0.998%, it is equivalent effect at a significance of 1%. This may be as a result of increasing spending on the livestock sector that have direct impact on increasing service coverage on the sector, which lead to reduction to mortality and improving production and productivity. The impact of livestock population (LIVPOP) and livestock production performance (LIVPROIND) significant at 1%, the change in one percent in livestock population and livestock performance induce increment to the livestock development by 0.014% and 0.088% respectively. The livestock export value **(**LIVEXPOVA) negatively affect the development of the livestock sector insignificant way. The change in the rate of animal death positively the development of the sector, it may be due to creating government attention toward the sector. The control variables exchange rate to local currency **(**EXCHRAT) and inflation (INF) have negative impact to the development of the sector at 1% level. The interpretation of the error correction term (ECT_{t-1}) indicate that, the adjustment term (-0.81) is statistically significant at the level 10% (p -value=0.089), suggested that previous year's deviation from long - run equilibrium are corrected for with in with the current year at a convergence speed of 81%. In general, the long -run analysis confirm that the government attention to the sector have a direct effect on the development of the sector significantly.

4.4.2. Short Run Analysis

In the short run estimations of LIVGDP are presented, which indicate that the short run LIVGDP in Ethiopia is a function of one period lagged difference of the LIVGDP itself and one period lagged difference of the other variables such as: LIVEXP, LIVEXPOVA, INF, EXCHRAT, LIVPOP, LIVPROIND, ANIHESECO and CHCATDERA. The table 4.7 indicate the short run relationship among variables based on indicators like: coefficient, standard error, T-statistic and P- value, also the significance level indicated by asterisk.

Table 4.7: The Estimated Short Run Model for LIVGDP

Dependent variable - Dln(LIVGDP)				
Variable	**Coefficient**	**Std.Err.**	**T- Statistic**	**P- Value**
$Dln(LIVGDP)_{t-1}$	-1.568845	4.97578	-0.32	0.753
$Dln(LIVEXP)_{t-1}$	1.6866492	4.97366	0.34	0.735
$Dln(LIVEXPOVA)_{t-1}$	0.0493332	0.1176529	0.42	0.675
$Dln(INF)_{t-1}$	0.028728	0.0181883	1.58	0.114
$Dln(EXCHRAT)_{t-1}$	0.1524567	0.2319803	0.66	0.511
$Dln(LIVPOP)_{t-1}$	-0.4071852	0.4139801	-0.98	0.325
$Dln(LIVPROIND)_{t-1}$	-0.356577	0.4003022	-0.89	0.373
$Dln(ANIHESECO)_{t-1}$	1.697686	0.6014882	2.82	0.005***
$Dln(CHCATDERA)_{t-1}$	0.0001102	0.0072843	0.02	0.988
_Cons	-0.0025371	0.0416397	-0.06	0.951
ECT t-1	-0.814256	0.393708	-2.07	0.089*

*Source: Calculations from own study -STATA; *indicates significant (*** = significant at 1% , ** = significant at 5 % , and * = significant at 10%)*

According to the table 4.7 result the fluctuation in the short run on the variables has significant impact on the long run interaction of the variables. It means that the change in the first variables and its impact show different result than the second variables. One of the important results indicates that current period LIVGDP has impact on the next year livestock development, LIVGDP. Also, the result from the short-run shows the change in lag period have significant impact, for example one-year lag among variables have impact on each other. One them, the effect of this year dependent variable, $(LIVGDP)_t$ on the next year dependent variable, $(LIVGDP)_{t+1}$. According the analysis result, 1% increment in the LIVGDP in the current period leads to 1.6% reduction in the next year LIVGDP growth, whereas the government expenditure for the livestock sector in the current year increased by 1.7% has effect on next year sectoral development, to the opposite direction. From the above discussion and the result indicated on the table 4.7 the estimators indicate that the effect of LIVGDP in the previous period has negative and insignificant effect in the current LIVGDP of the Ethiopian economy, it may be due to the government attention and level of discharging commitment to the sector. It means the interest coverage to industry rather than agriculture sector including livestock.

The impact of animal health service in the current year has impact to the next year Livestock service coverage positively and significant. Also, the livestock service has significant impact on Livestock sectoral development, 1% LIVGDP increment in the current year influenced by the coverage of animal health service in the previous year by 1.7%, it is significant at level 1%. In the case of Livestock export value (LIVEXPOVA) and change in cattle death rate (CHCATDERA) the change in the current year influence positively the next year livestock sectoral development (LIVGDP), but insignificant. In the same way, the change in one present in livestock development the next year influenced by 0.04% of export value and 0.0001% of change in death rate of cattle in the current year. The short run analysis table 4.7 result show that the livestock population and production performance in this year negatively affect the next year sectoral development, change in 1% in LIVGDP in this year negatively influenced by 0.41% of livestock population and 0.35% of livestock production. Such type of interaction may be seen due to the mis much between the increasing the number of livestock population and increasing demand for livestock product at the national level. The control variables inflation and local currency exchange rate in the current year positively affect the next year livestock development, but not significant. It supported that, the economic theory, the effect of inflation and devaluation of local currency direct impact the economic development of the country.

The table 4.7 also describes that the coefficient of the error correction terms in both cases have a negative sign and they are significant, indicating that they are error-correcting. That shows the short run model adjusts towards its equilibrium position or its long run model for any deviation. Based on the result in the study model 81% of the short run disequilibrium in the LIVGDP in one period will adjusts towards its long run value every year, thus full adjustment would require a period of less than two years.

4.4.3. Granger Causality Test Result

The VECM analysis also give as opportunity to see different causality to show that the effect of the dependent variables on the independent variables or the effect of independent variables. Also, the granger causality shows the effect one variable on another variable at different lag period. According to this study some of the variables has bidirectional effect. on dependent variables. The

change in the coverage of animal health service affect the government expenditure at a significance of 1% positively by 1.7%. Livestock export value significant (at 1%) affect the production performance positively by 0.41%, also animal health coverage affects production performance in the positive direction at a significanc of 1% by 0.22%. The control variable, especially inflation significantly affect the change in the independent variables. The lag casualty indicates that increasing in the lag number change the effect of the independent variables on the dependent variables increasingly the positives direction.

4.4.4. Post-Estimation Diagnostics

The truthfulness of the regressed models and also to guarantee the Gaussian assumption different post-estimation diagnostic tests were performed. Accordingly, the diagnostics results on residual normality test, error vector autocorrelation test and heteroskedacity test tell us that in three of the cases the null hypotheses are accepted for both models since the p-values are more than the 5% in all cases, thus the regressed model is suitable to the data. The results of these diagnostics are presented in the table below. The stability of the VECM model can also affect the truthfulness of the estimators estimated from regressed model and also inferences made from the model. Moreover, the validity and robustness of the results of the impulse response functions also depend on the result of the stability of the model as well as the other pre and post diagnostics test results. Therefore, the result of these diagnostics together with the results of the other pre and post estimation diagnostic tests, suggests the validity and robustness of the estimated results.

Table 4.8: Post-Estimation Diagnostics Test

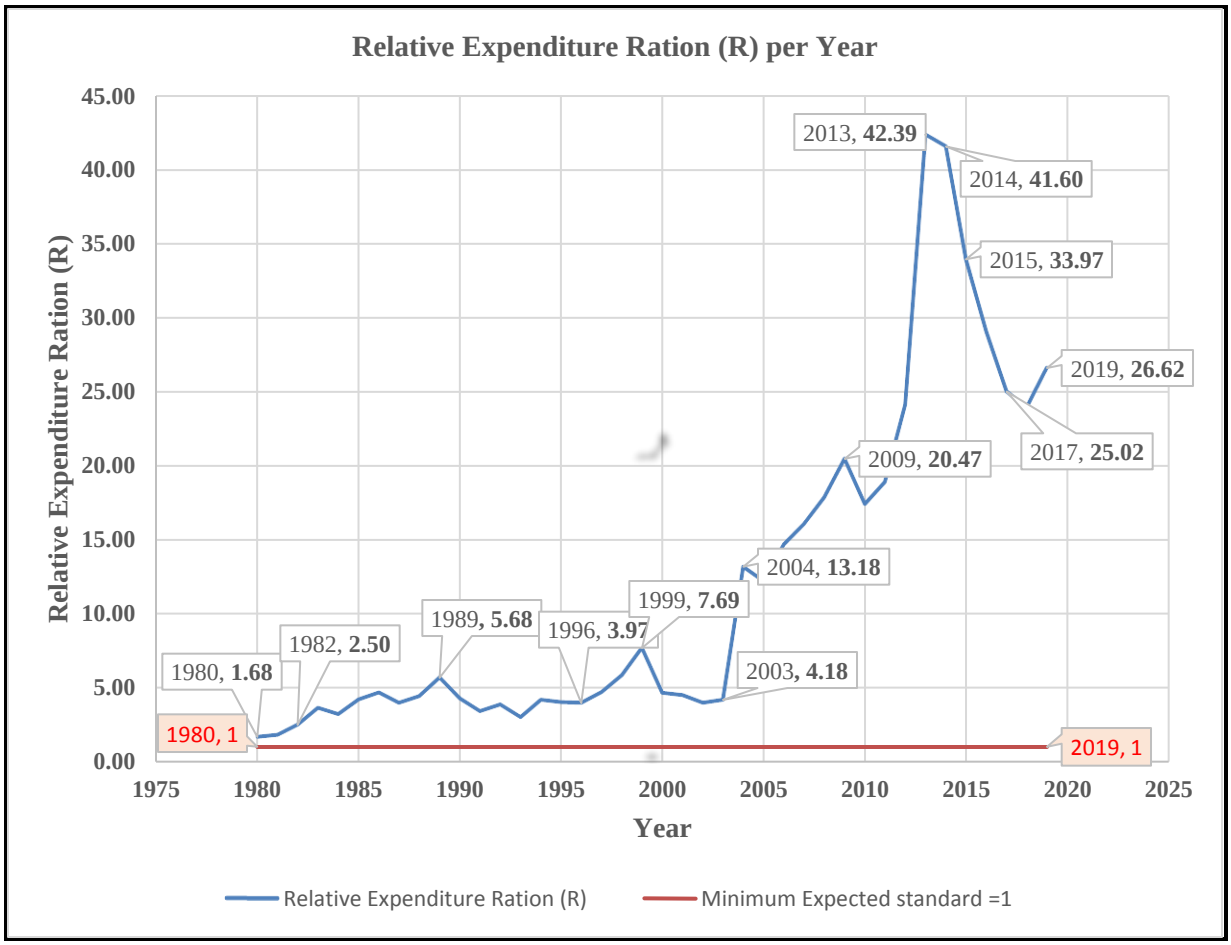
Test type	lag	Chi^2	P- Value
Residual Vector Serial Correlation (LM) test	1	72.2664	0.74525
	2	93.2277	0.16652
Residual Vector Normality (Jarque-Bera test)		3.0898	0.32994
Residual Vector Heteroskedasticity		14.52538	0.4571

Source: Calculations from own study -STATA

4.5. Adequacy Measurement for Livestock Government Expenditure

4.5.1. The Relative Expenditure Rations

The relative expenditure ratio is the ratio computing using agricultural expenditure and agriculture GDP with livestock expenditure to Livestock GDP. The interpretation of the relative expenditure ration is, if the value of R less than one it indicates the expenditure is adequate and when the R value greater than one it means not adequate. The result in the study indicate that in the case of Ethiopia the value of R computing from 1980 up 2019 and it indicate that the value of R greater than 1 thought out the study period, it means than not adequate thought the study period. The minimum value that diverge from the international adequacy level was recoded in 1980 the value of 1.68, it is closest to the intranational adequacy level one. The expenditure in the 1980 was relatively good than the others consecutive year. The largest deviation from the standard recorded in 2013 a value of 42.39, it is far for the standard (far from adequacy level). Also, the study indicate that the avenger R value was 11.88, it is far from the adequacy level by 10.88. In general, the measurement shows us the livestock expenditure in the case of Ethiopia is far from adequacy level or inadequate and the government not give emphasis to the sector compered to its contribution to the economy.



Source: Calculations from own study

Figure 4.2: Trend of Relative Expenditure Ration (R) per Year in case of Ethiopia

Table 4.9: A summery table for Relative Expenditure Ration (R) of Ethiopia

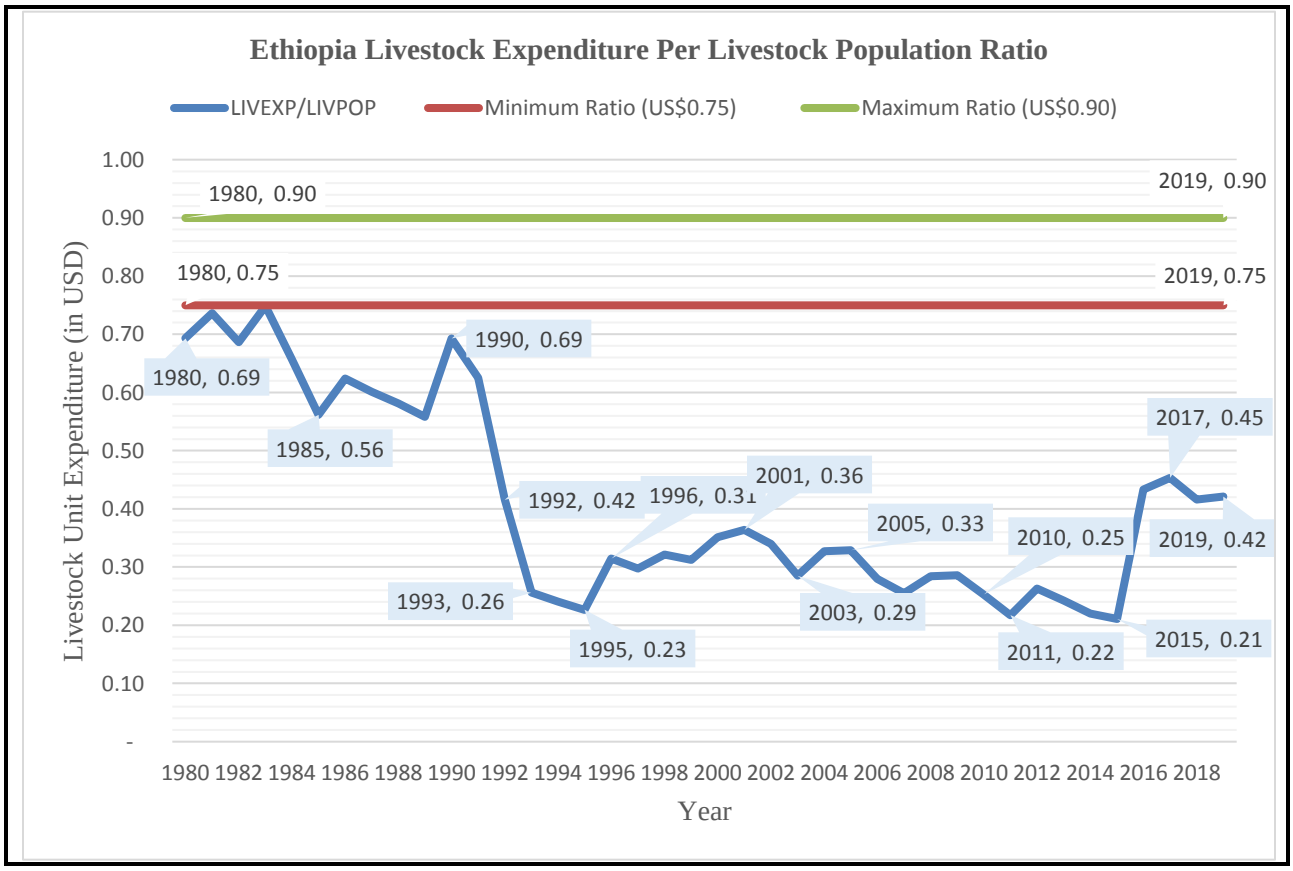
Relative Expenditure Ration (R)

	Percentiles	Smallest		
1%	1.68	1.68		
5%	2.155	1.81		
10%	3.105	2.5	Obs	40
25%	3.97	3.01	Sum of Wgt.	40
50%	4.68		Mean	11.88425
		Largest	Std. Dev.	11.31736
75%	18.37	29.09		
90%	27.855	33.97	Variance	128.0826
95%	37.785	41.6	Skewness	1.23185
99%	42.39	42.39	Kurtosis	3.532705

Source: Calculations from own study -STATA

4.5.2. The Ratio of Unit Expenditure to Livestock Unit

The ratio of unit expenditure to livestock unit is one of the measurements applied in the study to measure the adequacy of the government expenditure to the livestock sector. The ratio computed by dividing the yearly government expenditure to the yearly livestock population using TLU. The standard allocated budget for a unit livestock is form 0.75 – 0.90 USD. Based on this standard and computing for Ethiopia case indict that it is below the minimum level the high was recorded in 0.75 USD in 1984 and the minimum recorded in 2015 around 0.21USD. The average unit expenditure is 0.41, is less than the minimum requirement by 0.34. In general, this measurement also confirm that the government not allocate the minimum required amount of the expenditure to the livestock sector compared to the population potential of the country.



Source: Calculations from own study

Figure 4.3: The Trend of Unit Livestock Expenditure in Ethiopia Economy.

Table 4.10: Summery of Unit Livestock Expenditure Descriptive

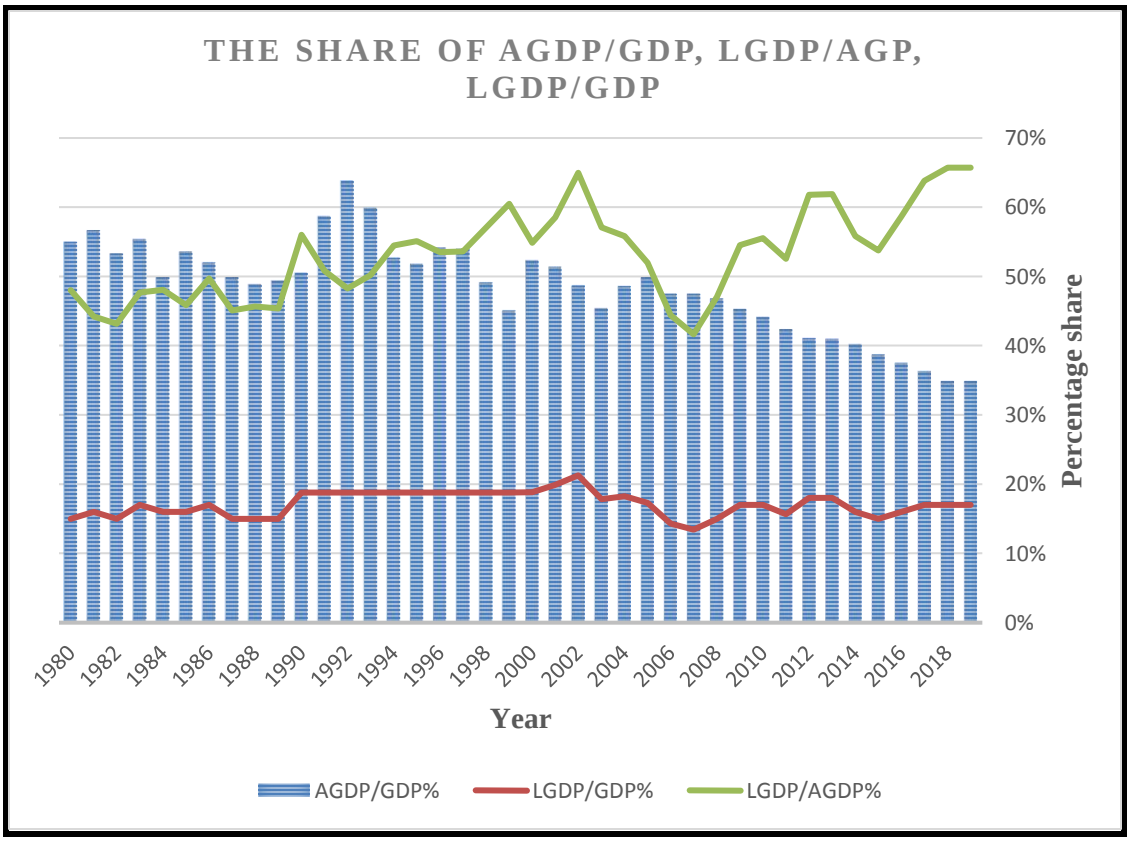
LIVEXP/LIVPOP

	Percentiles	Smallest		
1%	.21	.21		
5%	.22	.22		
10%	.235	.22	Obs	40
25%	.27	.23	Sum of Wgt.	40
50%	.335		Mean	.40975
		Largest	Std. Dev.	.1716509
75%	.57	.69		
90%	.69	.69	Variance	.029464
95%	.715	.74	Skewness	.6719714
99%	.75	.75	Kurtosis	1.992201

Source: Calculations from own study- STATA

4.5.3. Compering the Share of the Livestock Sector to GDP

The third measurement for the adequacy of the livestock sectoral government expenditure is by compering the contribution of the livestock sector to economic development. In this study the share of the agriculture to the economy of the nation, the share of livestock to agriculture sector and the share of the livestock sector to GDP. By proxy this share for economic growth indicate the government commitment expressed by budget allocation to the sector. The maximum proportion of agriculture to GDP recorded in 1984 about 63.8% and the minimum recorded in 34.9% in 2010 & 2011. On average the share of agriculture to GDP is 48.46 in the study period from 1980 up to 2019. The share of Livestock to Agriculture GDP on average 36.1% with in the study period, this share not include the contribution of the livestock to crop production, transportation, saving and social. If all share included it may reach above 47%. The maximum livestock contribution to agriculture recorded value of 48.71% in 2018/19 and the minimum value of 28.1% in 1980/81. The share of the livestock sector to GDP is maximum is 21.28% in 2001 and the minimum recorded in 2007, 13.4%. In general, the contribution of livestock to the economic growth on average 17.12% with out its contribution to crop production and others, but the share of livestock expenditure from the total expenditure is less than 1%.



Source: Calculations from own study

Figure 4.4: The Trend for share of AGDP/GDP, LGDP/AGP, LGDP/GDP.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

Agriculture play a significant role in the economy of Ethiopia; the government attention is to shift the economic dependency from agriculture to industry. So, the government support to the agriculture sector become reduced from time to time. Within the agriculture the livestock sector not get enough attention compered to its role in the economy and the livestock population of the country. The main objective of this study is to investigate the impacts of government Livestock sectoral expenditure on the development livestock sector in Ethiopia over the period 1980 to 2019, with a particular focus on livestock expenditure and other related factors.

The study used a secondary time series data from relevant secondary source, using both published and unpublished source from Ministry of Agriculture, National Bank of Ethiopia, Ministry of Finance and Economic development and FAOSTAT database. The data cover from 1980 up to 2019 on the variables: livestock sectoral development (the share of the livestock sector from the total GDP share), the government expenditure to the livestock sector, the export share of the livestock sector, livestock population (Using Tropical Livestock Unit, TLU), Livestock production index, Animal Heath service coverage, change in the rate of cattle death and other control variables (Inflation and local currency exchange rate ETB/USD). On the study multivariable time series methodology deployed, VECM techniques deployed in order to identify short run and long-run impacts the independent variables with dependent one. The result from the study indicate that the governmental expenditure to the livestock sector have a significant positive impact in the development of the sector in the long run. The government increase the livestock expenditure by 1% that induce equivalent amount of increment to the livestock sector. In the short run the one-year lag of the livestock development affects the next year expenditure. The impact of the livestock development in this year negatively affect the development of the livestock insignificantly, the negative effect may be due to reduction of the government policy to shift from the agriculture to

industry. The current year livestock expenditure insignificantly affects the next year livestock development by 1.6% to the positive direction. Other factors such as livestock export, livestock population, livestock production index, animal health service coverage and change in cattle death rare. Most of them have significantly affect the livestock development positively in different direction. The direction of the interaction between the dependent variable, livestock development and independent variable like livestock expenditure and other variables those have direct interaction with livestock have bidirectional interaction to livestock development and themselves. The causality analysis confirms that there is significant interaction among them. The control variables inflation and local currency exchange rate negatively affect the development of the livestock sector significantly in the long run. Also, the change in the short run have a significant effect on the long-run in traction of the variables.

The adequacy of the government expenditure to the livestock sector indicate, the government of Ethiopia not allocate the required amount budget to the sector, which significantly affect the growth of the sector. This study includes the limited contribution of the sector by excluding the contribution of the sector to crop production, transportation, saving and social value. The source of the budget mostly depends on the external donors, due to the revenue collected from the livestock sector is near to null, because the revenue collection from the sector does not have wide rage compared to other countries.

In general, agriculture play a great role on Ethiopia economy by creating income both household level or national level, by insuring food security, creating social value and export. The livestock sector has a great contribution to the agriculture also the nation anal economic growth. The livestock sector shares up to 47% of the agriculture, but the focus of the government to ward the sector is very less compered its contribution to the nation food security and economic growth. According to this study the government expenditure to the sector directly affect the development of the livestock sector significantly, that have impact by proxy to agriculture sector and its contribution to the economic development of the country.

5.2. RECOMMENDATIONS

This study analyzed the effect of livestock expenditure on livestock sectoral development and its contribution to economic growth in Ethiopia. The study covered the data from 1980 up to 2019 and vector error correction model (VECM) data analysis techniques deployed for this study. On the basis of the study findings the following policy recommendations can be made:

The study depicts that the government expenditure on the livestock sector has a positive effect on the development of the livestock sector and its contribution to economic growth. The long run effect of the government expenditure has significant impact on the development of the sector. so, to use the existing potential of the livestock in this country, the government should give attention to the livestock sector and improve the budget allocation to the sector. Along with this study we observe that the budget allocated to sector not adequate as per its contribution to the national growth, it is also affected by source of finance more dependent to external donor and the way of financing also have its won problem. The government should focus to maximizing the way for collecting revenue from livestock by deploying like: livestock head tax, livestock product control tax, sale tax, slaughter related fee, Vet health inspection tax, Livestock transportation tax and cost recovery approach for veterinary service.

The way of financing also has its own problem, like the treatment cost for animal health and livestock extension service cost are allocated at regional level based on the regional capacity, while the cost for vaccination allocated by the federal government by subsidy. This way of financing has lack uniformity along the region and its difficult to cover the cost, so most of the regional government and the federal ministry not give emphasis to this cost. This way of financing needs a police support to allocate the reasonable budget to the sector.

Generally, the government should optimize its spending more on livestock sector to maximize the sectoral contribution as the livestock resource to the economy of the country and need a taggable improvement on the area for financial source, way of financing and way of collecting livestock revenue.

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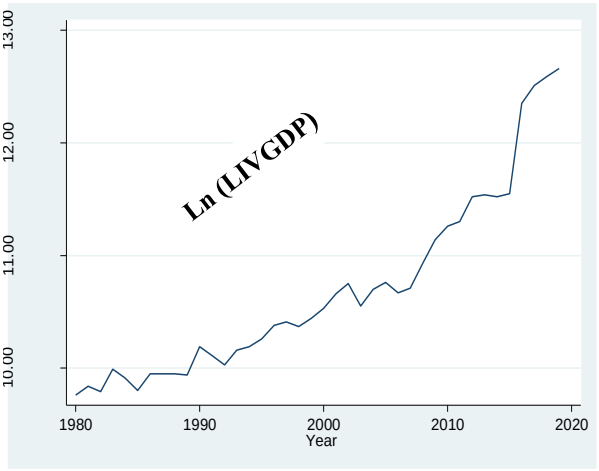
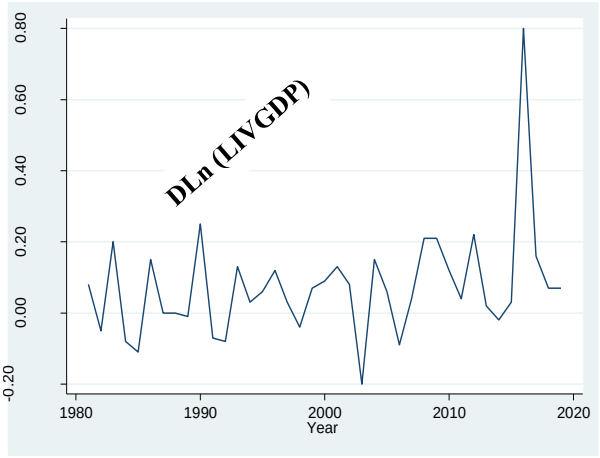
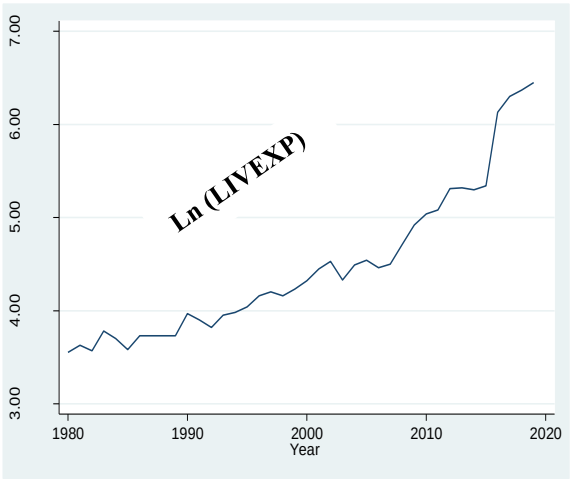
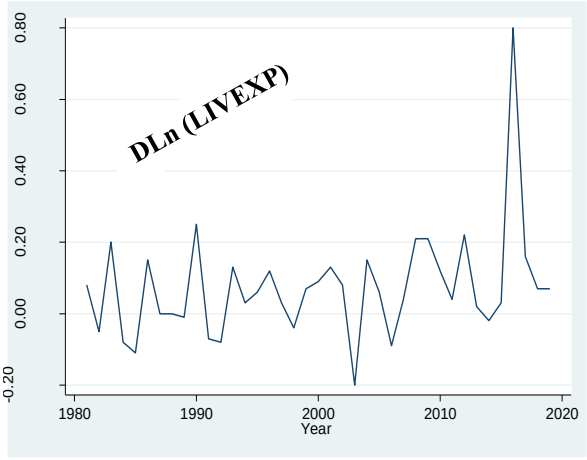
APPENDIXES

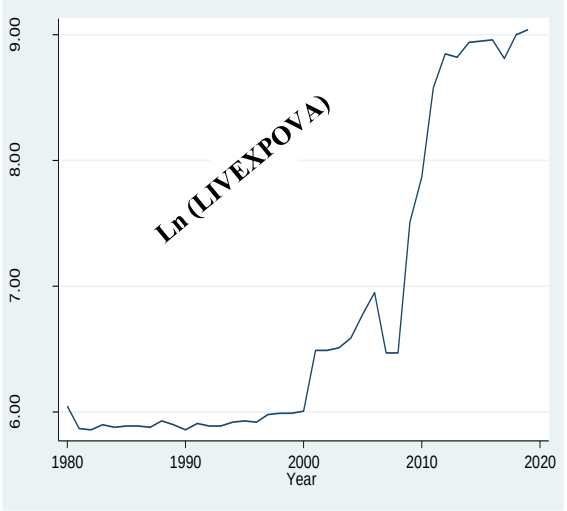
Appendix 1: Graphical Stationarity Test for Variables

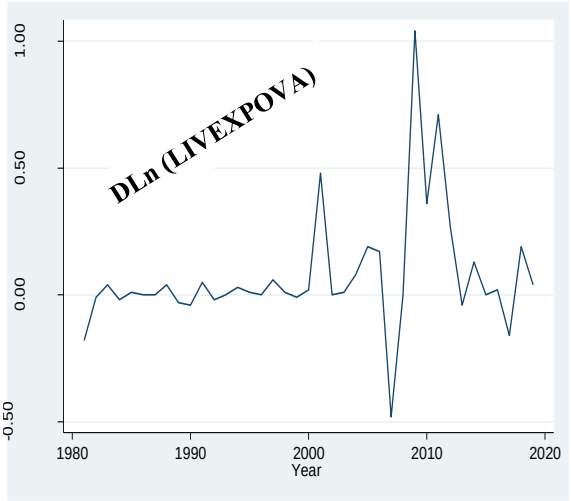


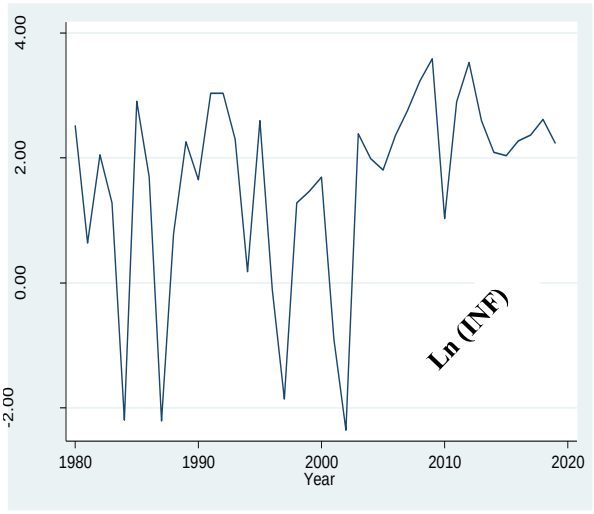








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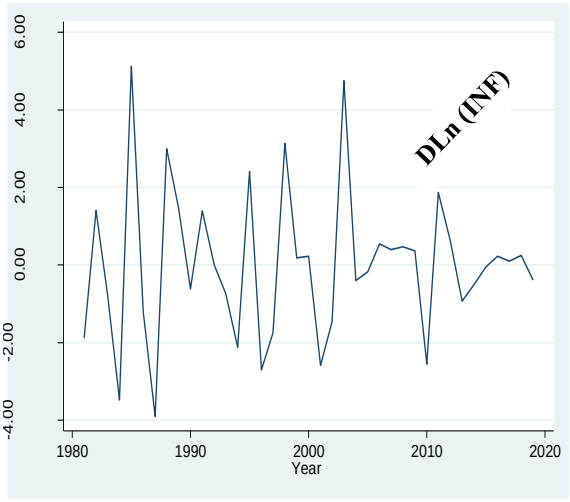
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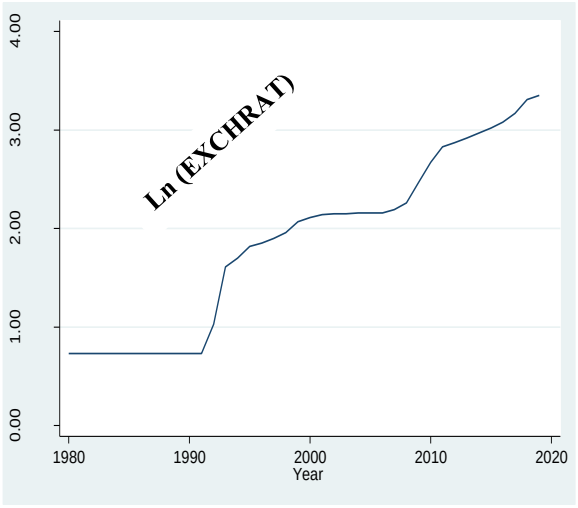
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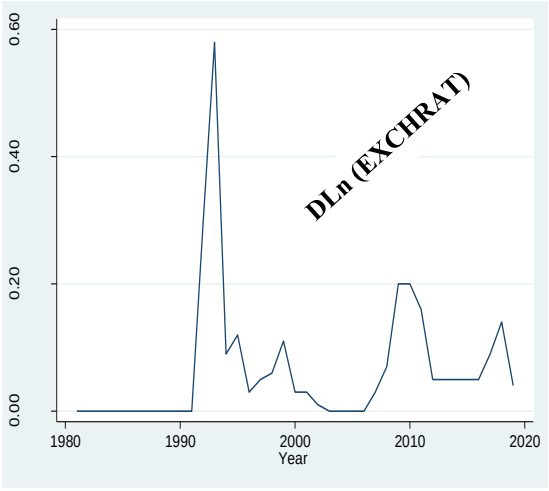
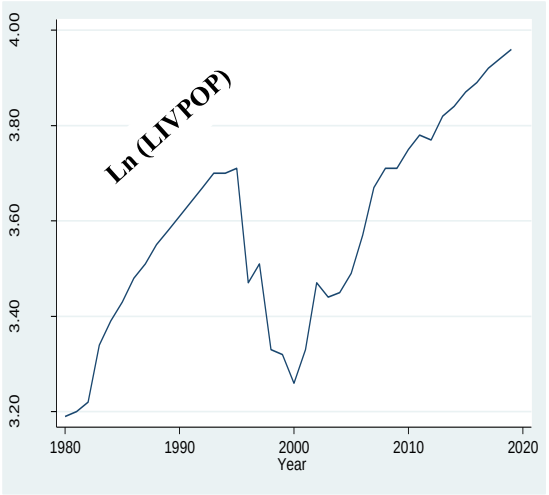
2020
Year


DLn (EXCHRAT)
0.60
0.40
0.20
0.00
1980
1990
2000
2010
2020
Year


Ln (LIVPOP)
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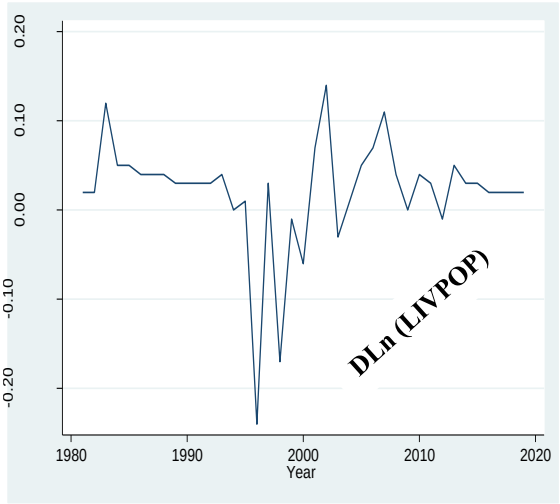
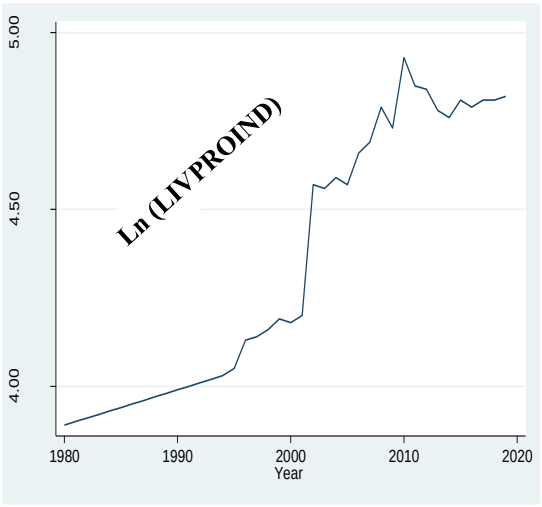
3.80
3.60
3.40
3.20
1980
1990
2000
2010
2020
Year


DLn (LIVPOP)
0.20
0.10
0.00
-0.10
-0.20
1980
1990
2000
2010
2020
Year


Ln (LIVPROIND)
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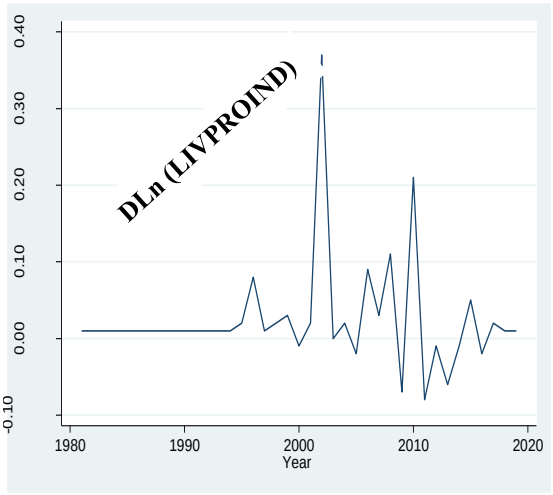
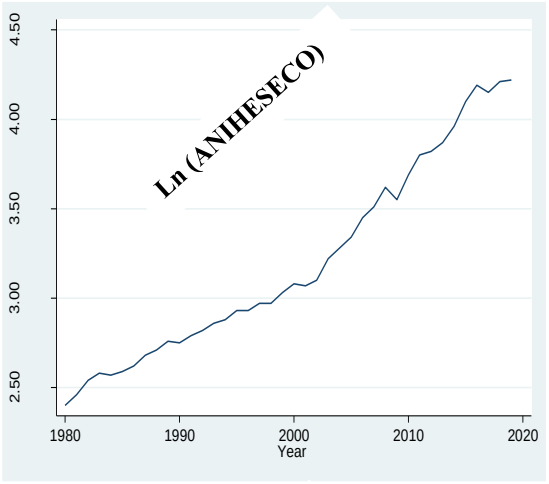
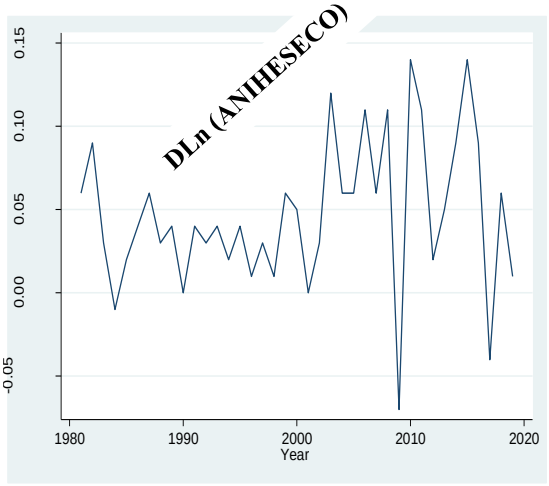
4.50
4.00
1980
1990
2000
2010
2020
Year


DLn (LIVPROIND)
0.40
0.30
0.20
0.10
0.00
-0.10
1980
1990
2000
2010
2020
Year


Ln (ANIHESECO)
4.50
4.00
3.50
3.00
2.50
1980
1990
2000
2010
2020
Year


DLn (ANIHESECO)
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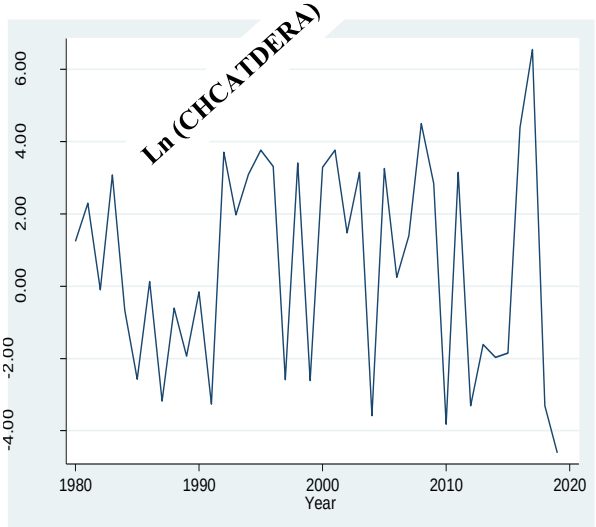
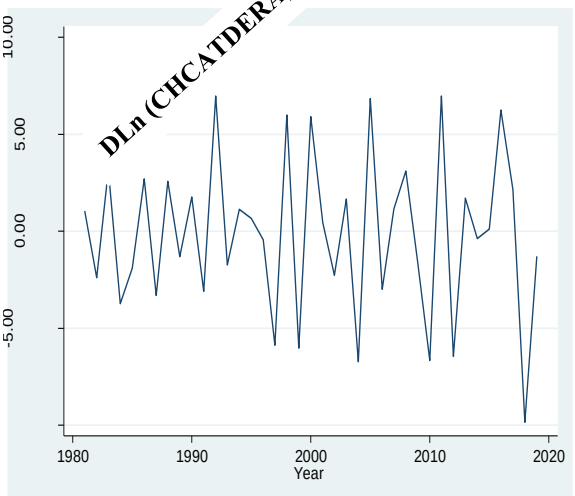
0.10
0.05
0.00
-0.05
1980
1990
2000
2010
2020
Year


Ln (CHCATDERA)
6.00
4.00
2.00
0.00
-2.00
-4.00
1980
1990
2000
2010
2020
Year


DLn (CHCATDERA)
10.00
5.00
0.00
-5.00
1980
1990
2000
2010
2020
Year

Appendix 2: Augmented Dickey-Fuller Test for Unit Root

```
. dfuller lnlivgdp, trend regress lags(4)

Augmented Dickey-Fuller test for unit root         Number of obs   =        35
```

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	1.333	-4.288	-3.560	-3.216

MacKinnon approximate p-value for Z(t) = 1.0000

D.lnlivgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnlivgdp						
L1.	.2629635	.197284	1.33	0.193	-.1411545	.6670815
LD.	-.5360341	.3079777	-1.74	0.093	-1.166898	.0948296
L2D.	-.6752946	.3029703	-2.23	0.034	-1.295901	-.0546881
L3D.	-.4439354	.2840331	-1.56	0.129	-1.025751	.1378801
L4D.	-.0618284	.2966232	-0.21	0.836	-.6694335	.5457768
_trend	-.003799	.0100399	-0.38	0.708	-.0243648	.0167667
_cons	-2.532375	1.851743	-1.37	0.182	-6.325498	1.260748

```
. dfuller dlnlivgdp, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38
```

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-6.693	-4.260	-3.548	-3.209

MacKinnon approximate p-value for Z(t) = 0.0000

D.dlnlivgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dlnlivgdp						
L1.	-1.122392	.167707	-6.69	0.000	-1.462855	-.7819287
_trend	.0050548	.002396	2.11	0.042	.0001906	.0099189
_cons	-.0161283	.0509367	-0.32	0.753	-.1195353	.0872787

```
. dfuller lnlivexp, trend regress lags(4)

Augmented Dickey-Fuller test for unit root         Number of obs   =        35

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)             1.347           -4.288            -3.560           -3.216
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 1.0000

------------------------------------------------------------------------------
D.lnlivexp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------+------------------------------------------------------------------
  lnlivexp |
         L1. |   .2640788   .1960066     1.35   0.189    -.1374224      .66558
         LD. |  -.5191143   .3071209    -1.69   0.102    -1.148223     .1099944
        L2D. |  -.6800394   .3013037    -2.26   0.032    -1.297232    -.0628468
        L3D. |  -.4327912   .2830762    -1.53   0.138    -1.012647     .1470642
        L4D. |  -.0506211   .2927849    -0.17   0.864    -.6503637     .5491215
      _trend |  -.0039628   .0099377    -0.40   0.693    -.0243194     .0163938
       _cons |  -.9017912   .6240915    -1.44   0.160    -2.180185     .3766022
------------------------------------------------------------------------------

. dfuller dlnlivexp, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -6.693           -4.260            -3.548           -3.209
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.dlnlivexp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
  dlnlivexp |
         L1. |  -1.122392    .167707    -6.69   0.000    -1.462855    -.7819287
      _trend |   .0050548    .002396     2.11   0.042     .0001906     .0099189
       _cons |  -.0161283   .0509367    -0.32   0.753    -.1195353     .0872787
------------------------------------------------------------------------------
```

```
. dfuller lnlivexpova, trend regress lags(1)

Augmented Dickey-Fuller test for unit root         Number of obs   =        38

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical      10% Critical
                  Statistic         Value             Value            Value
------------------------------------------------------------------------------
 Z(t)               -1.725           -4.260            -3.548           -3.209
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.7397

------------------------------------------------------------------------------
D.lnlivexp~a |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lnlivexpova |
         L1. |  -.1112816   .0645093    -1.73   0.094    -.2423804    .0198171
         LD. |   .2129557   .1633022     1.30   0.201    -.1189143    .5448256
      _trend |   .0142366   .0068379     2.08   0.045     .0003404    .0281329
       _cons |   .5286194   .3254793     1.62   0.114    -.1328341    1.190073
------------------------------------------------------------------------------

. dfuller dlnlivexpova, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        38

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical      10% Critical
                  Statistic         Value             Value            Value
------------------------------------------------------------------------------
 Z(t)               -4.959           -4.260            -3.548           -3.209
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0002

------------------------------------------------------------------------------
D.dlnlivex~a |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
dlnlivexpova |
         L1. |   -.825743   .1665039    -4.96   0.000    -1.163764   -.4877222
      _trend |   .0041494   .0036716     1.13   0.266    -.0033044    .0116033
       _cons |  -.0114553   .0788972    -0.15   0.885     -.171625    .1487145
------------------------------------------------------------------------------
```

Appendix 3: Lag Section

Selection-order criteria
Sample: 1984 - 2019 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-58.4327				1.59035	3.30182	3.31717	3.3458
1	-.126671	116.61*	1	0.000	.0659*	.118148*	.148853*	.206122*
2	.723426	1.7002	1	0.192	.066469	.126476	.172534	.258436
3	.771822	.09679	1	0.756	.070115	.179343	.240753	.35529
4	.837866	.13209	1	0.716	.073915	.23123	.307992	.451163

Endogenous: lnlivexpova
Exogenous: _cons

Selection-order criteria
Sample: 1984 - 2019 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-58.4327				1.59035	3.30182	3.31717	3.3458
1	-.126671	116.61*	1	0.000	.0659*	.118148*	.148853*	.206122*
2	.723426	1.7002	1	0.192	.066469	.126476	.172534	.258436
3	.771822	.09679	1	0.756	.070115	.179343	.240753	.35529
4	.837866	.13209	1	0.716	.073915	.23123	.307992	.451163

Endogenous: lnlivexpova
Exogenous: _cons

Selection-order criteria

Sample: 1984 - 2019 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-44.8265				.746807	2.54591	2.56127	2.5899
1	28.3011	146.26	1	0.000	.013583	-1.46117	-1.43047	-1.3732
2	32.6574	8.7126*	1	0.003	.011275*	-1.64763*	-1.60158*	-1.51567*
3	33.1211	.92732	1	0.336	.011623	-1.61784	-1.55643	-1.44189
4	33.164	.08581	1	0.770	.012268	-1.56467	-1.4879	-1.34473

Endogenous: lnexchrat

Exogenous: _cons

Selection-order criteria

Sample: 1984 - 2019 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	8.8098				.03794	-.433878	-.418525	-.389891
1	47.587	77.554	1	0.000	.004652	-2.53261	-2.50191	-2.44464
2	47.7006	.22718	1	0.634	.004889	-2.48337	-2.43731	-2.35141
3	51.2433	7.0854*	1	0.008	.004247*	-2.62463*	-2.56322*	-2.44868*
4	51.2478	.00909	1	0.924	.004492	-2.56932	-2.49256	-2.34939

Endogenous: lnlivpop

Exogenous: _cons

Selection-order criteria

Sample: 1984 - 2019 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-14.5082				.138582	.861569	.876921	.905555
1	42.4387	113.89*	1	0.000	.006193*	-2.2466*	-2.21589*	-2.15862*
2	43.2999	1.7224	1	0.189	.006243	-2.23888	-2.19283	-2.10692
3	43.4368	.27367	1	0.601	.006553	-2.19093	-2.12952	-2.01498
4	43.6568	.44018	1	0.507	.006849	-2.1476	-2.07084	-1.92767

Endogenous: lnlivproind

Exogenous: _cons

Selection-order criteria
Sample: 1984 - 2019 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-27.8082				.290136	1.60046	1.61581	1.64444
1	59.9286	175.47*	1	0.000	.002344*	-3.21825*	-3.18755*	-3.13028*
2	60.4688	1.0804	1	0.299	.002405	-3.19271	-3.14665	-3.06075
3	60.9355	.9335	1	0.334	.002479	-3.16308	-3.10167	-2.98714
4	61.5182	1.1653	1	0.280	.002539	-3.1399	-3.06314	-2.91997

Endogenous: lnanihesecc
Exogenous: _cons

Selection-order criteria
Sample: 1984 - 2019 Number of obs = 36

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-91.1086				9.76969*	5.11715*	5.1325*	5.16113*
1	-91.1061	.00516	1	0.943	10.3274	5.17256	5.20326	5.26053
2	-91.099	.0142	1	0.905	10.916	5.22772	5.27378	5.35968
3	-91.013	.17199	1	0.678	11.4908	5.2785	5.33991	5.45444
4	-90.4029	1.2202	1	0.269	11.7528	5.30016	5.37692	5.52009

Endogenous: lnchcatdera
Exogenous: _cons

Appendix 4: Cointegration Test

Johansen tests for cointegration

Trend: constant — Number of obs = 38

Sample: 1982 - 2019 — Lags = 2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	90	239.18395	.	371.4661	192.89
1	107	292.08419	0.93822	265.6656	156.00
2	122	332.66697	0.88187	184.5001	124.24
3	135	360.62846	0.77046	128.5771	94.15
4	146	379.95904	0.63847	89.9159	68.52
5	155	394.34878	0.53109	61.1365	47.21
6	162	406.71814	0.47849	36.3977	29.68
7	167	417.7135	0.43937	14.4070*	15.41
8	170	424.75909	0.30983	0.3158	3.76
9	171	424.917	0.00828		

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	90	239.18395	.	105.8005	57.12
1	107	292.08419	0.93822	81.1656	51.42
2	122	332.66697	0.88187	55.9230	45.28
3	135	360.62846	0.77046	38.6612	39.37
4	146	379.95904	0.63847	28.7795	33.46
5	155	394.34878	0.53109	24.7387	27.07
6	162	406.71814	0.47849	21.9907	20.97
7	167	417.7135	0.43937	14.0912	14.07
8	170	424.75909	0.30983	0.3158	3.76
9	171	424.917	0.00828		

Appendix 5: Vector Error-Correction Model

Vector error-correction model

Sample: 1982 - 2019		Number of obs	= 38
		AIC	= -9.741273
Log likelihood = 292.0842		HQIC	= -8.10068
Det(Sigma_ml) = 1.70e-18		SBIC	= -5.130175

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_lnlivgdp	11	.150235	0.4691	23.85371	0.0134
D_lnlivexp	11	.147388	0.4831	25.23882	0.0084
D_lnlivexpova	11	.246353	0.3206	12.74151	0.3106
D_lninf	11	1.29766	0.6897	60.01798	0.0000
D_lnexchrat	11	.106407	0.5134	28.48237	0.0027
D_lnlivpop	11	.071604	0.2197	7.600266	0.7486
D_lnlivproind	11	.067768	0.4484	21.94942	0.0248
D_lnaniheseco	11	.045268	0.6589	52.15408	0.0000
D_lnchcatdera	11	3.34885	0.5483	32.77299	0.0006

Cointegrating equations

Equation	Parms	chi2	P>chi2
_cel	8	1.19e+07	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_cel						
lnlivgdp	1	.	.	.	.	.
lnlivexp	-.9980112	.0017623	-566.32	0.000	-1.001465	-.9945572
lnlivexpova	.0005376	.0006046	0.89	0.374	-.0006475	.0017226
lninf	.0038786	.0002305	16.83	0.000	.0034269	.0043303
lnexchrat	.0083221	.0010668	7.80	0.000	.0062313	.010413
lnlivpop	-.0140779	.0022582	-6.23	0.000	-.018504	-.0096518
lnlivproind	-.008845	.0024903	-3.55	0.000	-.0137259	-.0039641
lnaniheseco	-.0101275	.0043459	-2.33	0.020	-.0186453	-.0016096
lnchcatdera	-.0007645	.0001397	-5.47	0.000	-.0010382	-.0004907
_cons	-6.125554	.	.	.	.	.

Appendix 6: Post- Estimation Test

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	72.2664	81	0.74525
2	93.2277	81	0.16652

H0: no autocorrelation at lag order

Appendix 7: The Share of Livestock to National Economy

AGDP/GDP%

	Percentiles	Smallest		
1%	34.9	34.9		
5%	35.6	34.9		
10%	38.1	36.3	Obs	40
25%	44.615	37.5	Sum of Wgt.	40
50%	49.25		Mean	48.46
		Largest	Std. Dev.	6.832201
75%	53	56.7		
90%	56.05	58.7	Variance	46.67897
95%	59.3	59.9	Skewness	-.2116122
99%	63.8	63.8	Kurtosis	2.68162

LGDP/GDP%

	Percentiles	Smallest		
1%	13.4	13.4		
5%	14.65	14.3		
10%	15	15	Obs	40
25%	15.82	15	Sum of Wgt.	40
50%	17		Mean	17.11775
		Largest	Std. Dev.	1.762979
75%	18.8	18.8		
90%	18.8	18.83	Variance	3.108094
95%	19.35	19.87	Skewness	-.007814
99%	21.28	21.28	Kurtosis	2.332546

LGDP/AGDP%

	Percentiles	Smallest		
1%	28.14	28.14		
5%	28.22	28.22		
10%	29.66	28.22	Obs	40
25%	31.04	29.47	Sum of Wgt.	40
50%	35.835		Mean	36.09175
		Largest	Std. Dev.	5.713239
75%	39.01	43.9		
90%	43.85	46.83	Variance	32.6411
95%	47.77	48.71	Skewness	.5447261
99%	48.71	48.71	Kurtosis	2.467288