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Analysis of Factors Influencing Smallholder Farmers' Participation in Tobacco Contract Farming and its Impact on Land Productivity. A Case of Hurungwe District, Mashonaland West Province, Zimbabwe.

By

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Dissertation Submitted in Partial Fulfilment of the Requirements of the Master of Science Degree in Economics

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Declaration

This Dissertation is entirely my own work and references have been made where other sources were used. I do hereby declare that this piece of work has not been submitted for the award of another degree at any University.

Signed:  Date: 22 July 2020

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Dedication

I dedicate this piece of work to my lovely family, mom and dad for the amazing and unending support they always give me.

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Abstract

This study used farm level data from Hurungwe district in Mashonaland West province of Zimbabwe to estimate a logistic regression to identify factors that influence smallholder farmers' decision to participate in tobacco contract farming. The results reveal that age and distance to the main road negatively influence while gender, farming experience, education level, access to internet and firm reputation positively influence smallholder farmers' decision to participate in contract farming. To determine the impact of contract farming on land productivity (yield per hectare) between contract farming participants and their counterparts who did not participate, the treatment evaluation model with the associated propensity score matching (PSM) was used. The model permits comparison in terms of yield per hectare between the two groups after controlling for other observable and non-observable smallholder farmer characteristics. The estimated results support the hypothesis that contracted tobacco farmers obtain higher yield per hectare than non-contracted farmers do. The study recommends that the government of Zimbabwe through the ministry of agriculture should create an environment comfortable for tobacco contracting firms and tobacco farmers to work together since tobacco contract farming increase farmers' yield. More so, policies that aim to encourage farmers' education and farmer's access to internet are important since educated farmers participate more in tobacco contract farming.

Table of Contents

Declaration i

Dedication ii

Acknowledgments iii

Abstract iv

List of Figures viii

List of Tables ix

List of Acronyms x

CHAPTER ONE 1

INTRODUCTION AND BACKGROUND 1

1.1 Introduction 1

1.2 Background to the Study 2

1.2.1 Contract Farming in Zimbabwe 2

1.2.2 The Nature of Contracts that exists between Firms and Farmers. 8

1.3 Research Problem 9

1.4 Research Objectives 10

1.5 Research Questions 11

1.6 Hypotheses 11

1.7 Rationale of the Study 11

1.9 Outline of the Study 12

CHAPTER TWO 13

LITERATURE REVIEW 13

2.1 Introduction 13

2.2 Contract Farming and its Role in Agriculture 13

2.3 Land Productivity 14

2.4 Theoretical Literature Review 14

2.5 The Incentive Structure within Contract Farming 16

2.5.1 Conceptual Framework on the Contracting Firm Decision to Initiate Contract Farming and the Farmers' Decision to Participate 16

2.6 Empirical Literature Review 19

2.7 Conclusion 24

CHAPTER THREE 25

METHODOLOGY AND MODEL SPECIFICATION 25

3.1 Introduction 25

3.2 Research Design 25

3.2.1 Sample Size and Sampling Procedure 25

3.2.2 Research Instruments 26

3.2.3 Pilot Testing 26

3.2.4 Ethical Considerations 26

3.2.5 Data Collection Procedures 26

3.3 The Empirical Model of Participation in Tobacco Contract Farming 27

3.3.1 The Logit Model 27

3.4 The Empirical Model of the Impact of Participation on Land Productivity 32

3.4.1 Propensity Score Matching (PSM) 33

3.4.2 Propensity Scores Estimation 33

3.4.3 Treatment/Impact Evaluation Model 33

CHAPTER FOUR 36

ESTIMATION, PRESENTATION AND INTERPRETATION OF RESULTS 36

4.1 Introduction 36

4.2 Descriptive Statistics 36

4.2.1 Contracting Firms and Proportion of the Participants in Tobacco Contract Farming 36

4.2.2 Descriptive Statistics for Continuous Variables 37

4.2.3 Summary Statistics for Categorical Variables 38

4.3 Pre-Estimation Tests 39

4.3.1 Multicollinearity Test 39

4.4 Post-Estimation Test Results 40
4.4.1 Goodness of Fit of the Logit Model 40
4.4.2 The Balancing Condition Property Check. 40
4.5 Econometric Results 40
4.5.1 Factors Influencing Smallholder Participation in Tobacco Contract Farming 40
4.5.2 Interpretation of Logit Marginal Effects Results 42
4.5.3 The Impact of Participation on Land Productivity (Yield per hectare). 43
4.5.4 Interpretation of Treatment Evaluation Results 44
4.6 Conclusion 44
CHAPTER FIVE 45
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS 45
5.1 Introduction 45
5.2 Summary of the Main Findings 45
5.3 Policy Implications and Recommendations 45
5.4 Limitations of the Study and Areas of further Research 46
References 47
Appendix A: Survey Questionnaire 52
Appendix B: Pairwise Matrix 54
Appendix C: Logit Model Results (Propensity Scores Estimations) 55
Appendix D: Marginal Effects of the Propensity Scores 55
Appendix E: Hosmer-Lemeshow Goodness of fit test of the Logit model 56
Appendix F: Treatment Effects Results 56
Appendix G: Balancing Condition Property Check 57

List of Figures

Figure 1: Number of Tobacco Contracting Firms and Tobacco Growers in Zimbabwe since 2005..... 3

Figure 2: Map showing the location of Hurungwe District in Zimbabwe..... 7

Figure 3: Number of Contracting Firms that farmers are Contracted with and Percentage of Contracted and Non-Contracted Farmers. 36

List of Tables

Table 1: Summary of Variable Definition and Measurement 32

Table 2: Descriptive Statistics of Continuous Variables 37

Table 3: Descriptive Statistics for Categorical Variables 38

Table 4: Matrix of Correlations 39

Table 5: Logistic Regression Output (Propensity Scores) 41

Table 6: Average Marginal Effects from the Logistic Regression (PS Marginal Effects) 41

Table 7: Treatment Effect Results using PSM 44

List of Acronyms

AfDBZ	African Development Bank of Zimbabwe
AGRITEX	Agricultural Technical and Extension Services
AME	Average Marginal Effects
ATET	Average Treatment Effect on the Treated
DID	Difference in Differences
FAO	Food Agricultural Organization
FCA	Foreign Currency Account
FGD	Focus Group Discussion
FTLP	Fast Track Land Reform Program
IE	Impact Evaluation
LPM	Linear Probability Model
MLE	Maximum Likelihood Estimation
NIE	New Institutional Economics
NNM	Nearest Neighborhood Matching
OLS	Ordinary Least Square
PSM	Propensity Score Matching
RBZ	Reserve Bank of Zimbabwe
TCA	Transaction Cost Approach
TCF	Tobacco Contract Farming
TE	Treatment Evaluation
TIMB	Tobacco Industry and Marketing Board
ZTA	Zimbabwe Tobacco Association

CHAPTER ONE
INTRODUCTION AND BACKGROUND

1.1 Introduction

Lack of effective agriculture sector financing[1]accompanied with low land productivity is one of the challenges that most developing African countries are facing (Food Agricultural Organisation, 2016). Contract farming is one prominent coping strategy that both developed and developing countries have adopted in a bid to address financial constraints smallholder farmers are facing (OYA, 2011). Parirenyatwa and Mago (2014) defined contract farming as agricultural production carried out according to an agreement between a farmer and a buyer which establishes conditions for the production and marketing of a farm product. Nguyen *et al.* (2015) argue that contract farming provides the much-needed farm inputs that are key to farmers attaining the highest possible yield from the area planted. Therefore, land productivity is expected to be positively related to contract farming. However, Khan *et al.* (2019) found no evidence of increased farm productivity due to farmers' participation in contract farming.

Contract farming in Zimbabwe has significantly increased as evidenced by the sharp increase in contracting firms from 6 in 2005 to 30 in 2019 (Tobacco Industry and Marketing Board, 2019). The different findings in empirical literature motivate the current study to probe into contract farming's effectiveness in improving land productivity in Zimbabwe. Identification of both factors influencing farmers' participation and the effectiveness of contract farming on land productivity would help all economic agents involved in the process and policy makers when formulating policies. On its development, contract farming was mainly for the growing of cash crops though it has been diversified to the growing of non-cash crops (Grosh *et al.,* 1996).

In Zimbabwe contract farming is dominant in tobacco farming where 80 percent of tobacco growing is done under contract farming (TIMB, 2018). Despite the benefits contract farming brings in agriculture, it is associated with delays in delivery or payment, lack of negotiation power, uncertainties in production and marketing (Rehber, 2007). These challenges are more prevalent in areas with high concentration of participating farmers. Tobacco contract farming is high in

[1] Support in the agricultural sector by financially assisting farmers resulting in achievement of intended objectives which are higher and quality output (FAO, 2016).

Mashonaland West province with Hurungwe district recording 36 percent of the total growers in the province (TIMB, 2019). This study therefore seeks to identify factors that influence smallholder farmers' participation in contract farming given the problems associated with it in Hurungwe District. The Tobacco Industry and Marketing Board (TIMB) annual statistics show considerable fluctuations in the land productivity of both contract and non-contract farmers. Fluctuations in land productivity permits this study to further investigate the impact contract farming has on land productivity.

1.2 Background to the Study

Despite the recent increased attention to contract farming in agricultural development strategies, it has been used as a mode of agricultural production for several decades in the developed world (Lindholm, 2014). Contract farming originated in North-American agricultural industry in the early 19th century and later spread to developing countries in the 1960s, with focus more on cash crops; though it was later diversified to non-cash crops (Watts, 1992). The emergence of contract farming in the African continent was partly due to the contemporary trend of nationalization of developing countries' agriculture sector which led to foreign companies to look for alternatives to direct ownership of farms (Minot, 2011).

According to FAO (2001), contract farming in Sub-Saharan Africa emerged to assist agricultural sector development through transfer of technology from the developed economies to the less developed African agricultural sector. In addition, contract farming came in to assist African countries to be food sufficient and reducing poverty as contract farming has potential to increase farmers' incomes (Warning and Key, 2002). However, some studies argue that emergence of contract farming in the Sub-Saharan Africa was as a result of an opportunity by contracting firms to make profit. Rehber (2007) argue that firms purchase agricultural products at very low prices which they process and sell at higher prices.

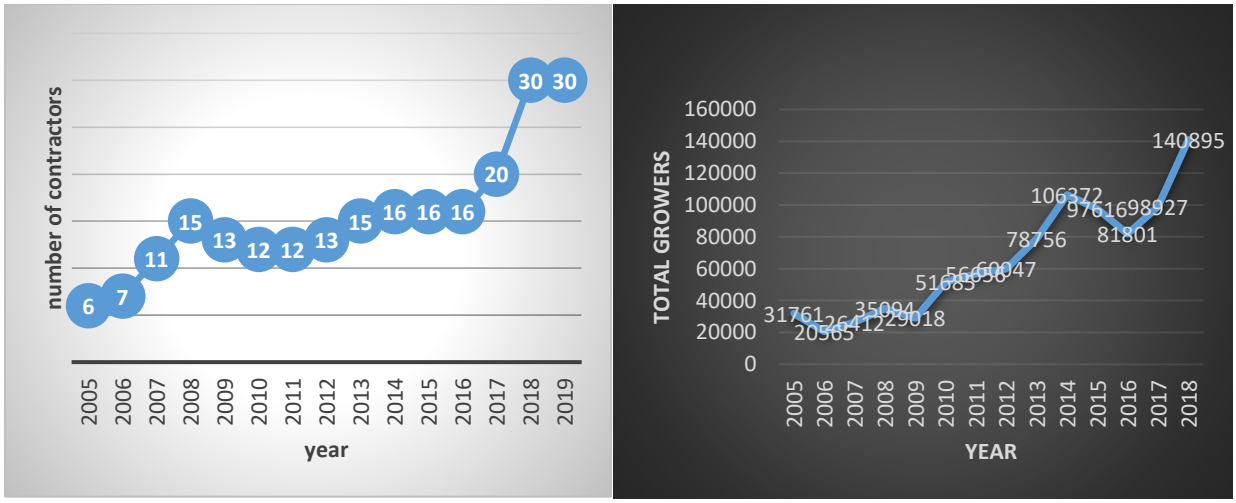
1.2.1 Contract Farming in Zimbabwe

Contract farming in Zimbabwe up-surged tremendously in early 2000s' in the farming of flue-cured tobacco and cotton. It was after the Fast Track Land Reform (FTLR) program when black farmers got access to land that they took to growing these cash crops previously predominantly

grown by large commercial white farmers (Parirenyatwa and Mago, 2014). Literature poses many reasons for the dominance of contract farming which includes collapse of crop pricing policy, depletion of government finances due to severe devaluation of Zimbabwean dollar, among others (Sachikonye, 2016). Therefore, tobacco contact farming came in to fill an existing gap in financing of small growers, the majority of whom had no collateral security to borrow directly from financial institutions (*Ibid, 2016*). *Prior* to the land reform program, 1 700 white commercial farmers produced about 237 million kgs of the golden leaf (ZTA, 2005). These white farmers could easily access loans from banks to finance the growing process.

Tobacco farming received more attention from both the contractors and the farmers for the product sell at a higher price on international market. In 2005, the British American Tobacco and Tian Ze Tobacco became pioneers to contract tobacco farmers under a centralized model[2] setup (TIMB, 2015). Tobacco contract farming has increased since its inception as evidenced by an increase in both contracting firms and number of participating farmers.

Figure 1: Number of Tobacco Contracting Firms and Total Number of Tobacco Growers in Zimbabwe since 2005



Source: TIMB, 2019

[2] Centralized model is one of the five models of contract farming that is commonly used for tobacco farming. The other models are Nucleus estate model, multipartite model, informal model and the intermediary model.

Figure 1 shows an increasing trend in the number of contracting firms registered by TIMB. Muroiwa *et al.* (2018) asserts that higher profits enjoyed by participating firms in tobacco farming attracts a number of firms to join as tobacco farming contractors. These contracting firms are differentiated oligopolists for they are several, each serving the same purpose but offering slightly different contracts to the farmers. The firms constitute 80 percent of tobacco growing and selling in Zimbabwe (TIMB, 2018). Minot (2011) pinpoints three types of contract farming offered by contracting firms. There is marketing contract that stipulates only sale and purchase conditions for tobacco from the farmers. Under marketing contract type, farmers carry out the whole farming process using their own inputs. This type of contract is more costly to the farmer since the contractor pays higher price only for quality tobacco. Quality control in tobacco farming is very difficult and farmers who join this type of contract usually suffer lower prices for their tobacco (TIMB, 2018).

However, farmers under marketing contracts are better off than any other farmers under the other types when they produce quality tobacco (TIMB, 2018). Marketing contract gives both parties the freedom to choose the best partners to sell to or buy tobacco from when the agreed purchase conditions are not met. For example, when the farmer fails to produce the required quality agreed with the contractors, she is free to look for a different contractor who requires that quality produce. Therefore, there is flexibility with market contracts. The most common type is the contract where production inputs are supplied by the contracting firm and the produce is purchased at pre-agreed prices. When farmers choose this type of contract, they are able to obtain the production inputs with less struggle (no need to look for finance) while having a guaranteed market for their tobacco. However, farmers face challenges with the whole growing process and labor costs are high in tobacco farming.

Total contracts also exist where the contracting firm supplies and manages all the production inputs on the farm and the farmer only supply land and labor (Rehber, 2007). Farmers under total contracts have less much work to do as they are closely monitored and assisted by the contractor. However, they enjoy less income since the contractors charge all the assistance provided to the farmer during the end of the season. The farmers' incomes are relatively lower compared to farmers under other types of contracts. Different conditions offered by these contracting firms

have implications on the farmers' decision to participate in contract farming and complying with the contract.

The motive for contracting firms as the key economic agent in contract farming is centered on profit maximization (Sukhpal, 2007). They achieve this objective by either minimizing costs or maximizing revenue. Cost minimization includes the firm offering lower price to the farmer and sourcing for production inputs at low costs. Revenue maximization entails the firm selling the product at a higher price on the international market. Lower prices offered by contracting firms to farmers act as an incentive for farmers to engage into side marketing, a practice by which farmers sell the tobacco to different contractors at a higher price (Rehber, 2007). In addition, the practices by contracting firms in a bid to achieve their objectives says a lot about their reputation which is one of the factors that influences smallholder farmers' participation in contract farming. Muroiwa *et al.* (2018) argue that contracting firms delay payment to the farmer after receiving the product which is a challenge that has long persisted in many contract farming agreements.

According to Muroiwa *et al.* (2018), the information that farmers have about the efficiency and effectiveness of the contracting firms influences their decision to participate in contract farming. The information is obtained either through experience in tobacco farming with regular encounter with the firms or through the internet where the farmers can easily learn about contract farming. The ability of the farmers to use the internet to learn about contract farming is based on their level of education. Therefore, farmers' experience, farmers' education level and access to internet become critical variables that influence the decision by farmers to participate in tobacco contract farming.

Smallholder farmers are economic agents that are also important in contract farming. They provide land, labor and other fixed equipment (Sambuo, 2014). These farmers have small pieces of land from as small as 1 hectare up to 10 hectares and most of the farmers are beneficiaries of the FTLRP. Most of the farmers depend on family labor which to a greater extent determines the output they produce. The more family members are in a household, the more labor force is available to help on the farm, *ceteris paribus*. Masangano *et al.* (2017) argue that rational farmers seek to produce maximum output per unit of inputs used which is obtaining the highest possible output from farms.

Productivity is one of the issues that FAO has made many efforts in addressing it in many developing countries.

Rising demand for agricultural land is of great concern in most developing countries, Zimbabwe in particular, where about 70 % of its population is in the agricultural sector. According to the Zimbabwe Ministry of Lands, Agriculture, Water and Rural Resettlement, there is high demand for land as citizens need land for farming. Achieving land productivity help the few farmers who get the land to maximize their yield, which after selling brings in foreign currency to the country and helps the nation at large. Farmers' relationship with the contractors is based on their decision to accept the offer made by the contractors based on the conditions they set. In an attempt to obtain higher output from the farmers, some contracting firms offer contracts to farmers with bigger land that enable them to produce higher quantities (Rehber, 2007). However, according to TIMB (2018), tobacco contract farming has been characterized by farmers with small pieces of land. Therefore, farm level characteristics is argued to determine contractual relationship that exists between the farmers and the firms.

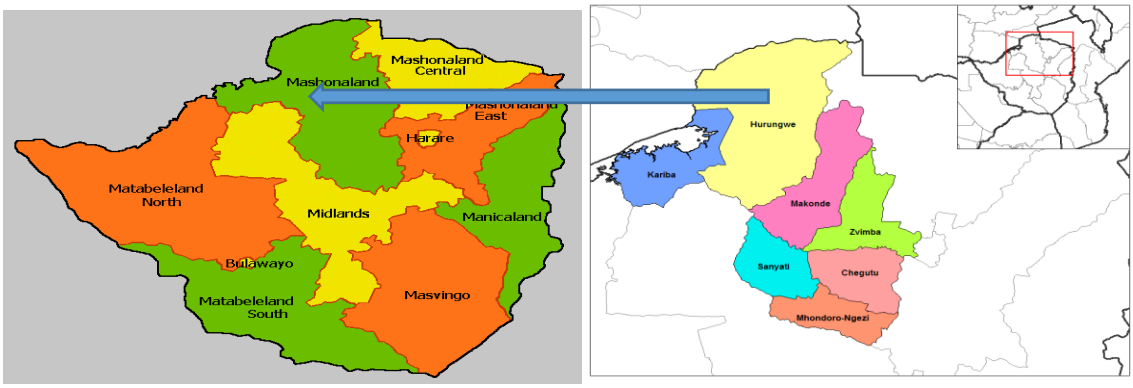
TIMB annual statistics indicate that smallholder farmers participate more in tobacco farming, some on commercial basis. The number of farmers participating in tobacco farming has significantly increased from 31 761 farmers to 140 895 farmers since the inception of contract farming in 2005 (TIMB, 2019).

Figure 1 also indicates the total number of farmers who have participated in tobacco farming since the year 2005. Despite a reduction in the number of growers in the year 2014 to 2016, the industry has shown a positive trend in tobacco farming. According to TIMB (2018), smallholder farmers accounts for 86 percent of the total tobacco growers. Tobacco crop grows well in loam soils and in areas that receive good rainfall. In Zimbabwe this is mainly in Agro-Ecological region 2[3]. Tobacco farming takes place largely in Mashonaland West Province. Amongst the 7 districts in that province, Hurungwe District has recorded the highest number of farmers who grow tobacco. During the 2018-2019 farming season, Hurungwe district produced 36 percent of the total tobacco produced in the province. Most parts of Hurungwe district fall in Agro-Ecological region 2 which

[3] Receives rainfall of about 750mm-1000mm per annum

is suitable for tobacco farming though some parts of the district overlap to other regions which are not suitable for tobacco farming.

Figure 2: Map showing the location of Hurungwe District in Zimbabwe



Source: Google Maps (2019)

Fig 2 shows the location of Hurungwe District which is located in Mashonaland West Province. Smallholder farmers in Hurungwe district have a wide spread alternative sources of income which include maize and soya beans production. Farmers therefore make their decision to concentrate in tobacco farming or maize production since the same province produces the highest maize in Zimbabwe (Dube and Mugwagwa, 2017). The two crops compete in the use of most resources in their production which are land, labor and fertilizer which are the main production inputs. The diversion of production inputs from tobacco farming to maize production affects the maximum possible yield that the farmer gets by the end of the growing season (Scoones *et al.,* 2018). Maintaining the leaf quality is one of the biggest challenges that tobacco farmers face. In addition, tobacco crop is too prone to diseases which make quality control a big challenge. Despite the challenges associated with its production, tobacco growing still records more farmers each growing season as indicated in figure 2.

The growing of tobacco in Zimbabwe involves a number of economic agents including commercial banks and the government. Though 80 percent of tobacco is grown under contract, commercial banks still play a critical role in offering loans to smallholder farmers with AgriBank, ADBZ and ZB bank being the leading banks in giving out loans to farmers. Loans are given to farmers with a good repayment record and collateral security. The conditions banks put when farmers apply for

loans are so stringent because there is high repayment failure (non-performing loans) in the agricultural sector since agricultural investments are affected by weather (Anifowose and Ladanu, 2015). Most of new participants in tobacco farming lack collateral security which makes it difficult for them to access loans for the first time. Therefore, according to TIMB (2019) weekly report, new tobacco farmers register with contracting firms in order to get financial assistance.

Henningsen *et al.* (2015) asserts that land (farm) productivity increases with availability of resources for the farmers to use on the farms. On the other hand, according to the theory of inverse relationship, land productivity decreases with increase in area planted, holding other things constant. Farm productivity is important for it leads to better competitiveness on the agricultural market to personal benefit of the farmers such as income, health and wellbeing as well as being able to increase the outputs of labor. Despite the increase in contracting firms in tobacco farming in Zimbabwe, yield per hectare has remained low.

1.2.2 The Nature of Contracts that exists between Firms and Farmers.

Centralized contract farming is the common type of contract farming that applies to tobacco farming and is popular in the Zimbabwe tobacco industry. According to Shasha Tobacco Company, the main duties of a contracting firm is to disburse tobacco production inputs to the farmers, offering of agronomic backstopping, collection and transportation of contracted bales of tobacco from farmers to the floors. In addition, contracting firms purchase the tobacco from the farmers at a price usually agreed before the contract commences. Contracting firms have negotiating power over the farmers as they provide the production inputs that are a challenge to the farmers (Rehber, 2007). Therefore, it results in contracting firms offering lower prices compared to the prices offered in the auction floors. Farmers on the other side of the contract, agree to the conditions set by the contracting firms. However, the relationship between the two parties consists of hidden information presented from both parties. The contractor may not reveal that she will delay payment after obtaining the product from the farmer. On the other hand, the farmer does not tell that he/she may engage in side marketing during the signing of the contract. All the practices occur after the contract has been entered into of which they affect both parties' willingness to engage into this contract given the actions of the other part after the contract is

signed. In addition, nature possesses some asymmetric information that is key to all parties' decision making before and after engaging into the contract.

Watts (1992), argues that farmers in some cases breach the contract by conducting side marketing where they get higher prices for their tobacco. When farmers do side marketing, firms loose. Policy change is one of the unforeseeable factors that affect efficiency of contracts that exists between firms and farmers. The 2018-2019 tobacco selling season was characterized by chaos between farmers and contracting firms due to changes in the agreed conditions during the growing season (TIMB, 2019). The Reserve Bank of Zimbabwe (RBZ) introduced a different payment system where farmers had to open foreign currency account (FCA) in which their payments for the tobacco sales were to be deposited by firms and collected in local currency. The policy changes affected farmers since they did not get the US dollars, they had agreed with contracting firms during the farming season. Both the farmers and the firms had no control over policy change but affects famers' decision to continue participate in contract farming.

1.3 Research Problem

Tobacco contract farming (TCF) is considered to be an effective farming arrangement that assists farmers in the growing of tobacco while farmers enjoy high incomes that come with the sale of tobacco (Nguyeni *et al.,* 2015). However, contract farming has its shortfalls that includes the contractor charging very high prices on the production inputs they supply to the farmer, delays in payment after the farmer delivers the product. Despite these shortfalls, there is increased number of farmers participating in TCF each farming season in Zimbabwe. There rise issues of research interest as to why farmers are participating more in TCF given these challenges associated with it? Addressing this question requires an investigation of what influences farmers' decision to participate in TCF. At theory level, the Principal-Agent theory argues that the decision by the agent (farmer) to participate or accept a contract is centered on the wage (benefits) offered by the principal (contractor) that maximizes his/her utility (welfare). Empirically, Kagwirira and

Gichucki, (2017) and Huffman *et al.* (2002) argued that participation by farmers in contract farming is determined by demographic[4], economic[5] and farm level characteristics[6] factors.

The current study adds reputation of the contractor as a factor influencing smallholder farmers' decision to participate in TCF, which has not been considered by existing empirical literature. The 2018-2019 tobacco-selling season was characterized by delays in payment to farmers by contractors and the change in the agreed predetermined price in USD (TIMB, 2019). The observed changes in the conditions of the contracts agreed upon between contractors and farmers has serious implication the contractors' reputation which influences the decision by the farmer to participate.

Contract farming is argued to improve farmers' yields since it transfers technology into the agricultural sector (Lindholm, 2014). The Zimbabwe Tobacco industry has been characterized by an increase in TCF with an aim to assist farmers with resources while improving their yields. However, on average farmers' yields (per hectare) has remained low since the inception of TCF in Zimbabwe averaging 2 000 kilograms of tobacco per hectare lower than the recorded 6 000kgs commercial farmers harvested (TIMB, 2018). The increase in total harvest of tobacco every year is as a result of increase in the number of farmers participating in tobacco farming (TIMB, 2018). It therefore raises issues of research curiosity and matter of policy concern as to why yield per hectare (land productivity) has remained low regardless of increase in TCF? Is it that the provided production inputs are diverted for the intended use? These questions call for investigation of the impact of TCF on farmers' yields. Investigating the impact of TCF on farmers' yield is an extension on the factors influencing the decision to participate, that most empirical literature focused on.

1.4 Research Objectives

The objectives of this study are in two-fold:

[4] Age and sex of the farmer which determines their ability to provide labor.

[5] The farmers level of income and their access to credit facilities.

[6] The size of the farm and nearness to the main road

- To identify factors that influence smallholder farmers' decision to participate in tobacco contract farming.
- To estimate the impact of participation in tobacco contract farming on smallholder farmers' land productivity (yield per hectare).

1.5 Research Questions

This research questions of this study are in two-fold:

- What are the factors that influence smallholder farmers' participation in tobacco contract farming?
- What impact does involvement in tobacco contract farming has on farmers' land productivity?

1.6 Hypotheses

- Economic, social, demographic, infrastructural and farm level characteristics significantly affect smallholder famers' decision to participate in tobacco contract farming.
- Participation in tobacco contract farming has a positive impact on the smallholder' yield per hectare.

1.7 Rationale of the Study

TCF in Hurungwe district has the ability to improve farmers' yields and improving their standards of living. Identification of factors influencing farmers' decision to participate in TCF would enable policy makers to formulate and implement appropriate policy responses that promote farmers to grow tobacco under contracts. Even though this study is carried out in Hurungwe district, the findings of the study will give insights on the policies that can be put forward in order to encourage farmers to engage into TCF so that their yields improve. If this study is not carried out, both parties (farmer and contractor) may not be aware of the issues that hinder the success of their contracts. Failure in TCF not only affect the farmer and the contractor alone, but the whole nation since tobacco is the highest agricultural foreign currency earner product in Zimbabwe.

1.8 Methodology

This study uses both theoretical and empirical literature to address factors that influence smallholder farmer's participation in tobacco contract farming and the impact of participation on land productivity. In order to address the first research objective, the study uses a binary choice model (Logit model)[7] which is specified to estimate factors influencing smallholder farmers' participation in tobacco contract farming using primary data. The treatment evaluation model associated with the Propensity Score Matching (PSM) is specified to estimate the average benefit of participation in tobacco contract farming in terms of yield per hectare as it best addresses the second research question.

1.9 Outline of the Study

Chapter Two gives both theoretical and empirical review of the study. Chapter Three presents the methods and procedures used while Chapter Four outlines the results and interpretation of the estimated results. Chapter Five summarizes the study, outlines policy recommendations and suggests areas for further research.

[7] Logit model is a binary choice model with a discrete dependent variable taking value of 1 for probability of success or 0 otherwise (Greene, 2012)

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents theoretical and empirical literature review which help us to develop a conceptual framework for the specification of an estimable empirical model of factors influencing smallholder farmers' choice to participate in tobacco contract farming and its impact on land productivity.

2.2 Contract Farming and its Role in Agriculture

According to FAO (2001), contract farming is an agreement between farmers and processing or marketing firms for the production and supply of agricultural products under forward contracts. Well-managed contract farming is an effective way to coordinate and promote production and marketing in agriculture (Nguyeni *et al.*, 2018). It is an approach that can contribute to both income for farmers and higher profits for contracting firms. The process is comprised of three key economic agents which are the farmers, the contracting firm and the government.

The Farmer

Farmers are the most important economic agents in a contract farming set up for they provide land, buildings and other fixed equipment necessary but not sufficient for the production of tobacco (Rehber, 2007). The quantity and quality of tobacco harvested by the end of the season heavily depend on the level of effort farmers put during the faming season. Farmers have their objectives when they engage in farming. Rational farmers seek to get the most possible output per unit of inputs used. When farmers produce high output from the inputs they are given, they can fetch a high income which improves their welfare. High income also implies improved standards of living and reduction in poverty levels.

The Contracting Firm

Contracting firms provide production inputs and technical assistance to the farmers with an objective to maximize profit. The firm achieve this by either minimizing costs or maximizing revenue. These contracting firms do not have control over international prices. Therefore, they

seek to minimize costs through offering low predetermined tobacco price per kilogram which is part of its cost and look for higher price on international market in order to maximize revenue.

The Government

The role of the government and local agencies in enabling regulatory and developmental aspects are vital for successful contract farming (Rugimbana, 2008). The role of the government in contract farming is to regulate the relationship between the farmer and the contractor. In Zimbabwe this is done through the Tobacco Industry and Marketing Board under which the contracting firm has to be registered with. The government also levy some taxes from all the parties, raising its revenue. It is the role of the government to allocate land to the farmers and offering extension services that help farmers in managing their farms in a bid to achieve high and quality output (FAO, 2001).

2.3 Land Productivity

Land productivity which is also referred to as crop or farm productivity measures the amount of output that farmers obtain from a certain piece of land under use (Heady, 1965). It is commonly used in the context of cropping activities though it can be extended to livestock production. In the context of tobacco farming, land productivity measures the number of kilograms of tobacco a farmer obtains from the planted area. In this study, land productivity looks at the average kilograms of tobacco per hectare.

$$land\ productivity = \frac{volume\ of\ output(kgs)}{area\ planted(hectares)}$$

2.4 Theoretical Literature Review

The Transaction Cost Approach

The Transaction Cost Approach (TCA) explains the existence of transaction cost that firms incur in the marketing and production of products in the economy. Ronald Coase founded the TCA in 1937 in his famous article explaining why firms exist. The theory was later developed by Williamson and North in 1990 as a component of New Institutional Economics (NIE). According to Williamson (1975), when firms find it expensive to acquire a product on the market than producing it, they vertically integrate into the production of the product. The theory has been adopted in empirical literature to explain contract farming as both the contracting firm and the famer incur transactional costs if they act independently (Man *et al.,* 2017). Contracting firms in

agriculture face higher prices when they intend to acquire a product in the market than the prices they face when they vertically integrate with the farmers. The high prices contracting firms pay in the market make them engage with farmers, initiating contract farming. On the other hand, farmers also face difficulties in accessing the required production inputs that make them accept offers given by contracting firms.

Contracting firms as cost minimizers set out conditions under which the farmer has to comply with. Farmers on the other hand also consider the benefits they will derive by entering into the contract. The information asymmetries that exist on both parties about their behavior before and after entering the contract lead them to set conditions under which every part has to agree to, before the contract commences. The Principal-Agent approach best explain the contractual relationship that exist between two parties under information asymmetry.

The Principal Agent Theory

The Principal-Agent theory forms the basis for the explanation of optimal contractual relationship that exists between economic agents given prevailing information asymmetries and the agents' risk aversions (Mas-Colell *et al.,* 2011). The theory was first developed by Stephen Ross and Barry Mitnick and was later improved by an American financial economist Michael C Jensen and William Meckling in their 1976 paper about "theory of the firm, managerial behavior, agency costs and ownership structure." The theory is used in literature in many academic fields to explain relationship among parties involved in a contract. The theory is also used in contract farming to explain the relationship between the contracting firm (Principal) and the farmer (Agent). The contracting firm in this context provides the much-needed inputs to the growing of tobacco and therefore it is referred to as the principal. On the other hand, the farmer makes a decision to accept or reject the financial assistance from the contracting firm and therefore it is the agent (Rehber, 2007).

The contracting firm provides tobacco seeds, fertilizer, pesticides and extension services to the farmer. In return, the farmer carries out the whole growing process till tobacco is harvested. Tobacco yield obtained does not only depend on the resources provided by the firm, but on the effort the farmer puts and state of nature. The effort farmers put is in most cases unobservable

before the contract starts and presents information asymmetry. The presence of information asymmetry makes the Principal Agent theory appropriate in addressing the relationship that exists between the firm and the farmer.

2.5 The Incentive Structure within Contract Farming

The incentives embedded within contract farming motivates both parties to participate in contract farming. Firms have the advantage of obtaining tobacco at a lower price compared to market price. In Zimbabwe, tobacco is the highest agricultural crop that sells internationally at a high price. Firms gain high foreign currency and profits when they sell the product. On the other hand, farmers in contract farming have a ready market as the firms buy all the tobacco harvested. Farming becomes easier and less costly as farmers obtain production inputs on credit basis from the firms.

2.5.1 Conceptual Framework on the Contracting Firm Decision to Initiate Contract Farming and the Farmers' Decision to Participate

In most cases, contracting firms are the ones that initiate contract farming as they identify the opportunity to reap profits from entrusting their resources with the farmers (Rehber, 2007). The farmers then make a decision to participate, receiving a compensation to meet their needs and improving their welfare. In this contract, farmers' type may be observable or unobservable. Farmers' type is observable when the firm knows about the capabilities of the farmer. This includes the farmers' level of effort they put in tobacco farming. The firm can only identify these observable characteristics on farmers' history about their participation, quantity and quality of tobacco the farmers produced in the past farming seasons. When the farmers type[8] is observable, the firm can design and enforce a contract where the farmers' wage (price of tobacco) and benefits the farmer may get are agreed before the start of the growing season. The farmer's level of effort is also key to attainment of farm productivity. High effort is correlated with high productivity while low effort is associated with low productivity (Henningsen *et al.,* 2015).

When the firm cannot observe the farmers type, the benefits the farmer obtains will depend on their output they produce by the end of the growing season. The farmer will be paid according to the output and the quality of their tobacco for the price cannot be agreed prior to growing season.

[8] Whether the farmer exerts much effort in the whole farming process till harvesting or shirks

The firms' objective when engaging into contract farming is to maximize profit. However, profits are not known with certainty since they depend on the agents' effort and the state of nature[9]. Therefore, the firm seeks to maximize expected profits. The firms' objective function is expressed as:

$$\underbrace{max}_{w(\pi),e\in[e_H,e_L]} \int_{\pi_L}^{\pi_H} [\pi - w(\pi)] f(\pi|e) d\pi \dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Farmers' Decision to Participate in Contract Farming.

According to the Principal-Agent theory, the decision by the farmer to participate or accept the offer given by the contracting firm is based on the Participation Constraint (PC) and the Incentive Compatibility Constraint (ICC) (Kvaloy, 2006). The participation constraint makes the farmer accept the offer if and only if the expected utility from the contract is at least equal to the farmers' reservation option. In this context, we assume farmer derives utility from the return they obtain from tobacco sales. The benefits a farmer derives from participating in contract farming does not only depend on the contracting firm offering higher price per kilogram but also on the farmers level of effort that determines the output he obtains. If the farmer puts high effort (e_H) ceteris paribus, he obtains a big harvest. On the other hand, if the farmer chooses to put low effort (e_L) the harvest will be little affecting both the farmer's benefits and the contracting firm's expected profits.

The farmer chooses to participate in contract farming if the benefits derived from participating are at least as good as his outside option. The farmer's outside option is the benefit he derives from growing and selling tobacco outside contract farming. The farmers' participation constraint can have the following representation:

$$E[u,e] = \int_{\pi_L}^{\pi_H} v[w(\pi)] f(\pi|e) d\pi - g(e) \geq \overline{U} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

[9] State of nature refers to conditions that both the parties cannot control like unexpected changes in the average weather.

Where $E[u, e]$ is the farmer's expected utility that is conditioned on the level of effort the farmer puts and $g(e)$ is the cost the farmer incurs. Farmers' costs in this context refers to economic costs. Farmers' costs encompass most of the factors that influence their decision to participate in tobacco contract farming. These costs include labor available to conduct the growing process, costs of acquiring information and knowledge about tobacco farming either by acquiring educational training or through searching from internet. The wage or prices that the contracting firm offers also depends on the level of expected profit it gets. $\overline{U}$ is the farmers' outside option[10]. Equation (2) states that in order for the farmer to accept the offer given by the contract farming, the contracting firm must give a better offer[11] than the farmer would get if he does not participate.

After the farmer decides to participate in contract farming, the contracting firm must offer a compensation wage[12] that induces the farmer to put the required level of effort (e_H) of which in most cases it is the contracting firm's desire that the farmer works hard. The favorable compensation wage could be free transport cost to the market or offering and additional dollar on the agreed price. The Incentive Compatibility Constraint is given by the following equation:

$$e = \arg\max \int_{\pi_L}^{\pi_H} v[w(\pi)] f(\pi|e) d\pi - g(e) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Equation (3) simply say the contracting firm (Principal) has to offer a compensation wage that induces the farmer (Agent) to put the level of e_H that the principal requires. The relationship between the principal and the agent can be represented in a more formal form as:

$$Max\ E(\pi/e) = P_H(\pi_H|e_H) + P_L(\pi_L|e_H) - w_H \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Subject to

$$w_H - g(e_H) \geq \overline{U} \dots\dots\dots\dots\dots\dots\dots\dots PC \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (5)$$

[10] Outside option is the benefit that the farmer derives from growing tobacco outside contract farming which can be referred to as opportunity cost.

[11] Better offer in terms of enough tobacco seed, fertilizers, pesticides, extension services and higher price for the output

[12] Compensation wage a tobacco farmer is interested in is a higher price per kilogram that the contracting firm is offering.

$$E[u(w|e_H)] \geq E[u(w|e_L)] \ldots\ldots\ldots\ldots\ldots\ldots ICC \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Equation (4) is the firms' profit maximizing problem where P_H is the probability that the firm will get high profit and P_L is the probability for occurrence of low profit. P_L is also given as $(1 - P_H)$ Equation (5) is the farmer's participation constraint and equation (6) is the incentive compatibility constraint. In this study, we only consider that the firm is concerned about getting a higher profit for simplicity and convenience.

2.6 Empirical Literature Review

Empirical literature poses different views and findings on factors influencing farmer's participation in contract farming. This led to some studies to concentrate on factors influencing smallholder farmers' participation (Kagwiria and Gichuki, 2017; Sambuo, 2014; Muroiwa *et al.*, 2018). Few studies in Zimbabwe, (Dube *et al*, 2017, Muroiwa *et al*. 2018, Scoones *et al*., 2015) examined TCF but did not consider implications of participation it has on land productivity unraveled. Most studies found that the smallholder farmers' decision to participate in contract farming is influenced by demographic, infrastructural and farm level characteristics. The demographic characteristics comprise of gender, marital status and farmers experience, education level while infrastructural characteristics include access to electricity and road network. Farm characteristics covers land ownership and land size. Following the argument of the Principal-Agent, the farmer incurs costs in a bid to acquire knowledge about contract farming by either getting education or accessing it through internet. These costs reduce the benefits that the farmer derives by joining TCF. The current study adopts education level and access to internet as variables that captures the cost that the farmer incurs when it engages in contract farming. More so, the current study adds reputation of the contracting firms as an additional variable influencing participation in contract farming since contracting firms have a tendency of plundering the farmer. The way the contractor treats and honors that contractor might have serious implications on the decision by the smallholder farmer to participate in TCF.

Using the transaction cost theory in explaining contract farming, Randela *et al.* (2010) carried out a study in Mpumalanga, South Africa to investigate factors that influence small scale farmers'

participation in contract farming. Primary data collected from 117 small scale farmers was used and the logistic regression results indicated that age, access to credit, distance to market and land size had positive influence on farmers, participation in contract farming. Similar study can be conducted in Zimbabwe in identification of factors influencing participation in contract farming. The current study focuses on a specific product (tobacco) grasping the concept of transaction cost that farmers incur when they intent to do farming using their own resources.

There are mixed findings in empirical literature on the impact of contract farming on farm productivity. Hamidi (2010) investigated the impact of contract farming on the profit of Virginia tobacco farming in Indonesia using survey data of 147 farmers. By using profit function analysis, the study concluded that contract farming positively affected the profit of farmers. Despite many studies finding positive relationship between contract farming and farm productivity, there are some studies that argue for no evidence of increase in farm productivity as a result of participating in contract farming. Mwanselle (2010) carried out an economic analysis of contract farming for small-scale tobacco farmers in Songea district of Tanzania. The objective of the study was to assess the influence of contract farming on tobacco harvest among other objectives. Using a sample of 112 tobacco farmers, the study found no significant difference in farmers' yields between contracted and non-contracted farmers. Regardless of efficiency and productivity being closely related, Begum *et al.* (2012) carried out a study on the impact of contract farming on farm productivity and efficiency in Bangladesh and found contract farming having no impact on farm productivity but increasing farm efficiency. The findings in literature motivates further investigation on the impact contract farming has on farm productivity as its existence in Zimbabwe is becoming more popular regardless of observed decrease in average kilograms per hectare farmers are experiencing. More so, the current study focuses on land productivity alone which is a subset of farm productivity[13].

Analysis of factors influencing participation in contract farming and the implication of that participation on farm productivity is very crucial in the agricultural sector. Identification of the factors influencing participation in contract farming presents important policy variables that help the government in policy making when it wants to stimulate productivity in the agricultural sector.

[13] Farm productivity is a universal measure of land (crop and livestock), labor and capital productivity.

Guo *et al.* (2006) explored determinants of tobacco contract farming in China using primary data collected from Shangdong provinces. The study was qualitative in nature and the analysis concluded that market access, credit support were the key factors motivating farmers to participate in contract farming. The current study employs both qualitative and quantitative analysis in identifying factors influencing participation in TCF. Focusing on participation in TCF may not be interesting for policy analysis, however identifying the implication contract farming has in the agricultural sector may give richer policy implication on the success of agricultural sector. For this cause, the current study investigates jointly the factors influencing participation and the impact contract farming has on land productivity which is a different dimension compared to existing literature on tobacco contract farming in Zimbabwe.

The techniques used to estimate the effect of participation in contract farming on farm productivity in most contract farming studies are not convincing to address the study objectives and answer the posed research questions. Descriptive statistics used by Mambo *et al.* (2017) to analyze the effect of tobacco contract farming on the welfare of smallholder farmers in Angonia district in Mozambique might be biased as it uses summary statistics to draw conclusions on the effectiveness of a policy. The study concluded that TCF was dysfunctional as it failed to improve farmers' welfare. Appropriate econometric techniques may be used for better and clearer results in estimating the average benefit of participating in contract farming relative to non-participating smallholder farmers.

The use of treatment effects model and the propensity score matching technique best address experimental research questions, in particular when there is no need for randomization of selecting members belonging to the control and treated group (Cameron and Trivedi, 2009). Impact evaluation models best address the effectiveness of a policy or a program between a treated and control group (Green, 2012). The experimental objective is to determine the average impact in terms of land productivity in contract farming relative to non-contract farming. Treatment effects model compares the average land productivity (in terms of kilograms per hectare) of smallholder farmers who participated in tobacco contract farming and of those who did not participate after controlling for other observable and unobservable explanatory variables using the Propensity Score Matching technique. Few studies used treatments in estimating the effectiveness of contract

farming in agricultural sector between participants and non-participants and this study employs it in addressing the second research question outlined in chapter one of this study.

Some studies carried out on tobacco contract farming focuses on its impact on farmers welfare which is complex and difficult to capture in one index. Welfare of farmers constitute of income, reduction in poverty, food security and health status which cannot be measured by one index. Mambo *et al.* (2017) explored the relationship between tobacco contract farming and smallholder farmers' welfare in Mozambique using descriptive statistics for analysis. The study used primary data from 359 randomly selected farmers in Angonia district and found contract farming to be dysfunctional as it fails to improve the welfare of farmers. Examining the impact of contract farming at a micro level focusing on land productivity becomes more relevant as it gives a better analysis. Use of better econometric models and estimation techniques improves results compared to basing results on descriptive statistics. In their 2009 microeconometrics publication, Cameron and Trivedi proposed the use of treatments evaluation models to be best in analyzing the benefits of a particular project between participants and non-participants. This study employs the treatment effects model and propensity score matching in finding out impact contract farming has on participants and no-participants.

Shaffril *et al.* (2009) carried out a review of contract farming and factors that impinge youths' acceptance to contract farming in Malaysia. The review showed that knowledge, attitude, involvement in agricultural activities (farming experience), gender, age, education and income levels are the influencing factors in contract farming participation. The study was based on collection of already carried out studies in identifying factors influencing participation. Drawing conclusions basing on review of already done studies may not be convincing since the studies were carried out in different countries and of course in different crops under study. The current study employs an econometric analysis (logit model) in finding out factors that have significant importance in influencing participation in contract farming focusing on TCF. Looking at different dimension by still reviewing already done studies to draw conclusions, Nguyeni *et al.* (2015) analyzed whether contract farming improve farm productivity and income of farmers by collecting 23 studies from developed and developing countries. Out of the 23 studies, 11 studies were on impact of contract farming on productivity while 12 studies focused on farmers' incomes. The

findings of the study were that contract farming increases farm productivity after review of already done studies. The current study uses survey data and employs econometric estimation technique to draw factors influencing participation and the impact of TCF on yield.

Few studies have narrowed down to examine the impact of contract farming on land or crop productivity. Henningsen *et al.* (2015) used cross sectional data from sunflower farmers in Tanzania to determine the effects of contract farming on efficiency and productivity of small-scale sunflower farmers in Tanzania. The study found a significant selection bias. Contracted farmers had a significant increase in yield potential but with lower technical efficiency compared to non-contracted farmers. The current study looks at the factors influencing participation and further narrows the study to find the impact contract farming has on farm productivity.

There are few studies carried out in Zimbabwe on contract farming despite its increased acceptance by farmers. Dube *et al.* (2017) examined the impact of contract farming on smallholder tobacco farmers' incomes in Makoni district of Manicaland province in Zimbabwe. Using a Tobit regression model, the study found no significant effect of contract farming on farmers' incomes. Another study carried out by Muroiwa *et al.* (2018) focused on factors influencing smallholder farmer participation in tobacco contract farming arrangements in Mount Darwin district of Zimbabwe. The explanatory variables included in the study were gender, marital status, education level among others, which were analyzed using the logit model. In another study, Musitini *et al.* (2018) focused on the factors influencing efficiency and productivity of contracted and non-contracted tobacco farmers in the same district (Mount Darwin) using cross sectional primary data. The study employed the Data Envelopment Analysis (DEA) to estimate efficiency scores while Tobit model censored to zero was used to evaluate the determinants of efficiency among contracted and non-contracted farmers. The results from the study showed that contracted farmers were more productive and efficient than non-contracted farmers. The existing literature in Zimbabwe did not consider the impact contract farming has on land productivity which the current study seeks to examine. Rational farmers seek to get the best output from the input mix they use so as to attain high incomes, profits, expansion and attaining a better welfare (Soullier and Moustier, 2018). Addressing productivity in tobacco farming is not only key to the farmers, but to the country as a

whole as Zimbabwe is an agricultural backed economy. In addition, the current study adds to the few existing empirical literature on TCF in Zimbabwe.

2.7 Conclusion

The literature review and conceptual framework discussed in this chapter indicated the main factors influencing smallholder farmers' decision to participate in tobacco contract farming categorized into demographic, economic and farm level characteristics. This study adds reputation of the contracting firm as a new factor left out in the existing empirical literature which influence the decision by smallholder farmers to participate in tobacco contract farming. In addition, the discussion in this chapter indicates that treatment evaluation and propensity score matching are better tools to address the research questions. The next chapter outlines the methodology and estimation techniques used in the study and presentation of estimable model specification.

CHAPTER THREE
METHODOLOGY AND MODEL SPECIFICATION

3.1 Introduction

This chapter specifies the empirical models used to estimate the factors influencing smallholder farmers' decision to participate in TCF and its impact of farm productivity. The data collection methods used, sampling procedures, sampling size, econometric methods and the estimation techniques employed are also outlined and discussed.

3.2 Research Design

3.2.1 Sample Size and Sampling Procedure

A sample is defined as a set of individuals with the same characteristics, selected to represent a statistical population by a certain procedure (Amemiya, 1994). Use of a sample instead of population in research help to reduce financial costs and time needed to complete the survey (*ibid*, 1994). Hurungwe district has a number of approximately 37 446 registered tobacco farmers (TIMB, 2019). In order to determine the required sample, the study employed the Cochran's (1977) formula for sample size determination presented as;

$$n = \frac{z^2 pq}{e^2} = \frac{2.57^2(0.5)(0.5)}{0.10^2} = 165 \text{ farmers.}$$

where n is the sample size, z represents the critical value 2.57 at 99 % confidence interval, p is the proportion of the smallholder farmers participating in tobacco contract farming. According to Cochran (1977), if this proportion is not known with certainty it must be assumed to be half of the population. Therefore $p = 0.5$ while $q = 1 - 0.5 = 0.5$ which is the proportion of smallholder farmers not participating in tobacco contract farming. e is the allowable error equal to ± 10%.

The researcher randomly selected three wards (Kapfunde, Kanyati and Dandahwa) out of twenty-one wards in Hurungwe District which had high tobacco farmer concentration (TIMB, 2019). According to TIMB (2018), Hurungwe District is the highest District in Mashonaland West Province that produces more tobacco. Since the 2015/2016 farming season, it has been producing about 36 % of the total tobacco in the province. The study employed one-stage cluster sampling technique where the population is divided into three clusters (three wards – Kapfunde, Kanyati and Dandahwa). The awards have approximately equal number of registered smallholder tobacco

farmers. An equal number of farmers (55 in each ward) were then randomly selected from each cluster (ward) for interviews.

3.2.2 Research Instruments

The research was conducted using structured questionnaires administered directly to the farmers in Hurungwe District during the first week of June 2020. Open-ended questions given to the respondents (smallholder farmers) enabled them to respond in their own words providing detailed information about the research. During the data collection process, a Focus Group Discussion was used to gather information about the target farmers.

3.2.3 Pilot Testing

Teijlingen and Hundley (2002) stressed the importance of conducting a pre-test in any field research. Pilot testing identifies potential practical problems the researcher may encounter during the interviews. In addition, it indicates expected time needed to complete each questionnaire and the overall time needed to complete the whole survey (*ibid*, 2002). According to Mugenda and Mugenda (1999), a pretest sample should range between 1 to 10 percent depending on the sample size used. In the current study, a pretest sample of 17 questionnaires was used which is 10 percent of the sample size (165) under one key informant group and one Focus Group Discussion in Kapfunde area, ward 7 of Hurungwe District.

3.2.4 Ethical Considerations

According to Glattke (2007), ethical considerations are the most important parts of research. The researcher sought guidance from the supervisor from the Economics Department, University of Zimbabwe as well as approval from the local leadership in Hurungwe District. The researcher approached the local chiefs, village heads and the local department of agricultural technical and extension services (AGRITEX) for permission to conduct the survey. At the farm level, consent from the farmer was sought accordingly and confidentiality of the response assured.

3.2.5 Data Collection Procedures

The data was collected from the farmer as a sampling unit. The researcher collected the data from smallholder farmers in Hurungwe District with the help of two research assistants who were

educated on the subject matter and data collection procedures. Checking of omission errors, commission and completeness of the questionnaire was done during the interview process. Farmers were interviewed in their local language, which is *Shona* for better understanding and clarity of the questions. The collected data was entered and stored in excel sheet.

3.3 The Empirical Model of Participation in Tobacco Contract Farming

The dependent variable on the factors influencing farmer's decision to participate in tobacco contract farming is binary (participate =1, 0 otherwise). The use of linear estimation techniques for example Ordinary Least Squares (OLS) or Linear Probability Model in case of a binary dependent variable yields biased results. Linear estimation may yield probabilities that lie outside the reasonable range of between zero and one which is nonsensical. Therefore, the Maximum Likelihood Estimation (MLE) techniques (e.g. Probit and Logit) are appropriate in estimating the factors influencing smallholder farmer's decision to participate in tobacco contract farming (Cameron and Trivedi, 2009). The choice between Probit and Logit model does not matter as the models yield quantitatively similar results where $\beta_{logit} = 1.6\beta_{probit}$ or $\beta_{logit} = 1.8\beta_{probit}$ when the data are centered on the mean or zero respectively (Amemiya, 1985). The current study employed the Logit model in answering the first research question on identifying factors that influence smallholder famer's decision to participate in tobacco contract farming.

The conceptual framework outlined in the preceding chapter allows us to model smallholder farmers' decision to participate in tobacco contract farming using the Logistic regression model since farmers either participate in contract farming or carryout their farming independently.

3.3.1 The Logit Model

The logit model addresses problems of using Linear Regression in case of a binary dependent variable by using a different distribution to the Bernoulli distribution, where the relationship between explanatory variables and probability is non-linear and probability is always between 0 and 1. According to Greene (2012), a binary choice model is the best model to use when we have a binary dependent variable (takes two values). Having the basic regression model given by;

$$Y_i = \alpha_0 + \alpha_1{}'X_i + \varepsilon_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (7)$$

Where $Y_i = \begin{cases} 1\ if\ farmer\ participates \\ 0\ if\ farmer\ does\ not \end{cases}$

X_i represents all the explanatory variables included in the study. α_0 is the intercept while α_1 represents slope coefficients. The probability that the farmer participates $(Y_i = 1|X_i)$ can be expressed as a cumulative logistic distribution function as;

$$p_i = E(Y_i = 1|X_i) = \alpha_0 + \alpha_1 X_i \dots\dots\dots\dots\dots\dots\dots\dots (8)$$

According to Wooldridge (2000), the logit model was derived from the logistic function which gives the probability in favor of success as;

$$P_i = \frac{1}{1 + e^{-z_i}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (9)$$

Where $z_i = \alpha_0 + \alpha_i X_i$

The problem of non-linearity in equation 7 can be solved by creation of the odds ratio.

$$1 - P_i = \frac{1}{1 + e^{z_i}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (10)$$

$$\frac{p_i}{1 - p_i} = \frac{\frac{1}{1 + e^{-z_i}}}{\frac{1}{1 + e^{z_i}}} = e^{z_i} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (11)$$

$$L_i = \ln\left(\frac{p_i}{1 - p_i}\right) = z_i = \alpha_0 + \alpha_1{}' X_i \dots\dots\dots\dots\dots\dots (12)$$

Equation 12 is the log of the odds ratio which is linear in parameters. The estimated slope coefficients in logit regression can be interpreted in two different ways. The coefficients can be interpreted either as the change in the log of the odds or can be interpreted as changes in probability in favor of success after calculating marginal effects. Marginal effects for the logit model are estimated as;

$$\frac{\partial P_i}{\partial x_i} = \hat{\alpha}\frac{\partial F(x_i\hat{\alpha})}{\partial x_i} = \hat{\alpha}\frac{\exp(-x_i\hat{\alpha})}{(1 + \exp(-x_i\hat{\alpha}))2} \dots\dots\dots\dots\dots\dots\dots (13)$$

The slope coefficients in this study are interpreted as marginal effect as estimated in equation 13.

3.3.2 Justification and Measurement of Variables in the Logit Model

Both theoretical and empirical literature reviewed in chapter two gives the variables expected to influence smallholder farmer's decision to participate in tobacco contract farming. The variables

include demographic, farm level and infrastructural characteristics. Personal differences in endowments and innate abilities among smallholder farmers are captured by demographic characteristics while farm level characteristics represents farmer's wealth which influences the decision to participate in contract farming.

The Dependent Variable

Participation in Tobacco Contract Farming (*Treat*)

Participation in tobacco contract farming is the dependent variable in the logit model specified in this chapter. The variable is binary which takes the value of 1 if the household participated in tobacco contract farming in the past growing season, and 0 if otherwise. This variable becomes a regressor in the treatment evaluation model in a bid to answer the second research question. The farmers who participated in contract farming are referred to as the treated sample while those who did not participate are the non-treated sample in the treatment evaluation model. Smallholder farmers who participate in tobacco contract farming are expected to produce relatively more tobacco per hectare than non-participants as suggested by both theoretical and empirical literature reviewed.

Regressors

Gender of the Farmer (*FGender)*

Gender of the farmer is key in decision making since men are presumed to be more active than females in engaging into contracts with any interested partners in farming (Monson, 2000). Therefore, men are expected to have a higher chance to participate more in tobacco contract farming than their female counterparts. Tobacco farming requires manpower which makes men to participate more in its farming. This variable is coded as binary which takes the value of 1 if the farmer is male and 0 for female.

Age of the Farmer (*FAge*)

Age has an important bearing on the farmer's decision to engage into contract farming due to experience and observation on how beneficial it is to engage into contract farming. Sambuo (2014) argues that young farmers are active and more exposed to technology and information than older farmers which makes them participate more in contract farming. However, Masangano *et al.*

(2017) found older farmers to have more experience with contractors making them to participate more than young farmers. The effect of this variable in increasing the probability of participation in contract farming is subject to empirical investigation for the effect differs from one study to another. This variable is measured as a continuous variable defined as the number of years of the respondent at the time of the interview.

Household Size *(Hhsize)*

The number of family members in most households, rural areas in particular determine the availability of labor force available to work in the fields. Farmers in rural areas depend on family labor as their main source of labor (Muroiwa *et al.,* 2018). Tobacco farming requires maximum attention and manpower which makes farmers with high labor supply participate in tobacco farming, contract farming included. In addition, families with many members tend to participate in high income earning activities like tobacco farming as a source of income to finance their higher demand for food (Opuku-Mensa, 2012). Farmers with more family members are expected to have a higher probability of participating in tobacco contract farming and having a higher yield per hectare. The variable is discrete that is the total number of members in the family.

Farmers' Education Level (*FEduc*)

According to Kagwirira and Guchuku (2017), educated farmers are expected to have the knowledge on the benefits they may derive and challenges they may encounter by entering into contract farming. With the knowledge they have, farmers are able to choose the best contract offered by the firms. Therefore, the expected sign of the coefficient of farmers' education level is positive that is being educated increases the probability that a farmer participates in tobacco contract farming. This variable is measured as continuous variable defined by a number of years a farmer spent at school after completing their primary education.

Farming Experience *(FExper)*

This variable is measured as a continuous variable defined by the number of years a farmer has spent in tobacco farming. The experience the farmers acquire by spending more time in tobacco farming influences their decision to participate in contract farming. Farmers with more experience in tobacco farming know the right contracting firms to work with and are expected to have a thigh

probability of participating in contract farming than farmers with less experience. The expected sign of the slope coefficient of farm experience is positive.

Access to Credit *(Access_cr)*

The variable is binary that is the farmer either has access to capital (takes value 1) or does not have access (take the value 0). According Begum *et al.* (2012), having access to credit enables the farmer to carryout tobacco farming independent of contractors as they will have less transactional costs compared to the costs that farmers without access to credit would incur. Therefore, having access to credit is expected to reduce the probability that the farmer participates in contract farming. The expected sign of the slope coefficient of this variable is negative.

Access to Internet (*Access_int)*

Access to internet is one of the technological key factors that enable farmers to be efficient in agricultural activities. Most agricultural economies have moved for technology uptake in the sector. Accessing internet by farmers is key to acquiring knowledge about efficient ways to carry out farming (Jarolimek and Vanek, 2011). Farmers who have access to internet are expected to have a higher probability of participating more in contract farming than their counterparts since they know the benefits associated with the program. This variable is captured as a dummy variable which takes the value 1 for farmers who have access to internet and 0 otherwise. Therefore, the expected sign of the slope coefficient of this variable is positive.

Distance to the Main Road *(Dist)*

This variable is measured as a continuous variable defined by a number of kilometers a farmer is located away from the main tarred road. Farmers who are located far away from the main road are expected to have a lower chance of participating in contract farming for they are assumed to have less information about contracting firms (Ton *et al.*, 2017). Therefore, the expected sign of the slope coefficient of distance is negative.

Reputation of the Contracting Firm *(FReput)*

This variable is measured as a dummy variable taking the value 1 for good reputation and 0 if otherwise. Farmers that see contracting firms as helpful are coded as 1 and 0 if otherwise.

Reputation of the firm influences the relationship that may exist between farmers and contracting firms. Since most of the new farmers engage in contract farming, the information they acquire about the reputation of the firm is important. According to Dube and Mugwagwa (2017), a number of contracting firms change the conditions of the contract during the selling season where they charge different price from the predetermined one. In addition, the contracting firms delay payment to the farmers after obtaining the product. Some firms leave out farmers without any money after deducting the money they would have assisted the farmers with. All the practices that the contracting firm do influences the decision by the farmer to continue work with it in the following growing season. Farmers are expected to have a higher chance of participating in contract farming if the contracting firm has a good working history with the farmers.

Table 1: Summary of Variable Definition and Measurement

	DEFINITION AND MEASUREMENT
Treat	1 if the farmer participated in tobacco contract farming and 0 if not.
Yphctre	Number of kilograms of tobacco on average a farmer harvested from a hectare planted.
REGRESSORS	
FGender	Takes the value 1 if the farmer is male, 0 if female.
FAge	Age of the farmer in years at the time of the interview.
Hhsize	Number of household members that stays on the farm.
FEduc	Number of years of schooling of the farmer after completing primary education.
FExper	Number of years a farmer has spent in tobacco farming.
Access_cr	Takes the value 1 if the farmer has access to credit, 0 if otherwise.
Access_int	Taking the value of 1 if the farmer has access to internet, 0 if otherwise.
Dist	Distance from the farm to the main road in kilometers.
FReput	Taking the value of 1 if the farmer view contractors as good, 0 if bad.

3.4 The Empirical Model of the Impact of Participation on Land Productivity

The Impact Evaluation (Treatment Effects) model seeks to address the second study research question to find the impact of smallholder farmers' participation in TCF on land productivity (yield

per hectare) between farmers who participate in tobacco contract farming and those who do not participate. Propensity score matching is a tool of Treatment Evaluation which has recently gained popularity in impact evaluation studies. PSM does not require randomization or baseline (pre-intervention data) which makes it easier to apply compared to other treatment evaluation tools like Difference in Differences (DID) techniques.

3.4.1 Propensity Score Matching (PSM)

PSM assumes that selection can be explained purely in terms of observable characteristics among the treatment group (participants) and non-treatment group (non-participants). It assumes that for every member in the treatment group, a matching (twin) is found among the non-treatment group which is dictated by observable characteristics. Therefore, what is required is to match each member exposed to the treatment (contract farming) with one or more non-treated members having the same observable characteristics. The degree of similarities between farmers participating in contract farming and those who do not given a set of observable characteristics not affected by the program, is measured by probability of the farmers being exposed to contract farming known as propensity scores. There are a number of steps involved with PSM which are as follows;

3.4.2 Propensity Scores Estimation

Propensity score estimation is the first step in carrying out a PSM approach. These are probabilities of each individual in the sample to participate in tobacco contract farming. According to Rosenbaum and Rubin (1983), propensity scores are obtained from Probit or Logistic regression. Formally, propensity scores are estimated as,

$$Pr(D_i = 1|X_i) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (13)$$

where $D_i = 1$ is the observable treatment and 0 if otherwise. X_i is a set of covariates used in the estimation of propensity scores which are exactly the same as variables in the logit model.

3.4.3 Treatment/Impact Evaluation Model

The treatment evaluation model compares on average, the difference in yield per hectare of tobacco between farmers growing tobacco under contract farming and those who grow independent of contractors. The model is specified in equation 14 as;

$$Y_i = \sigma' C_i + \alpha D_i + v_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (14)$$

Where Y_i is the dependent variable in the Treatment Evaluation model which is yield per hectare, that is the total harvest the farmer obtained divided by the number of hectares under tobacco farming. The variable is measured as the number of kilograms that a farmer obtained from the cultivated hectares. Farmers that produce higher tonnage of tobacco from same hectares cultivated are assumed to be high productive, *ceteris paribus* (Henningsen *et al.*, 2015). C_i denotes the set of variables as in X_i in equation 13, which explain smallholder farmer participation decision while σ' is the vector of corresponding slope coefficients in the Treatment Evaluation model. D_i has same definition as in equation 13 while v_i is the treatment evaluation model error term.

The parameter of interest in the Treatment Evaluation model is the Average Treatment on the Treated (ATET). The parameter is presented as:

$$\hat{\alpha} = ATET = E(Y_1 - Y_0|X)$$
$$= E(Y_1|X) - E(Y_0|X)$$
$$\hat{\alpha} = E(Y|X, D = 1) - E(Y|X, D = 0) \dots\dots\dots\dots\dots\dots\dots (15)$$

Equation 15 represents the difference in expected yield per hectare of the participants(Y_i) given a vector of regressors(X_i), of farmers that has participated in TCF ($D = 1$) and the expected yield per hectare of the counterfactual group given the regressors ($D = 0$). According to Caliendo and Kopeinig (2008), Treatment Evaluation model is useful in experimental studies as it allows the researcher to make use of existing data sources while controlling the likely self-selection bias on observable characteristics that may lead the smallholder farmer to engage into TCF.

3.4.4 Treatment Evaluation Model Assumptions

The Treatment Evaluation model assumptions must be met in order to rely on the results estimated. The assumptions include the overlapping condition, the balancing property condition, conditional mean independence and matching algorithm.

Checking Overlap and Common Support

This step ensures that comparing of incomparable must be avoided. For example, only the subset of the comparison group that is comparable to the treatment group should be used in the analysis.

Therefore, there is need to check if there is at least one treated unit and one non-treated unit of each value of propensity score. The range in which the propensity score should lie can be expressed as $0 < Pr(D = 1|X) < 1$. The propensity score in this range shows that all individuals in the treated group (contracted farmers) have got a twin in the non-treated group (non-contracted farmer) with similar or close propensity score. Alternatively, the most straightforward way forward is the visual analysis of the density distribution of the propensity score in the two groups.

The Balancing Property Condition

This condition ensures that treatment assignment for individuals with same propensity scores is random and look identical in terms of the vector (X). Therefore, we interpret the treatment evaluation model after checking if the model has the balanced explanatory variables for the probability of participating in TCF. This step helps to check the elimination of selection bias that arises due to observable characteristics. This study used the balance box to check for the balancing condition.

Conditional Mean Independence

The outcome in terms of yield per hectare should be independent of the treatment assignment after we control for pre-treatment characteristics. The conditional mean independence assumption states that participation should not affect the distribution of the potential outcome. The outcome of a farmer whether she participates or not, should be independent of the treatment assignment given a vector of explanatory variables.

3.5 Conclusion

The chapter presented the methodology that was employed to collect the data for the key variables that were likely to influence smallholder farmer's decision to participate in TCF. Data collection procedure, empirical model specification and research instruments used in the study were done in this chapter. In addition, this chapter looked at definition and justification of variables used in the study. The next chapter focuses on estimation, presentation and interpretation of research results in a bid to provide answers to the posed research questions in Chapter One.

CHAPTER FOUR

ESTIMATION, PRESENTATION AND INTERPRETATION OF RESULTS

4.1 Introduction

This chapter focuses on the estimation, presentation and interpretation of the empirical findings on the factors influencing the smallholder farmers' decision to participate in tobacco contract farming and the impact of participation on land productivity using farm level data from Hurungwe district. The chapter begins with descriptive statistics followed by pre-estimation tests, post-estimation tests and interpretation of econometric results.

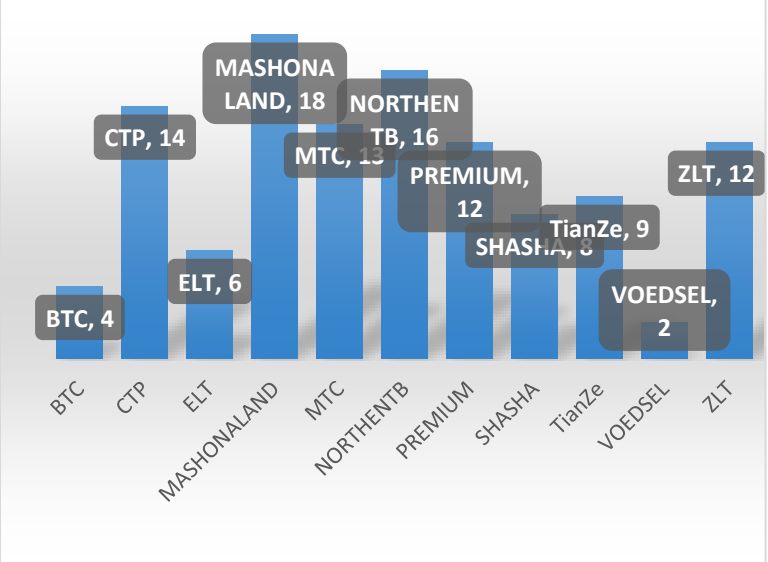
4.2 Descriptive Statistics

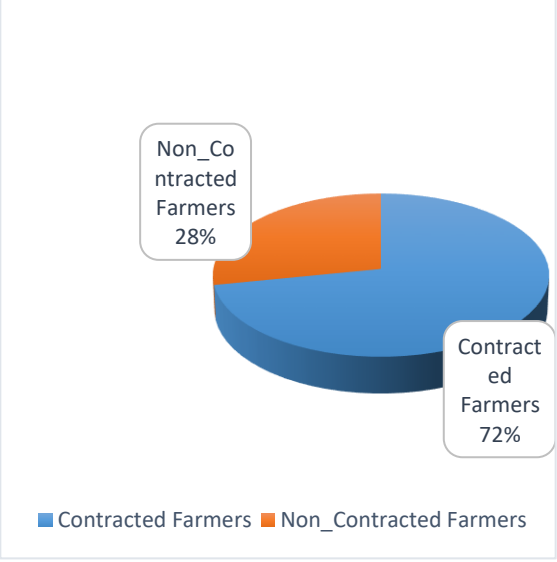
This section describes and summarizes the data collected from field work. The explanatory variables are grouped as categorical and continuous variables.

4.2.1 Contracting Firms and Proportion of the Participants in Tobacco Contract Farming

Figure 3 gives the names of contracting firms in Hurungwe and the percentage of participants and non-participants in TCF.

Figure 3: Number of Contracting Firms that farmers are contracted with and Percentage of Contracted and Non-Contracted Farmers.





The collected data indicated that out of the 160 farmers who responded, 72 percent (equivalent to 115 farmers) participated in tobacco contract farming while the 28 percent did not. The participating group are registered under different contracting firms with more farmers contracted by Mashonaland Tobacco.

4.2.2 Descriptive Statistics for Continuous Variables

Table 2 below gives a summary of descriptive statistics for continuous variables of both participants and non-participants.

Table 2: Descriptive Statistics of Continuous Variables

	Treated Group (Participants)			**Non-treated Group (Non-Participants)**		
Variable	**Obs**	**Mean**	**Std.Dev**	**Obs**	**Mean**	**Std.Dev**
Yld_Hctr	115	2905.217	957.507	45	1641.111	699.13
FAge	115	41.583	10.828	45	36.911	13.616
Hhsize	115	6.817	2.581	45	3.378	1.371
FEduc	115	6.965	2.655	45	2.478	2.369
FExper	115	5.333	2.585	45	4.113	2.852
Dist	115	2.652	1.427	45	5.904	2.497
Lnd_Cult	115	2.375	0.762	45	4.013	1.067

Table 2 shows that on average farmers who participated in tobacco contract farming are older than those who did not participate. The participating group had an average of 42 years against 36 years for the non-participating group. In addition, farmers who participated in tobacco contract farming are more educated than those who did not participate since the treated group spend more years at school (7 years after primary education) against an average of 3 years after primary education for farmers who do not engage in contract farming. Farmers who participated in tobacco contract farming had on average, larger household size of 7 members than the non-treated group which had a mean of 3 members. Farmers participating in tobacco contract farming had more tobacco farming experience with an average of 5 years in tobacco farming, than non-participating farmers who had an average of 4 years. The average distances to the main tarred road are 2.65 km and 5.9 km respectively for both the treated and non-treated group. Farmers participating in tobacco contract farming had smaller pieces of land under cultivation than farmers not participating with an average of 2.375 hectares for treated group and 4.013 hectares for non-treated group. The statistics obtained

shows that on average, farmers under contract farming had higher yield per hectare than non-contracted farmers.

4.2.3 Summary Statistics for Categorical Variables

Table 3 gives summary statistics for the categorical variables used in the study. The table summarizes the proportion of variables in the treated and non-treated group.

Table 3: Descriptive Statistics for Categorical Variables

	Treated Group (Participants)			Non-Treated Group (Non-Participants)		
Variable	**Proportion**	**Std.Err**	**[95%Conf. interval]**	**Proportion**	**Std.Err**	**[95%Conf. Interval]**
Gender						
Females	0.296	0.043	0.218 0.387	0.422	0.074	0.283 0.575
Males	0.704	0.043	0.613 0.782	0.578	0.074	0.425 0.717
Access to internet						
No access	0.139	0.032	0.086 0.216	0.711	0.068	0.557 0.828
Access	0.861	0.032	0.784 0.914	0.298	0.068	0.172 0.443
Access to credit						
No access	0.626	0.045	0.533 0.711	0.244	0.065	0.138 0.396
Access	0.374	0.045	0.289 0.467	0.756	0.065	0.604 0.862
Firm reputation						0.425 0.717
Bad reputation	0.261	0.041	0.188 0.350	0.578	0.074	0.283 0.575
Good reputation	0.739	0.041	0.650 0.812	0.422	0.074	

Summary statistics in table 3 show that out of the 45 farmers who did not participate in tobacco contract farming, 57.8 percent of them are men while 42.8 percent are women. Out of the 115 farmers that participated in tobacco contract farming, 70.4 percent of them are men while 29.6 percent are females. The statistics show that men participate more in tobacco farming than women. In addition, 71.1 percent of the farmers who did not participate in tobacco contract farming had no access to internet while 21.9 percent of them had access to internet. Among the farmers who participated in contract farming, 86.1 percent of them had access to internet while 13.9 percent had no access to internet. Farmers that have access to internet participates more in tobacco contract farming than those who do not have access to internet. Furthermore, the proportion of farmers in

the participating group who have access to credit (37.4 percent) is lower than in the non-treated group. A higher proportion of farmers who have access to credit do farming independent of contracting firms. More so, the proportion of farmers in the treated group (73.9 percent) that view contract firms having good reputation is much higher than in the non-treated group (26.1 percent).

4.3 Pre-Estimation Tests

The study performed two pre-estimation tests in order to make sure that the models satisfy the necessary assumptions which are valid, and the models can be relied upon. Multicollinearity test was the first test performed before estimating the logit model while overlapping condition was the second pre-estimation test carried out before estimation of the treatment evaluation model.

4.3.1 Multicollinearity Test

The Pairwise correlation matrix was used to check for inter-correlation among continuous explanatory variables. The presence of multicollinearity makes it difficult to separate effect of an individual independent variable on the dependent variable. Absolute correlation statistic in excess of 80 percent indicates multicollinearity.

Table 4: Matrix of Correlations

Variables	(1)	(2)	(3)	(4)	(5)
(1) FAge	1.000				
(2) Hhsize	0.448	1.000			
(3) FEduc	0.187	0.474	1.000		
(4) FExpr	0.122	-0.136	-0.107	1.000	
(5) Dist	-0.127	-0.298	-0.464	0.126	1.000

Correlation statistics in table 4 indicates that there are no serious issues of multicollinearity therefore logistic regression is possible.

4.3.2 The Overlapping Condition Check

The overlapping condition check is a pre-estimation before running a treatment evaluation model. The condition ensures that farmers in the participant group have matching partners with close propensity scores in the non-participant group. Identical propensity scores enable us to match the two different group based on their observed and unobserved characteristics. The overlapping condition was checked and was satisfied.

4.4 Post-Estimation Test Results

Diagnostic tests are carried out to check whether the model was correctly specified so that the results can be relied upon.

4.4.1 Goodness of Fit of the Logit Model

The p-value of 0.572 for the Hosmer-Lemeshow test presented in Appendix E shows was that the logistic model was correctly specified and the results can be reliable for policy recommendations.

4.4.2 The Balancing Condition Property Check.

The results of the test are presented in Appendix G. The Balance Box plot was used to present the Balancing Condition test. The results show that the property is satisfied implying that the distribution of the cofounding factors was similar among the participant and non-participant matched samples. Therefore, self-selection bias was eliminated allowing the computation of average treatment effect on the treated (ATET).

4.5 Econometric Results

This section presents the results from both the Logistic regression and the treatment evaluation model.

4.5.1 Factors Influencing Smallholder Participation in Tobacco Contract Farming

Table 5 presents the results from the logistic regression estimation. The coefficients of logistic regression only indicate the sign of change of the probabilities for their magnitude cannot be relied upon since the model is non-linear. The best way to interpret the results from Maximum Likelihood

estimations is to use marginal effects. Therefore, after running the logistic regression, computation of the marginal effects is the next step.

Table 5: Logistic Regression Output (Propensity Scores)

Treat	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
FGender	2.906	1.360	2.14	0.033	0.240	5.571	**
FAge	-0.673	0.262	-2.56	0.010	-1.187	-0.158	**
Hhsize	-0.058	0.149	-0.39	0.697	-0.351	0.234	
FEduc	1.850	0.987	1.87	0.061	-0.085	3.784	*
FExper	0.662	0.263	2.51	0.012	0.146	1.179	**
Acc_int	0.888	0.466	1.91	0.057	-0.025	1.802	*
Acc_cr	-2.248	2.185	-1.03	0.304	-6.530	2.034	
Dist	-0.046	0.027	-1.71	0.087	-0.098	0.007	*
FReput	0.263	0.163	1.62	0.106	-0.056	0.581	
Constant	-2.480	1.621	-1.53	0.126	-5.657	0.697	

Mean dependent var	0.331	SD dependent var	0.472
Pseudo r-squared	0.787	Number of obs	160.000
Chi-square	159.888	Prob > chi2	0.000
Akaike crit. (AIC)	63.331	Bayesian crit. (BIC)	94.083

****** p<0.01, ** p<0.05, * p<0.1***

After running the logistic regression, computation of marginal effects is important which enables the interpretation of the margin of change in the probability of success given a change in the explanatory variables. Table 6 presents average marginal effects from the logistic regression.

Table 6: Average Marginal Effects from the Logistic Regression (PS Marginal Effects)

Delta-method

	dy/dx	Std.Err.	z	P>z	[95%Conf	Interval]
FGender	0.111**	0.050	2.230	0.026	0.013	0.208
FAge	-0.026***	0.009	-2.800	0.005	-0.043	-0.008
Hhsize	-0.002	0.006	-0.390	0.698	-0.013	0.009
FEduc	0.070**	0.036	1.970	0.049	0.000	0.140
FExper	0.025***	0.009	2.720	0.007	0.007	0.043
Acc_int	0.034**	0.017	2.010	0.045	0.001	0.067
Acc_cr	-0.086	0.083	-1.040	0.300	-0.247	0.076
Dist	-0.002*	0.001	-1.780	0.076	-0.004	0.000
FReput	0.010*	0.006	1.680	0.094	-0.002	0.022

******p<0.01, **p<0.05, *p<0.1***

4.5.2 Interpretation of Logit Marginal Effects Results

The estimated coefficient of farmers' gender is positive and statistically significant at 5 percent level of significance. In line with the prior expectation given in chapter one, being a male increases the probability that a farmer participates in tobacco contract farming by 11.1 percent. Tobacco farming is strenuous which makes men more participating in tobacco farming since they are generally stronger than women. The results obtained are in tandem with the findings of Simmons *et al.* (2005) in Indonesia.

Farmers' age coefficient has a negative value and statistically significant at 1 percent level of significance. Being older by one year reduces the probability that a farmer participates in tobacco contract farming by 2.6 percent. The results are similar to the findings of Opuku-Mensa (2012) who argued that younger farmers are more energetic than older farmers, engage in labor requiring farming activities like tobacco farming. Supporting the results of Muroiwa *et al.* (2018), the estimated coefficient of farmers' education level is positive and statistically significant at 5 percent level of significance. Increasing the level of education by one year increases the probability that a farmer engages in tobacco contract farming by 7 percent. This is because educated farmers know the best agricultural products to grow and the benefits of the assistance available from contracting firms.

The econometrics analysis has indicated that the coefficient of the smallholder farmers' farming experience is positive and statistically significant at 1 percent level of significance showing that spending more time in tobacco farming increases the chance of participating in tobacco contract farming. Having an additional year in tobacco farming increases the probability that the farmers participates in tobacco contract farming by 2.5 percent. Farmers that have spent more time in tobacco farming knows best the benefits of contract farming and are able to identify good contract firms to work with. Therefore, they participate more in tobacco contract farming than inexperienced farmers. The results support the findings of Nkurunziza and Ngabitsinze (2015) in Rwanda where farmers with farming experience participated more in contract farming than farmers with less experience.

The variable Access to internet has a positive slope coefficient which is statistically significant at 5 percent level of significance. Access to internet increases the probability of 3.4 percent of participating in tobacco contract farming than farmers who do not have access to internet. Internet access enables farmers to look for information on efficient ways to grow their crops. The results are in line with the prior expected sign of the coefficient.

The coefficient of distance to the main road is negative and statistically significant at 10 percent level of significance. An increase in distance from the main road by one kilometer reduces the probability of farmers located in that area to participate in tobacco contract farming by 0.2 percent. Farmers who are located far away from main road participate less in tobacco contract farming than farmers located near the main road. This could be as a result of high costs of transportation that contractors will charge during the repayment. The results obtained supports the findings of Muroiwa *et al.* (2018).

Regarding contracting firms' reputation, the study found the coefficient of firm reputation to be positive and statistically significant at 10 percent level of significance. Farmers have a good working history with contractors (rating contractors as good) have a probability of participating more in tobacco contract farming of 1 percent, higher than farmers who rate contracting firms as bad. Farmers who have a good working history with contract firms works more with contractors. This variable was included in the study to capture the challenges that raised in the 2018/2019 tobacco selling season where there was change in the conditions of the contacts both parties had agreed before the farming season. There were delays in payment by the firms during the selling season and change of payments methods. All these changes made farmers grumble and even stopped the selling process for some days as they had to negotiate with the contractors. Such activities could pose a threat to the relationship existing. It was therefore in the researchers' best interest to include this variable.

4.5.3 The Impact of Participation on Land Productivity (Yield per hectare).

Propensity scores matching (PSM) was employed as a treatment evaluation tool to quantify the impact of participation in tobacco contract farming on tobacco yield. Table 7 shows the results from the treatment evaluation using the PSM.

Table 7: Treatment Effect Results using PSM

Yld_Hctr	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ATET r1vs0.Treat	833.750	165.183	5.05	0.000	509.997	1157.503	***
Mean dependent var		2549.688	SD dependent var			1057.193	

****** p<0.01, ** p<0.05, * p<0.1***

4.5.4 Interpretation of Treatment Evaluation Results

The dependent variable in the treatment evaluation model was measured as the number of kilograms per hectare. The estimated average treatment effect on the treated (ATET) in table 6 of 833.75 means that on average, farmers who grow tobacco under contract farming realize higher yield per hectare on average than farmers who do not participate in tobacco contract farming by 833.75 kilograms. The outcome is in tandem with the findings of Nguyeni *et al.* (2015) who found contract farming to increase farmers yield after employing the same estimation technique.

4.6 Conclusion

The study found that gender, farmers' education level, farming experience, access to internet and firm reputation significantly influence smallholder farmers' decision to participate in tobacco contract farming. This chapter also revealed that contract farming has a positive impact on yield per hectare that farmers harvest. The next chapter gives summary, conclusion of the findings from the study, policy implications and recommendations.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter gives a summary, conclusion and policy recommendations from the study.

5.2 Summary of the Main Findings

The study investigated the factors that influence smallholder farmers' decision to participate in tobacco contract farming and the impact of participation on land productivity using sample data collected from Hurungwe district of Mashonaland West province of Zimbabwe. The study employed the logistic regression to identify factors which significantly influence smallholder farmers' decision to participate in tobacco contract farming which are farmers' gender, farmer's age, farmers' education level, farming experience, access to internet, distance to main road and firm's reputation. The propensity score matching (PSM) was used to eliminate self-selection bias that could arise from observable and unobservable factors that influence smallholder farmers' participation in tobacco contract farming. Land productivity was measured as the number of kilograms of tobacco a farmer obtained from the area (hectares) under cultivation. The results from the treatment effects show that farmers participating in contract farming have a positive and higher yield per hectare than non-participants.

5.3 Policy Implications and Recommendations

The empirical findings of this study suggest that contract farming could be used as a component of an overall strategy to improve tobacco farmers' yield. Farmers participating in contract farming had more yield per hectare than non-participants. Therefore, policy implication of this finding is that policies that aim to let contracting firms' contract farmers are likely to ensure increase in yield from the farmers. Increased yield is of benefit to the government of Zimbabwe since tobacco is the highest selling agricultural product that brings much foreign currency into the country.

In addition, the study found that farmers who view contracting firms having good reputation participate more in contract farming realizing high yield per hectare. In this regard, contracting firms have to fulfil their promises to the farmers, honoring the conditions of the contract. Regression results of the study showed an increase in probability in participation in tobacco

contract farming of farmers who spent more years at school. There is need for encouragement for farmers to get training in farming by either attending school or training from extension officers. Farmers acquiring knowledge on tobacco farming makes them able to produce more yield. More so, encouragement of farmers to engage in farming of the golden leaf is important through availing of capital by contracting firms, banks and other financial institutions. The government through local authorities can assist in construction of roads as the study found that farmers located near main road participate more in tobacco contract farming. Internet access positively influenced farmers' decision to participate in contract farming. Network providers should assist farmers by availing affordable internet to them and as well setup network boosters in some of the rural areas where farming activities are concentrated.

5.4 Limitations of the Study and Areas of further Research

The study only used 160 smallholder tobacco farmers to draw up conclusion on the factors influencing farmer's decision to participate in tobacco contract farming due to financial and time constraint. Given enough finance and time availability, more data can be collected and analyzed to give more conclusive and richer results. Furthermore, use of better treatment evaluation tools like Difference in Differences (DID) can give more intuitive results on the impact of contract farming on yield as it compares the yield between participants and non-participants before and after the program given the availability of data.

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APPENDCIES

Appendix A: Survey Questionnaire

UNIVERSITY OF ZIMBABWE

FACULTY OF SOCIAL STUDIES

DEPARTMENT OF ECONOMICS

SMALL HOLDER TOBACCO FARMERS SURVEY QUESTIONNAIRE

Good morning/afternoon/evening farmer, my name is **Prosper Ziyadhuma**, a final year student at the University of Zimbabwe pursuing a **Master of Science Degree in Economics.** I am carrying out a research on the factors that influence farmers decision to participate in tobacco contract farming and the impact of participation on land productivity. Your individual response will be used for academic purposes only. Kindly note that participation in completing the survey questionnaire is on voluntary basis and you are free to stop when do not feel like continuing or not to answer at all. Confidentiality is guaranteed since there will be no need for the respondent's name. ***(Please do not write your name, cellphone number or address, it remains anonymous.)***

Analysis of Factors Influencing Smallholder Farmers' Decision to Participate in Tobacco Contract Farming and its Implication on Land Productivity: A case of Hurungwe district.

Date of data collection……..
Questionnaire number……..
Location……

PART A: HOUSEHOLD IDENTIFICATION VARIABLES

1. Gender [0=Female 1=Male] ……
2. How old are you? …….
3. Are you married? ……..
4. How many years did you spend on education after completing your primary education? ……
5. How many years have you participated in doing tobacco farming?.....
6. How many household members fall in the group below 18 …. above 18 years?.....
7. How many of the household members work in the field? …….

PART B: INFRASTRUCTURAL CHARACTERISTICS

8. Do have a cellphone? [0=No 1=Yes]
9. If yes in 8, can you access internet on your phone? [0=No 1=Yes]
10. What is the approximate distance from the farm to the main road in kilometers? …..

PART C: FARM CHACTERISTICS

11. What is your total land size in hectares? ……..
12. How did you acquire land? 1=Inherent 2=Hired 3=given by government
13. What is your main source of labor? [0=hired 1=Family labor]
14. Apart from tobacco, what other crops do you grow and their land allocation?

Crop	tobacco	maize	soya beans	Other (specify)
Hectares				

15. How many kilograms of tobacco did you harvest during the past three farming season?

Farming season	2018-2019	2017-2018	2016-2017
Hectares under farming			
Estimated value of inputs used ($ZWL)			
Kilograms harvested			

PART D: CONTRACTING FARMING

16. Are you growing your crops under contract farming? [0=No 1=Yes]
17. If yes in 14, what is the name of the contracting firm? .....

18. For how long have you been growing tobacco under contract farming?.....
19. How did you hear about contract farming? ……..
20. What is the tenure of the contract? …….
21. Which production inputs are you receiving from the firm? Seeds/fertilizers/pesticides
22. Are the inputs received as credit? Yes/No
23. Are the inputs provided by the contracting firm expensive than other sources?.....
24. Did you receive sufficient inputs on time from the firm?.....
25. Does the contracting firm offer extension services? Yes/No
26. Has the tobacco yield increased under contract farming? Yes/No
27. How are the prices for the tobacco determined?.....
28. How long does it take for you to receive payment after surrendering the crop? …..
29. How do you rank the effectiveness of the contracting firms? [1=poor 2=good 3=excellent]

PART D: INCOME

30. Did you acquire any loan to finance tobacco farming? [0=No 1=Yes]
31. If yes in 15, what was the source of the loan?

Source	Contractor	Commercial bank	Microfinance	Farmers' cooperative	Other (specify)
Code					
Amount ($)					

Thank you!!!

Appendix B: Pairwise Matrix

```
> correlate FAge Hhsize FEduc FExper Dist
(obs=160)

             |      FAge     Hhsize FEduc     FExper    Dist
-------------+---------------------------------------------
        FAge |   1.0000
      Hhseze |   0.4477   1.0000
       FEduc |   0.1870   0.4741   1.0000
      FExper |   0.1218  -0.1355  -0.1073   1.0000
        Dist |  -0.1268  -0.2979  -0.4643   0.1261   1.0000
```

Appendix C: Logit Model Results (Propensity Scores Estimations)

```
. pscore $treatment $xlist, probit pscore(mypscore) blockid(myblockp) comsup

. logit $treatment $xlist,

Iteration 0:   log likelihood = -101.60965
Iteration 1:   log likelihood = -31.930209
Iteration 2:   log likelihood = -25.065165
Iteration 3:   log likelihood = -22.030609
Iteration 4:   log likelihood = -21.678193
Iteration 5:   log likelihood = -21.66566
Iteration 6:   log likelihood = -21.665618
Iteration 7:   log likelihood = -21.665618

Logistic regression                               Number of obs     =        160
                                                  LR chi2(9)        =     159.89
                                                  Prob > chi2       =     0.0000
Log likelihood = -21.665618                       Pseudo R2         =     0.7868

------------------------------------------------------------------------------
       Treat |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     FGender |   2.905516   1.359902     2.14   0.033      .240157    5.570876
        FAge | -.6725728   .2624616    -2.56   0.010    -1.186988   -.1581576
      Hhsize | -.0580776   .1492599    -0.39   0.697    -.3506217    .2344665
       FEduc |   1.849551   .9869834     1.87   0.061    -.0849012    3.784003
      FExper |    .662452    .263474     2.51   0.012     .1460524    1.178852
     Acc_int |   .8883433   .4659522     1.91   0.057    -.0249062    1.801593
      Acc_cr | -2.247996   2.184836    -1.03   0.304    -6.530196    2.034204
        Dist | -.0456528   .0266972    -1.71   0.087    -.0979783    .0066728
      FReput |   .2629723   .1625034     1.62   0.106    -.0555285    .5814731
       _cons |   -2.47974   1.620918    -1.53   0.126     -5.65668    .6971998
------------------------------------------------------------------------------
```

Appendix D: Marginal Effects of the Propensity Scores

```
. margins, dydx(*)

Average marginal effects                          Number of obs     =        160
```

```
Model VCE    : OIM


Expression   : Pr(Treat), predict()
dy/dx w.r.t. : FGender FAge Hhsize FEduc FExper Acc_cr Acc_int Dist FReput

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     FGender |   .1105273    .049576     2.23   0.026       .01336    .2076945
        FAge |   -.025585   .0091334    -2.80   0.005    -.0434861   -.0076839
      Hhsize |  -.0022093   .0057009    -0.39   0.698    -.0133829    .0089643
       FEduc |   .0703578   .0356963     1.97   0.049     .0003943    .1403213
      FExper |      .0252   .0092774     2.72   0.007     .0070166    .0433834
     Acc_int |    .033793   .0168501     2.01   0.045     .0007674    .0668186
      Acc_cr |  -.0855149   .0825793    -1.04   0.300    -.2473672    .0763375
        Dist |  -.0017367   .0009776    -1.78   0.076    -.0036528    .0001795
      FReput |   .0100036   .0059695     1.68   0.094    -.0016964    .0217036
------------------------------------------------------------------------------
```

Appendix E: Hosmer-Lemeshow Goodness of fit test of the Logit model

```
. estat gof

Logistic model for Treat, goodness-of-fit test

       number of observations =       160
 number of covariate patterns =       141
            Pearson chi2(131) =        62.54
                  Prob > chi2 =         .5720
```

Appendix F: Treatment Effects Results

```
. teffects psmatch ($ylist) ($treatment $xlist), vce(robust,) pstolerance(1e-8)

note: variance correction results in a negative variance estimate; ignoring the
correction term
```

```
Treatment-effects estimation                   Number of obs      =        160
Estimator      : propensity-score matching     Matches: requested =          1
Outcome model  : matching                                  min =          1
Treatment model: logit                                     max =          1
------------------------------------------------------------------------------
             |               AI Robust
    Yld_Hctr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ATE          |
       Treat |
   (1 vs 0)  |     833.75   165.1831     5.05   0.000     509.9971    1157.503
------------------------------------------------------------------------------
```

Appendix G: Balancing Condition Property Check

Balance condition check using summary statistics

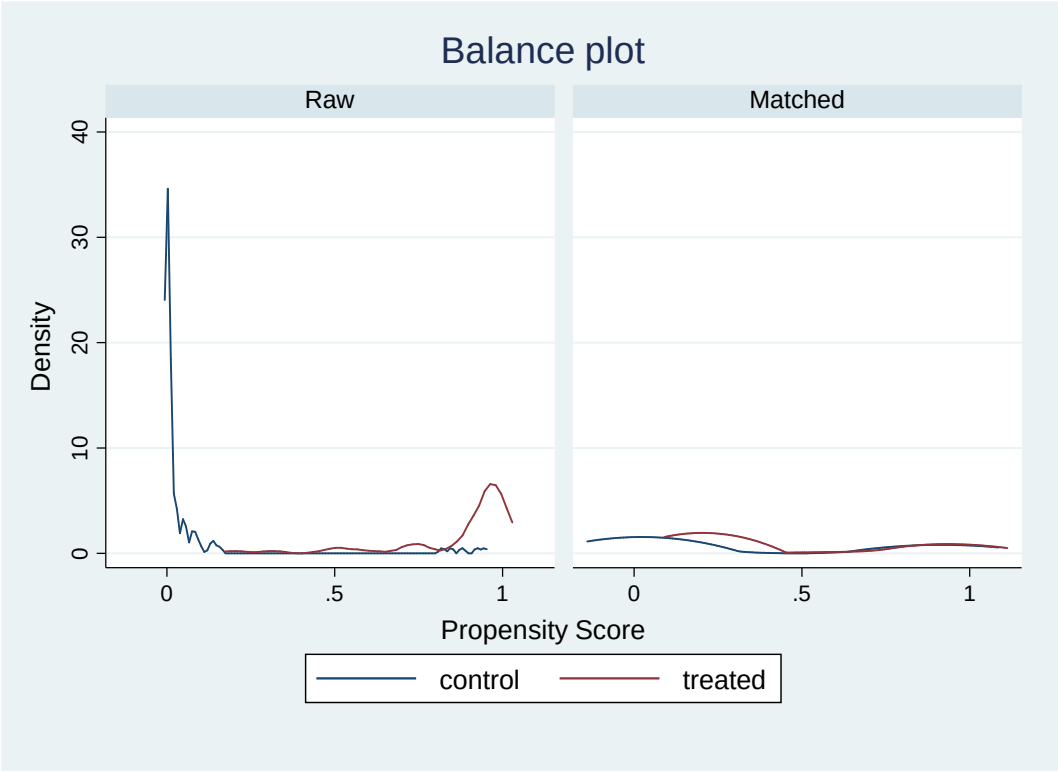
```
tebalance summarize
note: refitting the model using the generate() option

  Covariate balance summary
                                                    Raw      Matched
                          ----------------------------------------
                          Number of obs =           160          320
                          Treated obs   =            53          160
                          Control obs   =           107          160
                          ----------------------------------------

  ----------------------------------------------------------------
                  |Standardized differences          Variance ratio
                  |        Raw     Matched           Raw    Matched
  ----------------+-----------------------------------------------
          FGender |   1.108148    .8734313      .1477021   .0580989
             FAge |  -1.542357   -1.010118      .0504861   .0191064
           Hhsize |  -1.276708   -.9430939      .1167213   .0456636
            FEduc |    1.86004     .352174          3.21       1.77
```

FExper	1.338931	-.1334184	5.645271	1.048471
Acc_int	1.260267	.7990899	1.816571	.3425178
Acc_cr	.3235809	.2516925	1.114377	.2098627
Dist	.4384589	.2752244	.4100133	.2431709
FReput	.3476074	.3262275	3.149362	.6514229

Balance condition check using Kernel Density Plot

- tebalance density

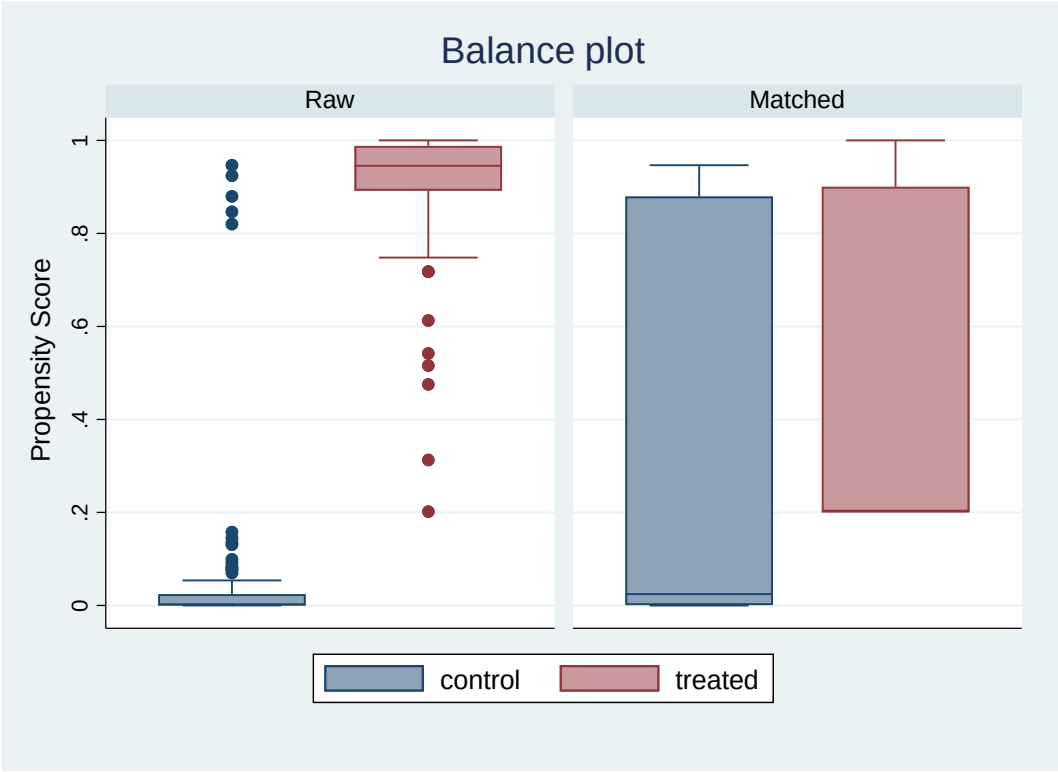
Note: refitting the model using the generate () option



Balance condition check using Box Plot

- rebalance box

Note: refitting the model using the genetare () option


Balance plot
Raw
Matched
Propensity Score
0
.2
.4
.6
.8
1
control
treated