

**IMPACT OF PRODUCTIVE SAFETY NET PROGRAM ON FOOD
SECURITY AND ASSET BUILDING OF HOUSEHOLDS: THE CASE
OF META DISTRICT, EAST HARERGHE ZONE, OROMIA REGION
OF ETHIOPIA**

M.SC. THESIS

DUGUMA AYANA

MARCH, 2017

HARAMAYA UNIVERSITY

**Impact of Productive Safety Net Program on Food Security and Asset
Building of Households: The Case of Meta District, East Harerghe Zone,
Oromia Region of Ethiopia**

**A Thesis Submitted to the School of Agricultural Economics and
Agribusiness Management, Postgraduate Programs Directorate
HARAMAYA UNIVERSITY**

**In Partial Fulfillment of the Requirement for the Degree of MASTER OF
SCIENCE IN AGRICULTURE (AGRICULTURAL ECONOMICS)**

**By
Duguma Ayana**

**March, 2017
Haramaya University**

HARAMAYA UNIVERSITY
POSTGRADUATE PROGRAMS DIRECTORATE

As thesis research advisor, I hereby certify that we have read and evaluated this thesis prepared under our guidance, by Duguma Ayana entitled “Impact of Productive Safety Net Program on Food Security and Asset Building of Households: The case of Meta District, East Harerghe zone, Oromia Region of Ethiopia”. We recommend that it be submitted as fulfilling the Thesis requirement.

_____	_____	_____
Major Advisor	Signature	Date
_____	_____	_____
Co- Advisor	Signature	Date

As members of the Board of Examiners of the final M.Sc. Thesis Open Defense Examination, we certify that we have read and evaluated the thesis prepared by Duguma Ayana and examined the candidate. We recommend that the thesis be accepted as fulfilling the thesis requirement for the Degree of Master of Science in Agriculture (Agricultural Economics)

_____	_____	_____
Chairman	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

DEDICATION

I dedicate this thesis manuscript to all of my family members.

STATEMENT OF AUTHOR

By my signature, I declare and affirm that this thesis is my work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. degree at the Haramaya University, and is deposited at the University Library to be made available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

Name: Duguma Ayana

Signature: -----

Date of Submission: _____

School: Agricultural Economics and Agribusiness

BIOGRAPHICALSKETCH

The author was born in 1989 in Amuru district, Horro Guduru Wollega zone. He completed his elementary education at Oberra elementary school in 2003 and junior secondary school at Amuru in 2006. After completing his senior secondary high school education, he joined Wollega University in 2007 and graduated with BSc degree in Agriculture in July, 2009.

He worked in Horro Guduru Wollega zone, Abe-Dongoro district, Agricultural and Rural Development Office for one and half year. Then he joined East Harerghe zone productive safety net program/Household asset building program and worked for more than two years. Then, he joined the School of Graduate Studies of Haramaya University in 2013 to pursue his M.Sc degree in Agricultural Economics with self sponsorship opportunity.

ACKNOWLEDGEMENTS

Above all I thank the almighty God for giving me the strength to start and go through with my studies and also his mercy and grace upon me during all these days.

First and foremost, I am deeply grateful and indebted to my major advisor Dr. Jema Haji for his encouragement, suggestions, guidance and overall assistance. Successful accomplishment of this research would have been very difficult without his generous time devotion from the early design of the proposal to the final write-up of the thesis by adding valuable, constructive and ever teaching comments and tireless efforts that enabled me to finalize the study.

Many thanks go to the sample households who responded to my questionnaire at the cost of their time. This study would not have been materialized had they not been extending their kind cooperation. I am also very grateful to staff members of Meta district Agricultural office.

I would like also to express my sincere gratitude to all my families whose pray and thoughts have been always with me and for giving moral support in every move of my academic success. Unreserved acknowledgements and appreciation go to the data enumerators who carefully and patiently collected the data for this study.

Finally, I would like to express my sincere appreciation and gratitude to my wife, Tolashi Kelbesa, for her special strength on shouldering all the responsibilities beside her encouragement, inspiration and help, which made the study successful.

LIST OF ACRONYMS AND ABBREVIATIONS

AE	Adult Equivalent
ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
CSA	Central Statistical Agency
CIDA	Canadian International Development Agency
DFID	Department for International Development (UK)
EDRP	Environmental Development and Protection Program
EC	European Commission
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
FSP	Food Security Program
GOE	Government of Ethiopia
IFAD	International Fund for Agricultural Development
IFSP	Integrated Food Security Program
KM	Kernel Matching
MDG	Millennium Development Goals
MOFED	Ministry of Finance and Economic Development
MOARD	Ministry of Agriculture and Rural Development
NGOs	Non-governmental Organizations
NN	Nearest Neighbor
OFSP	Other Food Security Program
PRSP	Poverty Reduction Strategy Program
PSM	Propensity Score Matching
PSNP	Productive Safety Net Program
PW	Public Work
RNE	Royal Netherlands Embassy
SDPRP	Sustainable Development and Poverty Reduction Program
SIDA	Swedish International Development Agency
TLU	Tropical Livestock Unit
UN	United Nations
UNDP	United Nations Development Program
USAID	United States Agency for International Development

USD	United States Dollar
WB	World Bank
WFP	World Food Program

TABLE O F CONTENTS

DEDICATION	iv
STATEMENT OF THE AUTHOR	v
BIOGRAPHICAL SKETCH	vi
ACKNOWLEDGEMENTS	vii
ACRONYMS AND ABBREVIATIONS	viii
TABLE OF CONTENTS	x
LIST OF TABLES	xiii
LIST OF FIGURES	xiv
LIST OF TABLES IN THE APPENDIX	xv
ABSTRACT	xvi
1. INTRODUCTION	1
1.1. Background of the Study	1
1.2. Statement of the Problem	3
1.3. Objectives of the Study	4
1.4. Research Questions	5
1.5. Scope and Limitations of the Study	5
1.6. Significance of the Study	6
2. LITERATURE REVIEW	7
2.1. Definition of Important Terms	7
2.2. Conceptualizing Food Security	8
2.2.1. Food security situation in the world	10
2.2.2. Food security situation in Ethiopia	11
2.3. Safety-Net Programs in Ethiopia	11
2.4. Impact Evaluation Methods	14
2.4.1. Experimental method	15
2.4.2. Non- experimental method	15
2.4.3. Quasi-experimental method	15
2.5. Empirical Studies on Food Security and productive safety net program	17
2.5.1. Studies on food security	17
2.6. Conceptual Framework	21
3. RESEARCH METHDOLOGY	24

3.1. Descriptions of the Study Area	24
3.2. Study Design	26
3.3. Data Types, Sources and Methods of Data Collection	27
3.4. Method of Data Analysis	28
3.4.1. Descriptive analysis	28
3.4.2. Econometric model	29
3.5. Variables Definitions, Measurement and Hypothesis	35
3.5.1. Dependent variables	35
3.5.2. Outcomes variables	35
3.5.3. Independent variables	36
4. RESULTS AND DISCUSSION	40
4.1. Descriptive Analysis of Sample Households' Characteristics	40
4.1.1. Socio-demographic characteristics	40
4.1.2. Livelihood Characteristics	41
4.1.3. Livestock holding, oxen ownership and household asset holding	43
4.1.4. Household calorie, income and expenditure	45
4.1.5. Perception about Targeting Households for productive safety net program	47
4.1.6. Graduation	47
4.2. Econometric Results	48
4.2.1. Propensity scores	48
4.2.2. Matching program and non-program households	51
4.2.3. Choice of matching algorithm	54
4.2.4. Testing the balance of propensity scores and covariates	56
4.2.5. Estimating treatment effect on treated	58
4.2.6. Sensitivity analysis for un observed bias	59
5. SUMMARY, CONCLUSION AND RECOMMENDATIONS	61
5.1. Summary	61
5.2. Conclusion	63
5.3. Recommendations	64
6. REFERENCES	66
7. APPENDICES	68

LIST OF TABLES

Table	Page
1. Finance provided by each productive safety net program donors	13
2. Determination of sample size and household head	27
3. Variable definitions and measurement	40
4. Demographic characteristics of sample households	40
5. Description of sex of household head	41
6. Cultivated land, distance to market and extension contact	41
7. Access to credit, off and non-farm activities and fertilizer use	42
8. Oxen, TLU, household asset in 2005 and 2016	44
9. Household calorie intake, income and expenditure	46
10. Community perception on the fairness the targeting process	47
11. Result of logistic regression model	50
12. Distribution of estimated propensity scores	52
13. Performance of matching estimators	54
14. Propensity score and covariate balance test	56
15. Chi-square test for the joint significance of dummy variable	57
16. Average treatment effect on the treated for food security in calorie intake and asset	58

LIST OF FIGURES

Figure	Page
1. Conceptual framework of the study	21
2. Map of the study area	25
3. Region of common support condition	33
4. Kernel density of propensity score distribution total households	51
5. Kernel density of propensity scores of control households	52
6. Kernel density of propensity scores of participated households	53

LIST OF TABLES IN THE APPENDIX

Appendix Tables	Page
1. Conversion factors of tropical livestock unit (TLU)	70
2. Conversion factors for computing calorie intake	70
3. Conversion factors for adult equivalent (AE)	71
4. Sensitivity analysis for estimated ATT of calorie intake	71
5. Sensitivity analysis for estimated ATT of household asset	72

IMPACT OF PRODUCTIVE SAFETY NET PROGRAM ON FOOD SECURITY OF HOUSEHOLDS: THE CASE OF META DISTRICT OF HARERGHE ZONE OF ETHIOPIA

ABSTRACT

Productive Safety Net Program is one of the largest social protection programs operating in Ethiopia. It has been operating in Ethiopia since 2005 though its impact on improving the food security and asset building of the participating households. The objective of this study was to evaluate the impact of productive safety net program on households' food security and asset building in Meta district, East Hararghe zone, Oromia Regional State, Ethiopia. Both primary and secondary data were used for this study. Primary data are collected from 160 randomly selected sampled households (75 participants and 85 non-participants) drawn from three randomly selected rural kebeles that are participating in the program. Descriptive statistics and propensity score matching were used to analyze data. The empirical model revealed that participation in productive safety net program significantly improved asset building, but not calorie intake of the participating households. The average treatment effect of treated (ATT) indicated that asset building were 34% more than non-participating households indicating the livelihood improvement due to participation in productive safety net program. Hence, this has an encouraging message for program designers, implementers, and funding agencies to take proper action to achieve the intended goals.

Keywords: Impact, Productive Safety Net Program, Propensity Score Matching (PSM), Food Security, Household Asset.

1. INTRODUCTION

1.1. Background of the Study

Ethiopia, historically, has suffered the detrimental effects of drought, flooding and other related natural challenges on nearly a cyclical basis. Given that the majority of the country relies on subsistence farming for their livelihood, these natural challenges have had devastating impacts on the population and have resulted in chronic food shortages. In order to tackle these crises, the country has typically appealed for humanitarian assistance and food aid to bridge the food gap in the region. Although this has helped the country survive instances of intense transitory need, it has not adequately addressed the reality of the situation in Ethiopia, being that these instances of transitory need are simply larger scale manifestations of the underlying concern - chronic food insecurity. Even more than this, the humanitarian responses that were being put into place as band-aid solutions at the height of food shortage crises was in reality, establishing responsive systems that decreased the population's resilience to food insecurity and related shocks. As the years have progressed and the reality of Ethiopia's chronic food insecurity has become more evident, the government of Ethiopia has altered its line of thinking towards a more proactive, longer term approach. This shift in thinking resulted in the birth of the PSNP (Hobson, 2012).

Ethiopia's economy is highly dependent on agriculture and related activities. Agriculture alone contributes 38.5% to the total gross domestic product (GDP), provides livelihood to about 72.2% of the population, constitutes more than 80% of the nation's total exports, and provides most of the foreign exchange earnings to the economy (United States Department of agriculture, 2011).

Agriculture is also a main source of raw materials for industries. In spite of its great significance in the Ethiopian economy, the performance of the agriculture sector until recently has been dismal. Growth in agricultural production has stagnated over the last five decades (Takele, 2004). Per capita food production has been declining and the pace of food production is lagging behind the population growth over the last three decades. FAO (2005) projected cereals production for 2009 to be 10 million metric tons whereas the requirement was projected to be 11.3 million metric tons indicating a gap of 1.3 million metric tons. The

same source indicated that the projected cereals production for 2015 is 11.3 million metric tons while the requirement is 13.1 million metric tons leaving a projected gap of 1.8 million metric tons.

Over the past decade, Ethiopia has experienced significant economic growth and progress toward Millennium Development Goals (MDGs). Ethiopia's annual GDP growth averaged 10.3% between 2004 and 2012, a period that also corresponded to an impressive decrease in poverty rates: in 2004, 38.9% of the population lived below the national poverty line (\$0.60 per day); in 2012, this figure was down to 29.6% (MoFED, 2012). These improvements reflect a strong commitment by the Government of Ethiopia (GoE) to invest in agriculture, health, and other pro-poor sectors. Ethiopia, with a population of 90.9 million and a population growth rate of 3.2 percent (a doubling time of 22 years) in 2011, faces increased levels of food insecurity. Ethiopian agriculture is heavily dependent on natural rainfall, with irrigation agriculture accounting for around 4 percent of the country's total plots (CIA, 2011).

Ethiopia is one of the poorest countries in the world and currently 29.6% of the population (25 million people) are said to be living below the country's poverty line (which is already below the global poverty line) (Teferi, 2012). This country also plays host to frequent droughts and other disasters, which have often times devastated the livelihoods of the largely rural farming population found throughout Ethiopia (Africa Today, 2012).

The United Nation Food and Agriculture Organization estimate that about 805 million people of the 7.3 billion people in the world or one in nine were suffering from chronic undernourishment in 2012-2014. Almost all the hungry people 791 million live in developing countries, representing 13.5 percent or one in eight of the population of developing countries and there are 11 million people undernourished in developed countries (FAO, 2014).

For over 30 years responses to food insecurity in Ethiopia were dominated by emergency food aid. While this food aid saved lives, it often failed to protect livelihoods and this became a growing concern. In response, during 2005 the Ethiopian Government revised its emergency food aid system and launched the productive safety Net program (PSNP) - a more productive approach to providing a safety net to vulnerable populations. Furthermore, between 2010 and 2014, the Ethiopian government stepped up its efforts to address both relief and development, with harmonized donor support. Through this more developmental

approach, the PSNP provides for households that are both chronically food insecure and poor and often affected by shocks. With an objective to assure food consumption, and simultaneously to protect and develop assets along with services, PSNP operates across widespread geographies and rural communities to determine eligibility to receive payments, based on specific criteria. Such payments are made to households that can contribute to public works (labor) or if labor is limited or impossible, unconditional support is provided. Through this infrastructure PSNP contributes to a local enabling environment for community development though making a program of this magnitude well- targeted presents many challenges. (IFPRI, 2014).

Productive Safety Net Program established in 2005, it is “one of the largest safety net programs in the world” (USAID, 2016). It was established by the Ethiopian Government to build the resilience capacity of chronically food insecure communities to protect them from shocks and climate changes and to give assistance to food-insecure households for six months of the year for up to five years, to prevent depletion of resources in farm activities such as crops and livestock at the household level (i.e., the beneficiaries were chronically food-insecure households). More specifically, in addition to direct sustenance given to the elderly, the disabled (handicapped), sick, pregnant women etc. the chronically food- insecure able-bodied participants were required to engage in labor intensive public works projects (such as water harvesting, irrigation, feeder roads) in-exchange for food-for-work programs or cash-for-work, possibly financed by monetizing food aid (USAID, 2016).

Productive safety net program involves conditional and direct transfers for chronically food insecure households, supports approximately 7.8 million people through public works and direct support. The aim of the PSNP is asset protection, accumulation and consumption smoothing. Assets are protected through participation of able-bodied household members on community asset building or public works programs (including soil and water conservation, road construction and maintenance, expansion of schools and health facilities as well as other community infrastructures). In return, participants benefit from in-kind or cash transfers based on minimum local labour wages. Direct transfers, on the other hand, support households with no working members or that have a reduced family workforce. These include pregnant women, the elderly, the chronically ill, and other vulnerable groups of the population. They benefit without directly contributing to the Public Works Program. The aim

of the Program is for vulnerable populations to graduate into sustainable livelihoods after three to five years of receiving support from the PSNP (CIDA, 2013).

Household Asset Building Program officially it was started in June 2013 by the Ethiopian Government, and the USAID Ethiopia mission in collaboration with nine other donor partners (USAID, 2016). Its objectives were to improve natural resources and food security by providing inputs to increase livestock and crop production, and by establishing training and market information for food insecure households.

Meta district is one of the major program locations in Eastern Harerghe zone of Oromia region which benefited from Productive Safety Net Program and other food security program. The program implementation started in 2005 and still operating in the area. Major portion of the fund was allocated for household asset building and income generating activities. Despite this, there are still significant numbers of food insecure households in the study area. Therefore, this study intended to assess the impact of the Productive Safety Net Program on households' food security.

1.2. Statement of the Problem

Ethiopia is one of the poorest countries in the world with worst scenario of poverty and food insecurity. Close to a quarter of the population in Ethiopia is malnourished with the largest proportion suffering from chronic hunger. The country has been structurally food deficient over the last four decades. The food gap in the country, for instance, rose to 5 million tons in 1993/94 from 0.75 million tons in 1979/80 (Befekadu and Berhanu 2000). Between 1994 and 2003, an average of five million Ethiopians were considered at risk and in need of emergency assistance every year, and from 1998 to 2005 the annual number of food aid beneficiaries fluctuated between 5 and 14million (Devereux et.al.2006). In 2006, an estimated 15 million rural people were food insecure (Mitiku et al. 2013), while in 2012, an estimated 3.2 million people were reportedly food insecure, down from a peak of 4.5 million during the year 2011. In 2015 alarm bells are ringing for a food emergency in Ethiopia. The UN says 15 million people will need help over the coming months. The governments, wary of stigma and therefore hesitant to ask for help, has nevertheless said more than eight million Ethiopians need food assistance. Inevitably, comment and media coverage compare the current situation

with 1984 – the year Ethiopia’s notorious famine hit the headlines. Reports suggest this is the worst drought in 30 years. One declares it a code red drought. (IRIN, 2015).

Starting 2005, the government of Ethiopia and a group of donors implemented a new form of safety net: the productive safety nets program (PSNP) with the aim of reducing chronic food insecurity, reducing asset depletion and enhancing productive investment to enable the participant household to graduate from problem of chronic food insecurity (Gilligan *et al.*, 2008). According to FDRE (2009), since its implementation, more than seven million people have received PSNP transfer enabling them to meet consumption needs, reducing the risks they faced and providing them with alternative options to selling productive assets.

The project implementation manual clearly outlined three key areas that are very critical for the success of the program (targeting of the chronically food insecure households, planning of the public work activities and mobilization of the communities for the implementation of the planned activities). The goal of the safety net program is achieving food security of the chronically food insecure households while its two objectives are to protect the depletion of household assets and to create community asset through the public work activity (MoA, 2014). The concerns are rising whether the safety net program is successful in meeting its objective and goal from many directions at different levels. The output of this study is expected to bridge the information gap that is crucial to improve households’ food insecurity and asset building. This research was focused on assessing the impact of productive safety net programme in addressing household food security and asset protection in Meta district of Eastern Hararghe zone Oromia Regional State.

1.3. Objectives of the Study

The overall objective of the study was to assess the impact of productive safety net program on household food security and asset building of farm households in Meta district.

The specific objectives were:

Examine farm households’ food security and asset protection status in the study area;

Measure the impact of productive safety net program on farm households' food security and asset building in the study area.

1.4. Research Questions

This study tries to answer the following research questions:

1. What is the food security and asset formation status of the households participating in Productive safety net program in study area?
2. What is the impact of the productive safety net program on households' food security and asset building in the study area?

1.5. Scope and Limitations of the Study

The study was conducted to assess the impact of the productive safety net program on households' food security and asset building in Meta district of Eastern Hararghe zone. The study was limited both in scope and coverage mainly due to the financial and time constraints. This is because the study covers only one of the nineteen districts of Eastern Hararghe zone of the Oromia National Regional State; and only three PSNP kebeles as a sample from the 28 productive safety net program beneficiary kebeles in the district. It was carried out by surveying a sample of 160 representative rural households selected from the three Kebeles included in the PSNP.

Several limitations faced during conducting this study. First, there is no baseline data before the implementation of the program. So, important data before the intervention of PSNP was collected from farmers through recall which might be subjected to recall biases and inexact answers. Second, despite the fact that the impact of the program can be viewed from various aspects, the study only focused on PSNP impact on food security and asset building at household level.

1.6. Significance of the Study

On the basis of the findings, this study attempted to provide some recommendations that would help the program implementation and outcomes in the study area. The findings and recommendations of this paper might provide information that would enable effective measures to improve the program and some policy suggestions that would help both the Government and those Non-Governmental organizations in the program implementation and serve as a reference to other concerned bodies that would like to deploy interventions in the area. The result of the study could also be utilized in other areas with similar physical and socioeconomic characteristics. Furthermore the study could serve as a point of departure for further researches on the area. Ultimately all these efforts might help policy makers to know where and how to channel efforts in order to smooth household consumption, protect household assets and consider household variations and related issues in formulating national, regional and local policies. The study would also contribute to the thin literature of the country on the subject.

1.7. Organization of the Thesis

This thesis is organized into five chapters. The first chapter has already set out introduction to the study. The second chapter presents review of related theoretical and empirical literature appropriate to the topic of this research. The third chapter presents the research methodology that includes description of the study area, sampling design and sampling size, method of data collection, and analysis. The fourth chapter presents results and discussion. The last chapter presents summary, conclusions and recommendations.

2. LITERATURE REVIEW

This chapter presents key concepts, theoretical explanations and previous research findings on the related topics to this study. The chapter tries to give the overall concepts of research topic and selectively review the theoretical as well as the empirical aspects of the investigation.

2.1. Definition of Important Terms

Safety net: Safety nets are defined as non-contributory social protection programs that are typically overseen by the national government. These initiatives are intended to assist the most vulnerable households to protect themselves against adverse conditions and improve their overall living standards by establishing a minimum level of consumption (Grosh, 2008). “Safety nets are a type of social transfers that mostly incorporate cash or in kind payments to the poorest section of a population either gratuitously or through public works (Mesfin *et al.*, 1997 cited in, Habtamu, 2011). Typically, the program is food/ cash based and they are short term in nature (Deveruex *et al.*, 2004).

Food Security: Food security defined as access all people at all times having both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life (Ministry of Agriculture, 2014). Food insecurity in turn was defined as the lack of access to enough food for a healthy, active life.

Asset: According to the definition of Wikipedia (accessed on 18 October, 2016), an asset is an economic resource that is capable of being owned or controlled to produce value with the ultimate objective of satisfying the material well-being of human. Asset may be tangible like liquid cash, labor and capital or intangible assets like social capital, location, bond and stocks, and empowerment. Physical assets can be broadly grouped as productive asset (like equipments and tools), household assets (like bicycles and radio), livestock and stock (like stored food). Livestock can be serving as a means for agricultural production and transport, and have extra economic and social values (Paul and Jeffery, 1999).

Impact: According to Omoto (2003) the term impact refers to the wide and long-term economic, social and environmental effects of an intervention resulting in anticipated or unanticipated, and desired or undesired outcome, at the individual or the organizational level that involve changes in both cognition and behavior.

Asset building: It means increasing the real value of all types of assets of the household over a specified reference period. The specified period is usually the period of time for which a program or an intervention that is expected to bring asset accumulation is implemented. (Norton et.al, 2001)

2.2. Conceptualizing Food Security

The conceptual framework of food security has progressively developed and expanded based particularly along with the growing incidence of hunger, famine and malnutrition in developing countries. The concept of food security attained wider attention in the early 1980s after the debate on “access” to food and the focus of unit of analysis shifted from national and global level to household and individual levels (Debebe, 2002).

According to Haddad (1997) food security is achieved when people at all times have access to sufficient food for a healthy and productive life and has three main components: food availability, food access and food utilization. Similarly, Thomson and Metz (1997) defined food security as assuring to all human beings the physical and economic access to the basic foods they need. This definition comprises three closely related concepts: availability, stability and access.

Similarly, Maxwell (1996) and Ehui *et al.* (2002) food security as physical, social and economic access by all people at all times to sufficient, safe and nutritious food which meets the dietary needs for an active and healthy life. This definition shows that food security can be ensured if and only if three conditions are fulfilled. First, sufficient food shall be available through domestic production and/or import. Second, people must have adequate resources to get the appropriate food. Third, food must be used in combination with adequate water, sanitation and health to meet nutritional needs.

Based on level of analysis, food security can be seen either at national level or at the household level. However, the household level of food security is probably the most important for analyst, in so far as the household is the basic economic unit which determines the level of consumption by the individual. In most analysis, there is a presumption that income comes to the household as a whole, resource allocation decisions are made at the household level and household consumption is divided amongst its members in some relation to the needs of the individuals. The households are identified as food secure if their entitlements, or demand for food is greater than their needs, defined as the aggregation of individual requirements (FAO, 1997).

Chronically food insecure groups are comprised of people who already today are below a food security threshold and who are unlikely to emerge from this in the foreseeable future (FAO, 2004). As Maxwell and Frankenberger (1992) point out Chronic food insecurity means that a household runs a continually high risk of inability to meet the food needs of household members.

Considering its span of duration, a distinction can be made between chronic and transitory food insecurity, which are closely intertwined. A constant failure to food “access” is distinguished as “chronic” while a temporary decline is considered as “transitory” food insecurity.

As to FAO (2005) cited in Hart (2009), chronic food insecurity is long-term or persistent in that it can be considered to be an almost continuous state of affairs. It is closely related to structural deficiencies in the local food system or economy, chronic poverty, lack of assets and low incomes which persistently curtail food availability and access over a protracted period of time.

Transitory food insecurity: on the other hand, is usually sudden in onset, short-term or temporary and refers to short periods of extreme scarcity of food availability and access (Barrett and Sahn, 2001 cited in Hart, 2009).

Transitory food insecurity can be further divided into cyclical and temporary food insecurity (CIDA, 1989 cited in Maxwell and Frankenberger, 1992). Temporary food insecurity occurs for a limited time because of unforeseen and unpredictable circumstances; cyclical or

seasonal food insecurity when there is a regular pattern in the periodicity of inadequate access to food. This may be due to logistical difficulties or prohibitive costs in storing food or borrowing.

Seasonal or cyclical food insecurity may be evident when there is a recurring pattern of inadequate access to food such as prior to the harvest period (the hungry season) when household and national food supplies are scarce or the prices higher than during the initial post-harvest period (Devereux *et al.*, 2008 cited in Hart, 2009). It is generally considered to be more easily predicted than temporary food insecurity as it is a known and regular occurrence. Chronic, cyclical and transitory food insecurity has been endemic in Ethiopia for several decades. The main causes of transitory food insecurity in Ethiopia are drought and war.

2.2.1. Food Security Situation in the World

According to FAO (2005) hunger hotspots are increasingly a manifestation of the consequences of conflict or economic failures. Natural disasters also undermine people's food security in various regions of the world. In many cases natural and human-induced factors reinforce each other, leading to complex emergencies and protracted crises. Pests and diseases add to the complexity of providing sufficient and safe food to all populations and test the ability of countries and the international community to cope with crisis. In the long run, all countries are likely to be affected by the climate changes as a result of the global warming phenomenon. The nature and severity of these shocks are being better understood over time, and some essential policy imperatives are emerging.

The United Nation Food and Agriculture Organization estimate that about 805 million people of the 7.3 billion people in the world or one in nine were suffering from chronic undernourishment in 2012-2014. Almost all the hungry people 791 million live in developing countries, representing 13.5 percent or one in eight of the population of developing countries and there are 11 million people undernourished in developed countries (FAO, 2014)

2.2.2. Food Security Situation in Ethiopia

Ethiopia is one of the poorest countries in the world and currently 29.6% of the population (25 million people) are said to be living below the country's poverty line (which is already below the global poverty line) (Teferi, 2012). This country also plays host to frequent droughts and other disasters, which have often times devastated the livelihoods of the largely rural farming population found throughout Ethiopia (Africa Today, 2012).

In Ethiopia extreme poverty is widespread. The major causes of poverty and food insecurity in rural areas include land degradation, recurrent drought, population pressure, low input subsistence agricultural practices, lack of employment opportunities and limited access to services (MoARD, 2009).

2.3. Safety-Net Programs in Ethiopia

The PSNP is one of several components of the Ethiopian government's Food Security Program. The other components are subsidies for voluntary resettlement and a package of programs jointly called Other Food Security Programs (OFSP). OFSP includes a wide range of activities that differ by regions, but the main element is a package of loans for agricultural and non-agricultural activities. The federal plan is that 30 percent of the PSNP beneficiaries should also be covered by OFSP. During the 2006–2007 seasons, 70 percent of OFSP funds were slated for household packages (Slater, 2006).

The PSNP has special features such as: types of transfers, specific objectives, basic principles, basic components, and targeting principles. The type of transfer may be cash only, both cash and food or food only based on specific situation of the safety net areas. The specific objectives of the cash and food transfers provided through the PSNP are: (1) to smooth household consumption – to bridge production deficits in chronically food insecure farming households that are not self-sufficient, even in good rainfall years; (2) to protect household assets – to prevent poor households from falling further towards destitution, vulnerability to future shocks and chronic dependence on external assistance; and (3) to create community assets – by linking the delivery of transfers to activities that are

productivity-enhancing, in order to promote sustainable developmental outcomes (FDRE, 2006).

The PSNP is already having a positive impact and there is clear evidence that several important changes have taken place in study areas in terms of nutrition, asset protection, asset building, and allowing people to feel secure enough in their income to take productive loans which they previously found too risky (Slater, 2006). A comparative study by Alemayehu (2008) pointed, access to the PSNP improves two measures of household food security: it reduces the likelihood that a household has very low caloric intake and it increases mean calorie availability. Relative to the control group, beneficiaries are more likely to be food secure, and are more likely to borrow for productive purposes, use improved agricultural technologies, and operate non-farm own business activities.

Additional empirical evidence reveals that Safety net activities are integrated with district development plans of targeted regions of the country and ensured quality assets which built within the necessary budget allocated. These activities include public works, on-farm improvements, and environmental protection measures such as tree planting on public land and soil/water conservation measures. And the study finally recommended that Safety net resources should be flexible enough to offer a wide range of activities that fit the food security plan of the district and also ensure timely and efficient use of these resources (Alemu, 2009).

The PSNP was introduced in 2005 and, after being significantly scaled up in 2006, has since become recognized as one of the biggest social safety net programs in all of Africa. This program is designed to transfer resources to chronically food insecure households and develop long-term solutions to food insecure families (USAID, 2012). The annual budget for the PSNP currently amounts to approximately USD 360 million and these costs are covered primarily through the support of nine external donors: the World Food Programme (WFP), the Canadian International Development Agency (CIDA), the Embassy of the Kingdom of Netherlands (RNE), the European Commission (EC), Irish Aid, the Swedish International Development Agency (SIDA), the United States Agency for International Development (USAID), the UK Department for International Development (DFID) and the World Bank (World Bank, 2009).

The amount of financing provided by each of these donors is summarized in the table below:

Table 1: Finance provided by each PSNP donors

S/no	PSNP donors	% of finance provided
1	USAID	32
2	WORLD BANK	28
3	DfID	15
4	Irish Aid	5
5	CIDA	5
6	RNE	5
7	EC	5
8	WFP	4
9	SIDA	1

Source: USAID (2012)

At household level, according to Hoddinott (2001), food security is best measured by: individual intakes, household caloric acquisition, dietary diversity, and coping indices.

Household caloric acquisition: Here the person responsible for preparing meals (the most knowledgeable person in the household) is asked a set of questions regarding food prepared for meals over specific period of time usually 7 or 14 days. This measure produces a crude estimate of number of calories available for consumption in the household. The advantage is that, it produces crude estimate of the number of calorie available for consumption in the household. Therefore, the level of skill required by enumerators is less than that needed to obtain information on individual intake. The disadvantage of the method is that, the method generates a large quantity of numerical data that needs to be carefully checked both in the field and during data entry (Hoddinott, 2001).

Individual intake: This is a measure of the amount of calories or nutrients consumed by individual in a given time period usually 24 hours. Methods of generating data with this method are that an enumerator resides in the household throughout the entire day, measuring amount of food served to each person. The second method is recall of the previous 24 hour

consumption for each household member. The advantage of this method is if implemented correctly, it produces the most accurate measures of individual caloric intake (and other nutrients) and therefore the most accurate measure of food security status of an individual. Second, because the data are collected on an individual basis, it is possible to determine whether food security status differs within the household. Against these advantages, the disadvantages are it requires highly skilled enumerators who can observe and measure quantities quickly and accurately (Hoddinott, 2001).

Dietary diversity: One or more persons within the household are asked about different items they have consumed in a specified period. Where it is suspected that there may be differences in food consumption among household members. The disadvantage of this measure is that the simple form of this measure doesn't record quantities. If it is not possible to ask about frequency of consumption of particular quantities, it is not possible to estimate the extent to which diets are inadequate in terms of caloric availability (Hoddinott, 2002; Migotto *et al.*, 2005; Smith *et al.*, 2006).

According to Alderman and Hoddinott (2007) cited in Yibrah (2010), social safety net programs intervention can lead to economic progress through their positive impact on asset creation, asset protection, resource allocation and redistribution. Social Safety Net Programs interventions, when well-designed and implemented, can complement pro-poor investments. Therefore, the program can tackle poverty in a sustainable manner on top of their short-term impact.

2.4. Impact Evaluation Methods

According to Ravallion (2005); Bryson *et al.* (2002), to know the effect of a program on a participating individual, we must compare the observed outcome with the outcome that would have resulted had that individual not participated in the program. However, as stated earlier two outcomes cannot be observed for the same individual. In other words, only the factual outcome can be observed. Thus, the fundamental problem in any social program evaluation is the missing data problem. In theory, evaluators could follow three main methods in establishing control and treatment groups: randomization/pure experimental design; non-experimental design and quasi-experimental design.

2.4.1. Experimental Method

In a randomized experiment, the treatment and control samples are randomly drawn from the same population. In other words, in a randomized experiment, individuals are randomly placed into two groups, namely, those that receive the program or intervention and those that do not. This allows the researcher to determine program impact by comparing means of outcome variable for the two groups (Ezemenari *et al.*, 1999), the main advantage of a randomized experiment is its ability to avoid problem of selection bias, which arises when participation in the program by individuals is related to their unobservable or unmeasured characteristics (like motivation and confidence).

2.4.2. Non-experimental Method

According to Bryson *et al.* (2002), there are two broad categories of non-experimental approach; before and after estimator and cross-sectional estimator. The essential idea of the before and after estimator of an impact evaluation approach is to compare the outcome of interest variable for a group of individuals after participating in a program with outcome of the same variable for the same group or a broadly equivalent group before participating in the program and to view the difference between the two outcomes as the estimate of average treatment effect on the treated.

2.4.3. Quasi-experimental Method

Quasi-experimental design involves matching program participants with a comparable group of individuals who did not participate in the program. This simulates randomization but need not take place prior to the intervention (Kerr *et al.*, 2000). A quasi-experimental method is the only alternative when neither a baseline survey nor randomizations are feasible options. Quasi-experimental method consists of constructed (matched) control where individuals to whom the intervention is applied are matched with an “equivalent” group from whom the intervention is withheld.

Quasi-experimental design has advantages in that it can draw on existing data sources; it is quicker and cheaper to implement; and it can be performed after a program has been implemented if sufficient data exist. However, it has some limitations, too. First, the

reliability of the results is often reduced as the methodology is less robust statistically. Second, the methods can be statistically complex. Finally, there is a problem of selection bias that yields inaccurate results (Baker, 2000). These limitations impose methodological challenge in non-experimental evaluation methods and hence affect the reliability of results when generating a comparison groups (Foster, 2003). To avoid or reduce these problems, different econometric approaches have been developed of which some are discussed as follows:

Instrumental variables or statistical control: In this method, one uses one or more variables that affect participation but not outcomes given participation. It is used to identify the exogenous variation in impact only due to the program, recognizing that the program is purposively placed rather than randomized. The instrumental variables are used to predict program participation first and then analyze how the outcome indicator varies with the predicted values (Baker, 2000).

Double difference or difference-in-differences (DID) method: This method enables evaluators to compare a treatment and comparison group before and after a program by identifying potential participants and collecting data from them. However, only a random sub-sample of these individuals is actually allowed to participate in a certain project. The identified participants who do not actually participate in the project form the counterfactual. This method can reduce the potential selection bias and the impact of other factors exogenous to the program on observable characteristics by analyzing the difference in outcome of treatment groups relative to the difference in outcome of control groups. It looks at the difference in indicators for the two groups at the end of the program relative to the difference in indicators at the beginning (Jalan and Ravallion, 1999; Baker, 2000).

Propensity Score Matching (PSM): The idea of PSM is to find a comparison group that is similar to the treatment group in all respects except the exclusion from the program. It is useful to evaluators with time constraints and do not have baseline data but use a single cross-sectional data (Ravallion, 2005). The method of PSM balances the observed covariates between a participant and a control (comparison) group based on similarity of their predicted probabilities of receiving the treatment (propensity scores) and can justifiably claim to be the observational analog of a randomized experiment (Rosenbaum and Rubin, 1983).

Reflexive comparison: This is one of the quasi-experimental methods in which a baseline survey of treatment groups is conducted prior to the intervention and a follow-up survey is done subsequently to measure the impact through the change in impact indicators before and after the intervention (Baker, 2000). Here, the treatment groups are compared to themselves before and after the intervention and serves as both treatment and comparison group.

In this study, propensity score matching method is used to assess the impact of productive safety net program on food security and asset building of the farm households, because there is no base line data and randomization is very unlikely.

2.5. Empirical Studies on the Impact of PSNP on Food Security and Asset Protection

A wide range of empirical studies are available in the areas of food security. But, insignificant number of previous study in Ethiopia has applied propensity score matching method (PSM) for social program evaluation. However, elsewhere, ample empirical applications of this method are found in the literature. Below, only a selected sample of such studies is presented.

2.5.1. Studies on Food Security and Asset Protection

Food insecurity in Ethiopia is not new and has a long history in the country. It has been one and the main among articulating features of poverty and backwardness for several years. Although this type of intricate problem was seen in both rural and urban areas, its width and coverage was boldly observed in rural areas. From the rural areas, it was widely observed in areas which were repeatedly affected by drought. It was recognized that even in recent years, this food insecurity problem affected up to 14 million people in the country. In Ethiopia, though food insecurity was evidenced as transitory and chronic, chronic food insecurity was the main feature of food security problem (MoARD, 2014).

In terms of asset protection, non-beneficiaries in the program were more likely than beneficiaries to experience falls in their asset-holdings during the 2005/06. Much of this asset depletion was attributed to sales of livestock to buy food conversely, 62% of PSNP

households reported being effectively protected against ‘distress sales’ of assets for essential purchases, while 23% even increased their asset ownership over the year. However, many PSNP households were forced to sell some of their assets, draw down their limited savings, or even rent out farmland, to survive the hungry season. Sales of productive asset such as land rights are especially concerning because they compromise the future viability agriculture based livelihoods. So the objective of preventing further impoverishment of the most vulnerable farming families was only partially achieved, probably because the transfers were too small (the average consumption of PSNP cash to total household expenditure was just 12%) and often delivered too late, to fully cover household food deficits. It is also true that asset-holdings of PSNP beneficiaries were lower initially, which is an indicator that the program was well targeted (Devereux *et al.*, 2006).

According to Shiferaw *et al.* (2005) household food security is strongly associated with demand side factors such as household size, market access and per capita aggregate production. On the supply side, the authors, reported technology adoption, farm size, and land quality as significant determinants of household food security. On the other hand, Berhanu (2004), emphasized institutional factors like land policy, input and output market system and poor rural infrastructure in relation to food insecurity problem in Ethiopia.

As for assets, overall it was found that beneficiary households held lower levels of assets than non-beneficiary households, which was to be expected given that this is a targeting method used within this program. Nevertheless, this assessment also found that over the 2004-2010 periods, beneficiary households experienced a slow but steady increase in their asset accumulation and there has been a decline in the distress sale of assets amongst these households (Berhane, 2011).

2.5.2. Studies on the Impact of Productive Safety Net Program

Impacts are generally positive. Community consultations revealed that a large number of the rural population need transfers, environmental rehabilitation activities and social infrastructure. However, to ensure that the needs of the most vulnerable are met, some adjustments are recommended in certain areas, as set out in the following lists below. Risks and challenges will be incorporated into the design of PSNP 4 in order to maximize positive and minimize negative impacts (MOARD, 2014).

In looking of income-related indicators, Ethiopia's GDP per capita increased from USD 711 in 2003 to USD 934 in 2011. In addition, the percentage of people living under the poverty line fell from 44.2% to 38.9% between 2005 and 2011. As for short-term health related indicators, since 2005, the mortality rate for children under five years of age decreased from 169 to 104 and the life expectancy at birth rose from 55.2 years to 59.3 years. Finally, in terms of education, the expected years of school has gone up from 6.7 to 8.5 years (UNDP, 2011, 2005).

In terms of the HDI for Ethiopia between 2005 and 2011, the period within which the PSNP has been implemented has clearly been marked by an upward trend in the HDI for the country. In 2005, the HDI for Ethiopia was at 0.313, whereas, in 2011 it was at 0.363. Looking from a global perspective though, the country has in fact dropped from ranking 170 to 174 out of 187 countries between 2005 and 2011 (UNDP, 2011).

Between 2006 and 2008 the International Food Policy Research Institution (IFPRI) undertook a longitudinal quantitative survey in which they collected data from households and at the locality level throughout four regions where the PSNP was being implemented: Tigray, Amhara, Oromiya and SNNPR. This survey was conducted in order to determine the overall impact of the PSNP and looked particularly at the effect this program had on household food security and livestock holdings. It is important to note that the timing of this survey also coincided with rising food prices, falling asset prices and drought shocks across the country (Gilligan *et al.*, 2009b).

Within this environment, it was still found that the PSNP was having an impact. Notably, the findings suggested that throughout this unstable period, non-beneficiary households experienced a decrease in food security, (measured by a drop in the number of months in which the families declared they would have “no problem satisfying the needs of their household”) while beneficiary households' food security situation remained stable. It was also found that the livestock holdings of non-beneficiary and beneficiary households rose between 2006 and 2007 but in 2008 non-beneficiary households experienced a decrease in their holdings while the amount of livestock within beneficiary households stayed the same (Gilligan *et al.*, 2009b).

In terms of food sources, it was found that over the 2006-2010 period, the fraction of food consumed from the households own production remained quite high, however, declined steadily as the fraction sourced from the PSNP increased. Additionally, the food gap experienced by these families, as measured by the number of months that the household would not be able to meet their food needs, declined from 3.6 months to 2.3 months (Berhane, 2011).

Lastly, in terms of perception, when asked about whether or not their economic situation had changed in the last year, 70% of beneficiary households stated that they felt their situation had either remained the same or improved in 2010. This is compared with only 41% of beneficiary households that responded in this manner when asked in 2008 (Berhane, 2011).

Finally, in terms of access and use of services, there were definite improvements witnessed within beneficiary households. Nearly half of the beneficiaries stated that they used healthcare facilities more frequently than in previous years and 76% stated this came as a result of the PSNP. Over one-third of households enrolled a greater number of their children in school and approximately half stated that they had kept the children in school for longer. More than half of these households stated this was due to the PSNP (Devereux *et al.*, 2006).

2.6. Conceptual Framework

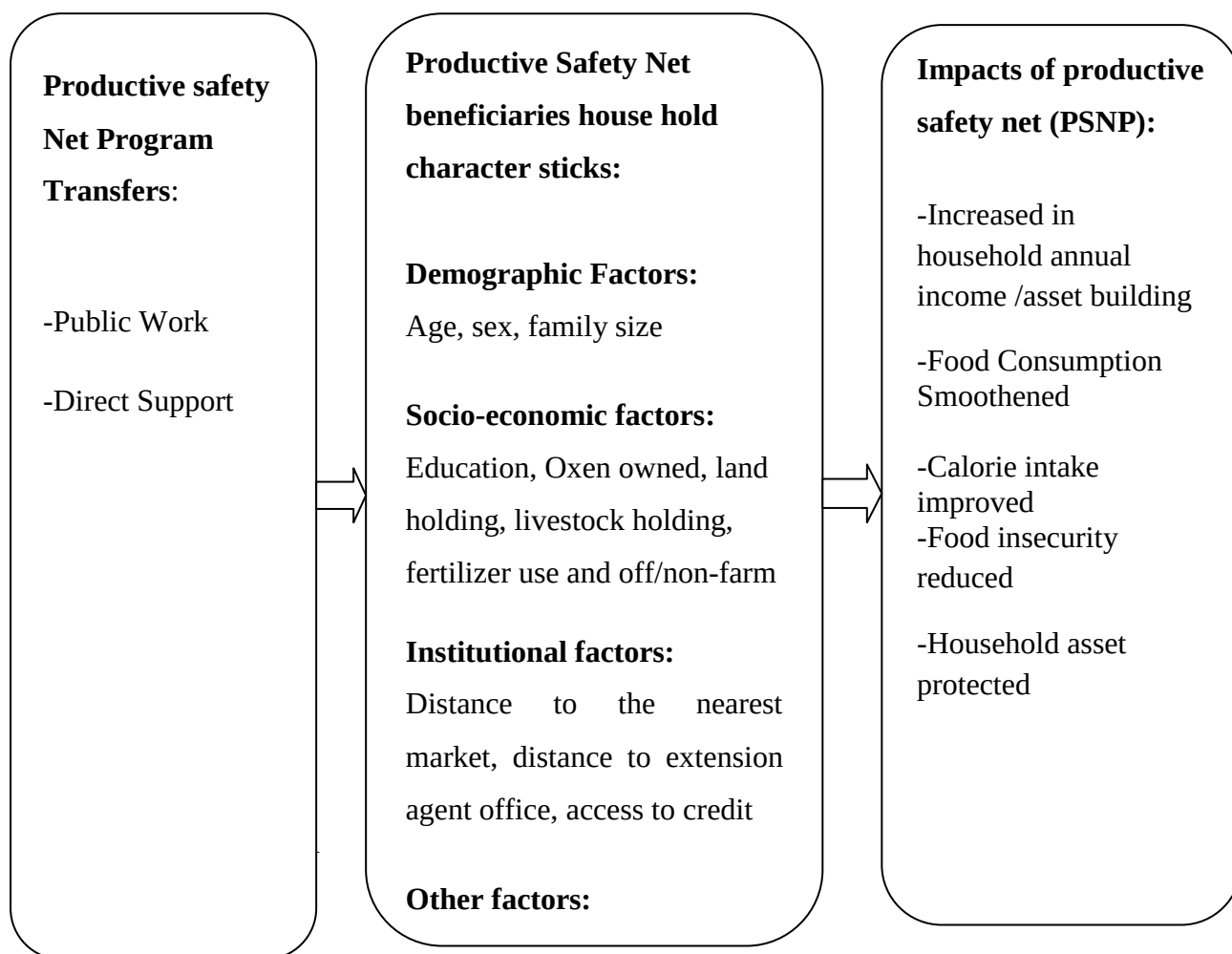
Different groups of poor people are poor for different reasons, and each set of causal factors implies different remedial actions. “Poverty and vulnerability” and their preferred opposites, “affluence and livelihood security” are determined by interactions between individual characteristics and external circumstances. Every individual has a unique combination of ability to work and skills to sell, though some people are poor precisely because they have no labor power at all but the extent to which this combination of strength and skills is converted into a viable livelihood is determined by the diverse economic, socio-cultural, physical and political environments within which people live (Devereux, 2000a).

In his analysis of Can Social Safety Nets Reduce Chronic Poverty, Devereux (2000a) identified the determinants of involuntary income or consumption poverty by disaggregating into three clusters:

Low productivity: inadequate returns to labor and other income-generating inputs;
Vulnerability: risks and consequences of sudden collapses in income and consumption;
Dependency: inability to generate an independent livelihood due to inability to work

Devereux (2002) categorized anti-poverty interventions into three main techniques: livelihood promotion, livelihood protection, and social safety nets (defined here as livelihood protecting or livelihood promoting interventions which compensate for state-contingent income declines, which at first sight seems to fit neatly into the “livelihood protection” category, but in fact could have also livelihood promotion impacts).

the household food security is affected by the institutional factor like distance to extension agent office, access to credit and distance to the nearest market and demographic factors like age, sex and family size; socio economic factors like off/non-farm, education, landholding, livestock holding, oxen owned and fertilizer use other factors like presence of other food security programs, good planning, effectiveness of targeting and mobilization of resources included in the study. The framework emphasized on the relationship of the explanatory variables with the dependent variables. However, the relationship of the explanatory variables was not shown in the diagram. This does not mean that there is no relationship between explanatory variables, but simply to concentrate on their relationship with the dependent variables rather than relationship among themselves. The conceptual framework described below incorporates these factors which have direct contribution for the success of productive safety net program towards food security.



Source: Own Construction, 2016

Figure 1: Conceptual framework of the study

3. RESEARCH METHDOLOGY

This chapter describes the procedures employed for this study; a way through which research problems are systematically resolved. It constitutes methods, designs, steps, and tools used in the field work and analysis. Understanding the impact of productive safety net program on food security involves both qualitative and quantitative approach in light with objectives of the study.

3.1. Descriptions of the Study Area

East Hararghe zone is located in the eastern part of the Oromia Regional National Sate, between 7°32' - 9°44'N and 41°12' - 42°53' E geographical grids. It has a total area of about 24,900 km² (64% of the total area of the region), 19 districts and 26 urban centres. The altitude of the zone is characterized by dissected mountains and various rivers flowing towards two opposite directions, Awash and Wabeshebele basins. Climatically, the zone is sub-divided in to Kola (55.8%), Woinadega (31.3%) and Dega (12.9%).

Meta Woreda is located at about 445 kilometers East of Addis Abeba and 78 kilometers west from Harer on the main road Harer to Addis. It is one of the nineteen districts of east Hararghe zone of Oromia Regional State. It is bounded by Shinile zone of Somali National Regional State in the North, Bedeno district of East Harerge in the south, Kersa district of East Harerge zone in East, Deder district of East Hararghe zone in the south west and Gorogutu district of East Hararghe zone in the west. As far as road networking is concerned in the Woreda 24 km asphalt and 364 km of rural roads are available.

The district has 55 kebeles in number out of which 51 are rural and 4 are urban kebeles. It is characterized mostly by flat and undulating land features with altitude ranging from 1400 up to 2850 m.a.s.l. ambient temperature of the District ranges from 14 to 26⁰C with average of 16⁰C. Average annual rainfall is 963 mm/year. Agriculture is the main source of income of the population in the district, there are three major livelihood zones are identified namely sorghum maize chat), coffee maize chat and wheat barley and potato livelihoods zone. The total population living in the district is estimated to be 283,049 of which 142,941 male and 140,108 female (CSA, 2010). The total cultivated land is estimated to be 30,817.5ha out

of which 26, 893ha is cultivated through rain-fed while 3924.5ha is through irrigation. The district has three major agro ecological zone namely Dega, Woynadaga and Kolla having 36 %, 33% and 31 % area coverage, respectively. The topography of the district is characterized by mountains, plateau dissected gullies and degraded hills, different species of flora and fauna exist. *Juniperus procera*, *Podocarpus gracilior* and *Olea Africana* are the major flora species among many and from fauna species hyena, leopard and others are sheltered. In the district there are three major livelihood zones are identified namely coffee maize chat, sorghum maize chat and wheat barley and potato livelihoods zone

The main livelihood activities consist of agriculture, husbandry and small-scale trade. Farm and farming is mainly geared towards satisfying households' consumption demands. The agricultural activities are mainly rain-fed; only a few farmers irrigate their plots. Farming activities are usually complemented by livestock holdings. The predominant cash crops in the area are chat and coffee.

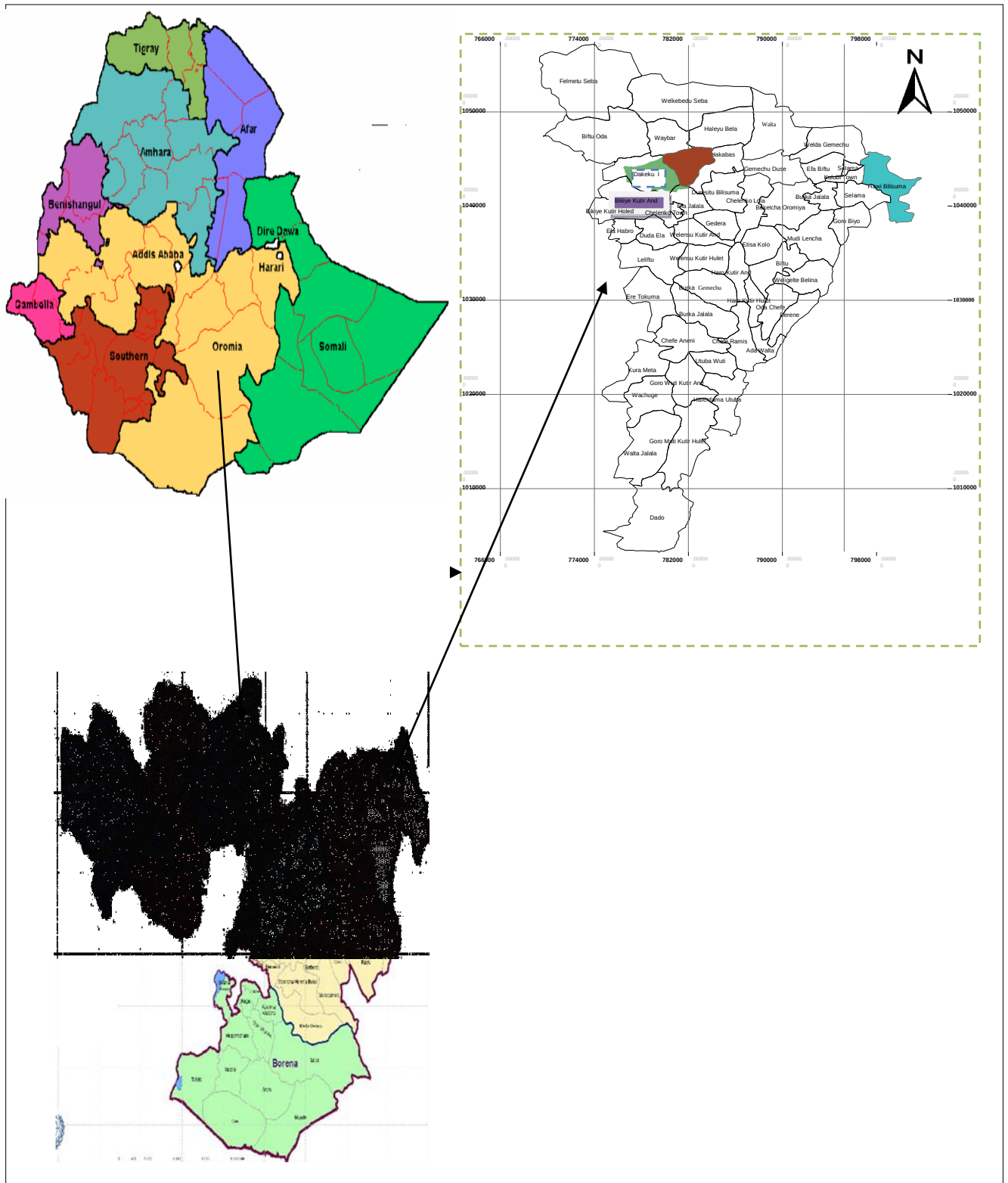


Figure2: Map of the study area

3.2. Study Design

Research design stands for advance planning of the methods to be adopted for collecting the relevant data and the techniques to be used in their analysis, keeping in view the objective of the research, time and money. Generally, the design need to minimize bias and maximizes the reliability of the data collected and analyzed (Kothari, 2004).

3. 3. Data Types, Sources and Methods of Data Collection

The study used qualitative and quantitative data from primary and secondary sources. Primary data were collected from sample of 160 households (75 PSNP participants and 85 non participants) using survey questionnaires while secondary data were relevant to the research work were collected from different stakeholders particularly from district and agriculture and rural development office, non-governmental organizations operating in the district, published and unpublished documents, and others sources supposed to have relevant information for this particular study.

The primary data were gathered from sample households using structured questionnaire. The household survey focused on household characteristics (family size, education, sex and age category, etc), land holding (own, rented and leased), participation in food security programs, access to credit services, livestock and non livestock asset ownership before and after the intervention, non-farm employment and other socioeconomic factors.

The questionnaire was pre-tested before the actual conduct of the interview using households identified for the purpose. Experienced enumerators were recruited based on their proficiency in the local language and then trained on data collection techniques and on the content of the questionnaire.

3.2.2. Sampling technique and Sample Size

After purposely choosing Meta district based on its wide coverage of the PSNP; a multistage sampling technique was used to determine the sampling households. First, three representative kebeles were selected out of total 28 based on their participation in the productive safety net program and based on accessibility. Second, the PSNP participant and non participant households identified from the households list available at each kebele. Finally, representative samples were selected from three kebeles based on probability proportional to sample size. Systematic random sampling was used to select a specific household in each kebele. Following this procedure, 160 sample households (75 PSNP participants and 85 non-participants) were selected from these kebeles. Having non-beneficiary households from the same communities as PSNP beneficiaries helps to control for enough pre-program observable household and community characteristics that are correlated with program participation and the outcome variable by providing a similar distribution of unobserved community characteristics like economic shocks (Gilligan *et al.*, 2008).

Table 2: Determination of sample size and household type

Kebele	PSNP-beneficiary households			Non-PSNP-beneficiary households			Total Sample size
	Population	%	Sample	Population	%	Sample	
Doke #2	166	30	22	906	45	38	60
Hawi Bilisuma	211	38	29	695	35	30	59
Haro #2	177	32	24	390	20	17	41

Source: own sampling procedure, 2016

3.4. Methods of Data Analysis

Different types of analytical methods were used to address the objectives of the study and draw conclusion and recommendations. According to Hopkins *et al.* (1996) and Pallent (2001), each and every analytical method has its advantage and limitation; hence, it is advisable to select the one that can better suit to the specific purpose.

3.4.1. Descriptive Analysis

Descriptive statistics such as mean, standard deviation, percentage, chi-square test and t-test are used for describing household characteristics and comparing participants and nonparticipants in terms of different explanatory variables.

3.4.2. Measurement and Estimation of Food Security

In this study, household daily calorie intake per adult equivalent is used to determine the status of food security situation of the household. Daily calorie intake can be measured in two ways, based on consumption per equivalent male adult and consumption based on age and sex without converting equivalent male adult. Food balance sheet and aggregate household calorie consumption were constructed for the purpose of the food security analysis. Food security scales calculated based on calorie requirement, according to sex, age, and activity level of household members, as recommended by WHO and FAO (1985).

Household calorie intake was computed from each food item consumed and grouped into seven food groups, adjusted for food processing to get the net weekly calorie availability. The net weekly calorie availability was divided by seven days to get the household daily calorie supply. The family size of each household was converted into adult equivalent family size which considers age and sex of each family member in the household. The daily net calorie consumption of the household was divided by the adult equivalent family size to obtain the daily calorie availability per adult equivalent of the household. Households with daily calorie availability of 2200 kcal or more per day were categorized as food secure, and those households whose daily calorie supply intake fall below this food security threshold were categorized as food insecure.

3.4.3. Propensity Score Matching (PSM) Method

The impact of PSNP on food security or asset building is the difference in households' with the program and without the program. However, households participating in the program could not be simultaneously observed in two states. A household can either be in the program or outside the program. Thus, the fundamental problem of such an impact evaluation is a missing data problem.

Hence, this study applies a propensity score matching technique, which is a widely applied impact evaluation instrument in the absence of baseline survey data for impact evaluation. The technique attracted attention of social program evaluators. The PSM technique enables us to extract from the sample of non-participating households a set of matching households that look like the participating households in all relevant pre-intervention characteristics. In other words, PSM matches each participant household with a non-participant household that is (almost) the same likelihood of participating into the program.

This study attempts to estimate the average impact of treatment on treated (ATT). In this case “treatment” implies participation in the program, which is a Productive safety net Program, and “impact” is meant for the change of food security. On the other hand, “control” stands for non-participant/non-treated households used for comparison. According to Caliendo and Kopeinig (2008), the implementation of PSM involves five steps. These are: PSM estimation; choosing matching algorithm, checking for overlap (common support); matching quality (effect) estimation and sensitivity analysis.

Procedures of propensity score matching estimation

Estimation of propensity score is the first step in PSM technique. Rosenbaum and Rubin (1983) revealed that matching can be performed conditioning only on $P(X)$ rather than on X , where $P(X) = \text{Prob}(D=1|X)$ is the probability of participating in the program conditional on X . According to these authors, if outcomes without the intervention are independent of participation given X , then they are also independent of participation given $P(X)$ which reduces a multidimensional matching problem to a single dimensional problem,

Estimating the propensity score involves decision on two choices; what model to be used for the estimation and what variables should be included in this model. Regarding the decision of choosing the type of model to be used, for the binary treatment case, where we estimate the probability of participation versus non-participation, both logit and probit models often yield similar results. Therefore, it is not a critical problem. However, due to the complexity of estimation procedure of probit model than the logit model, logit is widely used (Caliendo and Kopeinig, 2005). To capture this advantage, the logit model is used for estimating the propensity score in this study.

According to Gujarati (2004), in estimating the logit model, the dependent variable is participation which takes a value of 1 if the household participated in a program and 0 otherwise. The logit model is mathematically formulated as follows:

$$P_i = \frac{1}{1+e^{-Z_i}} \quad (1)$$

Where P_i is the probability of a household participation for i^{th} household and Z_i is a function of m explanatory variables (X_i) and is expressed as:

$$Z_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_m x_{im} \quad (2)$$

Where β_0 is the intercept and β_i is the slopes parameter in the model which is estimated using maximum likelihood method.

The probability that a household belongs to non-participant is:

$$(1-P_i) = \frac{1}{1+e^{Z_i}} \quad (3)$$

If the disturbance term U_i is taken into account the logit model becomes:

$$z_i = \beta_0 + \sum \beta_1 x_{i1} + U_i \quad (4)$$

3.4.3.1. Matching estimators

After estimation of the propensity scores, seeking an appropriate matching estimator is the major task of a program evaluator. There are different matching estimators in theory. Below, only the most commonly applied matching estimators are described. These are:

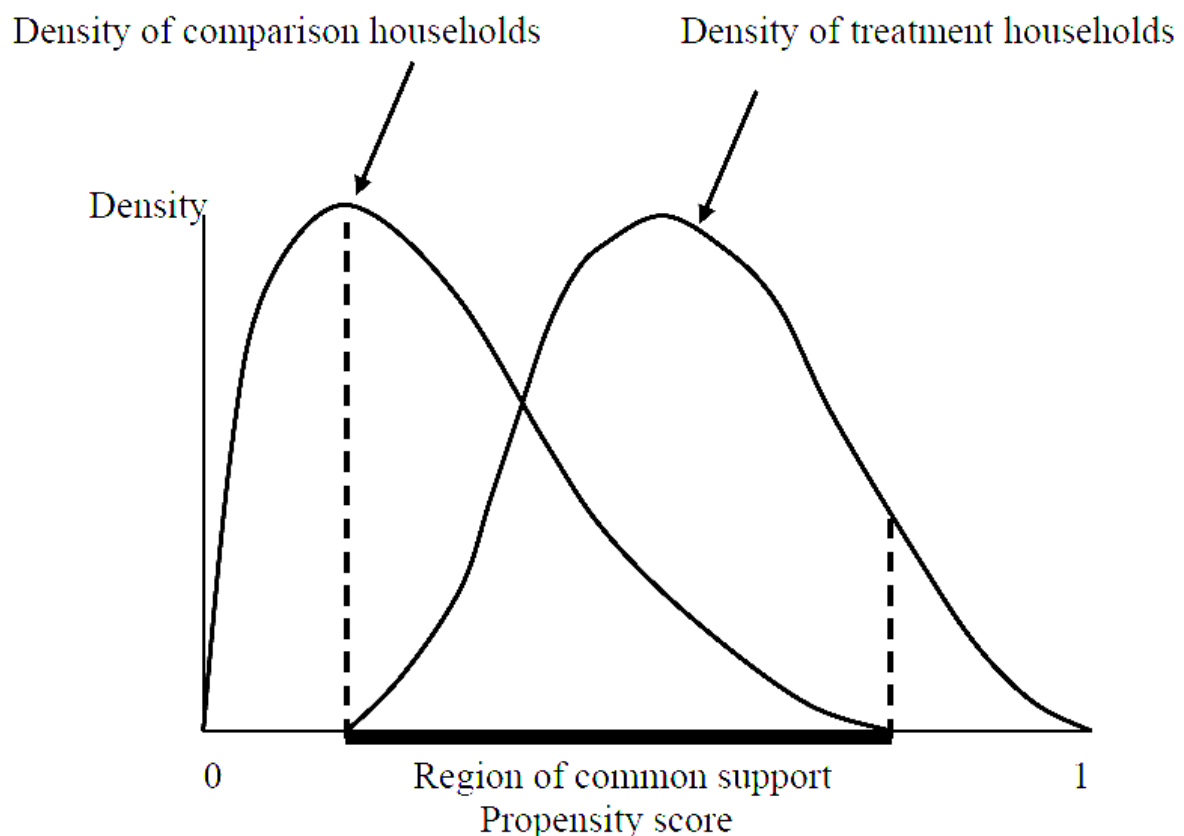
Nearest Neighbor Matching (NN): It is the most straightforward matching estimator. In NN matching, an individual from a comparison group is chosen as a matching partner for a treated individual that is closest in terms of propensity score (Caliendo and Kopeinig, 2005). NN matching can be done with or without replacement options. In the case of the NN matching with replacement, a comparison individual can be matched to more than one treatment individuals, which would result in increased quality of matches and decreased precision of estimates. On the other hand, in the case of NN matching without replacement, a comparison individual can be used only once.

Caliper Matching: Use a tolerance level on the maximum propensity score distance (caliper) to avoid the risk of bad matches; match with the NN within the caliper. The radius matching is to use not only the closest NN within each caliper, but all the individuals in control group within the caliper (Vivien and Zeiser, 2008).

Kernel Matching: this is another matching method whereby all treated units are matched with a weighted average of all controls which are inversely proportional to the distance between the propensity scores of treated and controls (Becker and Ichino, 2002). This method use more information and hence advantageous in lowering variance. However, they also have a drawback of the probability of using observations having bad match which leads to the importance of imposing the common support condition (Caliendo and Kopeinig, 2005).

3.4.3.2. Region of common support condition

The common support region is the area which contains the minimum and maximum propensity scores of treatment and control group households, respectively. It requires dropping of all observations whose propensity scores is smaller than the minimum and larger than the maximum of treatment and control, respectively (Caliendo and Kopeinig, 2005).



Source: Ravallion, 2005

Figure3. Region of common support condition

3.4.3.3. Testing the matching quality

The primary purpose of the PSM is that it serves as a balancing method for covariates between the two groups. Consequently, the idea behind balancing tests is to check whether the propensity score is adequately balanced. The propensity scores themselves serve only as devices to balance the observed distribution of covariates between the treated and comparison groups. The success of propensity score estimation is therefore assessed by the resultant balance rather than by the fit of the models used to create the estimated propensity scores (Lee, 2006).

There are several indicators to check for matching quality. These are: t-test standardized bias, joint significance and Pseudo- R^2 , and stratification test.

t-test: It is an approach preferred when there is a concern with significance of results. Two-sample t-test is employed to check if there is significant difference between the covariate means of treated and control group and suggested by Rosenbaum and Rubin (1985) as the covariates must be balanced after matching and there should be no significant difference between the two groups. However, this test has a limitation of showing clearly visible bias reduction before and after matching.

Standardized bias (SB): As noted by Rosenbaum and Rubin (1985) the SB is an appropriate indicator which enables to assess the distance in marginal distributions of the X -variables. Though SB is a common method used, it has a drawback if there is no a clear indication for the success of the matching procedure.

Joint significance and pseudo- R^2 : The Pseudo- R^2 shows how best the regressors explain the probability of participation and it should be fairly low since there should not be significant difference in the distribution of both groups after matching (Caliendo and Kopeinig, 2005).

Stratification test: This approach is dividing observations into strata based on the estimated propensity score to show that there is no statistically significant difference in the mean of the estimated propensity score of both treated and comparison groups as used by (Dehejia and Wahba, 1999, 2002).

The mean impact of the PSNP on food security or asset formation is given by:

$$A = \sum_{j=1}^P (Y_{ij1} - \sum_{i=1}^{NP} Y_{ij0}) / P \quad (5)$$

Where, Y_{ij1} is the post intervention food consumption of household j , Y_{ij0} is the asset holding of the i^{th} non-participant matched to the j^{th} participant, P is the total number of participants, NP is the total number of non-participants and A is household asset in birr.

3.4.3.4. Sensitivity analysis

Checking the sensitivity of the estimated results becomes an increasingly important topic in the applied evaluation literatures (Caliendo and Kopeining, 2008). Matching method is based on the conditional independence or unconfoundedness assumption, which states that evaluator, should observe all variables simultaneously influencing the participation decision and outcome variables. This assumption is intrinsically non-testable because the data are uninformative about the distribution of the untreated outcome for treated units and vice versa (Becker and Caliendo, 2007). However, if there are unobserved variables which affect assignment into treatment and the outcome variable simultaneously, a hidden bias might arise (Rosenbaum, 2002). Since it is not possible to estimate the magnitude of selection bias with non-experimental data, the problem can be addressed by sensitivity analysis.

Multicollinearity test

Since the existence of strong multicollinearity seriously affects the parameter estimates of the regression models, it is necessary to check its occurrence among the explanatory variables. Accordingly, Variance Inflation Factor (VIF) technique was employed to detect the problem of multicollinearity for the continuous variables (Gujarati, 2004). According to Gujarati (2004), VIF can be defined as:

$$VIF(x_i) = \frac{1}{1 - R_i^2} \quad (6)$$

If a strong linear relationship exists among the explanatory variables then this would result in large VIF value. To detect this problem, contingency coefficients were computed from the survey data. The contingency coefficient is computed as:

$$C = \sqrt{\frac{x^2}{N + x^2}} \quad (7)$$

Where, C= Coefficient of contingency
 χ^2 =Chi-square of random variable and
 N = total sample size.

3.5. Variables Definitions, Measurement and Hypothesis

3.5.1. Dependent Variables

In this case the dependent variable is participation in the PSNP and it is a dummy variable which takes the value of one if the household is participant and zero otherwise.

3.5.2. Outcomes Variables

These are the variables which show the program impacts. These are food security and total household asset.

Total household asset (Asset): It was the variable representing the household asset as the main indicator of the program impact, which shows what extent to which the household asset level change in birr. Household assets which are measured in birr such as farm tools, household durables goods, house constructed for rent serve as source of saving and as a hedge against food insecurity in most rural farm households of the survey area. Households with high asset value are less food insecure than those who do not. Hence, as the total asset of a household increases the likelihood of participating in the program decreases.

Food security (Fs): It refers to the kilocalorie intake per adult equivalent of the household measured by using seven days recall method which is a continuous variable.

3.5.3. Independent Variables

The independent variables are a combination of socioeconomic, demographic, institutional and location factors were used to explain household participation in the PSNP as well as the resulting wellbeing outcomes which is food security measured in terms of calorie intake and total annual income.

Age of household head (age): It is a continuous variable measured in terms of years completed during the survey year. As it is described in the PIM (2010), conditional transfers is done for households that face regular food shortages and that have members who are able-bodied (fit and healthy) and above 16 years of age and below 55 years of age. Such households receive transfers on condition that their able-bodied members (both male and female) contribute labor to public works. It is assumed that as farmers' age increases the probability of participating is expected to decrease because the probability of accumulating assets, livestock's usually increase and because of this the probability of households targeting by the PSNP program decreases due to better food security condition. Therefore, it was hypothesized that age has a negative relation with the participation of the household in PSNP.

Family size (famsz): This variable refers to the size of household member. An increase in household size implies more mouth to be fed from the limited resources and has negative relation with household food security (Mequanent, 2010). Therefore, family size is hypothesized to have positive effect on participation in PSNP.

Sex of the household head (Sex): It is classified as dummy variable taking the value of zero if the household head is female and 1 otherwise. Because of different socio-economic and cultural factors female-headed household are liable to be disadvantaged portion of the society in using extension services and in participating on other livelihood activities. Cultural influence has made women to be docile, less mobile and inactive (Wosagni, 2010). It was hypothesized sex has negative effect on participation in PSNP.

Size of cultivated land (Land): This variable represents the total cultivable land size of the household which is measured in hectare. As the cultivated land size increases, provided that other production factor remains constant, the livelihood that the holder gets more output.

Therefore, it is hypothesized that cultivable land has negative impact on household participation in program.

Number of oxen owned (Oxen): It refers to the number of oxen owned by the household. Oxen are the most important means of land cultivation and it is the basic farm asset. Household who own oxen have better chance to produce more. It is hypothesized to have negative impact on household's participation in program.

Livestock holding (Tlu): It refers to total livestock holding of the farmer measured in terms of tropical livestock unit (TLU). Theoretically, livestock can support households in two ways. First, livestock is used as a source of cash to purchase inputs such as fertilizer. Second; they provide farmyard manure and compost for fertilizer. In this regard, livestock ownership has positive impact on fertilizer use and manure application (Croppendstedt *et al.* 2003; Fitsum, 2003; Pender and Berhanu, 2004; Chilot, 2007). Therefore, livestock production constitutes a very important component of agricultural economy, a contribution that goes beyond direct food production to include multipurpose use such as skins, fiber, fertilizer, and fuel, as well as capital accumulation. Possession of large livestock size is hypothesized to have negative impact to household participation in the program.

Distance to the market (Dist): What and how much farmers should produce can be determined by their proximity to market places in kilometer and it can be treated as a continuous variable. Farmers at better proximity can have the chance and advantages for being market oriented and modify their economic behavior accordingly rather than waiting for the unreliable assistance of others. In addition to this, market is also a place where people can find wage-labor employment. On account of these advantageous situations, farmers at closer proximity may perform better in their economic activities and, hence, scoreless in dependency syndrome (Wesagni, 2010) and this was hypothesized that it has a negative effect on dependent variable.

Access to credit Service (Credit): This refers to access of households to different sources of finances. It is dummy variable that takes a value of 1 if a household has an access to credit services and 0 otherwise. It helps to solve liquidity constraints of the household to purchase fertilizer and has a positive effect (Chilot, 2007; Maiangwa *et al.*, 2007). Therefore, this study hypothesized a positive association between access to credit and program participation.

Off/non-farm activities (OFF/N-farm): This refers to activities undertaken away from the household's own farm. It takes the value of 1 if household participated in off and non-farm activity and 0 otherwise. Barrett *et al.* (2001) stated off/non-farm activities as “activities that are taken place away from home .i.e. all activities away from one's own property, regardless of sector or functional classification; can be wage or self-employment. They also used to classify off-farm activities as formal and informal activities. Nonfarm activities refer to those activities that are not primary agriculture or forestry or fisheries. However, non-farm does include trade or processing of agricultural products (even if, in the case of micro-processing activities, they take place on the farm). It is hypothesized to have negative effect on households' participation in the program.

Extension contact (EXN): It is continuous variable measured in terms of the number of days the household head contacted extension agent per year. Visit of development agent (access to extension services) has a positive influence on different farm activities because farmers who have access to extension services get training that enhance their knowledge. Studies show that access to extension services has a positive effect on fertilizer use (Chilot, 2007; Maiangwa *et al.*, 2007). It was hypothesized that the frequency in which the household head contact and get extension services or advisory services was negatively related with household's participation in the program.

Fertilizer use (Frtqt): It is dummy variable taking value 1, if the farmers use chemical fertilizers and 0 otherwise. Fertilizer use has often been perceived as improving productivity per unit area. Households using fertilizer were expected to have better food security status than the non-users (Mequanent, 2009). And it was hypothesized that it has negative linkage with the dependent variable.

Education level of household head (HHEDS): Education equips individuals with the necessary knowledge of how to make living. It is a continuous variable measured in maximum grade attended. Empirical studies show the presence of positive relationship between education and participation in development programs (Dereje *et al.*, 2001; Chilot, 2007; Maiangwa *et al.*, 2007). However, educated households are usually better off in terms of resource ownership and hence are off the targeting by PSNP. Therefore, education of the household head is hypothesized to have negative relation with participation in the program.

Table 3: Summary of Variables definition and measurement

Variable	Type and definition	Measurement Hypothesis
Dependent variable		
Participation	Dummy, participation in the PSNP	1 if yes, 0 otherwise
Outcomes variables		
Household asset	Continuous, asset level	Asset in birr
Food security	Continuous, calorie intake	Kilo Calorie
Independent variables		
Age of Household head	Continuous, age of household head	y e a r s
Family Size	Continuous, family size	Number of hh members
Sex of household	Dummy, sex	1 if male and 0 otherwise
Cultivated land	Continuous, cultivate land size	Hectare
Number of oxen	Continuous, number of oxen	In number
Number of livestock	Continuous, livestock holding	Tropical livestock units
Distance from market	Continuous	In km
Credit service	Dummy, access to credit services	1 if yes, 0 otherwise
Off-farm activities	Dummy, access off-farm activities	1 if yes, 0 otherwise
Extension contact	Continuous, frequency of contact	Frequency of contact
Fertilizer use	Dummy, fertilizer use of the HH	1 if using and 0 otherwise
Education status	Continuous, education of household	Years of schooling

4. RESULTS AND DISCUSSION

In this chapter the findings of the impacts of productive safety net program on household food security and asset building of program participants using both descriptive and econometric analyses are presented.

4.1. Descriptive Analysis of Sample Households' Characteristics

Propensity score matching (PSM) method was employed to estimate the impact of the program on household food security and asset building. The results of the descriptive analyses are presented in the form of mean, standard deviations and percentages as discussed below.

4.1.1. Socio-demographic Characteristics

Age of household head (Age): The mean age of the sampled household heads was 38.5 years with the maximum of 65 and the minimum of 26 years. The mean age of beneficiary households was 39.2 years and that of non-beneficiary households was 37.8 years.

Family size (famsz): The result presented in Table 4 shows that the average family size of sample households was 5.3 with the maximum family size of 9 and the minimum of 2. The mean family size of beneficiary households was 5.7 and that of non-beneficiary was 5. It seems that beneficiaries' households have larger family size than non beneficiaries' households; the t-test shows that there is significant difference between the two groups in terms of family size at five percent probability level (Table 4).

Education status of household head (HHEDS): The survey result shows that the mean educational level of sampled households was 1.3 with the maximum educational level of 9 and the minimum of 0. The mean educational levels are 1.06 and 1.68 for beneficiary and the non-beneficiary households respectively. The t-test for the equality of mean of education level shows statistically significant mean difference between beneficiaries and non-beneficiaries at ten percent probability level (Table 4).

Table 4. Demographic characteristics of sample households

Variables	Total sample N=160	Non- beneficiary N=85	Beneficiary N=75	Mean difference	t-value
Age	38.5	37.8	39.2	1.4	-1.53
Family Size	5.3	5.7	5	0.73	-2.90**
Education	1.3	1.68	1.06	0.62	1.69*

Source: Own calculation based on household responses

**, *, significant at 5% and 10% probability level

Sex of the household head (sex): Out of the 160 respondents, 81.25 percent are male-headed and 18.75 percent are female-headed households. About 21.3 and 78.9 percents from beneficiaries were female and male headed households respectively. About 16.5 and 83.5 percents of non-beneficiary households were female and male headed households respectively. However, the statistical test analysis shows that there is no statistically significant difference in terms of sex of the household heads between beneficiary and non-beneficiary households (Table 5).

Table 5. Description of sex of household heads

Variable	Category	Participant (N=75)		Non-participant (N=85)		Total (N=160)		χ^2 -value
Sex	Female	16	21.3	14	16.5	32	18.75	-0.78
	Male	59	78.7	61	83.5	128	81.25	

Source: Own calculation based on survey data

4.1.2. Livelihood Characteristics

Size of cultivated land (Land): Crop production requires primarily the availability of suitable cultivable land. The mean land size of the total respondents is 0.61 and the mean land sizes of the beneficiary and non-beneficiary households are 0.53 and 0.67 ha respectively. The mean comparison of the two groups in terms of mean cultivated land size reveals that

there is significant difference between the two groups at one percent probability level (Table 6).

Extension contact (exn): According to results presented in Table 6, the mean extension contact of the surveyed households was 1.98. The results also show that the mean extension contacts were 1.88 and 2 for beneficiary and non-beneficiary households respectively. The comparison of the mean extension contact of the two groups shows that non-beneficiary households have slightly more extension contact than beneficiary households though not statistically significant.

Distance to the market (Dist): Table 6 depicts the statistical results of the mean distance of the total respondent from market center which is 6.7km. The results also show that the mean distances were 7.1km and 6.3km for beneficiary and non-beneficiary households respectively. The comparison of the mean distance of the two groups indicated that non beneficiary households are living nearer to the market center than beneficiary, though the mean distance of the two groups is not statistically significant.

Table 6. Cultivated land, extension contact and distance to market

Variables	Total sample Households N=160	PSNP households N=75	Non PSNP households N=85	Mean difference	t-value
Cultivated land	0.61	0.53	0.67	0.13	4.66***
Extension contact	1.98	1.88	2.00	0.20	1.01
Distance to market	6.70	7.10	6.30	0.80	-1.17

Source: Own calculation based on household responses

***, *, significant at 1% and 10% probability level

Access to credit service (credit): In the study area, out of the total sampled respondents, 40.6 percent have access to credit. The result also shows that from the total beneficiary respondents 33.3 percent and from the non-beneficiary respondents, 47 percent have access to credit service. The statistical test shows that there was statistically significant difference at ten percent between beneficiary and non-beneficiary households in accessing credit service.

Off/non-farm activity (off/non-farm): In the study area, out of the total sampled respondents, 40.8 percent have access to off and non-farm activities. The result also shows that from the total beneficiary respondents 40.3 percent and from non-beneficiary respondents 43.8 percent have access to off and non-farm activities. The chi-square test shows no statistically significant difference between beneficiary and non-beneficiary households in their access to off/non-farm activities.

Table7. Access to credit, off/non-farm activities and fertilizer use

Variable	Category	PSNP HH (N=75)		Non-PSNP (N=85)		HH Total (N=160)		χ^2 - value
		N	%	N	%	N	%	
Access to credit	Yes	38.66	51.6	46.88	55.2	85.5	53.4	1.59
	No	36.34	48.4	38.12	44.8	74.4	45.3	
Access to off/ non-farm	Yes	25	33.3	40	47	65	40.6	0.79
	No	50	66.7	45	53	95	59.37	
Fertilizer use	Yes before	15	20	11	13	26	16.3	0.03
	and after	46	61.3	51	60	97	60.6	
	Yes after	14	18.6	23	27	37	23.1	
	No							

Source: Own calculation based on household responses

* Significant at 10% probability level

4.1.3. Livestock Holding, Oxen Owned and Household Asset

Number of oxen owned (Oxen): Oxen provide traction power and income. Moreover, they are sold as one of the coping mechanisms during food shortage. Average number of oxen owned by the beneficiary households increased from 0.58 to 0.94. Similarly, the average number of oxen owned by the non-beneficiary households increased from 0.72 to 0.81. This shows that an increment in number of oxen for beneficiary households was greater than that of non beneficiaries. Consequently, the difference between the two groups in terms of number of oxen owned increased from 0.36 to 0.1. It is possible to say that beneficiary

group's had better rate of change in oxen holding. The statistical test for the equality of the mean of number of oxen owned shows statistical significant difference between beneficiaries and non-beneficiaries' households at 10 percent probability level after program intervention (Table 8).

Livestock holding (TLU): Livestock provide milk, meat, traction power, income and transport. Moreover, they are sold as one of the coping mechanisms during food shortage. The main livestock owned by the sample households include cattle, sheep and goat, and poultry. The numbers of livestock owned by the beneficiary and non-beneficiary groups of households before and after the implementation of the program were converted into tropical livestock unit (TLU). Average TLU of the beneficiary group was 0.66 TLU before the implementation of the program which was increased to 1.5 TLU after the implementation of the program. Similarly, for the non-beneficiary group the average TLU 1.3 before the program was increased to 1.63 TLU after the implementation of the program. This shows the increment of TLU for beneficiary households is greater than that of non-beneficiaries. Consequently, the difference between the two groups in terms of livestock holding decreased from 0.63 TLU to 0.12 TLU. It is possible to say that beneficiary group's had better rate of change in livestock's holding. The statistical test for the equality of the mean of TLU shows statistical significant difference between beneficiaries and non- beneficiaries' households at one percent probability level before program intervention and no statistical significant difference between beneficiaries and non-beneficiaries' households after program intervention (Table 8).

Household asset: The value of household assets were measured using 2005 market price as base year prices to avoid the impact of the current price inflation on value of the assets owned during 2005 and 2016. It helps to avoid over or under estimation of a similar unit values of household assets in one of the years. In this study, household assets considered were farm tools, durables goods and house for rent.

Table 8 shows household asset values of the sampled household in 2005 and 2012. The beneficiary households' mean asset values increased from Birr 2078.52 in (2005) to Birr 3990.33 in (2016) which is an increment of Birr 1911.83. On the other hand, asset values of the non-beneficiary households increased from Birr 4007.52 in (2005) to Birr 4684.11 in (2016) which is an increment of Birr 676.59. This indicates that the beneficiaries' asset value increased more than the non-beneficiaries by birr 1235.24. The mean difference between

beneficiary and non-beneficiary households is statistically significant at one percent probability level both before and after program intervention (Table 8).

Table8. Oxen, TLU and Household Asset in 2005 and 2016

Variables	Beneficiary	Non Beneficiary	Total sample	Mean	
	HHs	HHs	HHs	Difference	t-value
	N=75	N=85	N=160		
Oxen 2005	0.58	0.72	0.66	0.14	1.68*
Oxen 2016	0.94	0.81	0.87	0.13	1.76*
TLU 2005	0.66	1.3	1	0.63	7.42***
TLU 2016	1.50	1.63	1.57	0.12	0.9458
Asset 2005	2078	4007.52	3103	1929	28.78***
Asset 2016	3990.33	4684.11	4358.90	693.78	1.76***

Source: Own calculation based on household responses

* and ***, significant at 10% and 1% probability level respectively.

4.1.4. Household Calorie, Income and Expenditure

Calorie intake per adult equivalent

Results in Table 9 shows that beneficiary and non-beneficiary households have intake of 2601.23 and 2476.96 kilo calories respectively. This indicates that households in the non-beneficiary have better calorie intake than beneficiary households. The average kilo calorie intake of the households in general is 2539. The comparison of calorie intake of the households in the district with the nation's minimum requirement (kilo calorie per AE per day is 2200 for the nation as stated in (MoFED, 2008) shows the household calorie intake in the district is above the national level.

There is significant number of households who are still food insecure and below the national food security line (2200 kilo calories/AE/day). As far as calorie intake is concerned, there is statistically significant difference between the two groups at five percent of probability level (Table 9).

Total annual income

The households' annual income is one of the important factors that help to create assets in the way it contributes to the food security of the households in the study area. The income of the household is obtained from both farm and non-farm activities such as livestock and crop production, petty trade, employment, sale of natural product and other sources which are used for the households to run different economic, social and cultural activities. The annual income of sample households is ranging from 4,390 to 47,520 birr.

The mean income of the sampled respondents was 11,924.15birr per household per year. Similarly the mean income of beneficiary and non-beneficiary households were birr 11,342 and 12506.3 respectively. The statistical test of the mean difference in incomes of beneficiary and non-beneficiary groups shows statistical significant difference at ten percent probability level. On average, non-participant households had higher annual income of 1194.3 ETB as compared to participant households.

Total annual expenditure

The mean expenditure of the sampled respondents was 11012.5 birr per household per year. Similarly mean annual expenditure of the beneficiaries and the non-beneficiary households were birr 11,480 and 10,545 respectively. There was statistically significant difference between beneficiaries and non beneficiary households at ten percent probability level.

Table 9. Household's calorie intake, income and expenditure

Variables	Total HH N=160	Non PSNP HH N=85	PSNP HH N=75	Mean difference	t-value
K/calorie/AE/day	2539	2601.23	2476.96	124.27	1.01**
HH income(birr)	11976.5	12536.3	11,342	1194.3	1.71*
HH expenditure(birr)	11012.5	11480	10545	935	1.82*

Source: Own survey data.

* * and *, significant at 5% and 10% probability levels, respectively

4.1.5. Perception about Effectiveness of Targeting Households for PSNP

Information on the fairness of targeting was collected during the household survey conducted in July 2016 and the statistical results shown in Table 10 revealed that 56.87% of the total sampled households reported that the targeting process is fair and is in accordance with the project implementation manual in addressing the food in secured households. From this, 89% of the participant households confirmed the targeting process is fair and the PSNP resource is used for vulnerable (like female headed HHs) and food in secured household. However, only 23.5% of the non-participant sampled households supported the fairness of targeting process in their community. Besides, about 76% of the non-participant households believed that they need to be considered to participate in the PSNP and they mentioned that the allocated resources were not sufficient and few peoples were also targeted without fulfilling the criteria and because of this peoples that need to be supported by the program were excluded.

Table10. Community perception on the fairness of the targeting process

	Non participant HH		Participant HH		Total	
	N	%	N	%	N	%
Fair						
Yes	20	23.5	67	89.33	87	54.37
No	65	76.5	8	10.66	73	45.62
Total	85	100	75	100	160	100

Source: Own survey data, July, 2016

The result from the focused group discussion conducted with the WFSTF, KFSTF and key informants revealed that the resources allocated to the district was not sufficient to address all the food insecure households and due to this some of the households excluded from the program.

4.2. Econometric Results

This section describes the result according to the steps followed to measure the impact of the productive safety net program more precisely; it explains the estimation of propensity scores, matching methods, common support region, balancing test and sensitivity analysis. It also explains the treatment effect of the program across the participating households.

4.2.1. Propensity Scores

This part presents the results of the logistic regression model employed to estimate propensity scores for matching treatment household with control households. As indicated earlier, the dependent variable in this model is a binary variable indicating whether the household was a participant in the PSNP. The model is estimated with STATA 11 computing software using the propensity scores matching algorithm. In the estimation data from the two groups; namely, program and non-program participating households were pooled such that the dependent variable takes a value 1 if the household was beneficiary (in the program) and 0 otherwise.

Robust standard errors were estimated to tackle heteroscedasticity problem in the data. The variables included in the model are assumed to affect not only a household's participation in the program but also the outcome of the program, which is household food security and household asset measured in calories and Birr respectively. Breusch-Pagen test was applied to test heteroscedasticity. This test resulted in rejection of the existence of hetroscedasticity hypothesis ($\text{Prob} > \chi^2 = 0.1679$) and there was no need to make the standard error robust.

Table 11 shows the estimation results of the logit model. The estimated model appears to perform well for our intended matching exercise. The pseudo- R^2 value is 0.21. A low pseudo- R^2 value shows that the allocation of the program has been de facto random (Pradhan and Rawlings, 2002). In other words, a low pseudo- R^2 value means that program households do not have much distinct characteristics overall and as such finding a good match between program and non-program households becomes easier. The pseudo- R^2 indicates how well the repressors explain the participation probability. After matching there should be no systematic

differences in the distribution of covariates between both groups and therefore, the pseudo- R^2 should be fairly low (Caliendo and Kopeinig, 2005).

As indicated in Table 11 out of the twelve explanatory variables selected, the program participation is significantly influenced by seven explanatory variables such as family size, land holding, oxen, total livestock unit (TLU), credit, extension service and education level. Age, distance from extension office and other food security intervention had positive and significant effect on the decision to participate in the PSNP program. Household with older age and supported with other food security program, were the one to get a better chance to be selected as the program beneficiaries. In the contrary, there is a negative relationship between farm size/land holding, educations, distance from extension office and livestock ownership (which is measured in total livestock unit). Based on the result presented in Table 11, beneficiary households who have relatively large farm size, living near extension office, having large number of oxen and livestock, access to credit and who are literate were not targeted by the safety net program. Besides, community members that are literate and living near to the office of the extension agent have less chance to be targeted by the program. This is mainly due to the nature of the program in addressing the remotely living people in low land area with less access to the service of extension agent, illiterate and who are living a lower living standard than others.

Table 11: Results of the Logistic regression model

Variable	Coef.	Std. Err.	z-value	p>z
Age	-0.054	0.043	-1.27	0.202
Family size	0.499***	0.172	2.90	0.004
Sex	0.478	0.532	0.90	0.369
Land	-4.214***	1.069	-3.94	0.000
Oxen	-0.663*	0.363	-1.83	0.068
Livestock	-0.549**	0.245	-2.24	0.025
Distance from market	0.056	0.050	1.12	0.262
Credit	-0.481*	0.447	-1.75	0.081
Off-farm	-0.139	0.480	-0.29	0.771
Extension	-0.270*	0.158	-1.70	0.089
Fertilizer	0.194	0.436	0.45	0.656
Education	-0.150*	0.086	-1.75	0.081
Constant	3.655**	1.713	2.13	0.033
Number of obs	160			
LR $\chi^2(12)$	47.02			
Prob > χ^2	0.000			
Pseudo- R^2	0.212			
Log Likelihood	-87.081			

Following this, the second step in propensity score matching technique is to compute the common support region. According to the procedure stated earlier, only observations in the

common support region are matched with the other group and others (out of the common support region) should be out of further consideration. Once the common support region defined, individuals that fall outside this region have to be discarded and for these individuals the treatment effect cannot be estimated. Figure 4 shows the distribution of households with respect to estimated propensity scores. As can be seen from this figure, most of treatment households are found to the right of the distribution, while most of the control households are found in the left side of the distribution.

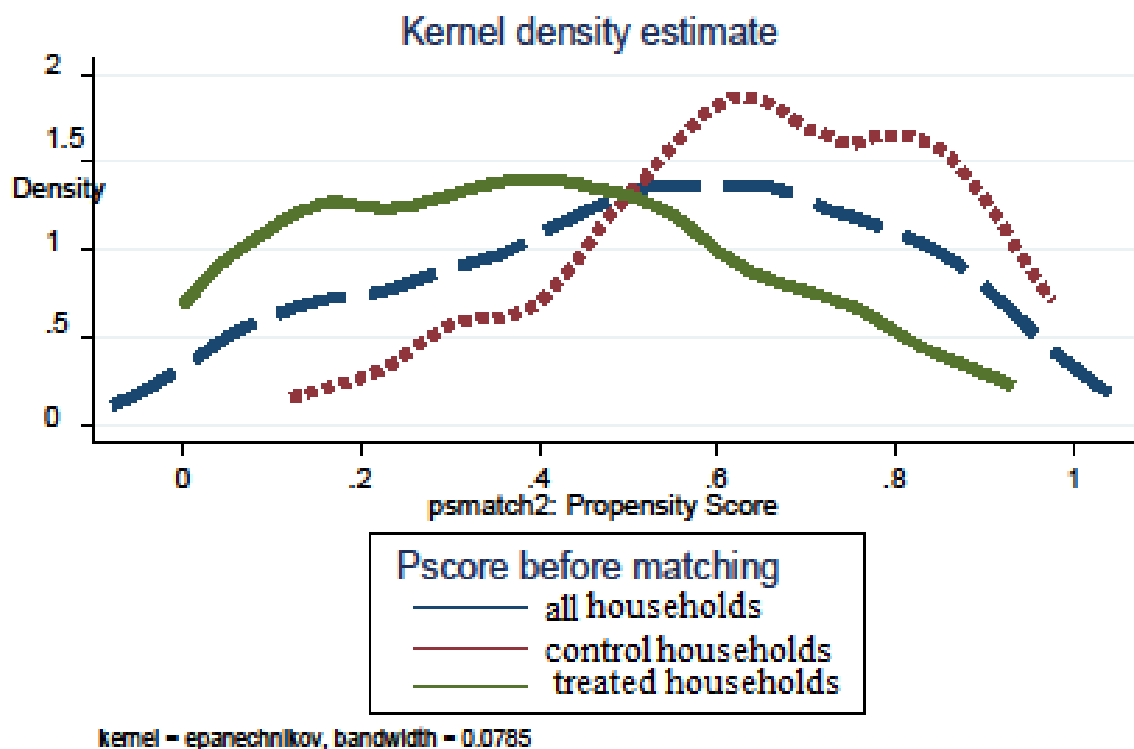


Figure4. Kernel density of propensity score distribution

4.2.2. Matching Program and Non-Program Households

As stated before, four main tasks should be accomplished before one launches the matching task itself. First, predicted values of program participation (propensity scores) should be estimated for all households in the program and outside the program. Second, a common support condition should be imposed on the propensity score distributions of household with and without the program. Third, discard observations whose predicted propensity scores fall outside the range of the common support region. And finally sensitivity analysis should be

done in order to check the robustness of the estimation (whether the hidden bias affects the estimated ATT or not).

As shown in Table 12, the estimated propensity scores vary between 0.046 and 0.96 (mean = 0.69) for program or treatment households and between 0.035 and 0.95 (mean 0.52) for non-program (control) households. In other words, households whose estimated propensity scores were less than 0.046 and larger than 0.96 are not considered for the matching exercise. As a result of this restriction, 12 households (3 program and 9 control households) were discarded. This shows that the study does not have to drop many PSNP households from the sample in computing the impact estimator.

Table 12. Distribution of estimated propensity scores

Groups	Obs	Mean	Std. Dev.	Min	Max
Treatment households	75	0.69	0.22	0.046	0.96
Control households	85	0.52	0.22	0.035	0.95
Total households	160	0.67	0.22	0.04	0.96

Source: Own calculation based on household responses

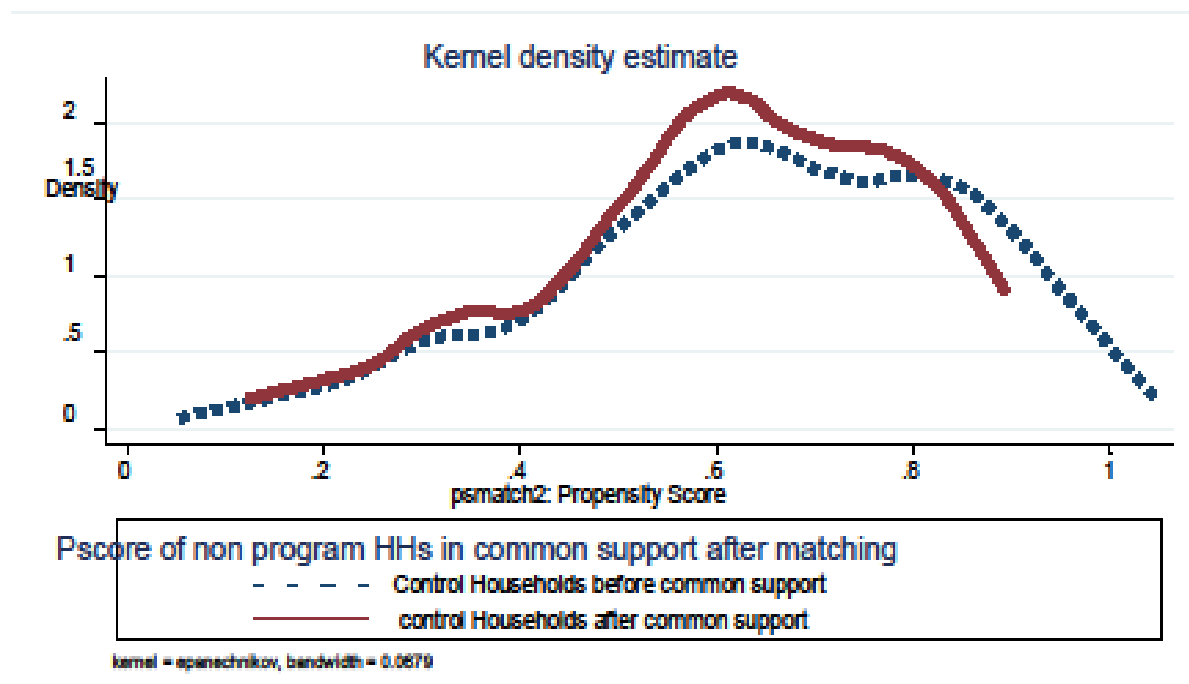


Figure 5. Kernel density of propensity scores of control households

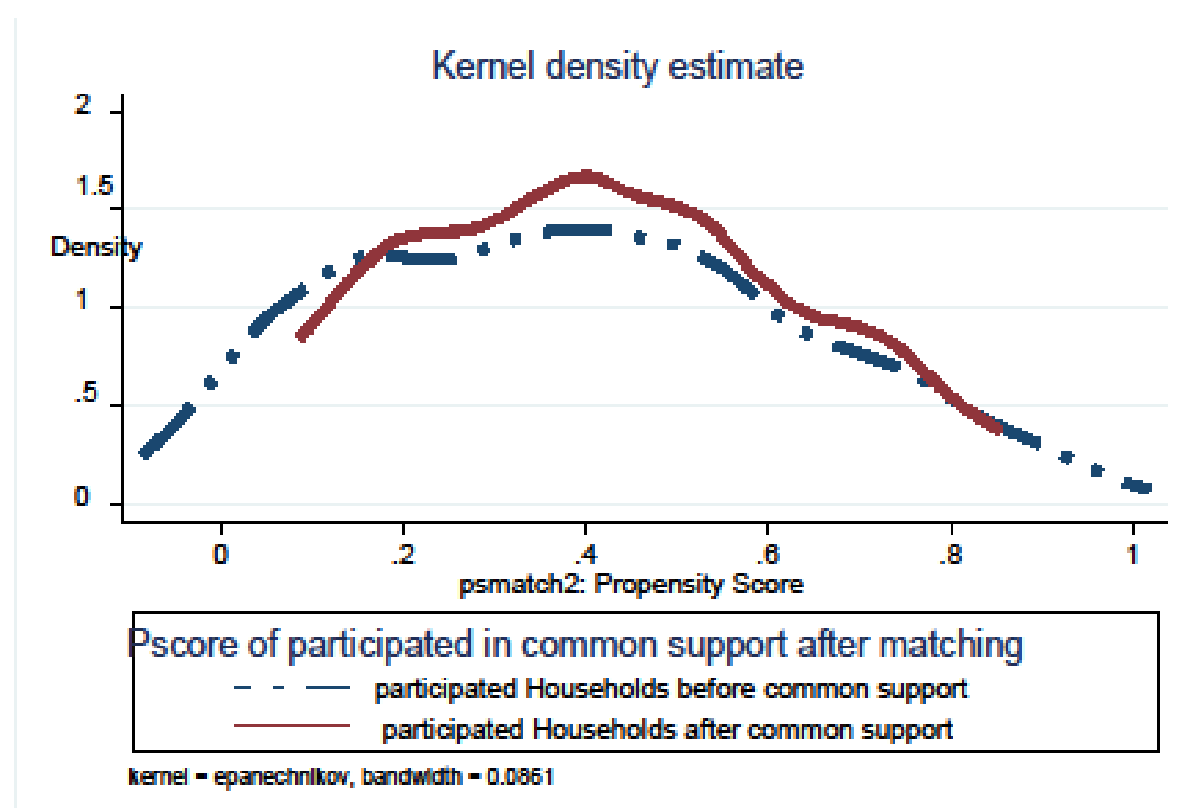


Figure 6. Kernel density of propensity scores of participated households

The above two figures (Figures 5 and 6) portray the distribution of estimated propensity scores, with and without the imposition of the common support condition, for program and

non-program households, respectively. Most of the program households have propensity score greater than 0.79 whereas a significant majority of the non-program households have propensity score around 0.68.

4.2.3. Choice of Matching Algorithm

Different alternatives of matching estimators were conducted to match the treatment program and control households fall in the common support region. The decision on the final choice of an appropriate matching estimator was based on three different criteria as suggested by Dehejia and Wahba (2002). First, equal means test (referred to as the balancing test) which suggests that a matching estimator which balances all explanatory variables (i.e., results in insignificant mean differences between the two groups) after matching is preferred. Second, looking into pseudo- R^2 value, the smallest value is preferable. Third, a matching estimator that results in the largest number of matched sample size is preferred. To sum up, a matching estimator that balances all explanatory variables, with lowest pseudo- R^2 value and produces a large matched sample size is preferable.

Table 13 shows the estimated result of tests of matching quality based on the above mentioned three criteria. Looking into the result of the matching quality, Kernel with band width 0.5 was found to be the best for the data at hand. Hence, the estimation results and discussion for this study are the direct outcomes of the Kernel with band width 0.5.

Table 13. Performance of matching estimators

Matching Estimator	Performance Criteria		
	Balancing test*	Pseudo-R ²	Matched sample size
Nearest Neighbor			
1 neighbor	7	0.347	148
2 neighbor	7	0.347	148
3 neighbor	8	0.095	148
4 neighbor	6	0.511	148
Caliper Matching			
0.01	9	0.416	98
0.1	7	0.347	128
0.25	8	0.095	148
0.5	8	0.095	148
Kernel Matching			
With no band width	7	0.291	137
Band width of 0.1	8	0.215	148
Band width of 0.25	8	0.215	148
Band width of 0.5	11	0.053	148

Source: own calculation result

* Number of explanatory variables with no statistically significant mean differences between the matched groups of program and non-program households.

Kernel matching associates the outcome of the treated household with the matched outcome that is given by a kernel-weighted average of all control groups for PSNP participated. Since the weighted averages of all non-participant households in the control group are used to construct the counterfactual outcome, kernel matching has an advantage of lower variance because more information is included in the analysis (Heckman *et al.*, 1998).

4.2.4. Testing the Balance of Propensity Scores and Covariates

After choosing the best performing matching algorithm, the next task is to check the balancing of propensity score and covariate using different procedures by applying the selected matching algorithm (in our case kernel matching). As indicated earlier, the main purpose of the propensity score estimation is not to obtain a precise prediction of selection into treatment, but rather to balance the distributions of relevant variables in both groups. The balancing powers of the estimations were ascertained by considering different test methods such as the reduction in the mean standardized bias between the matched and unmatched households, equality of means using t-test and chi-square test for joint significance of the variables used.

Table14. Propensity score and covariate balance test

Variable	Sample	Mean		%reduction		t-test	
		Treated	Control	%bias	Bias	t	p>t
pscore	Unmatched	0.72	0.27	97.6		8.19 ***	0.00
	Matched	0.60	0.59	56.9	69.3	-1.21	-1.21
Age	Unmatched	43.31	39.33	1.4		0.96	0.33
	Matched	41.42	40.90	-0.8	40.6	0.49	0.62
Famsz	Unmatched	4.52	4.13	13.8		0.93	0.35
	Matched	4.46	4.45	-0.6	95.4	0.55	0.58
Sex	Unmatched	0.65	0.72	-19.6		-1.31	0.19
	Matched	0.71	0.77	-13.2	32.7	-0.11	0.91
Land	Unmatched	1.78	1.67	81.5		5.47 ***	0.00
	Matched	1.74	0.42	1.6741	81.2	-0.82	0.41
Oxen	Unmatched	1.81	1.58	-26.5		-1.77 *	0.07

	Matched	1.80	1.66	-17.3	34.5	-0.05	0.95
Tlu	Unmatched	2.90	4.51	-43.4		7.08 ***	0.00
	Matched	4.40	3.79	-3.7	60.9	-1.20	0.23
Dst market	Unmatched	11.77	9.58	-51.3		-3.44 ***	0.00
	Matched	10.06	9.49	13.4	73.9	0.54	0.58
Credit	Unmatched	0.56	0.73	-35.3		-2.37 **	0.01
	Matched	0.59	0.59	0.99	97.5	0.34	0.73
Of-farm	Unmatched	0.56	0.44	-24.5		-1.64	0.10
	Matched	0.49	0.43	11.2	54.2	0.58	0.56
Exn service	Unmatched	2.11	1.97	-17.2		-1.15	0.25
	Matched	2.13	2.03	4.3	75.1	0.20	0.83
Frtqt	Unmatched	0.27	0.26	-2.5		-0.17	0.86
	Matched	0.29	0.29	0.3	89.9	-0.49	0.62
Education	Unmatched	5.37	4.62	-25.1		-1.68 *	0.09
	Matched	4.84	4.74	-3.5	85.9	0.12	0.90

Source: Own estimation result

***, **and * means significant at the 1%, 5% and 10% probability levels, respectively.

The mean standardized bias before and after matching are shown in the fifth columns of Table 14, while column six reports the total bias reduction obtained by the matching procedure. In the present matching models, the standardized difference in X before matching is in the range of 2.5 percent and 81.5 percent in absolute value. After matching, the remaining standardized difference of X for almost all covariates lies between 0.6 percent and 17.3 percent, which is much below the critical level of 20 percent suggested by Rosenbaum and Rubin (1985). In all cases, it is evident that sample differences in the unmatched data significantly exceed those in the samples of matched cases. Unmatched sample size was 160 households but after matching it reduced to 148 households. Thus, 12 sample households

were discarded from the sample (Table 11). The process of matching thus creates a high degree of covariate balance between the treatment and control samples that are ready to use in the estimation procedure. Similarly, t-values in Table 14 show that before matching seven of chosen variables exhibited statistically significant differences while after matching six of the covariates are balanced.

Table15. Chi-square test for the joint significance of variables

Sample	Pseudo- R ²	LR chi ²	p>chi ²
Unmatched	0.294	88.54	0.000
Matched	0.059	11.99	0.628

Source: Own calculation based on household responses

All of the above tests suggest that the matching algorithm that has been chosen is relatively best with the data at hand. Thus, it is possible to precede estimation of ATT for households.

4.2.5. Estimating Treatment Effect On Treated

In order to attain the objective of this study the following impact indicators of the treatment effect were performed using the PSM model.

4.2.4.1. Impact estimation of PSNP on household food security and asset building

The estimation result presented in Table 16, provides supportive evidence that the program brings significant effect on food security. After controlling for pre-intervention differences in demographic and asset endowment characteristics of the beneficiary and non-beneficiary households, it has been found that, on average, the non-beneficiaries' food consumption has a bit increased. But the mean difference between beneficiary and non-beneficiary households' calorie intake is not statistically significant after matching. It is possible to say that even non beneficiaries were used better consumption, even though beneficiaries were fulfilled their basic needs. This narrow gap between two groups indicates the improvement of participant household livelihood and this improvement was an impact of the program. It covers the six

month food gap and encourages them to produce more through giving credit and other facilities.

As the estimation result presented in Table 16 shows, there is supportive evidence on the effect of the program on household asset protection and building. After controlling for pre-intervention differences, it has been found that, on average, the program beneficiaries have fewer assets than non-beneficiaries. However, the mean difference of asset between beneficiary and non-beneficiary households was statistically significant after matching at one percent probability level.

Table 16. Treatment effect on the treated

Variable	Sample	Treated	Controls	Difference	S.E.	t-value
KCALOR	ATT	2489.5	2368.05	121.45	56.6	0.21*
HHASSET	ATT	4619.78	3339.12	1280.65	123.81	10.34***

Source: Own calculation based on household responses

4.2.5. Sensitivity Analysis for an Observed Bias

Propensity score matching provides an estimate of the effect of treatment variables that is largely free of bias arising from an association between treatment status and observable variables. However, propensity-score matching estimators are not consistent estimators for treatment effects if the assignment to treatment is endogenous, i.e., if unobserved variables that affect the assignment process is also related to the outcomes. In order to estimate the extent to which such “selection on un observables” may bias our qualitative and quantitative inferences on the effects of PSNP, sensitivity analysis was conducted. One strategy to address this problem is the Rosenbaum bounds (2002) approach, which allows the analyst to determine how strongly an unmeasured confounding variable may affect selection in the treatment. If there are unobserved variables that simultaneously affect assignment into treatment and the outcome variable, a hidden bias might arise to which matching estimators are not robust (Rosenbaum, 2002).

However, the result shows that the inference of the effect of the program is not changing though the beneficiary and non-beneficiary households have been allowed to differ in their odds of being treated up to 200 percent (maximum value of gamma 3 with 0.1 increments) in terms of unobserved covariates. That means for calorie and asset of household or ATT of each outcome variables were estimated at various levels of critical values of gamma. The p-critical values are significant which further indicated that we have considered important covariates that affected both participation and outcome variables. We couldn't get the critical value gamma where the estimated ATT is questioned even if we have set gamma largely up to 3. Thus, it can safely be concluded that our impact estimates (ATT) of calorie and asset were insensitive to unobserved selection bias and were the result of pure effect of the program

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

This study was conducted in Meta district in east Hararghe zone of Ethiopia to examine the impact of PSNP on household food security and asset building. The two specific objectives of the study were to examine the household food security the present status in the study area and to assess the impact of productive safety net program on households' food security and asset building in the study area. Both primary and secondary data were used. The primary data were collected from 160 households. The sample respondents were taken from both program beneficiaries and non-beneficiary households. It was also tried to examine different documents to support the primary sources. Therefore, this study has used propensity score matching to address the main research question of this study.

The primary data collected from interview schedule with sample respondents were analyzed using descriptive statistics such as mean, standard deviation, percentage, and ranges. The test statistics such as chi-square test and t-test to measure significance of mean difference among the participant and non participant households' and also test significance between association members and non-members of sample households were also used. The study has applied a propensity score matching technique which has become most widely applied non-experimental tool for impact evaluation of social programs. It is used to extract comparable pair of treatment-comparison households in a non-random program setup and in the absence of baseline data. Secondary data were obtained from different actors like District agriculture office and NGOs.

As the result from descriptive analysis shows, majority of beneficiary households own less cultivated land compared to non-beneficiary households. The result shows that there was strong significant difference on possessing cultivated land. Similarly, most of beneficiary households do not have better access to credit. However, majority of beneficiary households have high family size compared to non-beneficiaries. On the other hand, the result indicated that relatively small number of respondents have access to extension service. Similarly most of beneficiaries were illiterate compared to non-beneficiary.

As far as livestock holding and asset creation is concerned, on average, there was a sign of increment in both sides. The average TLU owned by beneficiary households indicates that there was better increment on livestock holding and Oxen compared to other. In addition, the beneficiary group shows promising improvement on asset creation. Thus, the difference they had before and in the program reduce livestock holding and asset creation. Even if there was an improvement on beneficiary households' livestock holding and asset creation, there was a significant difference on annual income, expenditure and calorie intake before matching, after matching no significant difference on calorie intake. Although both beneficiary and non-beneficiary household's calorie intake was above the minimum requirement index at national level.

The participation in the program was determined by a combination of pre intervention factors and both the inferential and logit model result showed that households in the program were more likely to have small land holding, high family size, small number of livestock ownership, located at far distance from the extension agent office, illiterate and they have high dependency ratio. However, non-program households were better in terms of extension service, land holding, TLU, less literate in their education status compared to the program participants.

Looking into the estimated coefficients, the result indicates that program participation was significantly influenced by seven explanatory variables. Cultivated land and TLU are found to have strong negative relationship to participation. Oxen, extension service and education level has also negative relationship. On the other hand, family size and access to credit has positive relationship with household participation in the program. As the regression in logit model shows it was likely to say that majority of households who were involved in program possess small cultivated land, and less TLU. They have high family size compared to non-beneficiary households.

After controlling for other characteristics, program participation has brought significant positive impact on participating households: calorie intake increased by 18%, household asset raised by 34%.

5.2. Conclusion

The Productive Safety Net Program (PSNP), which was launched in 2005, was mainly designed to achieve the following three major objectives:

- ✓ **Smoothing food consumption** in food insecure households through food or cash transfers
- ✓ **household assets** by minimizing the need for damaging coping strategies
- ✓ **Building community assets** through implementing developmental public works—activities

As propensity score matching estimation shows, it was possible to conclude that participation on the program was determined by seven major factors. Participants' who were involved in the program were likely to have small cultivated land, less access to credit, large family size and have less participation in off and non-farm activities. They have also posses fewer livestock's.

The program also covers six months basic food needs gap and it enables them to keep and build their own assets. Concerning this, there was no significant difference between participants and non-participants. The program possibly created a way for participant to cope up with others. On the other hand, PSNP likely brings improvement in terms of calorie intake. As the result shows, on average, participants' calorie intake increases. It was above the minimum requirement of the national level and there was significant difference comparing to non-participants. The participant's better calorie intake and asset preservation manifests that the program acts to brought an impact on household food security.

Besides, significant number of the non participating households expressed their feeling as the targeting process was not fair. Even if there is an issue of dependency (the need by each community members to be supported), due to the insufficiency of allocated resources, the PSNP program didn't well address the whole households and their family members that are food in secured. This suggested the PSNP program was not fully addressed all of the food in secured households and their families in the study area. Supporting the PSNP program participants with other food security programs is thought to enhance the graduation of the safety net beneficiaries. From the finding, the PSNP program fills the food gap up to six

month period of time, creates an opportunity in which the beneficiary tries to create new assets and improves the food security situation.

5.3. Recommendations

Based on the empirical findings reported in this thesis, the following policy recommendations are forwarded:

- ✓ In order to benefit the real food insecure part of the society, the office should take corrective actions on the targeting process i.e. retargeting, ensure that the beneficiaries are permanent dwellers during registration, make some discipline decisions on beneficiaries who use the support without fulfilling the criteria and those who use the support improperly as well as on the authorized body that use his/ her power for biased targeting.
- ✓ Credit access is highly related to resilience. The more farmers invest in productivity, the more they can achieve resilience. Creative livelihood programs and business linkages should be designed by the host government. Credit should be given to farmers who need it with minimal interest.
- ✓ In the context of Meta district, targeting the participant for such kind of projects needs to consider the livestock and oxen ownership, farm size and family size good indicators of expressing the wealth status and food insecurity situation of the household members. Targeting of the PSNP participant for such kind of program need to consider livestock holding, oxen, family size and land holding size as a good indicator for food insecurity at household level.
- ✓ Livelihood diversification should be encouraged and implemented in a border sense through expanding training programs and access to opportunities.
- ✓ As econometric result shows out of the twelve explanatory variables selected, the program participation is significantly influenced by seven explanatory variables such as family size, land holding, oxen, total livestock unit (TLU), credit, and extension

service and education level. Age, distance from extension office and other food security intervention had positive and significant effect on the decision to participate in the PSNP program. So when targeting is done consideration of these explanatory variables is important at household level.

- ✓ Current Behavioral change trainings provided by PSNP, should also focus to help farmers have attitudinal changes towards work and creativity
- ✓ Ministry of Agriculture should create options to ensure household food security, work on different household asset creation program and plan alternative food security programs in addition to the existing one to detach from this foreign dependency
- ✓ Finally, the writer suggests that PSNP requires Local government, development agents, selected committees, donor agencies and the community to work cooperatively together as partners in identifying, targeting, implementing, controlling, evaluating and reporting to achieve the objectives of the program.

6. REFERENCES

Africa Today (2012). Major Problems Facing Ethiopia Today.

Asfaw, S. Amare, M, and Calfat, G. (2011). Food Aid and Rural Poverty in Ethiopia. Rome: Food and Agricultural Organization (FAO).

Andersson, C., Alemu Mekonen and J. Stage (2009). Impacts of the Productive Safety Net Program in Ethiopia on Livestock and Tree Holdings of Rural Households. Discussion Paper Series. Environment for Development (EfD) Initiative. EfD DP 09-05.

Ayalneh Bogale and Wubshet Genene (2012). Impact of Productive Safety Net Financed Livestock Credit on Food Security and Poverty Status of Rural Households in Ethiopia: A Simulation Approach.

Andersson C., A. G. Ale. and C. Catherine (2001). Rural Non-farm activities and Poverty Alleviation in Sub-Saharan Africa. Policy Series 14. University of Greenwich: Greenwich.

Andersson, C., Alemu Mekonnen and J. Stage (2009). Impacts of the Productive Safety Net Program in Ethiopia on Livestock and Tree Holdings of Rural Households. Environment for Development (EfD) Initiative at the University of Gothenburg, Sweden.

Ashley, Mulugeta Tefera, Mengistu Buta and Delelegne Esubalew (2006). Ethiopia Productive Safety Net Program (PSNP): PSNP Policy, Program and Institutional Linkages. London and Bristol, UK and Addis Ababa, Ethiopia: Overseas Development Institute, the IDL group and Indak International Pvt. L. C.

Baker, J.L. (2000). Evaluating the Impact of Development Projects on Poverty: A Handbook for Practitioners. World Bank, Washington D.C.

Befekadu Degefe and Berhanu Nega (eds), 2000, Annual Report on the Ethiopian Economy, 1999/2000. Addis Ababa: Ethiopian Economic Association

Berhane, G., Hoddinott, J., Kumar, N., Taffesse, A. S., Diressie, M. T., Yohanes (2011). Evaluation of Ethiopia's Food Security Program: Documenting Progress in the Implementation of the Productive Safety Nets Programme and the Household Asset Building Programme. Washington, DC: International Food Policy Research Institute.

Bryson, A., Dorsett, R. and Purdon, S. (2002). The Use of Propensity Score Matching in the Evaluation of Labor Market Policies, Working Paper No. 4, Department for Work and Pensions.

Caliendo, M., and Kopeinig, S. 2008. Some Practical Guidance for the Implementation of Propensity Score Matching. IZA Discussion Paper No. 1588, University of Cologne.

CIA (Central Intelligence Agency), (2011). The World Fact Book, Accessed December 15, 2011, at <https://www.cia.gov/library/publications/the-world-factbook/geos/et.html>.

Devereux, S. (2000). Food Insecurity in Ethiopia. A Discussion Paper for Department for International Development (DFID), Sussex, UK: International Development Studies (IDS).

Devereux, S (2002). Poverty, Livelihoods and Famine, Paper Prepared for the *Ending Famine*.

Foster, E. 2003. Propensity Score Matching. An Illustrative Analysis of Dose Response. Lippincott Williams and Wilkins, Inc. *Journal of Medical Care*, 41(10): 1183-1192.

Ehui, S., S. Benin, T. Williams, and S. Meijer. (2002). Food Security in Sub-Saharan Africa to 2020. Socio-economics and Policy Research Working Paper 49. ILRI. Nairobi, Kenya.

Ezemenari, K., Rudqvist, A. and Subbarao, K. (1999). Impact Evaluation: A Note on Concepts and Methods, Poverty Reduction and Economic Management Network, World Bank.

FAO(Food and Agriculture Organization). (1997). Agriculture, Food and Nutrition for Africa: A resource Book for Teachers of Agriculture. Food and Agricultural Organizations of the United Nations, Rome. 412p.

FAO (Food and Agricultural Organization of United Nations), International fund for agricultural development and World food program (WFP), 2014. The State of Food Insecurity in the World: Strengthening and enabling environment to improve food security and nutrition. Rome

FAO (Food and Agriculture Organization). 2004. Food Insecurity and Vulnerability in Nepal: Profiles of Seven Vulnerable groups Food Security and Agricultural Projects Analysis Service.

FAO (Food and Agricultural Organization) (2005). Assessment of the World Food Security Situation.

FAO (Food and Agricultural Organization) and WFP (World Food Program), 2009. Crop and Food Security Assessment Mission to Ethiopia. FAO: Rome.

FDRE (Federal Democratic Republic of Ethiopia), 2006. Productive Safety Net Program: Program Implementation Manual (rev.). (MoARD), Addis Ababa.

FDRE (Federal Democratic republic of Ethiopia). 2009. Food Security Implementation and Poverty Reduction Program. Addis Ababa. Ethiopia.

FSCB. 2004. The New Coalition for Food Security in Ethiopia: Food Security Programme: Monitoring and Evaluation Plan (October 2004 – September 2009). pp 1-4.

Gilligan Daniel O., John Hoddinott and Alemayehu Seyoum (2008). The impact of Ethiopia's Productive Safety Net Programme and its linkages. IFPRI: Washington DC.

Gilligan, D., Hoddinott, J., Kumar, N., and Taffesse, A.S. (2009b). Can Social Protection work in Africa? Evidence on the Impact of Ethiopia's Productive Safety Net Programm on Food Security, Assets And Incentives. Washington DC: International Food Policy Research Institute.

Omoto, W. (2003). Impact assessment of urban agriculture research and development in Nairobi, Kenya.

Grosh, M. (2008). Promotion and Protection. Washington, DC: World Bank.

Gujarati, D.N. (2004). Essentials of Econometrics.4th edition. Mc-Graw-Hill Companies.

Habtamu, A. (2011). Impact of Productive Safety Net Program on the Household Welfare and labor supply in Rural Ethiopia: M.Sc.thesis, Department of Economics, Addis Ababa University.

Hobson, M. (2012). How Ethiopia's Productive Safety Net Program (PSNP) Responded to the 2011 Humanitarian Crisis in the Horn of Africa. Humanitarian Exchange Magazine.

Haddad L. (1997). Achieving Food Security in South Africa: New Challenges, New Opportunities, Washington, DC: International Food Policy Research Institute (IFPRI). 345p.

IFPRI (International Food Policy Research Institute), 2014. Ethiopian Strategy support program

Jalan, J. and Ravallion M. (2003). Estimating the Benefit Incidence of an Antipoverty Program by Propensity-Score Matching. *Journal of Business and Economics Statistics*, 21(1): 19-30.

Jennings, M. (2011). Social Assessment for the Education Sector, Ethiopia. London: Social Development Direct.

Kerr, J., Pangare, G., Pangare, V.L. and George, P.J. (2000). An Evaluation of Dry land Watershed Management Projects in India: Environment and Production Technology Division, International Food Policy Research Institute, Washington, U.S.A.

Maxwell, S. and Smith, S. (1992). Household Food Security: A Conceptual Review. In Maxwell, S. and T.R. Frankenberger (eds.) Household Food Security: Concepts, Indicators, Measurements (A Technical Review), UNICEF and IFAD, Rome.

Maxwell, S. (1996). Food Security: A Post-Modern Perspective. *Food Policy*, 21 (2): 155-170.

Mitiku, A., Fufa B., and Tadese B. 2013. Empirical analysis of the determinants of rural households food security in Southern Ethiopia: The case of Shashemene District. *Journal of Agricultural Science and Review*.vol. 1

MoARD (Ministry of Agriculture and Rural Development), (2014). Productive Safety Net Programme. Programme Implementation Manual. MoARD: Addis Ababa.

MoARD (Ministry of Agriculture and Rural Development), (2010). Household Asset Building Programme. Programme Implementation Manual. MoARD: Addis Ababa.

MoARD (Ministry of Agriculture and Rural Development), (2009a). Food Security Program 2010-2014 Household Asset Building August (2009).

MoARD (Ministry of Agriculture and Rural Development), (2004). Productive Safety Net Programme: Programme Implementation Manual. Addis Ababa, Ministry of Agriculture and Rural Development, Government of the Federal Democratic Republic of Ethiopia.

MoFED (Ministry of Finance and Economic Development), (2012). Assessing Progress Towards the Millennium Development Goals: Ethiopia MDG's Report (2012).

MoFED (Ministry of Finance and Economic Development), (2006). Plan for Accelerated and Sustained Development to End Poverty. MoFED: Addis Ababa.

Ministry of Foreign Affairs of FDRE (2010). The Government and Political System. Retrieved April 27, 2012, from Ministry of Foreign Affairs of Federal Democratic Republic of Ethiopia http://www.mfa.gov.et/Facts_About_Ethiopia/Government_Political_System.php

Rosenbaum, P. R (2002). *Observational Studies*. 2nd ed. New York: Springer
Teferi (2012, March 21). *Ethiopia Releases Interim Report on Poverty*. Retrieved April 25, 2012, from Embassy of the Federal Democratic Republic of Ethiopia to the Benelux & Permanent Mission to EU Institutions: <http://ethiopiaembassy.eu/ethiopia-releases-interim-report-on-poverty/>

Slater J. (2006). Ethiopia Productive Safety Net Program PSNP Policy, Program and Institutional Linkages.

Takele G. (2004). Modernizing Ethiopian agriculture: the way towards food self sufficiency. pp. 1-20. Proceedings of the Biological Society of Ethiopia. Addis Ababa, Ethiopia, 19-20 February 2004, Faculty of Science, Addis Ababa University.

Teferi. (2012, March 21). Ethiopia Releases Interim Report on Poverty. Retrieved April 25, 2012, from Embassy of the Federal Democratic Republic of Ethiopia to the Benelux & Permanent Mission to EU Institutions:

Thomson, A. and Metz K. (1997). Implication of Economic Policy Food Security: Training Manual. Rome, Italy.

UNDP (2011). Human Development Report 2011. New York: United Nations Development Program.

USAID (2016).“Agriculture and Food Security, Ethiopia” cited from <https://www.usaid.gov/ethiopi/agriculture--and-food--Security>.

USAID (2010). Famine Early Warning Systems Network (FEWS NET): East Africa Regional Food Security Outlook. USAID: Nairobi.

USAID (2001). Relief, Recovery, and Vulnerability Mitigation: Contingency Plan for Assistance in 2001. USAID: Addis Ababa.

USAID (2012). Productive Safety Net Program (PSNP). Retrieved April 24, 2012, from USAID Ethiopia: <http://ethiopia.usaid.gov/programs/feed-future-initiative/projects/productivesafety-net-program-psnp>

United States Department of Agriculture (2011). Bureau of African Affairs, Background Note: Ethiopia. <http://www.state.gov/r/pa/ei/bgn/2859.htm>. (Accessed on 11 October, 2016).

WB (2009). Productive Safety Net Apple III Project in Support of the Third Phase of the Productive Safety Net Program. World Bank: Addis Ababa.

7. APPENDICES

Appendix 1: Conversion factor of Tropical Livestock unit (TLU)

Livestock Category	TLU	Livestock Category	TLU
Ox	1	Horse	1.1
Cow	1	Sheep (adult)	0.13
Woyefen	0.34	Sheep (young)	0.06
Heifer	0.75	Goat (adult)	0.13
Calf	0.25	Goat (young)	0.06
Donkey (adult)	0.7	Hen/chicken	0.013
Donkey (young)	0.35	Camel	1.25

Source: Storck, *et al.*, 1991

Appendix 2: Conversion Factor for Computing Calorie Intake

Food item	Unit	Calorie	Food item	Unit	Calorie
Wheat	Kg	3574	Beef	Kg	1148
Teff	Kg	3589	Milk	litter	737
Barely	Kg	3723	Butter	Kg	7363
Lentil	Kg	3522	Egg	No	61
Hose bean	Kg	3514	Honey	Kg	3605
Sorghum	Kg	3805	Pepper	Kg	933
Peas	Kg	3553	Maize	Kg	3560
Vetch	Kg	3470	Millet	Kg	3260
Linseed	Kg	5109	Check pea	Kg	3630
Sugar	Kg	3850	Garlic	Kg	118
Coffee	Kg	1103	Edible oil	Kg	8964

Source: EHNRI, 2000

Appendix 3: Conversion Factor for Adult-Equivalent (AE)

Age group	Male	Female
< 10	0.6	0.6
10_13	0.9	0.8
>13	1	0.75

Source: Storck *et al.*, 1991

Appendix 4. Sensitivity analysis for estimated ATT of calorie intake

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	0	0	2316	316	2226.5	2388
1.1	0	0	2287.5	2329.5	2209	2408.5
1.2	0	0	2268	2348	2181.5	2431
1.3	0	0	2247	2169	2169	22451
1.4	0	0	2227	2388	2158.5	2462
1.5	0	0	2219	2150	2150	2477.5
1.6	0	0	2204	2418	2130.5	2495.5
1.7	0	0	2181.5	2431	2119	2508.5
1.8	0	0	2170.5	2446.5	2104	2525.5
1.9	0	0	2166	2455	2089	2549
2.	1.1e-16	0	2158.5	2462.75	2069	2560
2.1	4.4e-16	0	2151.5	2472.5	2057.5	2573
2.2	1.90E-12	0	2144.5	2484	2049	2587
2.3	8.4e-15	0	2132	2493.5	2038.5	2605.5
2.4	2.9e-14	0	2121.5	2503	2022.5	2616.5
2.5	9.3e-14	0	2112.5	2514.5	2002	2625.5
2.6	7.1e-13	0	2104.5	2523.25	1993.5	2636.5
2.7	1.8e-12	0	2099.5	2534	1987	2650
2.8	3.70E-10	0	2082.5	2552	1979.5	2656
2.9	7.30E-10	0	2071.5	2556	1974.5	2666.5
3	4.2e-12	0	2066	2569	1971	2672.5

gamma - log odds of differential assignment due to unobserved factors

sig+ - upper bound significance level

sig- - lower bound significance level

t-hat+ - upper bound Hodges-Lehmann point estimate

t-hat- - lower bound Hodges-Lehmann point estimate

CI+ - upper bound confidence interval ($\alpha = .95$)

Appendix 5. Sensitivity analysis for estimated ATT of household asset

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	0	0	3673	3673	3566	3782.5
1.1	0	0	3647	3708	3522	3826
1.2	0	0	3618	3728	3487	3878
1.3	0	0	3599	3755	3455	3917.5
1.4	0	0	3566	3782	3420.5	3950
1.5	0	0	3549.5	3810.5	3995	3995
1.6	0	0	3509	3840	3331	4046.5
1.7	0	0	3486	3878	3290.5	4100
1.8	0	0	3458	3902	3250	4138.5
1.9	0	0	3446	3931.5	3193	4178
2.	1.1e-16	0	3419	3950.5	3160	4223
2.1	4.4e-16	0	3400	3981	3118.5	4253
2.2	1.90E-12	0	3357.5	4003.5	3081.5	4301.5
2.3	8.4e-15	0	3332.5	4045	3051	4345
2.4	2.9e-14	0	3295.5	4081.5	3002.5	4390
2.5	9.3e-14	0	3281.5	4108	2965	4418
2.6	7.1e-13	0	3251	4136.5	2948	4442
2.7	1.8e-12	0	3225	4156.5	2930.5	4455
2.8	3.70E-10	0	3187.5	4185	2906.5	4471
2.9	7.30E-10	0	3165	4211	2894.5	4491.5
3	4.2e-12	0	3145	4235	2861.5	4500

gamma	log odds of	differential assignment due to unobserved factors
sig+	upper bound	significance level
Sig-	lower bound	significance level
hat+	upper bound	Hodges-Lehmann point estimate
t-hat-	lower bound	Hodges-Lehmann point estimate
CI+	upper bound	confidence interval (a= .95)
CI-	lower bound	confidence interval (a= .95)

Appendix 6: Survey questionnaires

A. Identification particulars

1. Name of interviewee _____ 2. Name of Kebele _____ 3. Got _____
4. Name of enumerator _____ 5. Date of interview _____ 6. Signature _____

B. Household demographics

1. Current basic household information

S/N	Name of the families members	Sex	Age	Relationship to the head	Education
	A	B	C	D	E
1					
2					
3					
4					
5					

Codes b: 1. Male 2. Female

Codes d: 1.head 2.wife/husband 3. Son/daughter 4. Parent 5. Brother/sister

6. Other relatives 7. Not related

Codes e: 0 for illiterate, for other year completed

2. Total cultivated land _____ in hectares

Owned land _____ Rented in land _____ Rented out land _____ Shared in _____

Shared out _____ Total land size possessed _____ Rate of land rental _____ Birr/ Timad

C. About the program

1. Do you participate in PSNP? 1. Yes 2. No

2. What are the criteria of selection to participate in PSNP?

1) Income level 2) land hold size 3) family size 4) other specify

3. Do you know when the PSNP started? 1. Yes 2. No

4. Do you receive the PSNP transfer in the right time? 1. Yes 2. No,

If the answer is no, what are the coping mechanisms of food gap because of delayance?

1. Sale livestock 2 . Sale of assets 3. Migration 4. Other specify

5. Are you ready to graduate from the program? 1. Yes 2.No,

If the answer is no when you graduate from the program?

D. Some welfare and welfare change indicators

1. What do you say about your general living standard of today compared to before 2005?

1. The same 2. Deteriorated 3.Improved 4.Other

2. What improvement in service as compared to the situation before 2005 has been? Most useful to you? 1. New or improved roads 2. Better sanitation 3. Better water supply

4.Better health care 5.Better schooling 6.Better housing 7. None 8. Others

3. How do you cope with food shortage before 2005? 1. Relief aid 2. Borrowing 3. Gift 4. Migrate 5. Sale of assets 6.Others

4. Have you received food aid in times of food shortage? 1. Yes 2. No

5. Did any of your household members migrate during the worst period? 1. Yes 2. No

E. Consumption

1. What are the main sources of your income?

1. Sale of livestock 2. Sales of livestock products and by-products 3. Sale of crops and chat 4. Trade 5. Off farm/non farm activities 6. Others

2. What type of food item is your family mostly used to eat (staple food)? 1. Sorghum 2. Maize 3. Teff 4. Milk 5. Wheat 6. Barely 7. Others

3. How many meals per day did your household eat in the last week? 1. Once 2. Twice 3. Three times 4. As obtained 5. More than 3 times

4. Do you tell us the consumption of each of the food items in your family for the last week?

Food items consumed for the last week	unit	Quantity	Unit price	Total price	1. own 2. Gift. 3 loan 4. Purchased 5. aid
Sorghum					
Maize					
Wheat					
Peas					

Beans					
Chickpea					
Milk					
Butter					
Beef					
Egg					
Coffee					
Honey					
Sugar					
Oil					
Pepper					
Other pecify					

F. Crop production (rainy season)

1. Major crops grown, average area covered before the program 2005 and during the program 2016

No	Crop type	Before the program 2005		During the program 2016	
		Area(he)	Producton(Qt.)	Area(he)	Producton(Qt.)
1	Sorghum				
2	maize				
3	Wheat				
4	Chick pea				
5	Chat				
6	Ground nut				
7	Other specify				

H. Live stock production

1. Do you have own livestock? A) yes B) no

2. If the answer is yes, Livestock holding (number) per household head

No	types	Before the program(2005)			During the program(2016)		
		Quantity	Unit price	Total price	Quantity	Unit price	Total price
1	Ox						
2	Cow						
3	Heifer						
4	Calf						
5	Sheep						
6	Goat						
7	Poultry						
8	Donkey						
9	Bee Colony						
10	Other specify						

J. Credit service

Credit Access	Before the program(2005)	During the program(2016)
do you get credit services	A)Yes B) no	A)Yes B) no

K .Income generating activities (off-farm activities)

Description	Before the program(2005)	During implementation(2016)
Do you participate off-farm income generating activities?	A) yes B) no	A) yes B) no

L .Income and expenditure

1. Household Income

Description	Unit	2005			2016		
		Quantity	Unit price	Total value	Quantity	Unit price	Total value
AGRICULTURE							
Crop production							
Horticulture production (vegetable and fruit)							

Chat production							
Rearing & Selling animals(cattle, sheep,goat, camel)							
Selling animal products(meat milk, skin)							
Poultry rearing and sale(egg, chickens)							
Other specify							
EMPLOYMENT							
Public work(food for work& cash for work)							
Agriculture worker(cash or food)							
Non-agriculture worker(cash or food)							
Other employment specify							
TRADING (buying and selling)							
Trading chat							
Trading in livestock &livestock products							
SALE OF NATURAL PRODUCTS							
Selling firewood or charcoal							

2, Expenditure

Description	Unit	2005			2016		
		Quantity	Unit price	Total value	Quantity	Unit price	Total value
Food items							
Cereals							
Pulses							
Animal source							
Other							
Non food items							
Private goods							
Cloth and shoes							

Entertainment							
Public goods							
Kitchen equipment							
Furniture							
Building materials for house							
Ceremonial expenses							