COOPERATIVES IN THE DEVELOPMENT OF
COFFEE FARMING IN RWANDA

Membership choice from a Transaction Cost Economics perspective

July 2007

MUJAWAMARIYA Gaudiose

Supervisor
Dr. Ir. Marijke D’Haese
COOPERATIVES IN THE DEVELOPMENT OF COFFEE

FARMING IN RWANDA

Membership choice from a Transaction Cost Economics perspective

By

MUJAWAMARIYA Gaudiose

Submitted in partial fulfilment of the requirements for the degree of

Msc. International Development Studies (MID)

in the

Department of Social Sciences

Development Economics Chair Group

Wageningen University

Supervisor : Dr. Ir. Marijke D’Haese
Examiners : Dr. Ir. Marijke D’Haese

Prof. Dr. Erwin Bulte

Wageningen, July 2007
A special dedication to *Mama et Papa*
TABLE OF CONTENTS

LIST OF TABLES ........................................................................................................ iii
LIST OF FIGURES ....................................................................................................... iv
ABBREVIATIONS ....................................................................................................... v
ACKNOWLEDGMENTS ............................................................................................... vi
EXECUTIVE SUMMARY ............................................................................................ viii

PART I
CHAPTER 1 INTRODUCTION .................................................................................. 1
  1.1 Background ........................................................................................................ 1
  1.2 Problem Statement .............................................................................................. 2
  1.3 Research objectives ............................................................................................ 3
  1.4 Research questions ............................................................................................. 3
  1.5 Thesis structure .................................................................................................. 3

CHAPTER 2 LITERATURE REVIEW ........................................................................... 4
  2.1 Governance structures ....................................................................................... 4
  2.2 Transaction cost economics ............................................................................... 6
  2.3 The cooperative as a hybrid governance structure ............................................. 9

CHAPTER 3 METHODOLOGY ................................................................................ 13
  3.1 Methods and techniques of the research ........................................................... 13
  3.2 Sampling procedure specifications ................................................................. 14
  3.3 Analytical approach .......................................................................................... 17
  3.4 Research hypotheses ......................................................................................... 18
  3.5 Modelling aspects ............................................................................................. 19

CHAPTER 4 OVERVIEW OF THE AGRICULTURAL SECTOR AND COFFEE PRODUCTION IN RWANDA ........................................................................... 22
  4.1 Overview of the agricultural sector ................................................................. 22
  4.2 Coffee production in Rwanda ........................................................................... 24
  4.3 Cooperatives in Rwanda ................................................................................... 28

PART II
CHAPTER 5 FARMERS AND COFFEE: A DESCRIPTIVE ANALYSIS ....................... 31
  5.1 Farmers and coffee farming ............................................................................... 31
  5.1.1 Farmers’ characteristics .............................................................................. 31
  5.1.2 Coffee growing ............................................................................................ 34
  5.1.3 Costs of coffee production .......................................................................... 39
  5.1.4 Location characteristics .............................................................................. 41
  5.2 Coffee marketing .............................................................................................. 42
  5.2.1 Type of coffee ............................................................................................. 42
  5.2.2 Sales of coffee ............................................................................................. 45
CHAPTER 6 GOVERNANCE STRUCTURES IN COFFEE TRANSACTIONS .......... 47
6.1 Main actors in the coffee sector in Rwanda ................................................................. 47
   6.1.1 Coffee supply chain in Rwanda ............................................................................... 47
   6.1.2 Coffee cooperatives ............................................................................................... 48
   6.1.3 Traders .................................................................................................................... 56
6.2 Comparative analysis of transaction structures ............................................................. 57
   6.2.1 Coffee cooperatives vs. Traders: transaction costs ................................................. 58
   6.2.2 Coffee cooperatives vs. Traders: contractual relations ............................................ 66
CHAPTER 7 ECONOMETRIC ANALYSIS OF FARMERS’ CHOICES ............ 69
7.1 Variables used in modelling ......................................................................................... 69
   7.1.1 Choice of membership status .................................................................................. 69
   7.1.2 Choice of type of marketable coffee ....................................................................... 72
   7.1.3 Choice of transaction structure ............................................................................... 74
7.2 Modelling results and discussion ................................................................................ 77
   7.2.1 Choice of membership status .................................................................................. 77
   7.2.2 Choice of type of marketable coffee ....................................................................... 81
   7.2.3 Choice of transaction structure ............................................................................... 83
CHAPTER 8 SUMMARY OF FINDINGS AND CONCLUSIONS ..................... 88
REFERENCES ...................................................................................................................... 93
APPENDICES ..................................................................................................................... 97
Appendix 1. Farmers’ questionnaire .................................................................................. 97
Appendix 2. STATA outputs ............................................................................................... 104
   2.1 Probit: Membership vs Non-membership status ....................................................... 104
   2.2 Probit: Early vs Late members .................................................................................. 105
   2.3 Poisson: Year of membership ...................................................................................... 107
   2.4 Probit for coffee type: Only_Berries vs Not_Only_Berries ........................................ 108
   2.5 Probit for transaction structure: Cooperative vs Traders ........................................... 109
   2.6 Multinomial logit for transaction structure: Only_Cooperative vs Only_Traders vs
      Both-Coooperative-and-Traders .................................................................................. 111
LIST OF TABLES

Table 2.1 Distinguishing attributes of governance structures ............................................ 4
Table 3.1 Number of informants per province and membership status............................... 17
Table 5.1 General descriptive of farmers characteristics per membership status and province .......................................................... 31
Table 5.2 Farmers’ education level per membership status ................................................. 32
Table 5.3 Household characteristics per membership status and province .......................... 33
Table 5.4 Characteristics of coffee growing per membership status and province ............... 36
Table 5.5 Coffee plot characteristics per membership status and province ......................... 37
Table 5.6 Seasonal labour requirements per membership status and province (persons per day) ......................................................................................... 40
Table 5.7 Location characteristics of cooperatives ............................................................... 42
Table 5.8 Sales of and income from coffee per membership status and province ................. 46
Table 6.1 Characteristics of cooperatives ............................................................................. 49
Table 6.2 Comparison of distance to selling point per membership status and transaction structure ................................................................................... 60
Table 6.3 Uncertainty associated with difficulties to access inputs per membership status and province (percentage within membership category) ....................... 62
Table 6.4 Delays in payment per membership status and province .................................. 64
Table 6.5 Summary of transactions characteristics ............................................................. 65
Table 7.1 Determinants of membership choice ................................................................. 71
Table 7.2 Determinants of coffee type choice .................................................................... 74
Table 7.3 Determinants of transactions structures .............................................................. 76
Table 7.4 Probit results of the choice of membership status ............................................. 77
Table 7.5 Percentage of members per year of adherence to the cooperative ....................... 79
Table 7.6 Probit and Poisson estimation results for the membership adherence time .......... 80
Table 7.7 Probit for the choice of type of coffee ................................................................. 82
Table 7.8 Estimates for choice of transaction partner ......................................................... 84
Table 7.9 Marginal effects from the multinomial choice of transaction partner .................. 86
LIST OF FIGURES

Figure 2. 1 Governance structures ................................................................. 9

Figure 3. 1 Provinces of Rwanda with location of cooperatives studied ............. 16
Figure 3. 2 Analytical framework .................................................................. 17

Figure 4. 1 Contribution of agriculture to GDP 1999-2004 ............................ 23
Figure 4. 2 Coffee production and exports evolution since 1985 ................. 25
Figure 4. 3 Evolution of price paid to the producer from 1985 to 2003 .... 26
Figure 4. 4 Evolution of Rwanda Coffee Quality ............................................. 27

Figure 5. 1 Purpose of growing coffee ........................................................... 35
Figure 5. 2 Ownership of coffee plots in different membership categories .... 38
Figure 5. 3 Fertilization type within membership status .................................. 41
Figure 5. 4 Coffee beans .............................................................................. 43
Figure 5. 5 Techniques of depulping .............................................................. 43
Figure 5. 6 Depulping method within membership status .............................. 44

Figure 6. 1 Coffee supply chain in Rwanda ................................................... 47
Figure 6. 2 Comparison of exportable production ......................................... 51
Figure 6. 3 Abahuzamugambi ba Maraba .................................................... 53
Figure 6. 4 Koakaka ...................................................................................... 54
Figure 6. 5 Coopac ....................................................................................... 55
Figure 6. 6 Kopakama ................................................................................... 56
Figure 6. 7 Farmers’ transaction partner per type of coffee ......................... 58
Figure 6. 8 Price variations of coffee over respondents ............................... 63
ABBREVIATIONS

ALUS : Agricultural, Livestock and Land Use Survey
BRD : Banque Rwandaise de Développement
COOPAC : Coopérative pour la Promotion des Activités Café
EICV : Integrated Survey on Household Living Conditions
FAO : Food and Agriculture Organization of the United Nations
GDP : Gross Domestic Product
IFAD : The International Fund for Agricultural Development
Kgs : Kilograms
KOAKAKA : Koperative y’Abahinzi ba Kawa ba Karaba (Coopérative des Cultivateurs de Café Karaba)
KOPAKAMA : Koperative y’ Abahinzi ba Kawa ba Mabanza (Coopérative des Cultivateurs de Café de Mabanza)
MINAGRI : Ministry of Agriculture and Animal Resources
MINALOC : Ministry of Local Government, Community development and Social affairs
MINECOFIN : Ministry of Finance and Economic Planning
MINICOM : Ministry of Commerce, Industry, Investment Promotion, Tourism and Cooperatives
OCIR (Café) : Office des Cultures Industrielles du Rwanda (National Coffee Board)
PDCRE : Projet de Développement des cultures de Rente et d’Exportation (The smallholder cash and export crops development project)
PEARL : The Partnership for Enhancing Agriculture in Rwanda through Linkages-Michigan State University
PSTA : Plan Stratégique pour la Transformation de l’Agriculture (Strategic Plan for Agricultural Transformation)
RWASHOSCCO : Rwanda Smallholders’ Specialty Coffee Company
Rwfs : Rwandan Francs

Exchange rates on 31 August 2006

1 Rwandan Franc = 0.001479 Euro
1 Euro (EUR) = 676.225 Rwandan Franc (RWF)

Lb: livre/pound = 453 grams
ACKNOWLEDGMENTS

It is with heartfelt gratitude that I first thank God, I believe that He has always been with me, led my path and helped me to achieve my goals.

I would also like to thank the Dutch Government for its scholarship award through Nuffic. I am grateful for this opportunity to study at Wageningen University.

I would like to thank many people who helped me to make this thesis a success.

First, I would like to gratefully acknowledge the enthusiastic supervision of Dr. Marijke D’Haese, for her inspiration in choosing this topic, her advices and a lot of good ideas in directing me all through this work.

I would also like to thank Dr. Laura Loucks for her great efforts in helping me disentangling the Transaction Costs Economics concepts. Prof Dr. Erwin Bulte gave me various insightful comments that helped me have the right perspective towards analyzing farmers’ decision; for that I am grateful to him. I would also like to express my thanks to Dr. Alison Burrell for helping me having another outlook on my dataset and for assisting me in reflecting on the econometric model specifications.

I am grateful to all the people in different institutions who generously offered me their time, guidance and suggestions that made me more enthusiastic about my field work: the staff and management of the Development Planning Unit-MINECOFIN, Zacharie Manirarora of OCIR, Alfred Mutebwa and Jean Mutabazi of PDCRE, Joy Dusabe of Twin Trading, Etienne Bihogo of PEARL-RWASHOSCCO, Damien Mugabo of MINICOM, Léon Haguma of Rwandex and Grace and Mike of Rwacof.

My gratitude also extends to the leaders of the cooperatives for their explanations about their activities and help in reaching out to farmers: Juvénal Habumukiza of Abahuzamugambi ba Maraba, Karekezi Angélique of Koakaka Emmanuel Rwakagara Nzungize, Simon and Isiaka of Coopac, Mathias Abimana and Frédéric Hakizimana of Kopakama.

To all the farmers who spent their times with me, answering all my questions, thank you so much.

Many thanks to the friends who helped me during data collection: Pascal, Norbert, Tranquillin, Géorgie, Jean Bosco and Winifrida; without your time and strength, there is no way I could have climbed the mountains alone.
To my friends here in Wageningen, in Rwanda or elsewhere, thank you for your continuous moral support and especially the many jokes you sent that saw me pass the hard times.

Finally, I am forever indebted to my parents, siblings and Joseph for their love, care, understanding, endless patience and constant encouragement when it was most required.

To all of you, thank you so much.
EXECUTIVE SUMMARY

Coffee farming in Rwanda is an important sector that highly contributes to the economy in terms of employment and income especially for the small farmers in rural areas. In order to improve coffee production in terms of quantity and quality, farmers are encouraged to form and join cooperatives so that they can increase their bargaining power and earn higher prices for their produce. This is achieved through the establishment of washing stations for the purpose of producing high-quality coffee that is competitive at the international markets.

Despite cooperatives’ efforts to attract members through the provision of inputs, technical advices and other incentives to farmers, membership adherence is low and slow. The main objective of this study is to find out determinants of farmers’ membership status as a choice that affects the process of decisions regarding production and transaction structures. With regard to transaction, traders form another structure in the coffee supply chain in Rwanda which has been in existence before cooperatives’ emergence. The Transaction Cost Economics Theory provided the basis for the study where the choice is conditioned by relative comparative advantage in terms of lower transaction costs.

As an attempt to answer the above problem, a research survey was performed in the Southern and Western Provinces of Rwanda where four cooperatives were visited and 171 farmers were interviewed: among them 121 are cooperative members and 50 non-members.

Results of probit estimations showed that choice of membership with regard to the cooperative is influenced by the access to labour so that coffee can be produced according to the cooperative requirements; expectations regarding access to cheap and reliable credit and access to land so that investments in coffee investments can be securely made. Trust in the cooperative is another important factor leading to membership, so is the image portrayed by the cooperative’s belongingness to a network such as the marketing union and the security it provides against the risk of being cheated at sale or stolen during coffee storage. There are deterring factors however associated with free riding where neighbours to the cooperative or farmers who have acquaintances already who are already members do not perceive any stringent need to become members themselves.

Decisions regarding the types of berries are mainly influenced by membership status-members are more likely to produce only berries- and production factors. With regard to the latter, the choice of supplying only berries is facilitated by the availability of hired labour and mulch.
Membership is the most important determinant of the choice of transaction structure i.e. between cooperatives and traders. In addition to this, transaction costs and contractual relationships play a major role. Transaction costs elements that move farmers’ choice towards transacting with the cooperative are the quantity of berries produced associated with perishability and shorter distances to the collection point. However, the ownership of coffee plantation and easier access to labour move the farmers’ choices in the opposite direction towards traders. In the multinomial logit, importance is given to existence of a third category where farmers can also transact with the cooperative and the trader. Distance to the trading centre and access to labour were found to increase the likelihood of transacting in both structures.

On the basis of the above results it can be concluded that membership to cooperatives is important for farmers who aim at increasing production and improving their incomes. Membership signifies in this case security of accessing inputs, security of market for the produced coffee and security of income. Furthermore, cooperatives are to members sources of reliable and cheaper credit. Hence, these incentives have to be carefully devised in order to exclude non-members. It would also expose their relative comparative advantage compared to the distance to reach the cooperatives’ selling points; requirements imposed by the cooperative or between traders and other cooperatives operating in the rural area.
PART I
CHAPTER 1 INTRODUCTION

1.1 Background

Agriculture is the main activity of Rwandan rural population. It contributes highly in terms of (1) employment: the 2002 Household Living Standards Survey (MINECOFIN, 2002) found that 87 percent of the active population is engaged in the agricultural sector and (2) GDP: the share of agriculture in the GDP varied from 43.4 to 40.5 percent in the period 1999 to 2004 respectively (MINAGRI, 2006). The revenues in agriculture are raised mainly from exports of cash crops such as coffee, tea, pyrethrum\textsuperscript{1}, etc. These amounted on average to 71 percent of the country’s total export revenues in the period 1999-2004 (MINECOFIN 2002; MINAGRI, 2004).

Coffee is one of the important traditional cash crops in the Rwandan economy. It has been grown in the country since its introduction by German Missionaries as early as 1904. Coffee growing is often a smallholders’ activity. These are mainly poor people who work small, fragmented plots. Coffee is produced to supplement staple production and thus achieve basic food security. In 2004, there were some 400,000 producers of coffee in Rwanda in 60 districts (OCIR 2005). Other actors in the sector include private traders, hulling and exporting companies, government institutions and in the recent decade, many cooperatives have emerged.

Cooperatives are established for multiple purposes. They are involved in the (1) provision of services to growers including accessing and managing inputs and monitoring their use; (2) production of high-quality coffee through washing stations and (3) improvement of farmers’ participation in the coffee sector. The goal is to increase farmers’ bargaining power in order to earn higher prices for their produce and ultimately, improve their incomes and livelihoods (OCIR, 2005).

However, coffee cooperatives face many constraints such as inadequate basic infrastructure (water, electricity, roads, etc.), difficulties in accessing loans for purchasing coffee berries and making long term investments. The Plan Stratégique pour la Transformation de l’Agriculture (PSTA) documented that the lack of human, material and financial resources and low level of participation of members in the cooperative organization and management were the constraints (MINAGRI, 2004).

Regarding the latter issue of membership, computations from the National Coffee Board (OCIR) figures show that, until 2006, only 8.2 percent of coffee growers were organised into cooperatives (OCIR, 2006). This is a big issue as membership participation is “the cornerstone of cooperatives” (Braverman et al., 1991). These cooperatives have not yet been able to attract many adherents. It is therefore a matter of investigation because it also reflects the low membership status observed in other

\textsuperscript{1} Chrysanthemum cinerariifolium and coccineum: its flowers are used to make insecticides
agricultural cooperatives in the country (MINICOM, 2006a). The outcome is that these agricultural cooperatives in general and coffee cooperatives in particular may achieve a low performance on the one hand because their financial capital, which correlates highly with membership, will remain low (MINICOM, 2006a) and on the other hand, there might be a sub-optimal use of the cooperatives’ washing stations if there is no sufficient supply of coffee berries needed as raw materials for processing.

1.2 Problem Statement

The emergence of cooperatives was associated with many expectations with regard to improving the sector performance. However, these expectations may not be fulfilled due to inability to attract members. The choice of membership status cannot be restricted to the simple question of the reasons of farmers’ ultimate behaviour but should be extended to the characteristics of coffee production, organisation and performance of cooperatives in the supply chain in comparison to other actors in the sector.

Becoming a member of the cooperative or not is a decision that affects the choice of whether coffee should be sold to cooperatives or traders. Cooperatives are interested in the berries while traders buy dry coffee beans processed by farmers themselves and berries that might not be of good quality and would otherwise be rejected by the cooperative. Therefore, although cooperatives would greatly reduce the burden of farmers in post-harvest processing, not all the farmers are willing to transact with them.

Looking closely, there are transactions costs in the marketing of berries and dry coffee but these costs differ depending on the transaction partner. Therefore, a decision on the transaction structure also affects the type of coffee produced. Furthermore, traders are involved in other relationships pertaining to the livelihoods in the society. Their exchanges with farmers are more than spot-market-buying-and-selling-arrangements. The cooperative on the other hand provides a more stable marketing channel and secure access to inputs and technical advice. Therefore, the ultimate choice is weighed against these relationships or ‘commitment factors’ associated with any membership status. The question remains then how the farmers differently evaluate these different choices.
1.3 Research objectives

The main aim of this study is to analyse determinants of farmers’ cooperative membership status by studying the coffee cooperatives in the Southern and Western provinces of Rwanda.

The following are the specific objectives of the study:

1. determine factors influencing farmers’ choice of membership status towards the cooperatives;
2. analyse the coffee farming system in Rwanda and explore determinants of choices of coffee type in production;
3. analyse transaction costs associated with marketing structures in the coffee sector.

1.4 Research questions

In order to reach the above research objectives, this study addresses the following research questions:

1. What motivates the farmers’ decision regarding membership choice?
2. What are the factors associated with production decisions in regard to the choice marketed coffee type?
3. What are the transaction characteristics of governance structures operating in the coffee sector in Rwanda?
4. What are the determinants of farmers’ choice towards the transaction structure?

1.5 Thesis structure

This thesis is divided into 2 parts. The first part comprises of 4 chapters. In addition to the introduction dealt with in this chapter, the next chapter reviews the theoretical framework of study. Chapter 3 explains the design of research and the analytical methodology. Chapter 4 gives an overview of agricultural sector, coffee production and cooperatives in Rwanda.

The second part of the thesis is analytical. Chapter 5 is a descriptive study of the surveyed farmers; Chapter 6 compares cooperatives and traders as transaction structures involved in marketing of coffee. Chapter 7 is an econometric analysis of the farmers’ decisions. Finally, chapter 8 summarizes the major findings and concludes.
CHAPTER 2 LITERATURE REVIEW

2.1 Governance structures

Governance structures or institutional arrangements are defined as alternative modes of organization described in terms of their patterns of attributes that differ in discrete structural ways (Williamson, 2000). These structures are ‘designed by trading partners to mediate particular economic relationships’ (Klein, 1999).

They are confined within specific ‘institutional environments’ or the ‘rules of the game’, that guide individuals’ behaviour whether formal (constitutions, laws, property rights) and/or informal social conventions and norms (North, 2005).

Markets and organizations (also termed as hierarchies) are the extremes of the spectrum of the institutional arrangements/governance structures. The market makes use of market incentives/prices. Within an organization, coordination takes place through ‘planning, command and control’: the decision-making is hierarchical and based on authority. However, there are overlaps between those two polar cases specified as hybrid forms. These forms work with both market incentives and modalities of coordination (Williamson, 2005). Examples of hybrid forms are cooperatives, clubs, contracts, franchising, etc.

Apart from the above mentioned coordination mechanisms, other characteristics that distinguish markets, hybrids and hierarchies are contract law regimes, incentives intensity and administrative control instruments. The intensity of incentives diminishes as the continuum of governance structures moves from market to vertical integration; while the reverse happens in case of administrative controls. These attributes are summarized in table 2.1 where ++, + and 0 denote respectively strong, semi-strong and weak incentive intensity or administrative controls or in the case of contract law, the classical, neo-classical or relational regime. These are described in the following sections.

Table 2.1 Distinguishing attributes of governance structures

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Governance structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
</tr>
<tr>
<td>Contract law</td>
<td>++</td>
</tr>
<tr>
<td>Incentive intensity</td>
<td>++</td>
</tr>
<tr>
<td>Administrative controls</td>
<td>0</td>
</tr>
</tbody>
</table>

• Contract law

Each form of organization is accompanied by a type of contract law. A three-way classification of contracts is used in New Institutional Economics: classical, neoclassical, and relational contract law (Williamson, 1979, 1991). The emphasis is on the nature of the contracting parties and their mutual relation.

In case of a classical contract, the identities and personal characteristics of the parties are irrelevant, a “discrete” exchange or transaction is specified. It is a legalistic regime as written documents may be used for resolving issues of disagreement (Williamson, 1991). In this respect, it corresponds with the ideal (spot) market transactions (Williamson, 1979) because the parties bear no dependency relation to each other or as Masten emphasized, ‘once a transaction is consummated, the parties have relatively few ongoing obligations’ (Masten, 2000).

A neoclassical contract is usually of fixed duration. In this case, the identity of parties is of importance and written documentation provides the basis for further negotiation. Recognition that the world is complex, that agreements are incomplete and that some contracts will never be reached unless both parties have confidence in the conflict settlement machinery, characterizes neoclassical contracts (Williamson, 1979). Hybrid modes of contracting are supported by neoclassical contract law because the parties to such contract maintain autonomy, even though they are ‘bilaterally dependent to a significant degree’ (Williamson, 1991).

With the need and pressure of sustaining ongoing relations, relational contracts have been formulated by progressively increasing the duration and complexity of contract (Williamson, 1979). For a relational contract, the identities and personal characteristics of the parties are crucial. The shared norms of behaviour specify the reaction to new developments and are of greater importance than written documents in settling disputes due to differences in opinions. Williamson (1991) maintained that hierarchies are characterised by a “forbearance” law manifested in the fact that internal disputes would not be referred to the court without undermining the efficacy and integrity of hierarchy.

When it comes to relationships and identities, the relational contract is not exclusive to hierarchies; it also applies to hybrid structures. This is because these hybrids are organized in the form of ‘pooled resources’ (Ménard, 2004). Therefore, their contract regimes, described as semi-legalistic, link activities and resources among partners who simultaneously operate unconnected transactions. These contracts intend to secure the relationship and, because the identity of partners matters, they create a framework for “transactional reciprocity”. The relational aspect is grounded in the advantages and risks of sharing resources among independent partners (Ménard, 2004).
• Incentives and control instruments

According to Williamson (1991), there is more to governance than contract law. Fundamental differences in the use of incentive and control instruments are also relevant.

In case of markets, transaction parties are autonomous. Therefore, in order to maximize their net receipts, they have strong incentives to position themselves in order to reduce costs and adapt efficiently. These incentives are described as high-powered in the sense that outside parties cannot be held accountable for the losses or make legitimate claims about the gains made. When bilateral dependency sets in as in the case of hybrids and hierarchies, the intensity of incentives reduces but administrative controls arises (Williamson, 1991).

As compared with markets, internal incentives in hierarchies are low-powered, which is to say that changes in effort expended have little or no immediate effect on compensation. This is because the high-powered incentives of markets are unavoidably compromised by internal organization. Also, hierarchy uses flat incentives because these bring forth greater cooperation. Moreover, the unwanted side effects are checked by added internal controls and associated bureaucratic costs; but these tend to be higher (Williamson, 1991).

The hybrid mode shows intermediate values of incentive instruments and administrative controls: as it preserves ownership autonomy, there are strong incentives. However, because there is bilateral dependency, long-term relationships are supported by added contractual safeguards and administrative apparatus (Williamson, 1991).

Once the features that distinguish organizational forms from one another have been identified, the remaining task is to match organizations and transactions (Masten, 2002) or more precisely to ‘align transactions with governance structures in a discriminating and transaction cost economizing way’ (Williamson, 1988).

2.2 Transaction cost economics

Each economic exchange is associated with costs that depend on the nature of the commodity and that of the transaction. These are called transaction costs. They differ according to the way in which exchanges or institutional arrangements are organised in terms of contracts regime, incentives and control regimes. In the market, such costs can include search and information costs incurred in determining the availability of the good on the market; the associated prices and bargaining costs to come to an acceptable agreement with the other party to the transaction. These costs may be so high that it may be difficult or impossible to arrive at a completely specified activity or good which can be used for a market transaction (Poulton et al., 1998).
Other arrangements such as the hierarchy are perceived as institutional solutions to avoid these costs associated with the market mechanism. However these arrangements also involve other costs such as for drawing up an appropriate contract, monitoring and enforcement costs to make sure that the other party abides by the terms of the contract (Ménard, 2004).

Therefore, since any governance structure necessitates costs that can be too substantial to the point of prohibiting the transaction, it is more efficient and effective to associate the type of transaction with the governance structure that offers a relative comparative advantage compared to other arrangements. According to Williamson (1991), the suitability of the governance structures to the transaction depends mostly on its characteristics, which are discussed in the next section.

**Characteristics of transactions**

There are critical dimensions according to which transactions differ. These subsequently influence the relative efficiency of various organisations structures. Williamson (1998) distinguishes characteristics of human decision makers and environmental characteristics of the transaction which determine the comparative advantages of the transaction mechanisms.

The human characteristics on which Transaction Costs Economics is based are: bounded rationality and opportunistic behaviour. As the behaviour might be “intendedly rational but only limitedly so” (Simon, 1985 as quoted by Williamson, 1998), economic agents are boundedly rational. This is because it may be too costly or impossible to consider all the consequences of a decision and to use the market for carrying out the transaction. Opportunistic behaviour refers to the provision of selective and distorted information, making promises which are not intended to be kept and pretending to be different from what the person actually is (Williamson, 1998).

Concerning the environmental characteristics on which this thesis focuses on, Williamson (1998) distinguished three aspects of a transaction which influence the size and nature of transaction costs. These are asset specificity, uncertainty and frequency.

Asset specificity refers to the degree to which an asset can be defined in terms of the fraction of its value that would be lost if it were excluded from its major use. Within asset specificity, a distinction can be made between (1) site specificity i.e. the (special) location of the asset, and the place-restrictions tied to a particular area reflecting the distance and accessibility in terms of time and money or the specific use of an asset as a result of its position; (2) physical asset specificity involving investment in a machine or building which has a narrowly defined use; (3) human asset specificity appearing
whenever people obtain training or develop their skills which can then only be applied in specialised areas; (4) *dedicated assets specificity* referring to investment in a general purpose asset made at the request of a particular transaction partner and (5) *brand name capital specificity* referring to becoming affiliated with a well-known brand name and thus becoming less free to pursue other opportunities (Bijman, 2002 citing Williamson, 1989).

Furthermore, uncertainty and frequency of a transaction affect the size and nature of the transaction costs. *Uncertainty* includes possibilities or events which cannot be anticipated, or are difficult to anticipate or can be anticipated but at high cost. In addition, it also includes the sort of uncertainty where one party has information which the other lacks. Uncertainty is mostly analysed in relation to complexity. This is because the more complex the transaction, the harder it will be to anticipate and describe fully and accurately the responsibilities of each party in a contract (Masten, 2000).

*Frequency* indicates the intensity with which transactions are handled. With a low frequency, the costs per transaction will be relatively high. If transactions are made regularly, trust and reputation between trading partners become important and special ‘low-cost’ provisions can be arranged (Bijman, 2002).

**Discrete Alignment Principle**

In the previous section, alternative ways of organizing relationships among economic units were distinguished. In the same perspective, these modes of organization are connected to transaction costs. Ménard (2005) argues that if agents have incentives to minimize transaction costs, the choice of organizational mode is made in a way that allows the development of contractual relationships. These relationships are meant to economize on bounded rationality while safeguarding transactions against opportunism. The need for protecting transacting parties from various hazards associated with exchange is also recognized (Klein, 1999), because the transaction governance goes in line with the aim of resolving ‘a conflict’ (Williamson, 1998) and should therefore also be looked at as “an effort to craft order and thereby realize mutual gains” (Williamson, 2000).

The comparative advantage of transacting through one mode rather than another depend on the frequency of transactions at stake, the uncertainty surrounding these transactions, and the degree of specificity of the assets involved. Transaction costs (TC) are therefore considered as a function: \( TC = f \left[ \text{asset specificity (positive coefficient)}, \text{uncertainty (positive coefficient)}, \text{frequency (negative coefficient)} \right] \) (Ménard, 2005 citing Williamson, 1991).
As all transactions involve the above three variables, what differentiates them are the level of each variable and their respective weight in the determination of transaction costs. Decision-makers, who are rational, tend to adopt the mode of organisation that minimises the transaction costs thus determined. However, it is primarily the specificity of investments required that plays a determining role in the trade-off between markets and hierarchies. The relationship between transaction/governance costs and the specificity of assets can be observed in figure 2.1.

![Figure 2.1 Governance structures](Source: Williamson, 1991)

At low levels of asset specificity, the most efficient governance structure is the market. But as the degree of asset specificity increases, the hybrid form of governance and thereafter the hierarchy are observed. Choosing the "right" structure (i.e., remaining on the lower segments of the curves, which correspond to lower transaction costs) becomes a factor of efficiency for agents that are assumed to be cost-economizing-seekers (Ménard, 1996).

### 2.3 The cooperative as a hybrid governance structure

A cooperative is collectively owned firm, established to support the economic performance of its members. It generally means a group of individuals bound together to achieve a common goal.
The International Cooperative Alliance (ICA) defines a co-operative as an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically-controlled enterprise (ICA, 2007). Accordingly, there are seven ‘Principles of Cooperatives’ which guide the cooperative operations. These are (1) *voluntary and open membership* to all persons able to use their services and willing to accept the responsibilities of membership without any discrimination; (2) *democratic administration* implying accountability and equal voting rights; (3) members’ *equitable participation* to the capital of their cooperative; (4) *autonomy and independence*; (5) *provision of information, education and training* to members, elected representatives, managers and employees so they can contribute effectively to the development of their cooperatives; (6) *cooperation among cooperatives* in order to strengthen the cooperative movement by working together through local, national, regional and international structures and last but not the least (7) *concern for community* since cooperatives also work for the sustainable development of their communities through policies accepted by their members (ICA, 2007; Gray and Kraenzle, 1998).

Cooperatives generally have a dual objective: (1) scale economies in commercial production or market transactions and (2) improvement of bargaining position in regards to external agents (Bijman, 2007). Braverman et al. (1991) mention other benefits such as gains of risk sharing, access to credit, input supply and profits to members.

Cooperatives in developing countries are institutional arrangements, involved in the organization of often small farmers with the advantages of reducing transaction costs of accessing input and output markets (Bijman, 2007), as well as improving the negotiating power of smaller farmers vis-à-vis large transaction partners (Kherallah and Kirsten, 2001). Ménard (2005) included cooperatives in the list of specific types of hybrids. This is because, hybrids, require on the part of their members some (1) commitment to achieve specific goals; (2) willingness to endorse or transform existing routines; and (3) response to incentives for maintaining or improving their participation.

Cooperatives are hybrids that can rely neither on command nor on prices for regulating transactions. Therefore, in order to avoid negative externalities which can result from problems of control, the selection of partners is crucial due to the risk of opportunistic behaviour (Ménard, 2004). In this context, long-term relationships are important. These are characterized as continuity that requires cooperation and coordination: partners must accept losing part of the autonomy they would have under market relationships without the benefits of extended control that hierarchies could provide (Ménard, 2004).
Cooperatives also rely on decentralized decisions because of the high cost of closely monitoring the numerous members. In cooperatives, the main mechanism implemented for coordinating parties who keep their rights of decisions separate is contractual. However, these contracts are highly incomplete (Ménard, 2004). Their incompleteness is due to the impossibility and expensiveness of accounting for all events and contingencies associated with uncertainty and complexity of transactions. According to Masten (2000), the lack of information and high transaction costs involved in obtaining the necessary information, the limited ability of individuals to process all available information given bounded rationality and controlling the observance of the contract and enforcing the agreement all contribute to explaining this complexity.

The cooperative movement in Sub-Saharan Africa dates back to colonial times (Holmén, 1990). Particular to East Africa, the growth of member-initiated cooperatives in the colonial era was associated with an attempt to break up the monopolies of Asian traders and middlemen. The purpose was therefore to aid European settlement by establishing the natives into the externally controlled, monetized economy where they could be easier taxed and made to produce for the export markets. Holmén (1990) viewed this as a system of politically controlled production and economy. As much as the natives were concerned, little attention was paid to the voluntary and democratic aspects of cooperation. On the contrary, cooperation in the colonies was strongly flavoured by the omnipresent paternalism of foreign rule. Moreover, power over local cooperatives was often captured by, or given to elites, enabling them to convert cooperatives as assets into supplementary resources and to establish themselves as private moneylenders. In most cases, the cooperatives were developed exclusively in relatively developed cash cropping areas and supported activities only related with those crops (Holmén, 1990).

After independence, many African governments viewed cooperatives as suitable vehicles for agricultural development and socio-political change (Attwood and Bariskar, 1998). Their aim was to help small and poor farmers without radically changing the distribution of economic power (Attwood and Bariskar, 1998).

Cooperatives however faced many constraints to their effective development: the excessive government involvement often aggravated by donor support turned cooperatives into indirect arms of external organizations such as lending institutions or extension services instead of being member-directed bodies. The rationale was often that ill-informed and illiterate members must be protected from abuses and mismanagement. The success of cooperatives was measured by the number of members, but this was often wrong as membership was sometimes made compulsory. Moreover, members had little interest in actively contributing to the organization’s share capital (Braverman et al., 1991).
Another issue was the expectation that cooperatives would fulfil too many functions. This means that cooperative were often used as a development tool in order to achieve social and economic goals. The result was an overburdened managerial and financial capacity of cooperative organizations that often rendered them more dependent on external resources. This is because the reinvestment of benefits was made to social activities rather than to economic purposes. This was blown up by poverty of members and production of little surplus. There were also weak infrastructure, high operating costs, low margins, low turnovers, narrow inventory stocks, fluctuating seasonal demand and trading patterns (Holmén, 1990).

Nevertheless, there remain economic advantages associated with cooperation: collective action and willingness to work together helps overcome problems arising out of government and private sector inefficiencies. These relate to institutional access to information, credit, input supply and provision related problems. Cooperation also enables large scale adoption of technologies and results in positive impact in terms of higher yields and income for farm households, as well as other less tangible and indirect gains. Moreover, in utilizing direct benefits from technology adoption for maximizing welfare gains, farmers and households that cooperate mainly seek to develop facilities which are likely to benefit the community as a whole, especially in investments for the future. This of course is in addition to individual level investments for increasing production and farm incomes (Deininger, 1995; Fulton & Sanderson, 2002).

In addition to the above, it is worthy to note the importance of trust without which members would not adopt cooperation. As Durlauf (2002) puts it, trust refers to the concern for one's associates and the extent to which one believes that the others will not act to exploit his vulnerabilities (Hansen et. al, 2002). Deininger (1995) adds on this that cooperatives provide an implicit insurance in an environment characterized by high risk and incomplete insurance markets. Members are more motivated to work together since they are relatively more confident about the sale of their produce and a relatively low cost of risk because of their sharing.
CHAPTER 3 METHODOLOGY

This study was carried out in the Western and Southern provinces of Rwanda. The rationale behind choosing these provinces was that coffee production is successful in the former province due to its natural soil endowment while the latter is known for its cooperative thrive in the coffee sector even though the climatic and soil fertility are not so suitable. This was viewed as giving representativeness of cooperatives and the coffee sector in Rwanda.

3.1 Methods and techniques of the research

Several techniques were used to get the data required such as literature research, discussion with key informants, survey and observation. An explanation of how each was performed follows below.

Literature research

This technique helped in acquiring secondary data which were analyzed in order to have better insights into the agricultural situation in Rwanda, and in particular, the cooperative movement in the coffee production. The data were also used in providing background information on the study area and the cooperatives which acted as the research subjects. This literature was important in setting up the foundation of all other techniques that were used later. Several documents that were collected include past studies and reports considered relevant to the research problem, policy papers and development plans from different institutions.

Discussion with key informants

Discussions with key informants were useful to collect as much information as possible about the research area and cooperatives. Informants were the staff in different ministries dealing with agricultural and development activities (MINICOM-Task Force on Cooperatives; MINECOFIN-Development Planning Unit); projects in the Ministry of Agriculture or institutions directly involved with coffee (PEARL, Twin, PDCRE); the National Coffee Board (OCIR), coffee exporting companies (Rwandex, Rwacof) and the leaders of the cooperatives studied.

Lengthy conversations held with these key informants were recorded and transcribed later from which, in the informants’ own views, much needed data on the cooperative movement in Rwanda in general and in coffee sector in particular were extracted. These discussions also paved the way for refining the questions designed for the farmers’ formal interviews.
Farmers’ interviews

A total of 170 farmers were interviewed with a formal questionnaire (See Appendix 1). This questionnaire was subdivided in 3 main parts. The first part included closed questions about general farmers’ characteristics, coffee farming/production systems, transaction partnership and membership status towards the cooperative. The second part of the interview related to farmer’s perceptions and attitudes towards trust and solidarity, risk elements and risk coping strategies. The third part included open-ended questions where the farmers could detail the benefits from or constraints towards the cooperative and express their views on how to improve their situation, the cooperative functioning/performance or the coffee sector in general. The interviews were conducted either at the cooperative head quarters, washing stations, the administrative cells’ office or the farmers’ homes.

Observation and informal interviews

Observations made during interviews or when travelling around the rural areas and farms are also important in explaining certain findings. For instance, farmers made reflections on the many problems they faced in the past and how they used to deal with them. This provided an understanding of the cooperatives benefits that were not mentioned in any document. Farmers also mentioned problems of selling secretly some of the produce by spouses or children, protecting the crops against thieves while at the same time experiencing the insufficient storage space.

Through visits of farmers in their homes, observations were made as to how the coffee is traditionally depulped by stone and the subsequent washing and drying process. In assisting one of the cooperative’s management meetings, clarifications were made on how the washing station is managed and the planning of coffee-related specially during harvest campaigns.

3.2 Sampling procedure specifications

This study was carried in the Western and Southern provinces of the country. (See map in figure 3.1).

The Western Province shares a border with the Democratic Republic of Congo in the west and the Republic of Burundi in the south. In the east, the Western Province shares its border with the Southern Province while in the north there is the Northern Province. It is composed of 7 districts (Figure 3.1).

Some parts of the province are found in a region covered by a chain of mountains with a multitude of rivers snaking between them that produce attractive scenery.
Farming and livestock are the dominant sectors in the Western Province largely due to high soils fertility. On numerous hills and valleys found in the province a multitude of crops are grown. These include food crops such as beans, sorghum, soya, sweet potatoes, bananas, tomatoes to name but a few. Cash crops are coffee, tea and pyrethrum of which there are respectively washing stations, factories and drying grounds (MINALOC 2002; RIEPA 2004).

The Southern Province also borders the Republic of Burundi in the South. In the east, it borders Kigali City, The Eastern Province and Kirundo (Burundi). In the north there is the Northern Province and the Western Province in the west. The Province is composed of 8 districts (Figure 3.1).

The predominant sector is agriculture and animal husbandry with 95 percent of rural population relying on subsistence farming for their survival. The province boasts an abundance of cultivable marshlands that are favourable conditions for the production of rice, soya, beans and maize. Coffee and tea dominate the cash crops: the Southern Province has a lot of tea factories and coffee washing stations. The province is also proud to be hosting numerous food and milk processing units. The handicraft industry is thriving and this is done mostly by associations. Other economic domains include trade, services and mines (MINALOC 2002; RIEPA 2004).

Sampling plan

An exploratory study provided the basic information on the coffee sector. Two coffee exporting companies were visited namely Rwandex and Rwacof. They provided information on the processing and export of coffee especially with respect to the cooperatives that export their produce through these companies. Also the unions representing coffee cooperatives were visited. These unions are Misozi and Rwashoscco (Rwanda Smallholders Speciality Coffee Company). The aim was to obtain cooperatives operating under the umbrella of these unions and at least one independent cooperative.

The selection of cooperatives and individual farmers was then performed in a multi-stage sampling process. In the first stage, 4 cooperatives were purposely selected for an in-depth study. These cooperatives are Coopac and Kopakama in the Western Province and Koakaka and Abahuzamugambi ba Maraba in the Southern Province. These last two cooperatives belong in Rwashoscco while Kopakama is part of Misozi. Coopac is an independent cooperative. The cooperatives studied according to their location in different provinces are shown in Figure 3.1.
Figure 3.1 Provinces of Rwanda with location of cooperatives studied

Source: MINALOC, 2007 (Edited)

Source: FAO, 2005
In a second stage, a selection of coffee growers was randomly made from lists of members within each cooperative. A third stage was the sample of non-members. A snowball sampling was performed to find these non-members: the members indicated some of their neighbours who are not members of the cooperatives and in turn, during their interviews, these would name other non-members. A total of 171 farmers were interviewed as indicated in table 3.1.

<table>
<thead>
<tr>
<th>Province</th>
<th>Cooperative name</th>
<th>Type of farmer in relation to coop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Member</td>
</tr>
<tr>
<td>Western</td>
<td>COOPAC</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>KOPAKAMA</td>
<td>29</td>
</tr>
<tr>
<td>Southern</td>
<td>Abahuzamugambi ba Maraba</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>KOAKAKA</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>121</td>
</tr>
</tbody>
</table>

### 3.3 Analytical approach

A step-wise approach is adopted in order to analyse reasons behind farmers’ choices where (1) farmers are described according to their personal and production characteristics; (2) transaction structures in coffee marketing in Rwanda are differentiated and then (3) choices of membership status, production of coffee per type and transaction structure are modelled. Figure 3.2 summarizes the analytical framework.
Membership decision depends on many factors. Among them are farmers’ characteristics, elements in contracts offered to farmers and location factors. Characteristics of farmers may be general (age, gender, education) or specific to the households (size and composition). Contractual elements include trust in the contracting party, expectations regarding the price, access to credit and other inputs, etc. The latter are however looked at in the context of production decision. Security of land ownership, perceptions regarding the cooperative status in the supply chain, etc. are the other factors that act as opportunities or constraints towards the cooperative membership choice. Location factors include in general the farmers’ location in the study sample (province). Particular to the choice of membership, the distance to the cooperative is also assumed to be an important factor that could influence the choice.

Membership status subsequently affects other decisions such as that of producing a certain type of coffee and choosing the structure in which to market it. This effect is direct. Though not studied here, it is important to note that membership has also an indirect effect to decision making through the access and use of production factors and transaction costs. Production factors include the size of their coffee plantation and access to inputs such as labour, fertiliser, pesticides, etc. The magnitudes of these factors vary between farmers within a particular area and even between different areas.

The first type of produce obtained is the coffee berry. This can be marketed as such or transformed into dry coffee (also called parchment coffee). Farmers have the option of selling both too. The structure of choice depends on the different characteristics embedded in transaction costs. Transaction Cost Economics theory provides the theoretical framework of study where a comparison of characteristics such as asset specificity, uncertainty and frequency is performed with the assumption that chosen a transaction structure offers relative advantages in terms of lower transaction costs. Proxies are set up through which these characteristics, such as size of coffee plantation, perishability and distance for asset specificity and access to inputs, price variations and delays in payments for uncertainty. Frequency is related to yearly coffee production and to farmers’ needs in the context of the rural community.

### 3.4 Research hypothesises

Associated with the above research approach, the following hypotheses are formulated:

1. Farmers’ characteristics, contractual elements, commitment factors and location factors are the main determinants of the membership status towards the cooperative;
2. Transaction costs and contractual relationships differ according to the governance structures;
3. The type of coffee marketed is determined through production and by membership status;
4. Besides transaction costs, the choice of transaction structure depends on the membership status towards the cooperative.

3.5 Modelling aspects

With reference to the above analytical framework, different kinds of analyses were performed. In the first stage, descriptive analyses were performed using the SPSS (11.0) statistical package. These analyses pertained to farmers’ characteristics and production patterns. Throughout, a clear-cut differentiation is made specifically between cooperative members and non-members and the survey area- Southern and Western Provinces. Differences in means of membership groups are tested with the help of the Analysis of Variance (ANOVA) for the continuous variables; while the independence between categorical variables is tested using Chi-square ($\chi^2$).

Next, marketing choices are analysed. These relate to cooperatives and traders as distinct transaction structures that are associated with a type of marketed coffee. On the basis of Transaction Cost Economics theory, a comparative analysis between these structures is performed from 2 perspectives: transaction costs and contractual relations. The analysis is based on factors generated from the study that are better proxies of elements associated with these aspects of transaction structures.

In the third stage, econometric analyses are done by the help of the econometric package STATA (9.2), in a attempt to identify credible determinants of farmers’ choices with regard to membership, the type of produced coffee and structure in which to market the coffee.

The following models are carried out:

- Binary choice models for decisions regarding membership, type of coffee in production and transaction structure

Although the factors determining each of the above decisions are different, their estimations are based on the method of maximum likelihood where probit models are used. In each case, there are two ‘discrete’ alternatives between which the choice is made: cooperative membership or non-membership; early or late membership; production of berries only or berries with/or dry coffee and transacting with cooperatives or traders.
The assumption underlying the probit model is that there is a response function of the type:

\[ Y_i^* = X_i\beta + \epsilon_i \]  \hspace{1cm} (1)

Where \( X_i \) is the observable vector of individual characteristics and \( Y_i^* \) is the underlying latent variable. What is observed is a dummy variable \( Y_i \) defined by:

\[ Y_i = \begin{cases} 1: & \text{if } Y_i^* > 0 \\ 0: & \text{otherwise} \end{cases} \]

The probit model is associated with the following cumulative normal distribution function:

\[ F(w) = \Phi(w) = \int_{-\infty}^{w} \frac{1}{\sqrt{2\pi}} \exp\left\{ -\frac{1}{2} t^2 \right\} dt \]  \hspace{1cm} (2)

- Poisson model for the year of membership

In reality, not all members of the cooperative join at its creation but at different points of time. Therefore as in this study; the dependent variable is associated with discrete values corresponding to the year of membership in relation to the year of cooperative creation.

The Poisson regression model is used. According to Greene (2003), the Poisson model specifies that each \( Y_i \) is drawn from a Poisson distribution with parameter \( \alpha_i \) which is related to the regressors \( x_i \) such that:

\[ \text{Prob}(Y_i = y_i | x_i) = \frac{e^{-\alpha_i} \alpha_i^{y_i}}{y_i!} \text{ where } y_i = 1, 2, 3, \ldots \]  \hspace{1cm} (3)

The loglinear model is formulated for \( \alpha_i \) so that

\[ \ln(\alpha_i) = X_i \beta \]  \hspace{1cm} (4)

Assuming there is a random sample of \( y_i \) and \( x_i \), if the Poisson distribution is correct; the model leads to a consistent, asymptotically efficient and normal estimator for \( \beta \).

- Multinomial model for the choice of transaction structure

In the choice of transaction structure, more than 2 alternatives are open to farmers who in addition to choosing to transact with a cooperative or traders, they can actually transact with both. On grounds of random utility, the multinomial logit model is used in this context where for the \( i \)th farmer faced with J choices, the utility of choice \( j \) is:
If the choice $j$ is made, it is assumed that $U_{ij}$ is the maximum among the $J$ utilities. The estimation of the model provides a set of probabilities for the $J+1$ choices for a decision maker with characteristics $x_i$, such that:

$$\Pr(\text{ob} \ Y_i = j \mid x_i) = \frac{e^{\beta_j x_i}}{1 + \sum_{k=1}^{J+1} e^{\beta_k x_i}} \quad \text{for } j=0,1,...,J \quad \text{where } \beta_0 = 0$$

(6)
CHAPTER 4 OVERVIEW OF THE AGRICULTURAL SECTOR AND COFFEE PRODUCTION IN RWANDA

Rwanda is a small, densely populated, landlocked country in Central-Eastern Africa. The country has 26,338 sq. km of total area, of which 24,950 sq. km (94.7 percent) is made up of land; of this, only 8,600 sq. km (32.7 percent) are suitable for agriculture. The population is estimated at 8.4 million with an annual growth of 2.4 percent; its density is of 311 inhabitants per sq. km. When taking into account the arable area only, this density increases to 955 inhabitants per sq. km making Rwanda one of the most densely populated countries in Africa (Rwanda Development Gateway, 2005; The CIA World Fact book, 2006).

The Rwandan economy is predominantly based on agriculture. This is reinforced by the quasi absence of minerals and other natural resources, the landlockedness, the current low level of industrialization and the low purchasing power of the population.

4.1 Overview of the agricultural sector

Agriculture is practiced on all land types, including land of marginal quality and steep slopes. Agricultural systems in Rwanda are characterized by small family farms with an average size of 0.76 hectare which integrate polyculture and animal production systems. They are highly labour intensive since the cultivation techniques are purely manual. However, the household’s arable land is becoming smaller due to the high population density combined with soil erosion. According to Agricultural, Livestock and Land Use Survey (Nkezabahizi et al., 2005), the soil fertility is declining due to a decline in the number of livestock causing scarcity of manure and compost. This increases the poor people’s vulnerability and only a few agricultural households have the opportunity to raise their incomes by being engaged in off-farm activities. The practices of land renting and share-cropping exist: on average 10.7 percent of farmland is rented in form of cash or kind (Nkezabahizi et al., 2005). However, the consequence is that people would not make long-term investments where land is being rented.

About 97 percent Rwandan agriculture depends on rainfall. According to FAO (2005), only 8.9 percent of the arable area is irrigated. The suitability of most land in Rwanda for irrigation, given her terrain, is a major constraint, but there could be some good pockets where irrigation could be practised.

Beans and sweet potatoes are the staples of the Rwandan diet and are cultivated everywhere in the country. Irish potatoes, sorghum, bananas and maize are grown in the majority of the rural communities, with regional patterns being apparent in some cases.
Majority of the total food production (66 percent) is for family consumption, but surpluses are marketed. However, not all households are able to sell their agricultural produce (only 60.3 percent can do so). Crops marketed by smallholders include bananas, potatoes, sorghum, beans, peas and maize which constitute the major sources of cash income for rural households (Nkezabahizi et al., 2005).

Other crops most likely to be sold are coffee, tea and pyrethrum. These perennial export crops are cultivated on 13 percent of the arable land. Recently, there is an emerging diversification with products such as maracuja (passion fruit) and plums developed by private enterprises that process the fruit into juices and horticultural products (tomatoes and other vegetables) that supply an increasing urban demand.

With regard to agricultural infrastructure, 91 percent of rural communities have a road leading to the community, but in more than a third of cases this is inaccessible for parts of the year (3.4 months on average). Only 14.8 percent of the communities have a weekly or daily market, and the average distance to the market is 4.6 km. Lack of access to markets acts as a serious constraint on developing more commercialized agriculture (Nkezabahizi et al., 2005).

Despite the above constraints, agriculture remains the main source of income in rural areas. The agricultural contribution to the total GDP in 2004 was 40.5 percent while that of industry and services were 21.5 percent and 38.1 percent respectively (Rwanda Development Gateway, 2005). The contribution of agriculture to the GDP ranges in percentage between 43.4 and 40.5 in the period 1999-2004. It is illustrated in Figure 4.1.

![Figure 4.1 Contribution of agriculture to GDP 1999-2004](image)

Source: Rwanda Development Gateway, 2005; EICV, 2002; PSTA, 2004

While contributions of agriculture to GDP remain almost constant, from 2002 there are variations in total GDP suggesting that other sectors are becoming more
responsive. It must be noted that much of this agricultural contribution is derived from the exports of cash crops.

4.2 Coffee production in Rwanda

Coffee has been grown in Rwanda since its introduction by German Missionaries in 1904. The crop was mainly kept by the colonial administration to respond to the need for coffee that they cherished but also to support the economy of the country. Coffee growing was then made compulsory and the number of coffee producers grew progressively and consequently, the number of coffee trees and the plantation area considerably increased. The National Coffee Board (OCIR) was created in 1945, with the mandate of fixing the qualitative norms and classification systems, generating and diffusing information pertaining to the coffee sector and establishing an environment of cooperation between different stakeholders that are engaged in the coffee sector. In 1998, coffee production occupied around 6.3 percent of the total cultivated land (OCIR, 1998). Meanwhile as production increased, private operators started setting up coffee processing factories.

Rwanda produces Arabica coffee of bourbon and typica species. In general, the coffee tree grows well and gives a sufficient production in regions with altitude between 1400 and 1900 meters, rainfall between 1500 and 1600 mm, temperature between 18 °C and 22° C and soils with acidity levels (pH) between 4.5 and 6, which are fertile, fragile and quite permeable (MINAGRI, 2004). Even though coffee is interspersed in all parts of the country, regions of suitability to its cultivation were identified relative to the above characteristics (OCIR 1998). For instance the shores of Lake Kivu in the Western province of the country are suitable for coffee growing with very good productivity. The rich volcanic soils, rainfall distribution and clement yearlong temperatures favour the slow maturation of the coffee bean which is good for the coffee taste. The productivity per hectare varies between 1100 and 1600 kg of dry coffee.

In general, the central and southern areas are moderately suitable for coffee growing with the yield varying from 200 to 900 kg of dry coffee per hectare. The highland region in the Northern Province is unsuitable for coffee because of very low temperatures. The lowland region of the eastern province is also not suitable for coffee growing due to insufficient rainfall and longer dry season; the soil fertility is too low for the coffee crop (OCIR 1998, MINAGRI, 2004). Mulch, manure and sometimes chemical fertiliser are used to maintain soil fertility. Coffee is harvested between the months of March and July (MINAGRI, 2004).
Almost all produced coffee is exported as its domestic consumption is quite low. The high volume importers include European countries France, Switzerland and Belgium, USA and Asia. Figure 4.2 shows the trends in production along with the exports.

![Coffee production and exports evolution since 1985](image)

**Figure 4.2 Coffee production and exports evolution since 1985**  
*Source: ICO, 2006*

Apart from productions recorded during the period in the 1980’s and some scattered peak years (1991, 1999, 2002 and 2004) the country’s coffee production and exports declined specially since 1990. In 1992 farmers had started neglecting coffee.

Some of the causes which led to the fall of production are poor fertility of coffee plantations and poor performance of coffee extension activities. This degradation is also associated with massacres and genocide: many coffee producers were killed while others went into a prolonged exile; coffee extension workers were very few, which resulted in a lack of follow-up and supervision for coffee producers to care for the crop. Research on coffee was also disrupted following the shortage of necessary means (OCIR, 1998). It is in the present decade that the crop is again taking off. In terms of quantity, the average production of coffee is now of 26,100 tonnes per year (OCIR, 2005).

External factors are also important. These include the big reduction in coffee prices on the international market maintained on a low level due to overproduction of coffee in countries like Brazil and Vietnam. Since the competitiveness of Rwanda coffee is being based solely on the price, the consequences of the fall in the market price have had a huge impact on Rwandan coffee sector. As the evolution of price paid to the producer in comparison with prices at the international market shows in Figure 4.3, Rwandan coffee producers continue to receive very low prices (OCIR, 2005).
In general, similar trends can be observed in fluctuations in world prices and the price paid to the producer. However, the gap is quite big: the price paid to the Rwandan growers was higher than 1.5$ per kg only in 1990 and 1992 while international prices went even up to almost 4.5$/kg. Moreover, at specific times, the changes at world level are not reflected to the producers’ level. For instance, while in 1996 the world prices increased tremendously, there was only a small increase in the price to the growers. This means that producers are not largely the beneficiaries of the earnings from coffee (OCIR, 2005).

The result of the declining production and relatively lower returns from coffee resulted in farmers’ lack of motivation. The coffee-covered area decreased gradually as some coffee fields were left untended, which led to their deterioration. During 1995, the number of neglected coffee-trees was estimated at 60 percent (OCIR, 1998). For all these reasons, coffee production and quality have been seriously reduced, propelling the sector in a vicious cycle of «low quantity-low quality» loop. This is illustrated in Figure 4.4.

Figure 4.3 Evolution of price paid to the producer from 1985 to 2003
Source: OCIR, 2005

![Evolution of price paid to the producer from 1985 to 2003](chart.png)
The quality of coffee depends on the maintenance of coffee trees in the cultivation stage. Other problems include inefficient systems of quality control in processing, insufficient price differentiation in relation to quality and excessive competition among factories and exporters (PSTA, 2004). The methods used by farmers in processing are traditional (depulping by stone) and were quite adequate when the quantity was low. However, with increasing quantity the traditional system failed and quality deteriorated. There were only a few washing stations which also lacked the appropriate equipment.

To meet the above challenges, since 1998 the Government, through OCIR Café, has undertaken a promotional programme of investing in coffee production. The changing trends include the replacement of old varieties by more performing varieties, improving the general plantations’ condition (weeding, mulching, pruning), using inputs (fertiliser, pesticides against diseases and pests), as well as the restructuring of the producers’ environment (establishment and support given to producers’ associations) in order to progressively take care of all the activities pertaining to output’s increase (MINAGRI, 2006).

The coffee quality is also being improved through making growers sensitive to producing high-quality coffee, strengthening the cooperative spirit within coffee producers’ associations for the establishment of washing stations and encouraging private entrepreneurs to invest in the sector (MINAGRI, 2006).

Results have started to show as the overall coffee production is now being revitalized in the different coffee producing regions of the country. Coffee production increased from 14,268 tonnes of green coffee in 1998 to 29,000 tonnes in 2004 (PSTA, 2004; MINAGRI, 2006); and the overall quality of coffee production has improved with
high-quality coffee rising from 19.2 percent in 2000 to 45 percent in 2005 (OCIR, 2005).

The remaining issue is to fairly distribute the increased incomes generated by the industry so that these reach the producer in relation to the effort, money and time spent in growing coffee. This is realized through the active participation of coffee growers to coffee marketing, mainly through their cooperatives.

4.3 Cooperatives in Rwanda

In Rwanda, cooperatives are recently more encouraged through the Government policy, but they are not at all new in the economy. The Cooperative Policy (MINICOM, 2006a) documents that the cooperative movement in Rwanda started in the colonial period, as a tool for promoting colonial Governments. At the time of its independence in 1962, Rwanda had 8 registered cooperative totalling 22,475 registered members. These cooperatives were mainly involved in social activities, development of the mining sector or cash crops such as tea, coffee and pyrethrum. After independence, the Government used these cooperatives as instruments of implementation of its policies and plans, thus becoming a tool for politicians. In the 1960-1970 decade, new cooperatives emerged around the development alternatives, especially in the handicrafts and artisanal activities supported by the catholic missions.

The 1970 decade experienced a strong intervention of the government which led to the creation of other cooperatives such as savings and credit cooperatives to ensure security of savings and distribution of credits. Until 1992, about 8750 cooperatives were counted (MINICOM, 2006b).

After 1994 there were 4,757 organizations with a cooperative character, mainly in the rural areas, allocated in the following categories:

(Number of cooperatives)
- Farming & breeding organizations: 3,596
- Commercialization organizations: 235
- Artisanal organizations: 234
- Other services: 692

Rural cooperatives continue to be conceived as organizations established for and by members “as vehicles to provide services to farmers” (Braverman et al., 1991). This is also applicable in the above classification. These cooperatives have helped substantially in supplying agricultural inputs and materials and the commercialization of agricultural and handicraft products (MINICOM, 2006a).
Studies on farmers’ cooperatives in Rwanda have however found that there are many problems in these cooperatives (Bingen & Munyankusi, 2002; Tardif-Douglin, et al., 1996). Mainly, cooperatives were engaged in multiple income-earning activities, but capital mobilization remained limited. Most cooperatives had discontinued the payment of dues and report very little savings: “some associations simply do not generate significant collective income” (Bingen & Munyankusi, 2002). To develop these cooperatives, education of farmers was recommended to ensure that the associations can prevent or minimize the damage from critical organizational crisis, such as embezzlement or conflict. Moreover their links with other agents, particularly for input suppliers was to be strengthened so that the traders and farmers could work with each other in the provision of needed services (Bingen & Munyankusi, 2002).
PART II
CHAPTER 5 FARMERS AND COFFEE: A DESCRIPTIVE ANALYSIS

Farmers differ in their individual characteristics and production patterns. Combined, these features determine the type and amount of coffee sold. By type of coffee, a distinction is made between coffee berries and parchment/dry coffee; this distinction is made clear in subsequent sections of this chapter. Section 5.1 is an analysis of the interviewed farmers’ personal and production characteristics and section 5.2 elucidates the process that leads to differentiating the type of coffee that is produced and marketed.

5.1 Farmers and coffee farming

5.1.1 Farmers’ characteristics

The sample was made up of 171 farmers out of which 121 were cooperatives members, and 50 are non-members. General characteristics of farmers were analysed as shown in table 5.1.

Table 5.1 General descriptives of farmers’ characteristics per membership status and province

<table>
<thead>
<tr>
<th></th>
<th>Southern Province</th>
<th>Western Province</th>
<th>St. dev.</th>
<th>Equality test&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Member</td>
<td>Non-Member</td>
<td>Member</td>
<td>Non-Member</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>113</td>
<td>43</td>
<td>13</td>
<td>41</td>
</tr>
<tr>
<td>Female</td>
<td>58</td>
<td>20</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>13.38</td>
</tr>
<tr>
<td>&lt;=30 years</td>
<td>28</td>
<td>11</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>31 to 40 years</td>
<td>34</td>
<td>9</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>41 to 50 years</td>
<td>50</td>
<td>17</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>51 to 60 years</td>
<td>43</td>
<td>19</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>61 years&lt;=</td>
<td>16</td>
<td>7</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
<td>0.75</td>
</tr>
<tr>
<td>No formal schooling</td>
<td>31</td>
<td>13</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Primary school</td>
<td>116</td>
<td>44</td>
<td>15</td>
<td>38</td>
</tr>
<tr>
<td>Secondary school</td>
<td>15</td>
<td>5</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Technical school</td>
<td>8</td>
<td>1</td>
<td>-</td>
<td>5</td>
</tr>
</tbody>
</table>

<sup>a</sup> Equality test pertains to membership categories. F values are given for continuous variables and Pearson $\chi^2$ for categorical variables.

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + if significant at 15% level.

A general observation is that farmers are different in their personal characteristics when a comparison is made between members and non-members. The F-statistics are significant at 15% for gender, age and education.
• Gender

Overall, the sample comprised of more males than females: out of a total number of 171 respondents, 58 were females, constituting only about one third in the proportion. It is interesting to note that women constituted a proportion of 30 percent and 42 percent respectively in member and non-members categories.

• Age

The average age of the respondents is overall 45 years old with variations within membership categories and provinces. The biggest proportion of farmers belongs to the age range of 30 to 60 years. These bounds can be explained by lower life expectancy (44 years for males and 47 for females) and as a consequence of war and genocide. The lower bound is also explained by the fact that the younger people are pursuing their studies and/or other occupations than farming. Those that are engaged in farming do so because they have no formal education or have discontinued their education at a younger age due to various reasons.

• Education

Education of farmers reveals that only 14 percent of interviewed farmers have had an education level higher than the primary school. The latter comprises the biggest proportion as shown in table 5.2.

Table 5.2 Farmers’ education level per membership status

<table>
<thead>
<tr>
<th>Education level</th>
<th>N</th>
<th>Percentage of farmers per membership status</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Member</td>
<td>Non-Member</td>
</tr>
<tr>
<td>No formal schooling</td>
<td>31</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>Primary school</td>
<td>116</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>Secondary school</td>
<td>15</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Technical school</td>
<td>8</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

\(\chi^2 = 3.23\)

Among the interviewed farmers, 18 per cent are illiterate and 68 percent have only attended the primary school. Farmers with some secondary education are found in agriculture due to own interest or the need to undertake farming. This happened mainly after restructuring the public sector service (ministries and other government institutions) that resulted in the dismissal of many non-university staff. The proportion of farmers who have attended technical schools is quite small, only 4 percent of the interviewed farmers. This is comprehensible as other activities such as construction, carpentry and mechanics are open to them.
It might be expected that membership status is associated with the level of understanding of benefits associated with coffee. However, the $\chi^2$ statistic of 3.23 is not significant which throws doubt on whether education really explains the choice of membership status: the same proportion of members and non-members (68 percent) has only received a maximum of primary school level of formal education. Differences are observed for the first category (the larger proportion of non-educated farmers i.e. 24 percent belongs to non-members category) and in the higher categories where the proportions among members are higher: for the secondary school and technical school categories, percentages of members are 11 and 5 percent respectively while it is 4 percent for both for non-members.

- **Household**

Other important aspects relate to the household; these are the size and dependency ratio. In economics, the dependency ratio is calculated as a proportion of family members not included in the labour force either because they are too young (under the age of 15) or too old (over the age of 65) to work\(^2\). Table 5.3 describes these aspects.

**Table 5.3 Household characteristics per membership status and province**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Southern Province</th>
<th>Western Province</th>
<th>St. dev.</th>
<th>Equality test(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Member</td>
<td>Non-Member</td>
<td>Member</td>
<td>Non-Member</td>
</tr>
<tr>
<td>Household size(^3)</td>
<td>159</td>
<td>6.4</td>
<td>6.5</td>
<td>6.9</td>
<td>6.2</td>
</tr>
<tr>
<td>Dependents(^4)</td>
<td>152</td>
<td>3.8</td>
<td>3.9</td>
<td>4.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Dependency ratio(^5)</td>
<td>152</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
</tr>
</tbody>
</table>

\(^4\) Equality test pertains to membership categories. F values are given for continuous variables and Pearson $\chi^2$ for categorical variables

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + if significant at 15% level.

With regard to household characteristics, the size of the household does not display any difference in membership status (F-statistics is not significant), neither does the dependency ratio. However, a 10 percent significant difference in the number of dependents is observed.

The average household size is of 6 to 7 members but this number can go to as high as 13 persons. This is because in addition to parents and children, often other family relatives (grand-parents, nieces and nephews, etc.) stay in the household either permanently or at least for a long time. The household size and structure determine the availability of family labour especially in the harvest season when any extra hands

---

\(^3\) Number of household permanent members  
\(^4\) Number of children under 12 years and elders unable to work  
\(^5\) Dependency ratio= Number of dependents/Household size
are needed. However, there are dependents that are too young or too old to be counted on for labour in any season. Their number is significantly different according to membership status. It is on average 3 to 4 dependents per household. In larger families the number of dependents can go to 9 persons. The dependency ratio is on average similar for all farmers: 60 percent except for non-members in the Western Province where this ratio is lower (50 percent).

5.1.2 Coffee growing

Farmers cultivate a diverse range of food crops (beans, maize, potatoes, sorghum, bananas, etc.) and cash crops (sugar canes, fruits and export products such as coffee, tea, pyrethrum, etc). These cash crops are undertaken to supplement rural farmers’ income (Rwalinda et al, 1992; Personal communication with farmers). Farmers also own livestock animals including cows, small ruminants (goats, sheep), poultry, etc. There are differences in the cultivation and livestock ownership patterns depending on geographical criteria.

Income from coffee is treated as unique by farmers since it is generated in a short period due to the seasonal aspect in coffee harvesting and can be obtained as a lump sum. Therefore for a coffee grower, it is with this money that he/she expects to fulfil many of his/her own needs and those of the household (Karekezi, Personal Communication).

The drawback of coffee farming is that it involves a cycle of long-term commitment. The trees produce after 3 to 4 years of planting and after 7 or 8 annual crops; trees are cut for regeneration and will be productive again in the next 1 or 2 to 3 years.

- Motivation for growing coffee

The interviewed farmers expressed their motivation for growing coffee. Among the given reasons are that coffee growing has become part of the culture, due to the compulsory nature of its cultivation inherited from the colonial period. Therefore, farmers have been cultivating coffee because their fathers and grand-fathers had been doing so. In addition to this, coffee was found to be, in those geographical areas where it is suitable, the most important source of income in the rural area. The reasons indicated by respondents are shown in figure 5.1.
It was found that the main reasons for growing coffee are to earn some income (42 percent) and to follow the tradition (34 percent) as farmers inherited the plantations from their parents. However a non-negligible proportion (14 percent) asserted that these conditions were combined to the lack of better alternatives in terms of other cash crops and soil conditions. The other reasons mentioned for growing coffee are the response to cooperative sensitization and/or government promotion in the region, protection against soil erosion, etc. A significant association between the purpose of growing coffee and membership status was found ($\chi^2 = 8.97^*$): only 32 percent of members grow coffee due to lack of other alternative or tradition while for the same reasons 54 percent of non-members cultivate coffee.

- Coffee farming characteristics

Other characteristics explaining the behaviour associated to coffee farming are experience in terms of the years farmers have been growing coffee and number of coffee trees. The latter can be decomposed into the number of trees that were productive in 2006 i.e. were harvested and those that are not productive because they were too young or have been cut for regeneration. These characteristics are shown in table 5.4.
Table 5.4 Characteristics of coffee growing per membership status and province

<table>
<thead>
<tr>
<th></th>
<th>Southern Province</th>
<th>Western Province</th>
<th>St. dev.</th>
<th>Equality test&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Member</td>
<td>Non-Member</td>
<td>Member</td>
<td>Non-Member</td>
</tr>
<tr>
<td>Experience in coffee growing (years)</td>
<td>159</td>
<td>24</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>Total number of coffee trees</td>
<td>170</td>
<td>790</td>
<td>268</td>
<td>765</td>
</tr>
<tr>
<td>Irreproducible trees</td>
<td>168</td>
<td>280</td>
<td>148</td>
<td>256</td>
</tr>
<tr>
<td>Reproducible trees</td>
<td>168</td>
<td>526</td>
<td>112</td>
<td>491</td>
</tr>
<tr>
<td>Number of farmers by reproducible trees</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;=100</td>
<td>38</td>
<td>11</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>101 to 300</td>
<td>66</td>
<td>24</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>301 to 500</td>
<td>31</td>
<td>11</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>501 to 1000</td>
<td>17</td>
<td>5</td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>1001 to 3000</td>
<td>15</td>
<td>9</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>3001&lt;=</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<sup>a</sup> Equality test pertains to membership categories. F values are given for continuous variables and Pearson $\chi^2$ for categorical variables

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + if significant at 15% level.

- Experience in growing coffee

Farmers have been growing coffee for a long time: 25 years on average. However, there are large variations in the number of years of growing coffee: differences among membership status are significant (F-statistic: 2.75**). In the Western Province, the average experience is the highest for members (28 years), while it is the lowest for non-members of the Southern Province (22 years).

The experience levels support the finding regarding farmers’ age and education. If the farmers have none or only a few years of education, their entering into farming in an early age is associated with longer experience of growing coffee. However, there are also farmers who started growing coffee in the last 5 years. This category of new ‘planters’ constituted 10 percent of interviewed farmers. Among them are those who have recently been sensitized in trainings and comprehended or observed other growers’ benefits from coffee production.

- Number of coffee trees

It could be expected that those farmers who have been growing coffee for many years are the ones owning more coffee trees. However, only a small but significant correlation coefficient was found between these variables (Pearson Correlation: 0.26*). This can be explained by trends in the 1990’s which saw the international coffee crisis, the neglect and consequent reduction of coffee trees due to war and genocide, changing agro-climatic conditions, lack of land or excessive costs as
compared to the earnings from coffee (Loveridge et al., 2003). The situation worsened up to a point where farmers themselves destroyed their trees. Since recently, positive trends have been observed following the government policy as mentioned in chapter 3. The average number of coffee trees is now increasing from 155 trees (Loveridge et al., 2003) to more than 200 trees in the study sample.

Significant differences of ownership of coffee trees exist between members and non-members: (F statistic: 14.24* for reproducible trees and 8.08* for irreproducible trees). As could be expected, members and farmers in the Western Province own on average more trees compared to non-members and farmers in the Southern province respectively. Details of coffee ownership show that the largest proportion of farmers (82 cumulative percent) in the Southern Province own up to 500 reproducible trees. It increases to 88 percent when the category of those who own up to 1000 trees is included. In the Western Province, the same cumulative proportions are 79 and 93 percent respectively. This shows that in the Western Province coffee farmers are larger owners of coffee trees compared to the Southern Province.

- **Coffee plot characteristics**

The land ownership patterns are characterised by fragmentation where farmers own many plots in different places (Musahara and Huggins, 2005). Consequently, coffee is also not cultivated in one plot and the distance to the plots varies. Table 5.5 illustrates these characteristics.

**Table 5.5 Coffee plot characteristics per membership status and province**

<table>
<thead>
<tr>
<th></th>
<th>Southern Province</th>
<th>Western Province</th>
<th>St. dev.</th>
<th>Equality test&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Member</td>
<td>Non-Member</td>
<td>Member</td>
<td>Non-Member</td>
</tr>
<tr>
<td>Number of coffee plots</td>
<td>167</td>
<td>2</td>
<td>2</td>
<td>1.38</td>
</tr>
<tr>
<td>Number of trees per plot</td>
<td>167</td>
<td>301</td>
<td>178</td>
<td>183</td>
</tr>
<tr>
<td>Distance to the farthest plot (minutes)</td>
<td>123</td>
<td>16</td>
<td>15</td>
<td>12</td>
</tr>
</tbody>
</table>

<sup>a</sup> Equality test pertains to membership categories. F values are given for continuous variables and Pearson $\chi^2$ for categorical variables

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + if significant at 15% level.

- **Number of coffee plots**

On average, the number of coffee plots is 2 with significant differences in the membership categories. These categories are shown in Figure 5.2 that indicates the percentages of farmers per number of coffee plots.
The largest share in any membership category is of farmers who have just one plot (34 percent and 57 percent for members and non-members respectively). However depending on the number of trees, farmers own 3 to even more than 6 plots.

Significant differences are also observed with respect to the average number of coffee trees that are planted in the plot. In any province, this amounts to around 300 trees for the members. For the non-members, the number of trees per plot is much lower: 180 trees.

- Distance to reach the plot

The importance of describing the land ownership system is that it might explain certain differences in terms of maintenance of coffee plantations and the resulting production. These differences are associated with the distance to reach the plots.

This distance is on average 15 minutes. But, there are large deviations: in some cases farmers may even walk for 2 hours to reach their plots. This explains the attitude that if farmers own a few plots which are also close to home, then maintenance is easier. In interviews with farmers, they in fact asserted that far-off plots tend to be neglected.
5.1.3 Costs of coffee production

Coffee farming involves maintenance costs in all seasons whether coffee trees are productive or not. However, the related income is only generated in the harvest season. Farmers were asked to recall elements of their expenses in production such as fertiliser or labour. Often, these are home-supplied and not traded in the market, therefore, it is difficult to calculate all the costs. The main cost elements were found to be land, labour and fertiliser.

- Land

The land ownership structure in Rwanda is individualized for farm households in rural areas. However, land distribution is characterized by increasing inequalities due to ways farmers can access and sell land. This has resulted in a high degree of land fragmentation which results in parcels too small to be productive. Land transactions for coffee plantations are mainly done through sales because other practices would not permit the long cycles and investments that are involved in growing coffee.

As many farmers have inherited land from their parents, only a few farmers reported to have bought land in recent years. Only 12 farmers did so, with the cost of land ranging from 15,000 Rwfs to 300,000 Rwfs (with t-statistic from mean = 4.19**). This cost varies depending on the size of the plot, the soil and location conditions and whether the plot was already under some coffee trees or not.

- Labour

Labour usage in coffee is typically seasonal, required for maintenance of the coffee plantation: weeding, mulching, cutting off old branches, spreading the pesticides, etc. More intensive labour is needed during harvest as the berries ripe almost simultaneously. Moreover, due to the quality requirements, berries have to be supplied within 4 to 6 hours to the washing stations. In case farmers choose to do their own processing and sell the coffee as dry, labour is also needed for the extensive harvesting and subsequent depulping. Since processing is not tied to a specific time limit, this labour is accounted for in the ordinary season.

In terms of the type of labour, a distinction is made between family and hired labour. Family labour is used in both seasons for the ordinary coffee maintenance and during harvest. Additional family members including school going students also help. A strong and significant relationship was found between family labour and household size (Pearson correlation: 0.461**).
Membership choice from a transaction cost economics perspective

Hired labour in coffee is also used: either continuously as part of other household chores and paid monthly or in other cases some casual labour for a few hours/days is needed for instance in transporting the manure from the household compound to the plot or in harvesting. The latter is the most usual practice. A few farmers (N=37) gave an estimation of hired labour in the harvest season, this number is 7 and 5 days for members and non-members respectively. A comparison of seasonal labour requirements can be made among the membership groups. This is shown in table 5.6.

Table 5.6 Seasonal labour requirements per membership status and province (persons per day)

|                      | Southern Province | Western Province | St. dev. | Equality test
|----------------------|-------------------|------------------|----------|-----------------
|                      | Member            | Member           | Non-     | Non-           |
|                      |                   |                   | Member   | Member         |
|                      |                   |                   |          | Non-Member     |
| Average persons per  | N                 |                   |          |                |
| day                  |                   |                   |          |                |
| Ordinary season      | 151               | 4                 | 3        | 4              | 3            | 1.82        | 7.46***    |
| Harvest season       | 153               | 6                 | 4        | 8              | 5            | 3.3         | 14.32**    |

• Equality test pertains to membership categories. F values are given for continuous variables and Pearson $\chi^2$ for categorical variables

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + if significant at 15% level

Differences in labour usage are significant within the membership categories during the ordinary and harvest seasons. This is because members need to meet cooperatives’ quality requirements, therefore need more labour both for maintenance of the coffee plantation and during harvest. In the ordinary season, members on average employ 4 persons per day while non-members employ 3 persons per day. There is a noticeable difference in the harvest season where the members use on average 6 to 8 persons per day of harvest while the non-members use 4 to 5 persons in a day of harvest.

An adult person can harvest on average 1 basket of berries equivalent to 10-15 kgs per day (Personal communications); this is almost the equivalent of the average production per coffee tree which was found to be equal to 12.8 kgs$^6$. Therefore, a difference is also reflected in the number of days accounted for the hired labour in both seasons.

- Fertilisation and other inputs

Farmers use organic and chemical fertiliser for coffee. The use of each type of fertiliser depends on local soil conditions and its availability. Differences are therefore expected between the provinces. The Western Province is more fertile due to its volcanic soils. Therefore apart from the mulch, not much of other types of fertiliser are used. The Southern Province on the other hand requires much fertiliser as the soil is mostly infertile due to erosion. Figure 5.3 shows the use of different types of fertiliser among the membership categories.

$^6$ Quantity per tree = [(Quantity of berries + 5*Quantity of dry coffee)/Number of reproducible trees]
There are differences in the use of fertiliser between the membership categories ($\chi^2=18.98**$). In general, fertiliser use is higher for the members who can combine mulch together with manure and/or other chemical fertiliser. Manure is home produced and mulch comes from crops residues. Chemical fertiliser on the other hand is distributed by cooperatives to the members.

Non-members have difficulties in accessing almost all fertiliser. In fact, a proportion of this group does not use any fertiliser at all. Mulch seems to be the most common type of fertiliser used, in a very few cases combined with manure or chemical fertiliser for those who can afford it or have obtained it in one way or another.

Difficulties in accessing inputs are not only found with respect to the use of fertiliser. For example with seedlings, 20.9 percent of non-members explained that seeds were not always sufficient i.e. they ordered the seedlings but never received them or were not given the required amount. This proportion is lower for members (14.5 percent). A detailed discussion of these difficulties in access to inputs is made in section 6.2.1.

5.1.4 Location characteristics

Differences in production patterns can be made with respect to geographical conditions. As mentioned, the sample was taken from 2 Provinces- the Western and Southern. In the previous sections, characteristics of coffee producers were different over these locations. It is therefore interesting to compare provinces’ major characteristics. Since within the province there are also variations, a distinction is made according to the cooperatives’ area of operation (Table 5.7).
Table 5.7 Location characteristics of cooperatives

<table>
<thead>
<tr>
<th></th>
<th>Abahuzamugambi</th>
<th>Koakaka</th>
<th>Coopac</th>
<th>Kopakama</th>
</tr>
</thead>
<tbody>
<tr>
<td>Province</td>
<td>South</td>
<td>South</td>
<td>West</td>
<td>West</td>
</tr>
<tr>
<td>Region</td>
<td>Middle Highlands</td>
<td>Middle highlands</td>
<td>Shores of Lake Kivu</td>
<td>Shores of Lake Kivu</td>
</tr>
<tr>
<td>Altitude (m)</td>
<td>1500-1900</td>
<td>1500-1900</td>
<td>1650-2100</td>
<td>1450-1800</td>
</tr>
<tr>
<td>Rainfall (mm)</td>
<td>1100-1200</td>
<td>1200-1600</td>
<td>1200-1400</td>
<td>1200</td>
</tr>
<tr>
<td>Suitability of coffee production</td>
<td>Moderate</td>
<td>Good</td>
<td>Very good</td>
<td>Very good</td>
</tr>
<tr>
<td>Average yield-1998 (kgs of dry coffee per ha)</td>
<td>930</td>
<td>900</td>
<td>1630</td>
<td>1100</td>
</tr>
</tbody>
</table>

Source: OCIR, 1998; Rwandex, 2006

The cooperatives in the Western Province are located on the shores of the Lake Kivu where production is naturally very good due to high altitude combined with sufficient rainfall and volcanic soils. The average productivity is 1630 and 1100 kgs of dry coffee per hectare respectively for Coopac and Kopakama. These levels are the highest in the whole country (OCIR, 1998).

The Southern Province, characterised by a plateau of mild highlands, is also appropriate for coffee production as the altitude and rainfall are still sufficient. However, due to the frequent soil erosion, the harvest of coffee is moderate. The average yield per hectare is around 900 kgs.

5.2 Coffee marketing

5.2.1 Type of coffee

As mentioned at the beginning of this chapter, 2 types of coffee can be produced: either berries or parchment/dry coffee. Dry coffee is usually a small proportion of the produce that is of low quality rejected by the cooperative or the sluggish berries harvested towards the end of the season. However, the entire produced crop can also be sold as dried coffee if the farmer is not a member of the cooperative, or is not interested in selling his coffee as berries. The following paragraphs give a brief overview of post harvest handling of coffee berries to obtain dry coffee.
• The practice of depulping

The coffee berry is made of different layers associated with different type of coffee product as pictured in figure 5.4: the outer skin (green when growing and red when ripe (1), the parchment skin for dry coffee (2) and the silver skin that covers the green bean (3).

Depulping entails the removal of the berry’s outer skin. Then after, coffee is left to ferment for 3 days and then water-washed many times to clear-off the pulp so that it is the parchment coffee is left. This is sun-dried for 10 to 14 days (Pearl, 2005). The processing of dry coffee involves removing the parchment so that there remains the green coffee. It will then be roasted in preparation for final consumption. There are different methods of depulping as shown in figure 5.5.
Cooperatives’ washing stations use heavy machines (3) for depulping. Farmers who depulp their coffee use stone (1), as this is the traditional technology. Some farmers may however have their own machines (2). There is also a possibility of using such machines available at some of the cooperatives’ washing stations or pay for the services at the trading centre. The payment can be in cash or kind i.e. a certain amount is taken as a proportion of berries brought for depulping.

Farmers who have sold a part or all of their production as dry coffee indicated the different methods they have used to depulp their coffee. These farmers form a proportion of 46.3 and 56 percent for members and non-members respectively. Figure 5.6 shows the percentages of farmers who have depulped their coffee per membership status.

![Figure 5.6 Depulping method within membership status](image)

There are differences in the depulping methods used by farmers according to the membership category as figure 5.6 shows. Among non-members who needed to depulp, 68 percent used stone, 4 percent used their own machine (only 1 non-member has his own machine) and 7 percent were able to depulp at the cooperative, these are neighbours to the washing station. Almost a third of them or 21 percent had to pay for depulping.

For members, 7 percent own depulping machines, 27 percent enjoy the advantage of using the cooperative’s machine, 48 percent use stone and only 11 of members made recourse to the paying machines.

There is a cost associated with depulping in terms of a direct payment (cash or kind) if the farmer used a paying machine. The payment in cash is on average 5 Rwfs per kg. The payment in kind is on average 4 mironko of berries per sack of berries\(^7\). At the cooperative, depulping of the coffee belonging to members (and non-members who

\(^7\) 1 mironko \(\approx\) 750 grams and 1 sack \(\approx\) 50 kilograms
Membership choice from a transaction cost economics perspective

have sold their better quality berries to the cooperative) is of course free. However, it can take days depending on the queue and how far home is to the washing station compared to other depulping points. This distance was estimated to go even up to 5 kilometres and farmers have little access to motorized transport.

Other costs are associated with the number of days of depulping (since this is usually done a few hours per day) and of drying. For instance when stone is used, depulping can take up to 60 days and drying to 90 days. Farmers who depulp with their own machines are flexible and the time of depulping is brought down to 20 days on average, as machines are easier and faster to operate. If farmers know they are to go to a paying machine, they prefer to bring a substantial amount of berries; therefore the number of days/time of depulping is reduced to 30 days on average.

- **Distance**

Cooperatives’ washing stations require high quality berries in order to produce the processed coffee that is of good quality. Quality of berries is checked by their density in a floatation tank. It follows from farming practices (through the use of inputs) and the harvesting process. One of the aspects involved in harvesting already described is labour. Another aspect is the distance to the washing station or the collection points set by cooperatives to ease the burden of transport. In case of dry coffee, the average distance to traders was also estimated by farmers. Elements of distance are discussed in detail in section 6.2.1

### 5.2.2 Sales of coffee

- **Coffee price**

At the beginning of the harvest season, OCIR fixes a minimum price per kg of berries and dry coffee that farmers are to receive for the sale of their coffee. For the 2005 season, the berries price was 100 Rwfs and 500 Rwfs for dry coffee. For the 2006 season, the minimum price was fixed at 120 Rwfs and 600 Rwfs per kg of berries and dry coffee respectively. In different locations the berries and dry coffee prices went higher to 140 Rwfs and 620 Rwfs respectively. However, in other locations, the dry coffee was sold at much lower prices even to 250 Rwfs depending on the trader.

- **Breakeven price**

Taking into account all the costs involved such as described in the previous sections, farmers felt that the minimum prices were lower than the costs they incur on coffee production. Therefore they suggested a breakeven price that proxy all the costs per kg of berries or parchment/dry coffee. For the berries such breakeven price would

---

8 Because 5kgs of berries=1kg of dry coffee
include the cost on coffee maintenance, fertiliser, the added labour in harvest, etc. For dry coffee, the breakeven price also includes the burden of depulping, washing/cleaning the coffee and drying it. It was found to be on average 180 Rwfs and 860 Rwfs per kg of berries and dry coffee respectively.

- Sales of coffee

Table 5.8 shows the different quantities of coffee sold and income thereby generated.

Table 5.8 Sales of and income from coffee per membership status and province

<table>
<thead>
<tr>
<th>Average of:</th>
<th>N</th>
<th>Southern Province</th>
<th>Western Province</th>
<th>St. dev.</th>
<th>Equality test¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Member</td>
<td>Non-Member</td>
<td>Member</td>
<td>Non-Member</td>
</tr>
<tr>
<td>Quantity of berries (kgs)</td>
<td>144</td>
<td>600</td>
<td>102</td>
<td>2328</td>
<td>590</td>
</tr>
<tr>
<td>Quantity of dry coffee (kgs)</td>
<td>84</td>
<td>74</td>
<td>53</td>
<td>64</td>
<td>44</td>
</tr>
<tr>
<td>Income from coffee, 2005 (Rwfs)</td>
<td>128</td>
<td>69874</td>
<td>24954</td>
<td>232288</td>
<td>53700</td>
</tr>
<tr>
<td>Income from coffee, 2006 (Rwfs)</td>
<td>155</td>
<td>83289</td>
<td>22667</td>
<td>284765</td>
<td>81305</td>
</tr>
</tbody>
</table>

¹ Equality test pertains to membership categories. F values are given for continuous variables and Pearson \( \chi^2 \) for categorical variables

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + if significant at 15% level

In the both provinces, members’ sales of berries are almost 5 times that of non-members (F statistic: 2.83*). The average quantity is also higher for members by 20 in any province; however, this difference is not statistically significant.

From the sale of coffee, income is made. Since this income is generated once a year in the harvesting season, it is used to satisfy the household needs. A higher proportion is used to make big investments: paying school fees, making investments such as buying a plot of land. In general, The Western Province shows higher incomes than the Southern Province. This is explained by the differences in productivity as described in section 5.1.4. On average, members have been making more money than non-members; differences between these membership categories are significant either in 2005 or 2006.

The quantity and incomes for any type of coffee are usually associated with the transaction partners: cooperatives in coffee production aim to improve the quantity and quality of coffee production through their washing stations, and traders buy dry coffee and berries (competing with cooperatives). The next chapter analyses these market relationships and tries to understand the farmers’ choices with regard to the transaction structures.
CHAPTER 6 GOVERNANCE STRUCTURES IN COFFEE TRANSACTIONS

The previous chapter concluded with a note on the existing association between the type of coffee produced and subsequently marketed with the transaction structures namely cooperatives and traders. This chapter is a detailed analysis of these structures.

A general presentation of the main actors participating in the coffee sector in Rwanda is made through analysing the supply chain. It is then followed by a specific emphasis on the structures acting as direct partners to farmers in their sales of coffee namely traders and cooperatives. The organisation of cooperatives and their achievements are shown. A comparative analysis of transaction structures is made on grounds of transaction costs and contractual relationships.

6.1 Main actors in the coffee sector in Rwanda

6.1.1 Coffee supply chain in Rwanda

The coffee supply chain is given in figure 6.1. It is divided into 3 stages corresponding to the type of coffee: berries, dry/parchment and green coffee. Not mentioned in the figure but important is the National Coffee Board (OCIR Café) that intervenes through regulatory measures.

![Coffee supply chain in Rwanda diagram](image-url)
Cooperatives buy berries from farmers, either members or neighbouring non-members. These berries will be processed into parchment coffee at the cooperatives’ washing stations. The operational area of the cooperatives is also an arena for other buyers such as private operators who might own mini-washing stations. These also buy the berries, but mainly from the non-members and undertake the same processing into parchment coffee. The bad quality berries or the produce of the non-members who do not trade at all with cooperatives are processed by farmers themselves who sell them as dry coffee to the traders.

The exportable coffee from Rwanda is green coffee. The transformation of berries into parchment coffee takes place through the process of depulping and drying. The subsequent transformation into green coffee by hulling (to remove the parchment) is performed either by cooperatives (few own the hulling machines) or ‘hulling and exporting’ companies. These are Rwacof, Rwandex, Sicaf, Coffee Business Centre, Agrocoffee and Caferwa. A small proportion of green coffee is roasted and domestically consumed, and the major share is exported. There are 5 roasting companies in the country: some are closely linked to the cooperatives studied (Coopac and Maraba) and others are departments within hulling companies (e.g. Rwandex).

After obtaining the exporting certificate from OCIR, coffee is exported either to Europe (France, Belgium, Switzerland, etc.), USA or new niches in Asia (e.g. China). Cooperatives sometimes operate through Fair Trade markets (where they are guaranteed a minimum price) and/or other international markets depending on the markets they have access to through their marketing unions. At the time of the research, there were 2 such unions: Rwanda Smallholders Speciality Coffee Company (Rwashoscco) and Misozi. The role of these unions is to act as intermediaries between international buyers and cooperatives.

6.1.2 Coffee cooperatives

About 80 cooperatives are registered with OCIR Café. For the purpose of this research, 4 coffee cooperatives were visited. These are Abahuzamugambi ba Maraba and Koakaka from the Southern Province and Coopac and Kopakama from the Western Province. These cooperatives share common features such as organisation and ownership of one or more washing stations. However each cooperative remains unique depending on characteristics such as location, growth and membership evolution and production

General presentation

The recent coffee cooperatives that emerged in the 1990’s are a response to Government policy, but remain the farmers’ own initiatives. In some cases, the founders are erudite farmers, who have an experience with coffee growing. Other
cooperatives were established by simple farmers who, reasoning on reconstructing their livelihoods after the war and genocide, decided to join hands and organise their production in cooperatives. Later, other coffee growers joined them and the cooperatives grew in size and capacity: due to the financial support from international organisations (IFAD\textsuperscript{9}), public and private projects (PDCRE\textsuperscript{10}, PEARL\textsuperscript{11}) and/or loans from the BRD\textsuperscript{12}, these cooperatives were able to construct washing stations. Table 6.1 describes the above aspects.

Table 6.1 Characteristics of cooperatives

<table>
<thead>
<tr>
<th></th>
<th>Abahuzamugambi ba Maraba</th>
<th>Koakaka</th>
<th>Coopac</th>
<th>Kopakama</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creators</td>
<td>Growers</td>
<td>Associations merge</td>
<td>Individual founder</td>
<td>Growers</td>
</tr>
<tr>
<td>Membership at start</td>
<td>230</td>
<td>900</td>
<td>110</td>
<td>94</td>
</tr>
<tr>
<td>Membership in 2006</td>
<td>1,250</td>
<td>1,610</td>
<td>2,198</td>
<td>708</td>
</tr>
<tr>
<td>Rate of membership evolution\textsuperscript{13}</td>
<td>10.2</td>
<td>5.5</td>
<td>11.9</td>
<td>10.8</td>
</tr>
<tr>
<td>Membership fees (Rwfs)</td>
<td>5,000</td>
<td>500</td>
<td>10,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Year of starting washing station operations</td>
<td>2001</td>
<td>2002</td>
<td>2003</td>
<td>2004</td>
</tr>
<tr>
<td>Washing station processing capacity (dry coffee) in tonnes</td>
<td>200</td>
<td>250</td>
<td>350</td>
<td>150</td>
</tr>
</tbody>
</table>

Source: Rwandex 2006

Abahuzamugambi, Kopakama and Koakaka are cooperatives initiated by farmers. However, the latter is a merge of 3 associations of coffee growers which were already in operation. Coopac has a different history. It was created by an individual entrepreneur who was interested in coffee growing.

The membership of cooperatives increased at the annual rate of around 10 percent except for the Koakaka which started with a relatively high membership level. The increase in membership for other cooperatives is associated with their success but it is also often the result of relaxation of membership requirements. For instance with Coopac, initially, to be a member a farmer was required to own at least 1,000 coffee trees and buy two shares each of 25,000 Rwfs. At present however, the membership fee was reduced to only 10,000 Rwfs. This partly explains the high membership

\textsuperscript{9} The International Fund for Agricultural Development

\textsuperscript{10} The smallholder cash and export crops development project

\textsuperscript{11} The Partnership for Enhancing Agriculture in Rwanda through Linkages-Michigan State University

\textsuperscript{12} Banque Rwandaise de Developpement

\textsuperscript{13} Yearly rate of membership (M) growth from initial time (0) to 2006 (t): \( R = [(M_t - M_0) / M_0] * 100 / T \)
adherence towards Coopac, the other reason being the location characteristics that include high coffee productivity in this region of Coopac’s area of operation.

In all cooperatives, members are encouraged to actively participate in the organisation of their cooperatives through different committees. The main organ at the cooperative level is the General Assembly that meets 2 times a year depending on the cooperative. A decentralized form of organisations is also present as in each zone of operation defined according to local administrative units where similar general assemblies are held 2 to 4 times.

Elected committees include:

- **An Administrative Committee:** in charge of executing all the decisions agreed upon by the General Assembly and monitoring all the cooperative’s activities.

- **An Oversight Committee** consists of people within or outside the cooperative. It is charged with the task of supervising cooperatives and following up their accounts.

- **A Management Service:** is under the supervision of the Administrative Committee. Its task is to monitor on daily basis the activities and finances of the cooperative. The running of the cooperative washing stations belongs to this businesslike management system. On the high level of hierarchy there is the General Director, who is, *de facto*, a member of the Administrative Committee.

The above cooperatives started operating washing stations from 2001. These stations have different capacity for processing coffee berries into parchment coffee. The smaller station in terms of capacity is that of Kopakama with 150 tonnes of dry coffee per year. Among the studied cooperatives Kopakama is also the only one that does not own a hulling machine (to process the parchment coffee into green coffee). It buys these services from a private hulling company (Rwacof).

Through these stations cooperatives have been increasing their exportable coffee as figure 6.2 shows.
The exportable production of the cooperatives through the operation of washing stations has been generally increasing. It is highest with Coopac which understandably operates in the area where coffee is intensively grown. Kopakama, which started its operations in 2004, is also showing big improvements, although Misozi, the marketing union to which Kopakama belongs, is not yet fully operational. Abahuzamugambi ba Maraba and Koakaka, that operate through Rwashocco also show steady improvements.

When coffee is exported, the main issue is whether the benefits reach farmers. This depends on the price at which coffee is internationally sold. Cooperatives in the study have all acquired Fair Trade certification which enables them to export their coffee often through Fair Trade markets. The main goal of Fair Trade certification is to guarantee a minimum price at the farmers’ level by charging a price premium to consumers in order to provide a fixed and high price to farmers, particularly in periods of price depression (Muradian and Pelupessy, 2005). In case of coffee, Fair Trade guarantees a minimum price of 126 US cents/lb for the arabica coffee that includes a premium of 5 cents/lb which is reserved for business and social development programmes. These programmes are beneficial to farmers in many ways: farmers receive rebates in cash as shares of profits made from sales. They also receive prizes in kind such as cattle and fertiliser. Other issues in which Fair Trade certification is involved are fair labour conditions for farm and cooperative workers and environmental protection activities such as filtering the waste by-products during the coffee washing process.

However, cooperatives have not yet started realizing the benefits from Fair Trade. This is because in addition to the costs associated with meeting the above Fair Trade requirements, ‘exorbitant’ fees have to be paid to obtain the certification\textsuperscript{14}. When

\textsuperscript{14} For detailed descriptions of the Fair Trade fees: \url{www.flo-cert.net}. 

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure6_2.png}
\caption{Comparison of exportable production}
\end{figure}

\textbf{Source: OCIR 2006, Rwandex 2006}
coffee is marketed through Fair Trade markets, cooperatives do not make any profit. Therefore, even though cooperatives are still selling in these markets, they are faced with a decision of whether to continue the Fair Trade path for guaranteed minimum prices with the risk of bankruptcy in the near future or trade through the ‘normal’ markets (Bihogo, Rwakagara, et. al., Personal Communication).

**Cooperatives achievements**

In addition to attracting members and increasing their production, cooperatives are achieving noticeable performances in the communities where they are established.

- **Abahuzamugambi ba Maraba Coffee Cooperative**

‘Abahuzamugambi’ means joining hands for a common goal. True to the name they have chosen, farmers created the cooperative with the objective of increasing production and commercialisation of high-quality coffee in order to alleviate poverty in the region (Sogestal, 2002).

Starting with one washing station constructed with funding from PEARL, Abahuzamugambi has constructed two additional stations in order to increase the total processing capacity. A hulling machine was also purchased so that the parchment coffee is directly processed into green coffee. All this signals the increased access to berries as a result of increased membership and farmers’ production. The expansion has also spread to the construction of storerooms where coffee is weighted and labelled to indicate the date of processing (Pearl, 2005).

In order to differentiate the coffee that is marketed by quality, a tasting laboratory was built where coffee is graded according to the beans flavour. This enables price differentiation at the market. According to the trained tasters, Maraba coffee has ‘great body and complexity, with chocolate undertones and medium acidity’ (Pearl 2005; Kalisa & Kampeta, personal communication).

By far the most important achievement of the cooperative was the improvement of the socio-economic status of its members. Families who are members of Abahuzamugambi saw their incomes increase significantly during 2001-2004 allowing them to increase their quality of life (Pearl 2005). Furthermore, casual jobs are widely offered both in cleaning the parchment and green coffee by hand sorting in order to eliminate off-colour, insect damage and irregular beans (Pearl 2005).

By 2003, 155 members could afford to send their children to school. In the same year, 76 percent of Abahuzamugambi’s members were able to purchase the health insurance. Another achievement was the set up of an internet centre which serves as an information place in the rural Maraba (Pearl, 2004a).
Figure 6.3 pictures some of these achievements. In (1) a room in the tasting laboratory is shown; in (2) is the cooperative store; in (3) women are hand-sorting coffee and in (4) is the internet centre.

![Image of a room in the tasting laboratory](image1)
![Image of the cooperative store](image2)
![Image of women hand-sorting coffee](image3)
![Image of the internet centre](image4)

**Figure 6.3 Abahuzamugambi ba Maraba**

Abahuzamugambi Cooperative was on 14th September 2005 announced as the winner of the City of Göteborg International Environmental Prize for 2005. This included an award of about 81.5 million Rwfs. The cooperative, the first winner of this prize from the African continent was selected for its pioneering effort to produce coffee in a sustainable way from social, environmental and economic aspects and thus contributing to the enhancement of the quality of life among its members (Pearl, 2004b).

- Cooperative of Karaba coffee producers (KOAKAKA)

The objective behind the creation of Koakaka was to increase coffee production to exportable levels. Created though a merger of 3 farmers’ associations, the cooperative has now expanded and constructed two washing stations with a total productive capacity of 250 tonnes of parchment coffee. These stations were funded by PEARL and PDCRE, the latter through a credit by IFAD.
Koakaka has risen to become one of the most important producers of high-quality coffee from the highly-eroded hills. The cooperative is now instructing its members to discontinue intercropping coffee with other crops. This resulted in increased productivity and income from the sale of coffee (Twin Trading, 2004). Profits from coffee exportations are distributed to members through rebates proportional to their sales of berries to the cooperative.

Figure 6.4 shows one of Koakaka’s washing station constructed through PDCRE (1 and 2); the hills on which coffee is planted (3) and farmers on a ceremonious day of receiving their rebates (4).

Moreover, Koakaka offers credit to farmers in order to meet their financial requirements. A health insurance system through the ‘mutuelle de santé’ (health insurance service) was created, all in order to improve the living conditions of hundreds of its members.

To supplement their income from coffee, various projects are implemented that include making baskets by women and cultivating maracuja (passion fruit) by young farmers (Karekezi, Personal Communication).
• Coopérative pour la Promotion des Activités Café (COOPAC)

Coopac was established with the objective of restructuring the coffee business in this high potential mountainous region by cultivating high quality coffee. The aim was to penetrate more profitable markets and improve substantially and sustainably the living conditions of the producers (www.coopac.com).

With regard to its achievements, Coopac has been able to assist in the construction of schools, health-care clinics, roads and bridges. The well-being of women and youth receives special attention. They are the first to be offered casual jobs at the washing station when it is operating. These jobs include the carriage of coffee sacks, the hand-sorting of coffee, etc.

Figure 6.5 shows coffee trees on the slope of a mountain (1), women sorting dry coffee (2) and children happy in front of classrooms constructed by Coopac (3).

Figure 6.5 Coopac

From the conversation/interview with the Director General-Founder of Coopac, it was understood that in addition to helping out the farmers in need through advances on their coffee sales, Coopac has been rewarding farmers who have delivered large quantities coffee during the season. They are given cows and goats. Then, when the first calves and goats are born, the farmers give them to Coopac for redistribution the following year to other farmers (Rwakagara, Personal Communication).
Coopérative des Cultivateurs de Café de Mabanza (KOPAKAMA)

Farmers started with the objective of improving the quantity and quality of their coffee production. However, there was a decline caused by the misuse of the cooperative funds in 2001-2002. Kopakama was revived in 2003. In 2004, with the credit of BRD of 81 millions Rwfs through the PDCRE, the cooperative constructed its washing station. It is now in the stage of sensitizing farmers to increase their production by involving members in the cooperative activities; for example through the seasonal evaluation meetings (see photo 2) in figure 6.6. It is done so that in the future the station will be utilized in its full capacity. Furthermore since in this region farmers have been neglecting their coffee; therefore, Kopakama has initiated the planting of coffee trees which serve as exemplary plots (1) as figure 6.6 show.

The cooperative does not yet have the capacity to hull coffee. Therefore it buys the services of Rwacof, a private hulling company which charges for this 30 Rwfs per kg of green coffee. It is expected in the near future to equip the station with such a hulling machine.

Apart from the creation of seasonal jobs at the time of processing, not much of additional benefits have yet been provided to the members because the cooperative is still in the revival stage (Hakizimana, Personal Communication).

6.1.3 Traders

Traders constitute a second group of buyers in the coffee sector. They are not only involved in coffee but also in other transactions such as small boutiques at the rural trading centres or markets.

In coffee transactions, traders act as intermediaries on behalf of larger operators. These are themselves exporters or deal with coffee hulling companies that will export the green coffee. This immediately implies that dry coffee is the main type of coffee.
in which traders are interested in. This is bought from farmers after they have depulped it. Traders have been buying this type of coffee even long before cooperatives were established.

At present, traders compete with cooperatives in gaining a share of the coffee market, even for berries. This is because apart from the washing stations owned by the cooperatives, also big private operators own such stations. The difference with cooperatives is that profits from the sale of coffee accrue to the private owner, without any interest in the sustainable survival of the growers. Another distinguishing factor is that traders are not interested in the high-quality production but more in quantity. Therefore a strategy for them is to accept berries without any rigorous quality requirements as cooperatives do.

Not much documentation on traders’ activities exists except for their relationships with farmers that involve malpractices on behalf of traders. Traders are often qualified as ‘opportunists’ (www.coopac.com). Normally, a common practice for them is to propose their "services" when farmers are experiencing difficulties such as in planting crops, incurring unexpected expenses such as for weddings, children are going back school or are sick, etc. The fact is that they are in the community and are more likely to sympathize with the farmers when the latter are experiencing problems. As such they remain a reliable source of income since they are independent in their decision rather than waiting for the cooperative’ agreements and policies in respect of insuring farmers in their needs. The unpleasant outcome is that often farmers are forced to pay exorbitant interests, either made in kind or cash. The other practice is to hold up farmers with their agricultural products mainly coffee and force them to sell their produce to them with no choice to accept whatever price these traders are offering. Often, traders offer lower prices to farmers indicating that there are fluctuations on the market, while the intention is to continue to exploit the farmers.

Despite the problems in the trading arrangements, traders cannot altogether be labelled as unimportant in the sector. They in fact constitute a form of market structure which has been in the business much longer than cooperatives. They are now faced with a difficult position of changing structures in the supply chain (due to the government policy of promoting cooperatives) which disrupts traditional ways of transacting in the society.

6.2 Comparative analysis of transaction structures

A comparison of cooperatives and traders provides more clarification on their relationship with farmers. Following the Transaction Cost Economics Theory, cooperatives can be labelled as hybrids while traders are spot market arrangements. The choice of farmers to transact with any structure depends on their comparative advantages analysed through transaction costs. The analysis of such costs is
performed in section 6.2.1. As two distinct governance structures, they exhibit different contractual relationships with farmers and the associated advantages and disadvantages. These are presented in section 6.2.2.

At the outset, it should be emphasized that farmers, depending on the type of coffee produced, have the choice of trading with any structure as figure 6.7 shows.

![Figure 6.7 Farmers’ transaction partner per type of coffee](image)

Cooperatives only buy berries: 47 members and 17 non members are transacting only with the cooperative. Traders buy berries and dry coffee: 6 non-members have sold only berries to traders; 18 members and 9 non-members sold only dry coffee. Furthermore, 9 members sold both berries and dry coffee to traders. Farmers who transact both with cooperatives and traders constitute a non-negligible proportion in the sale of berries, dry coffee or both.

### 6.2.1 Coffee cooperatives vs. Traders: transaction costs

One of the apparent reasons for being a non-member is the membership requirement such as subscription fee. Since these are often relaxed, there must be other reasons related to transaction costs. Cooperatives and traders present themselves as different governance structures in which farmers choose to operate. The guiding principle in choosing the ‘right’ transaction structure is that the transaction costs are to be lower thereby offering a comparative advantage (Coase, 1992). This analysis is therefore an attempt to compare and contrast the main elements of these costs and bring out the differences that could help in explaining the farmers’ choices.

---

15 C: cooperative, T: traders
   OB: Only berries, OD: Only dry coffee, BD: Berries and dry coffee
Asset specificity

Williamson (1995, quoted by Klein, 2004) defines asset specificity as “durable investments that are undertaken in support of particular transactions, the opportunity cost of which investment is much lower in best alternative uses or by alternative users should the original transaction be prematurely terminated”. It refers to the degree to which that asset has little or no value outside that relationship. This gives rise to a condition of ‘bilateral dependency’, whereupon what may have been a large number of supply conditions at the outset gets transformed into a small number of exchange relations thereafter (Joksow, 2003). In the context of coffee, elements of asset specificity are especially physical assets and site specificity.

- Physical asset specificity: coffee plantation and perishability

The elements of physical asset specificity observed in this study are the size of coffee plantation and perishability of coffee berries at harvest.

The coffee plantation is estimated by the number of trees and refers to that plot of land which is not used for other purposes except for coffee growing. If this plot was sold, the investment in coffee could not be recovered. This puts the farmers in an earlier situation of dependency towards the cooperative or traders: farmers have to produce coffee and nothing else and know they will at some point in time need to sell their produce.

The degree of specificity is different according to transaction structures. High asset specificity is assumed to be associated with cooperatives as the access to membership involves by principle, the ownership of a minimal number of coffee trees. The driving factor is to have more trees: farmers who do not have the required number of trees will plant more; those who already meet the number want to increase, thereby increasing also their dependency towards the cooperatives as transaction costs of trading with traders would be much higher (finding a good price for their coffee compared to the real costs of depulping and drying coffee). However, this dependency is two-sided: depending on the expected production, cooperatives also make asset specific investments such as purchasing machinery and building storerooms in order to increase the processing and storage capacity of their washing stations.

Transacting with traders involves relatively low bilateral dependency as farmers can have fewer trees. Moreover, since traders are only intermediaries in the supply chain of coffee, they need not be involved in other coffee transactions nor invest in machinery.

Another instance of asset specificity for coffee is perishability. It is associated with Masten’s idea (2000) of perishability of agricultural goods as ‘the most conspicuous attribute of specificity’. Perishability refers to the characteristic of the good associated
with the economic loss that arises when the good is not offered at particular moments in time. This also applies in case of coffee. Berries of coffee are highly perishable in terms of the quality standards required by the cooperatives for producing good quality coffee. This requires farmers to harvest their berries and bring them at the washing stations or collection points within 4-6 hours otherwise they would be rejected. This situation increases the asset specificity which is associated to transacting with the cooperatives.

Quality of berries is less of a problem to traders as they accept all farmers’ supplies, even when berries are sluggish or overripe. On the other hand, if coffee is transformed into dry coffee; the asset specificity is lower as there is not such a pressure of perishability and farmers can take their time to process coffee (see section 5.2.1).

- **Site specificity**

Site specificity refers to the (special) location of the asset, and the place-restriction tied to a particular area, reflecting the distance and accessibility in terms of time and money (Joksow, 2005). Table 6.4 shows the time used by farmers to reach either the traders or the washing station/collection point of the cooperatives.

### Table 6.2 Comparison of distance to selling point per membership status and transaction structure

<table>
<thead>
<tr>
<th>Percentage per distance in Minutes</th>
<th>Cooperative Washing station (87)</th>
<th>Cooperative Collection point (97)</th>
<th>Traders (110)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Members</td>
<td>Non-members</td>
<td>Members</td>
</tr>
<tr>
<td>&lt;=15min</td>
<td>94</td>
<td>25</td>
<td>64</td>
</tr>
<tr>
<td>16-30min</td>
<td>39</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>31-45min</td>
<td>22</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>46-60min</td>
<td>18</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>1hour-2hours</td>
<td>13</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>2hours&lt;</td>
<td>4</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

χ² = 31.10 **

The nearer the distance to the transaction point, the higher is the number of farmers who operate at that selling point: the total number of farmers in transaction declines with increasing distance. This is true for both members and non-members and whether the transaction partners are cooperatives or traders, as the significant χ² = 31.10 ** shows. If farmers live nearby the cooperative selling points, whether they are members or not, they are more inclined to sell their coffee as berries to the cooperative. This is associated with the fact these berries will still be fresh enough to meet the quality requirements. Since these requirements do not apply for the dry
coffee, transacting with a nearby trader is explained by the choice of a particular trader among others.

Since the washing stations are usually located near rivers to have access to sufficient water, they might be too far from farmers. Cooperatives therefore establish various collection points in their areas of operation that are closer to farmers in the neighbourhoods of their villages. It can be observed that at distances over 45 minutes not many farmers are entering into transactions: non-members do not transact anymore with the cooperatives whether and to a smaller extent with the traders. In the case of members, even at longer distances, they are still interested in selling their coffee either to cooperatives or the traders.

From the above, it can be concluded that the location of the cooperative/washing station/collection point or traders influence the transaction partner. Therefore, high site specificity is associated with both structures.

**Uncertainty**

Uncertainty includes possibilities or events which can be anticipated at high cost, as well as events which cannot be anticipated or are difficult to anticipate. Uncertainty is natural to any agricultural production because of climatic variability and problems of pests and diseases. These also pertain to coffee production.

Climatic variations are issues that farmers in Rwanda cannot influence. For instance, irrigation of coffee trees in the dry season is not very common as there are no means to do so. What is more realistic and feasible for the farmers is to combat the pests and diseases. Interviews with farmers indicated that their main problems are how to get pesticides, organic and chemical fertiliser and skilled labour. Other forms of uncertainty described here are price variations while selling their produce and delays in payment.

- Access to inputs

In section 5.1.3, access and use of fertiliser were described as an important concern for farmers, especially the non-members. Farmers have problems in accessing other inputs, but their degree is different in different provinces and according to whether they are members of the cooperative or not as table 6.5 shows.
The need to add other fertiliser mainly the mulch is advised in order to have a good produce. It is clear that even though high proportions for all farmers are uncertain about obtaining the fertiliser in general, relatively more non-members report it as problematic, however the difference between transaction structures is not significant.

Chemical fertiliser are imported by OCIR and distributed to farmers at least in proportion to the number of trees they have cut for regeneration. Even though it is easier for the members to obtain fertiliser through the cooperatives; a third of them still feel uncertain about obtaining the chemical fertiliser. This is however associated with the number of cut trees. When the proportions are weighted against the average number of cut trees in each membership category (figures in parentheses), mixed results are found: non-members who trade with cooperatives, in an urge to improve their production have cut trees but face higher uncertainty in accessing chemical fertiliser. On the other hand, non-members who transact mainly with traders have not cut their trees. In all cases, members have relatively easy access to chemical fertiliser.

Another important determinant of quality lies in control techniques for pests and coffee diseases. For the non-members, around 20 percent affirmed that they do not get the pesticides in sufficient amount. This proportion is much lower for the members: around 10 percent in both Provinces.

Labour is also problematic for all farmers. Higher proportions are found within the members who need a lot of labour in harvest.

- Prices variations

Coffee transactions are also faced with uncertainty due to price fluctuations. Even though the price is fixed by OCIR for dry coffee and berries, from the farmers’ perspective there is uncertainty regarding the amount that they will ultimately receive. The level of uncertainty is lower for the berries since cooperatives do not change the

---

Table 6.3 Uncertainty associated with difficulties to access inputs per membership status and province (percentage within membership category)

<table>
<thead>
<tr>
<th>Problematic access to:</th>
<th>N</th>
<th>Cooperative</th>
<th>Traders</th>
<th>Equality test (^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Member</td>
<td>Non-member</td>
<td>Member</td>
</tr>
<tr>
<td>Organic fertiliser(^b)</td>
<td>159</td>
<td>74</td>
<td>86</td>
<td>65</td>
</tr>
<tr>
<td>Chemical fertiliser(^c)</td>
<td>151</td>
<td>30(19)</td>
<td>14(90)</td>
<td>33(21)</td>
</tr>
<tr>
<td>Pesticides</td>
<td>155</td>
<td>8</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Labour</td>
<td>160</td>
<td>52</td>
<td>25</td>
<td>71</td>
</tr>
</tbody>
</table>

---

\(^a\) Figures in parentheses are obtained from weighing proportions of number of cut trees to total number of trees.

\(^b\) Refers to mulching.
price they offer. However, with the dry coffee, traders have the habit of changing prices for no particular reason, just by speculating on the farmers’ ignorance: farmers are told that they coffee is of very bad quality, etc. Figure 6.8 reflects cross-section data on price variations.

![Price variations of coffee over respondents](image)

**Figure 6.8 Price variations of coffee over respondents**

\(N=171, \chi^2 = 19.18^{***}\)

The fixed price of berries is 120 Rwfs and that of dry coffee is 600 Rwfs (both in 2006). Occasionally, there are small variations around the price of berries. However, for the dry coffee, large variations are often observed. High uncertainty is associated with the traders.

- Delays in payment

An important aspect to consider is the need for cash in the rural areas. Farmers sell their coffee with the expectations of satisfying the many household consumption requirements and making savings for the future contingencies that may include investments in coffee. Therefore, the trade-off is between the present need for cash and savings for the future.

The payment options offered to farmers depend on the transaction partner. With traders the payment is straightforward, made immediately after sale. However with cooperatives, payments are not made immediately after the transaction, mainly due to enormous work associated with the harvest season which corresponds to the coffee processing time. The quantity of coffee supplied and the payments are indicated on card-indexes and the farmer may take the money at a later date. Table 6.6 shows payment dates for farmers in provinces.
The largest percentage of non-members receives their payments immediately after harvest. This corresponds to the transaction with traders. The members who sell some of their produce as dry coffee also receive their payments immediately.

However with the sales of berries, payments are made at a later date, mainly up to a month or two and in a few cases the delay can even go to 3 or 4 months. While some farmers accept this as a reality, others, in the proportion of 27.3 percent openly complain about these late payments. To conclude, high uncertainty with regard to delays payments is associated with cooperatives.

**Frequency**

Frequency indicates the intensity with which transactions are handled. With low frequency, the costs per transaction are relatively high. The creation of a special governance structure is only appropriate if transactions are frequent (Williamson, 1987: 60). On the other hand, an increase in the intensity of the transactions can result in scale-effects. With an increase in the number of transactions, the costs per transaction will decline.

Frequency of transactions in coffee relate to the seasonal characteristics of production. These transactions are recurring every year, therefore already high intensity of frequency is associated with any transaction structure. The level of the intensity is however different between traders and cooperatives. With cooperatives, transactions in coffee are not only based on buying-and-selling. They entail other relationships namely the regular monitoring of coffee maintenance in the ordinary season by way of training and advising farmers, supplying them with chemical fertiliser and pesticides, offering emergency credits at lower rates, rewarding the best farmers with prizes in cash or kind and distributing rebates and dividends from the profits made

---

18 The ‘0 day’ delay means immediate payment.
after exporting the coffee. All these indicate that there are many occasions of interface between the cooperative and the farmers. Thirty-three percent of the members mentioned at least one of the above as a drive to transacting with the cooperatives.

Traders’ presence is natural in the community, considered as neighbours or relatives. These traders not only buy the coffee but also sell other daily stuff to the farmers and their family. This is one of the reasons some farmers prefer to obtain credits from them instead of turning to formal credit institutions because they already know each other and the traders do not complicate procedures of lending money. This happens despite that farmers know they will be held-on to this to sell their coffee at a relatively lower price. In fact, 12 percent of non-members cited the easy access to credit as one of the preference indicator towards the traders. Therefore, even though particular choice of an individual trader is not explicit here; it just shown that the encounters between farmers and traders are also frequent.

A comparison of the expected frequency of transactions in coffee between the cooperatives and traders shows no significant differences (F statistic= 0.46). To assess the fully intensity of frequency, there is need for an assessment of what a particular intervention either by the cooperative/trader means to a particular farmer in a particular period/season, how fast is the intervention made and how effective it responds to the need. Unfortunately, these questions are not in the scope of this study.

Characteristics of the transactions associated with cooperatives or traders are summarized in table 6.7. Their relative degrees are presented as high (++) or low (+) depending on the description made above. Where the results are somehow inconclusive, the degree is added with a * symbol.

<table>
<thead>
<tr>
<th>Table 6.5 Summary of transactions characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Cooperator</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Asset specificity</td>
</tr>
<tr>
<td>Coffee Plantation/site</td>
</tr>
<tr>
<td>Perishability</td>
</tr>
<tr>
<td>Distance</td>
</tr>
<tr>
<td>Uncertainty</td>
</tr>
<tr>
<td>Access to inputs</td>
</tr>
<tr>
<td>Price variations</td>
</tr>
<tr>
<td>Delays in payment</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
</tbody>
</table>

19 Computed as a weighted difference of farmer’s age from the life expectancy in Rwanda in proportion to experience in coffee growing
It can be concluded that the asset specificity remains higher with respect to cooperatives in terms of coffee plantation/site and perishability of the product. High specificity associated with distance is found for both cooperatives and traders.

High uncertainty is characteristic of traders with regard to accessing inputs and price variations. However, with regard to delays in payment, farmers selling to the cooperative observe higher levels of uncertainty.

More frequent and recurring transactions mainly related to coffee are observed between cooperatives and members. However, due to community settings, traders also are involved in many transactions with farmers besides coffee. Yet these transactions were not recorded in this study.

6.2.2 Coffee cooperatives vs. Traders: contractual relations

- Cooperatives

A contract between cooperatives and farmers stipulates each party’s rights and obligations. Cooperatives engage themselves in making available inputs to the farmers such as chemical fertiliser and pesticides. Farmers are closely monitored and offered constant advices and trainings with regard to better coffee farming practices. On the members’ side, farmers have the duty of ensuring proper maintenance of their coffee trees, pruning and mulching them, adding fertiliser in sufficient amount and on time so as to produce good quality coffee. The result of such relationships is that farmers obtain a good harvest in terms of quantity and quality. Moreover, they have market assurance as they know their cooperative will buy the harvested berries.

These contractual relationships are built on the trust that each party will honour his duties that go beyond the simple buying and selling transactions. They include more complex involvements that entail benefits to the members. Moreover, since coffee farming is a recurrent activity, especially when there are no other sources of income in rural areas, cooperatives get involved in building long-term linkages with farmers through the incentives they provide. These incentives are in the form of rebates obtained by members only in proportion to the coffee they have sold to the cooperatives. These rebates are distributed as shares of the profits from coffee exports. They are distributed in addition to dividends proportional to their membership contribution.

Cooperatives also undertake monitoring of farmers to ensure that they are implementing the advices and using the inputs provided to them for the purpose of coffee; for instance that the chemical fertiliser is not used by farmers to other crops. This implies that monitoring is not costless depending on the number of members.
What complicates the situation is also that these cooperatives are still in the phase of attracting members. At their start, they set up entry requirements such as a membership fee or number of trees that a farmer has to own in order to become a member. However, these are not strongly imposed. In some cases, they are even relaxed because the cost of enforcing farmers to abide by these requirements is often higher in comparison with the quantity of berries needed by cooperatives to survive through their washing stations. Two choices are open to them: either to enforce the stringent rules and exclude some farmers in which case there is a risk of sub-optimal use of their washing station capacity or widen their gates aiming for quantity. Often cooperatives prefer the latter option as they want to expand. For instance instead of stressing on the number of trees, a member is just required to be a coffee grower in the case of Kopakama or the membership fee is reduced as for Coopac.

The above can partly explain non-members’ attitude. It is true that some farmers might be unable to raise the membership fee. However, if no exclusion mechanism exists; even non-members obtain the same price as the members at sale of berries without any discrimination. They can also forego the worry of being constantly monitored if the extra inputs are not very much needed. Therefore, no real benefits are obvious to the non-members. In the study, 22 percent of non-members declared not to having observed any additional benefits provided by the cooperative to its members.

Another source of mixed response refers to delays in payment on the part of the cooperatives. Farmers, depending on their relative need for money adopt a different attitude. A delayed payment may disturb farmers’ plan constructed from their expectations about the income from coffee. Since their needs do not only arise after sale, cooperatives recognized this and are now trying to involve themselves in the supply of short term loans to their members usually at lower rates than the formal financial institutions. On the other hand, 8 percent of farmers who trade with the cooperative do not complain about the payment date; in fact they consider it as a way of saving. The more detailed discussion on the issue of payments and its implications follows in the next section on transaction costs.

In conclusion, the easy access to inputs, the possibility to obtain credit and the extra gains in the form of rebates and dividends constitute an incentive scheme for members to satisfy their needs but also a way of building trust and ensuring that members feel a sense of belongingness to the cooperative.
• Traders

The relationships with traders are not as easy to describe as those of farmers with the cooperatives. Focusing on the coffee business, traders who buy berries and/or dry coffee often act as intermediaries on behalf of private operators who will process the berries or the hulling companies which process the dry coffee.

The buying-and-selling relationships do not really resemble the spot markets maxims. In fact, one needs to account for the social context within which these traders operate. As mentioned above, they are not only involved in coffee but also in the daily life of the community, sympathizing with farmers in their times of need. They remain a reliable source of income since they are independent in their decisions especially in times of emergency. Yet as also mentioned, traders may hold-up farmers.

From the above description, it can be implied that the coffee cooperatives in Rwanda indeed appear to be hybrids if one considers their long-term relationships with farmers. These are mainly built on the mutual trust that each party will honour its engagement. Incentives through pre-harvest and post-harvest services play a role in the building of this trust. On the other hand, cooperatives take up costs in monitoring farmers to ensure that they respect the cultivation techniques and produce coffee that meets their quality requirements.

On the other hand, traders constitute a spot market structure when looked from the single point of view of coffee transactions. These only relate to buying-and-selling. However, the situation is more complex since transactions between farmers and traders go beyond coffee to the life in the community. They also have long-term relationships with the farmers that include friendship and even family ties.
CHAPTER 7 ECONOMETRIC ANALYSIS OF FARMERS’ CHOICES

In section 3.3 to 3.5, the analytical framework for this research was established. Correspondingly, descriptive analysis of coffee farming in Rwanda and comparative analysis of governance structures in coffee transactions were performed in chapters 5 and 6 respectively. The present chapter gives emphasis to the question of different choices done by farmers by purposely combining variables associated with farmers’ characteristics, coffee farming systems and transaction structures in decision models pertaining to the membership status, type of coffee and choice of transaction structure.

In section 7.1 variables used in modelling each set of decisions and their specifications are explained and section 7.2 presents the results obtained from the econometric analyses performed with the statistical software STATA.

7.1 Variables used in modelling

7.1.1 Choice of membership status

The choice of membership is explained by the following variables:

*Age at membership:* is estimated as the farmer’s age in 2006 (for non-members) minus his/her time of joining the cooperative (for members). This is because older farmers might show resistance to becoming members of the cooperative since they are used to processing (they might even have bought small depulping machines). Younger farmers might prefer the ease of selling berries instead of processing them. However, the reverse might also be true due to experience in coffee farming and associated realization of the costs and burdens.

*Gender:* men might be more interested in coffee cooperatives due their culture of participating in cooperatives and clubs. Furthermore, they are the ones to attend meeting of campaigns while women are left at to attend the household chores. Furthermore, men are the main recipients of incomes that will be generated from selling berries. Women might share the same interest; however, since there are other cooperatives in which they are more traditionally fitting than men such as cooperatives for growing and marketing fruits and vegetables or making handicrafts, less interest in becoming members of coffee cooperatives could be observed. The dummy for gender is ‘0’ for males and ‘1’ for females.

*Education:* at higher levels of education, farmers might be in a better position to evaluate benefits and costs associated with the membership choice. The education dummy is specified as ‘1’ if the farmer has had any post primary education and ‘0’ otherwise i.e. without any formal schooling or at least with the primary school level.
Household size: farmers would join cooperatives in expectation of some real benefits. In the rural agricultural context, larger households are associated with labour for coffee cultivation. Here proper maintenance and harvesting increase prospects for becoming cooperative members as these households would be able to meet the cooperative’s high-quality requirements which involve the need for more labour. Furthermore, large families may also have many sources of income where possibilities for hiring labour are present.

Distance to the cooperative: shorter distances to the cooperative would increase the likelihood of becoming its member.

Motivation for coffee cultivation: the membership choice towards the cooperative may be influenced by the farmer’s behaviour behind coffee farming. If the farmer has undertaken coffee cultivation with a strong purpose of making money or improving his/her livelihoods, his attitude will not be the same as the one cultivating coffee just because he has been traditionally doing so or just because he has no other choice. The growing purpose dummy has the value ‘0’ for the choice of coffee farming associated with traditions and ‘1’ for the economic rational decision associated with expected benefits.

Plan: if the farmer has been planning to take up activities of improving his production in terms of quantity and/or quality, the choice of becoming a member would be associated with access to inputs, technical advice and security needed to achieve his plans.

Credit: if the farmer has needed credit in the recent years, there is high likelihood of commitment to the structure which is offering or may offer him credit in the future.

Land security dummy: Coffee production requires long term investments associated with the coffee productive cycle: 2 to 3 years are needed for seedlings to grow and yield berries, 3 to 4 years are productive and after then coffee is cut for regeneration, 1 year after the trees becomes productive again and so on. The farmer cannot undertake the cultivation unless he has some security about the ownership of land. However, there remain issues regarding land insecurity that are not so much recent in the country, especially so after the war and genocide of 1994. There are changes in land policy expected to affect the tenure system in Rwanda so will be the use of land, either for coffee or other uses. The land security dummy is ‘1’ for farmers who considered the policy as secure towards their land use and ‘0’ otherwise.

Trust score: every farmer makes the option towards membership status depending on the level of trust he has towards the cooperative. Farmers were asked to rank at least 3 of elements of preference towards the cooperative. Values of the trust score are
thereby generated where 0 is for those who did not mark trust in any of their preferences and 1, 2 or 3 for the low, medium and high rank respectively.

**Relationship dummy:** for a farmer, the choice of membership might be done following the status of other family members, neighbours or friends. The relationship dummy is -1, 0 and 1 respectively for disagree, neutral and agree scores on the Likert scale of importance of relationship.

**Risk dummy:** membership choice might also be associated with farmers’ perception of the risk of being cheated by sellers or stolen the processed coffee that is stored in his home. The cooperative is therefore regarded as a protection against this risk. The risk dummy is -1, 0 and 1 respectively for disagree, neutral and agree scores on the Likert scale of the of risk of theft and cheating.

**Network dummy:** if the cooperative belongs to a larger network of marketing union, researchers, etc., farmers might perceive it as an element of stability and this projects a good image. The network dummy is ‘1’ for cooperatives belonging to a marketing union and ‘0’ otherwise.

**Location dummy:** cultural differences might be observed in different provinces affecting the attitude towards membership. Location dummy is the variable that accounts for these differences. It is ‘1’ for the Southern location and ‘0’ otherwise i.e. the Western province.

Table 7.1 specifies the above variables across membership status.

**Table 7.1 Determinants of membership choice**

<table>
<thead>
<tr>
<th>Continuous variables (average values)</th>
<th>Members</th>
<th>Non-members</th>
<th>Equality test</th>
<th>Expected sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at membership (years)</td>
<td>43</td>
<td>40</td>
<td>1.68'</td>
<td>+/-</td>
</tr>
<tr>
<td>Household size (persons)</td>
<td>7</td>
<td>6</td>
<td>0.85</td>
<td>+</td>
</tr>
<tr>
<td>Distance to cooperative (minutes)</td>
<td>54</td>
<td>101</td>
<td>4.02***</td>
<td>-</td>
</tr>
<tr>
<td>Expected production in future (kgs)</td>
<td>11248</td>
<td>2518</td>
<td>5.28**</td>
<td>+</td>
</tr>
<tr>
<td>Relation score (Likert score)</td>
<td>-0.26</td>
<td>-0.12</td>
<td>1.09</td>
<td>+</td>
</tr>
<tr>
<td>Risk score (Likert score)</td>
<td>0.67</td>
<td>-0.32</td>
<td>85.46***</td>
<td>+</td>
</tr>
<tr>
<td>Categorical variables (Percentage )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (1=female)</td>
<td>30</td>
<td>42</td>
<td>2.28</td>
<td>-</td>
</tr>
<tr>
<td>Education dummy(1=higher than Primary School level)</td>
<td>16</td>
<td>8</td>
<td>3.23</td>
<td>+</td>
</tr>
<tr>
<td>Motivation for growing coffee (1=economic rationale)</td>
<td>68</td>
<td>46</td>
<td>8.97*</td>
<td>+</td>
</tr>
<tr>
<td>Credit (1=if needed/taken)</td>
<td>47</td>
<td>28</td>
<td>5.08**</td>
<td>+</td>
</tr>
</tbody>
</table>
7.1.2 Choice of type of marketable coffee

There are different options for farmers to sell their coffee: either berries, dry coffee or both. Determinants of the above choice are:

**Membership status:** affects the type of coffee since members, in commitment to their cooperative which needs berries to optimally use its washing station, are more likely to supply berries.

**Gender:** women are increasingly becoming heads of the household and thereby growing coffee. In the social setting however, they are more responsible for the household chores. Coffee depulping and regular sun-drying are also part of these chores; therefore the quantity of dry coffee increases with women whereas men would prefer to sell berries. However, since women might be burdened by these chores, selling berries might also more appealing to them. The gender dummy is ‘0’ for males and ‘1’ for females.

**Education:** at higher levels of education, farmers might be in a better position to assess costs associated with any type of coffee aiming at maximizing their incomes. The education dummy is specified as ‘1’ if the farmer has had any post primary education and ‘0’ otherwise i.e. without any formal schooling or at least with the primary school level.

**Family labour ratio:** the availability of family labour can be regarded from 2 perspectives: (1) in terms of supplying coffee berries- more family labour is available for harvesting and transporting berries to the selling points or (2) sufficient labour is available for processing berries into dry coffee by farmers themselves. Labour requirements are associated with the coffee plantation size. Higher ratio of family labour to plantation increases quality, thereby supply of berries.
**Membership choice from a transaction cost economics perspective**

*Hired labour availability dummy:* gives an indication of availability of hired labour which could be used to supplement family labour: ‘1’ indicates easily available labour thereby increasing the production of berries.

*Experience in coffee growing:* since age is highly correlated with experience in coffee farming, the latter variable better explains production decisions: the longer the period of growing coffee, the more experienced farmers are in choosing the type of coffee to produce since they have formed ideas of costs and returns associated with each type of coffee.

*Number of reproducible coffee trees:* number of coffee trees owned by the farmer that were productive in 2006. More trees imply more production making it quasi impossible (as more costly) own processing, thereby increasing the likelihood of supplying berries. Since members were found to own more trees compared to non-members, an interaction with membership was used to account for the latter’s influence on the number of coffee trees.

*Distance to farthest plot:* plots in Rwanda are highly fragmented. Estimates of the distance from the farmer’s house to the farthest plot might explain the intensity of maintenance of the coffee plantation which reduces with larger distances. The more intensive the maintenance, the better is the quality of coffee with more likelihood of supplying berries.

*Other crops dummy:* mulch is the organic fertiliser obtained from crop residues such as bananas leaves, trees branches, etc. the dummy is ‘1’ for ownership of such crops implying easy access to mulching that is associated with better quality thereby increasing the probability of supplying berries.

*Livestock ownership dummy:* signifies access to manure that is also used as organic fertiliser. The produced manure would normally go to fertilizing the food crops in the first place, and as more manure is available then it fertilises the coffee plantation. For this reason, the livestock ownership dummy is ‘1’ only for more than 1 cow and/or goat owned by the farmer.

*Access to chemical fertiliser:* farmers who have easy access to chemical fertiliser can be expected to produce more berries that are of the quality good enough to meet the cooperative requirements. The access to chemical fertiliser variable Likert scale values 1 to 5 respectively from no access to easy access.

*Access to pesticides:* farmers who have easy access to pesticides so that they can protect coffee trees from pests and other diseases can also be expected to produce more berries. The access to pesticides variable has Likert scale values 1 to respectively from no access to easy access.
**Location dummy:** the two 2 provinces in which the study was performed exhibit differences in climatic and soil conditions that have an impact on coffee production and productivity. Location dummy is the variable that accounts for these differences. It is ‘1’ for the Southern location and ‘0’ otherwise i.e. the Western province.

The above determinants are different depending on the product type as shown in table 7.2.

### Table 7.2 Determinants of coffee type choice

<table>
<thead>
<tr>
<th>Continuous variables (average values)</th>
<th>Berries</th>
<th>Not only berries</th>
<th>Equality test *</th>
<th>Expected sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience in coffee growing (years)</td>
<td>25</td>
<td>24</td>
<td>0.12</td>
<td>+</td>
</tr>
<tr>
<td>Family labour ratio (persons)</td>
<td>0.9</td>
<td>0.9</td>
<td>0.20</td>
<td>+</td>
</tr>
<tr>
<td>Number of reproducible trees (trees)</td>
<td>437</td>
<td>321</td>
<td>1.38</td>
<td>+</td>
</tr>
<tr>
<td>Distance to farthest plot (minutes)</td>
<td>15</td>
<td>18</td>
<td>0.68</td>
<td>-</td>
</tr>
<tr>
<td>Access to chemical fertiliser (Likert score)</td>
<td>2.44</td>
<td>2.19</td>
<td>2.54</td>
<td>+</td>
</tr>
<tr>
<td>Access to pesticides (Likert score)</td>
<td>2.33</td>
<td>2.08</td>
<td>2.46</td>
<td>+</td>
</tr>
<tr>
<td>Categorical variables (Percentage )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (1=female)</td>
<td>31</td>
<td>42</td>
<td>1.62</td>
<td>+/-</td>
</tr>
<tr>
<td>Education dummy(1=higher than Primary School level)</td>
<td>16</td>
<td>5</td>
<td>3.04</td>
<td>+</td>
</tr>
<tr>
<td>Membership status (1=member)</td>
<td>78</td>
<td>45</td>
<td>15.7***</td>
<td>+</td>
</tr>
<tr>
<td>Hired labour availability (1=if easy availability)</td>
<td>44</td>
<td>45</td>
<td>0.01</td>
<td>+</td>
</tr>
<tr>
<td>Other crops dummy (1=ownership of other crops)</td>
<td>33</td>
<td>29</td>
<td>0.26</td>
<td>+</td>
</tr>
<tr>
<td>Livestock dummy (1=ownership of livestock)</td>
<td>30</td>
<td>16</td>
<td>2.87*</td>
<td>+</td>
</tr>
<tr>
<td>Location dummy (1=Southern province)</td>
<td>46</td>
<td>61</td>
<td>2.67*</td>
<td>+/-</td>
</tr>
</tbody>
</table>

*a Equality test pertains to coffee type. F values are given for continuous variables and Pearson χ² for categorical variables

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, +/- if significant at 15% level

### 7.1.3 Choice of transaction structure

Cooperatives and traders are the transaction structures or the farmers’ partners in coffee transactions. Explanatory variables for the choice of the transaction structure are:

**Membership status:** by commitment to the cooperatives, members are expected to sell their berries to cooperatives and non-members would sell to traders.

The choice also depends on the level of transaction costs. Since membership status affects the magnitude of these costs, its interaction with the variables used in the study is also given consideration.
Proxies of elements of these transaction costs are:

**Asset specificity-coffee plantation:** is estimated by the total number of coffee trees; using proxies generated from the computed averages in section 5.1.2 (See Table 5.4). Since there are differences in ownership per membership status and province, the associated asset specificity dummy is ‘1’ for farmers in the Western Province who are cooperative members and own more than 765 trees or non-members who own more than 305 trees. It is also ‘1’ for farmers in the Southern Province who are cooperative members and own more than 790 trees or non-members who own more than 268 trees. This is associated with high asset specificity’ and ‘0’ is hence associated with low asset specificity.

**Asset specificity-perishability:** is characteristic of coffee berries. It is therefore estimated by the relative proportion of quantity of berries in total production that was marketed where ‘1’ refers to relatively more quantity of berries, therefore high risk of losses due to perishability i.e. high specificity. ‘0’ refers to relatively more quantity of dry coffee i.e. low asset specificity.

**Asset specificity-distance to selling points:** the distance to the different selling points was estimated by the average time used by farmers to reach either the cooperative’s washing station or collection point or the trader.

There is uncertainty with regard to the access of inputs in coffee production such as labour (*access to labour*), organic fertiliser (*access to organic fertiliser*), chemical fertiliser (*access to chemical fertiliser*) or pesticides (*access to pesticides*). Dummies were used to quantify these sources of uncertainty Likert scale values 1 to 5 respectively from no access i.e. high levels of uncertainty to easy access or low uncertainty.

**Frequency of transaction:** frequency of transactions is deduced from the fact that coffee is an annual crop. It is also assumed that the farmer will produce coffee throughout his lifetime. The difference of the farmer’s age and the life expectancy in the country (44 years for males and 47 years for female) gives an indication of the remaining years of coffee growing. It is this difference weighted by the number of years that the farmer has already been growing coffee that gives the figure of frequency of transaction.

**Price score:** the coffee price is fixed by the National Coffee Board at the beginning of the harvest seasons. However this price is not constant, variations are observed especially with traders who have the habit of modifying the price offered to farmers. The weight given by farmers to the level of price would determine the choice of structure in which to sell their coffee. The price score dummy is -1, 0 and 1 respectively for disagree, neutral and agree scores on the Likert scale.
Membership choice from a transaction cost economics perspective

*Payment date score:* similar to the above issue is the payment date: traders make their payments by way of concluding transactions, whereas cooperatives pay with delays. Instead of accounting for the payment date as such, farmers’ perception towards the date of payment would be a better indication of the choice. The payment date score dummy is -1, 0 and 1 respectively for disagree, neutral and agree scores on the Likert scale.

*Location dummy:* farmers in different provinces might have different perceptions regarding the transaction structure thereby affecting the attitude towards the choice. The location dummy has values ‘1’ for the Southern location and ‘0’ otherwise i.e. the Western province.

In table 7.3, a comparison of determinants of transaction structures is presented.

**Table 7.3 Determinants of transactions structures**

<table>
<thead>
<tr>
<th>Continuous variables (average values)</th>
<th>Cooperatives</th>
<th>Traders</th>
<th>Equality test</th>
<th>Expected sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset specificity-coffee plantation (number of trees)</td>
<td>664</td>
<td>322</td>
<td>7.36***</td>
<td>+</td>
</tr>
<tr>
<td>Asset specificity-perishability (kgs)</td>
<td>1485</td>
<td>219</td>
<td>7.48***</td>
<td>+</td>
</tr>
<tr>
<td>Distance to washing station (minutes)</td>
<td>40</td>
<td>31</td>
<td>3.51</td>
<td>-</td>
</tr>
<tr>
<td>Distance to collection point (minutes)</td>
<td>14</td>
<td>13</td>
<td>2.26*</td>
<td>-</td>
</tr>
<tr>
<td>Distance to trading centre (minutes)</td>
<td>33</td>
<td>23</td>
<td>3.87**</td>
<td>+</td>
</tr>
<tr>
<td>Frequency of transaction (number of times)</td>
<td>165</td>
<td>143</td>
<td>0.46</td>
<td>+</td>
</tr>
<tr>
<td>Access to mulch (Likert score)</td>
<td>3.38</td>
<td>1.20</td>
<td>36.63***</td>
<td>+</td>
</tr>
<tr>
<td>Access to manure (Likert score)</td>
<td>2.94</td>
<td>1.02</td>
<td>56.50***</td>
<td>+</td>
</tr>
<tr>
<td>Access to chemical fertiliser (Likert score)</td>
<td>2.78</td>
<td>1.04</td>
<td>56.19***</td>
<td>+</td>
</tr>
<tr>
<td>Access to pesticides (Likert score)</td>
<td>1.67</td>
<td>0.68</td>
<td>48.69***</td>
<td>+</td>
</tr>
<tr>
<td>Access to labour (Likert score)</td>
<td>2.84</td>
<td>1.17</td>
<td>25.97***</td>
<td>+</td>
</tr>
<tr>
<td>Price score dummy (Likert score)</td>
<td>0.63</td>
<td>0.26</td>
<td>11.88***</td>
<td>+</td>
</tr>
<tr>
<td>Payment date score dummy (Likert score)</td>
<td>0.49</td>
<td>0.32</td>
<td>1.68</td>
<td>-</td>
</tr>
</tbody>
</table>

| Categorical variables (% problematic) | | | | |
|--------------------------------------| | | | |
| Membership status (1=member) | 89 | 33 | 57.33*** | + |
| Location dummy | 47 | 53 | 0.50 | + |

---

*Equality test pertains to transaction structures. F values are given for continuous variables and Pearson $\chi^2$ for categorical variables.

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + if significant at 15% level
7.2 Modelling results and discussion

7.2.1 Choice of membership status

- Member versus non-member choice

The choice of membership status was studied through a binary choice model where:

\[ Y_1 = \begin{cases} 
1: \text{cooperative member; with probability } P_i \\
0: \text{otherwise i.e. non-member; with probability } (1-P_i) 
\end{cases} \]

Estimation results from the probit are shown in table 7.4, where membership status is a function of farmer's characteristics, contractual elements, commitment and location factors.

**Table 7.4 Probit results of the choice of membership status**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimates</th>
<th>Standard errors</th>
<th>Marginal effects (dy/dx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at membership</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.00</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.22</td>
<td>-0.36</td>
<td>-0.03</td>
</tr>
<tr>
<td>Education</td>
<td>0.43</td>
<td>-0.66</td>
<td>0.04</td>
</tr>
<tr>
<td>Household size</td>
<td>0.19</td>
<td>-0.09**</td>
<td>0.02</td>
</tr>
<tr>
<td>Distance to the cooperative</td>
<td>0.02</td>
<td>0.00***</td>
<td>0.0</td>
</tr>
<tr>
<td>Motivation for growing coffee</td>
<td>0.26</td>
<td>-0.30</td>
<td>0.03</td>
</tr>
<tr>
<td>Plan</td>
<td>0.62</td>
<td>-0.57</td>
<td>0.12</td>
</tr>
<tr>
<td>Credit</td>
<td>0.46</td>
<td>-0.32*</td>
<td>0.07</td>
</tr>
<tr>
<td>Land security dummy</td>
<td>0.92</td>
<td>0.40**</td>
<td>0.11</td>
</tr>
<tr>
<td>Trust score_1</td>
<td>-0.10</td>
<td>-0.46</td>
<td>-0.01</td>
</tr>
<tr>
<td>Trust score_2</td>
<td>0.19</td>
<td>-0.51</td>
<td>0.02</td>
</tr>
<tr>
<td>Trust score_3</td>
<td>1.28</td>
<td>0.59**</td>
<td>0.12</td>
</tr>
<tr>
<td>Relation dummy</td>
<td>-0.79</td>
<td>0.31**</td>
<td>-0.10</td>
</tr>
<tr>
<td>Risk dummy</td>
<td>1.51</td>
<td>0.31***</td>
<td>0.20</td>
</tr>
<tr>
<td>Network dummy</td>
<td>3.16</td>
<td>0.78***</td>
<td>0.82</td>
</tr>
<tr>
<td>Location dummy</td>
<td>-1.29</td>
<td>0.50**</td>
<td>-0.17</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.90</td>
<td>1.60</td>
<td></td>
</tr>
</tbody>
</table>

N 153

LR $\chi^2$ (16) 96.24***
Log likelihood -38.73
Pseudo $R^2$ 55.4%

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + significant at 15% level.

The average probability of becoming a cooperative member obtained from the model is 0.93 where 81 percent correct predictions are made based on this cut-off.
The first significant variable in explaining the membership choice is the household size. Even though its marginal effect on the probability of becoming a cooperative member is very small, the coefficient of the household size variable is positive. This implies that the bigger the farmer’s household, the bigger is the prospect of becoming a cooperative member as more labour would be available for coffee maintenance and harvesting which would lead to meeting the cooperative requirements in terms of the quality of coffee supplied.

Another significant and positive factor is the distance to the cooperative. This goes against the expected sign on the assumption that persons nearer the cooperative are the most likely to be members. The less enthusiasm of cooperative neighbours in becoming members can be explained by the fact that they can get the benefits offered by the cooperative ‘trickled-down’ to them (in terms of access to inputs provided by or through cooperatives, access to a secure market, access to technical advice, etc). Therefore they do not feel any compelling need to attach themselves to the membership requirements. Kherallah and Kirsten (2001, quoting Cook and Iliopoulos, 2002) call this the lack of a clear definition of property rights assignments and organizational inefficiency. This might lead to problems associated with opportunistic behaviour (such as free-riding and moral hazard) that might discourage even the members and may lead them to discontinuing their membership.

Among the farmers’ expectations there is the need to obtain credit. It increases the likelihood of joining the cooperative since it can be regarded as a source of reliable credit in comparison to traders’ opportunistic behaviour but also cheaper compared to interest rates charged by formal lending institutions like banks and their associated collateral requirements.

Another significant variable to the choice of membership status is land security. In case the land use is secure, the likelihood of becoming a cooperative membership increases as farmers can undertake activities for enlarging the coffee plantation and improving production.

Trust is an important factor involved in the farmer's choice. It was included in the estimation model as scores from 0 to 3 where the 0 score was taken as the base. In relation to this base, it was found that as the trust score increases, the likelihood of becoming a cooperative member increases. The test of parameters (See Output 2.1) of the low scores variables showed that their effect is not significantly different from zero. Hence, it is the highest score that has a significant and positive effect on the likelihood of adherence to the cooperative.

The relationship dummy is another significant variable. The social capital evidences show that relationships-family, neighbour, etc- have a positive effect on farmers’ decisions (Bandiera and Imran, 2003). In this case however, against the expectations,
its sign is negative indicating that the likelihood for farmers to join the cooperative decreases based solely on the fact that other family members, neighbours or friends were to become members themselves. This might be explained by free riding behaviour in the context of social relations where without any exclusion of mechanism by the cooperative, farmers can still obtain benefits of the cooperative. However, on the cooperative level, the network dummy is positive and significant implying that if those cooperatives that belong to a larger network of marketing union attract farmers who might perceive it as an element of stability.

The risk dummy is also significant and positive implying that the higher the risk of being cheated at sale or stolen in coffee storage, the higher the likelihood of joining the cooperative.

At last, the location dummy is also significant but negative implying that farmers in the Western Province are more likely to adhere to cooperative.

- Early versus late membership adherence to the cooperative

Observations with regard to the years of adherence showed that the decision to become a member has been done at different points of time. These are illustrated by table 7.5, where the yearly adherence to different cooperative is shown.

**Table 7.5 Percentage of members per year of adherence to the cooperative**

<table>
<thead>
<tr>
<th>Year of Cooperative start</th>
<th>N</th>
<th>Abahuzamugambi ba Maraba</th>
<th>Koakaka</th>
<th>Coopac</th>
<th>Kopakama</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year2</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>Year3</td>
<td>15</td>
<td>10</td>
<td>3</td>
<td>41</td>
<td>-</td>
</tr>
<tr>
<td>Year4</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>Year5</td>
<td>12</td>
<td>3</td>
<td>21</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>Year6</td>
<td>29</td>
<td>13</td>
<td>45</td>
<td>-</td>
<td>37</td>
</tr>
<tr>
<td>Year7</td>
<td>12</td>
<td>10</td>
<td>9</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Year8</td>
<td>18</td>
<td>43</td>
<td>6</td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>Year9</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

It can be observed that there are farmers who become members in the early years of the cooperatives creation. However, in subsequent years membership varies. Hence an analysis of membership determinants per year of adherence can be informative.

Alternatively, taking 4 years after each cooperative started as the base (assuming that in 4 years farmers would have had an idea of the cooperative), a distinction can be
made between early and late adherers such that the following probit model can be estimated:

\[ Y_t = \begin{cases} 1: \text{early member; with probability } P_t \\ 0: \text{otherwise i.e. non-member; with probability } (1-P_t) \end{cases} \]

Furthermore, a Poisson model for count data taking the year of adherence to the cooperative in an increasing order can be estimated. Its equation is\(^{20}\):

\[ \text{Prob} \left( Y_t = y | x_t \right) = \frac{e^{-\alpha t} \alpha_t^y}{Y_t!} \text{ where } y=1,2,3,...9 \]  

Results of the probit and Poisson models are shown in table 7.6

Table 7.6 Probit and Poisson estimation results for the membership adherence time

<table>
<thead>
<tr>
<th>Variables</th>
<th>Probit model</th>
<th>Poisson model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimates</td>
<td>Standard errors</td>
</tr>
<tr>
<td>Age at membership</td>
<td>0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.11</td>
<td>-0.33</td>
</tr>
<tr>
<td>Education</td>
<td>-0.30</td>
<td>-0.43</td>
</tr>
<tr>
<td>Household size</td>
<td>0.15</td>
<td>0.06**</td>
</tr>
<tr>
<td>Distance to the cooperative</td>
<td>-0.00</td>
<td>-0.00</td>
</tr>
<tr>
<td>Motivation for growing coffee</td>
<td>0.08</td>
<td>-0.18</td>
</tr>
<tr>
<td>Plan</td>
<td>0.00</td>
<td>-0.57</td>
</tr>
<tr>
<td>Credit</td>
<td>-0.27</td>
<td>-0.30</td>
</tr>
<tr>
<td>Land security dummy</td>
<td>0.33</td>
<td>-0.31</td>
</tr>
<tr>
<td>Trust score_1</td>
<td>-0.66</td>
<td>-0.43*</td>
</tr>
<tr>
<td>Trust score_2</td>
<td>0.16</td>
<td>-0.48</td>
</tr>
<tr>
<td>Trust score_3</td>
<td>0.57</td>
<td>-0.42</td>
</tr>
<tr>
<td>Relation dummy</td>
<td>-0.19</td>
<td>-0.13*</td>
</tr>
<tr>
<td>Risk dummy</td>
<td>0.27</td>
<td>0.15*</td>
</tr>
<tr>
<td>Network dummy</td>
<td>-1.82</td>
<td>0.70**</td>
</tr>
<tr>
<td>Location dummy</td>
<td>-0.60</td>
<td>-0.35*</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.00</td>
<td>-1.26</td>
</tr>
</tbody>
</table>

N 114 113
LR \( \chi^2 \) (16) 42.38*** 35.63***
Log likelihood -55.28 -242.68
Pseudo R\(^2\) 27.7% 6.84%

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + significant at 15% level.

\(^{20}\) Greene, 2003; p740
For the probit model, the average probability of becoming a cooperative member in its early stage is 0.38 at which 75 percent correct predictions are made. The Poisson Goodness-of-fit $\chi^2$ is equal to 114.65* with the average year of adherence is predicted to be 4.65 years.

Among the farmers’ characteristics, education is the significant variable in the Poisson model with a positive sign implying that increasing levels of education increase the time of membership. In other words, the more educated farmers, the less they are likely to become early members as also supported by the probit results, even though the variable corresponding to education is not significant.

The household size is another significant variable both in the probit and Poisson models. It indicates that not only large households are likely to become cooperative members as obtained from the probit results in table 7.5; but also these larger households are the early members as they comprise a sufficient supply of labour that would positively affect the coffee quality thereby meeting the cooperative requirements.

In the probit model, low trust scores were found to have a significant deterring effect on the probability of becoming a cooperative member.

The relationship dummy is another significant variable both for the probit and Poisson model showing in both cases that farmers are hindered in their decisions by the existence of family ties, friendship or others. Furthermore, even though the cooperative belongingness to a larger network attracts members, its effect is negative on the time of adherence, associated with a cautious attitude on behalf of farmers.

Risk perception has also a significant and positive effect on the time of adherence implying that the higher the risk of being cheated at sale or stolen in coffee storage increases the likelihood of joining the cooperative.

Furthermore, the location dummy is also significant but negative implying that farmers in the Western Province are more likely to adhere to cooperatives in the early times of their creations.

### 7.2.1 Choice of type of marketable coffee

In production of coffee, berries and dry coffee are the 2 types of products obtained by farmers. Different options for selling are open to them: either berries, dry coffee or both; the later categories are joined. Since the number of farmers who have sold only dry coffee is very small (see figure 6.7), the larger proportion of the quantity sold is taken as the main choice such that a probit choice model is estimated:
Membership choice from a transaction cost economics perspective

\[ Y_k = \begin{cases} 
1: \text{only berries; with probability } P_k \\
0: \text{not only berries; with probability } (1-P_k) 
\end{cases} \]

Results from estimation are shown in table 7.7.

**Table 7.7 Probit for the choice of type of coffee**

<table>
<thead>
<tr>
<th></th>
<th>Estimates</th>
<th>Standard errors</th>
<th>Marginal effects (dy/dx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership status</td>
<td>1.33</td>
<td>0.66**</td>
<td>0.47</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.02</td>
<td>-0.32</td>
<td>-0.01</td>
</tr>
<tr>
<td>Education</td>
<td>0.17</td>
<td>-0.37</td>
<td>0.07</td>
</tr>
<tr>
<td>Family labour ratio</td>
<td>-0.11</td>
<td>-0.22</td>
<td>-0.04</td>
</tr>
<tr>
<td>Hired labour availability dummy</td>
<td>0.41</td>
<td>-0.28*</td>
<td>0.16</td>
</tr>
<tr>
<td>Experience in coffee growing</td>
<td>-0.03</td>
<td>0.01**</td>
<td>-0.01</td>
</tr>
<tr>
<td>Number of reproducible trees</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Distance to the farthest plot</td>
<td>-0.00</td>
<td>-0.01</td>
<td>-0.00</td>
</tr>
<tr>
<td>Other crops dummy</td>
<td>0.52</td>
<td>-0.31*</td>
<td>0.21</td>
</tr>
<tr>
<td>Livestock ownership dummy</td>
<td>-0.46</td>
<td>-0.37*</td>
<td>-0.18</td>
</tr>
<tr>
<td>Access to chemical fertiliser</td>
<td>0.05</td>
<td>-0.15</td>
<td>0.02</td>
</tr>
<tr>
<td>Access to pesticides</td>
<td>-0.38</td>
<td>-0.20*</td>
<td>-0.15</td>
</tr>
<tr>
<td>Location dummy</td>
<td>0.72</td>
<td>0.31**</td>
<td>0.28</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.19</td>
<td>-0.53</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LR ( \chi^2 ) (13)</td>
<td>29.56***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-59.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudo R(^2)</td>
<td>21.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + significant at 15% level.

The above model predicts the average probability of producing and marketing only berries as 0.46 in such a way that 70 percent correct predictions are made, both in terms of sensitivity and specificity.

As could be expected, membership status is the main determinant of the choice of the type of coffee marketed where members are more likely to produce only berries that will be processed at the cooperative washing station.

Experience in coffee growing is the sole farmers’ characteristic that is significant in making decisions regarding the coffee type. However, its coefficient sign is negative contrary to the expectation that the more experienced farmers are more likely to produce only berries. This implies that the probability of producing berries increases with farmers who newly embarked on coffee growing.
Among the factors of production, labour is very important. It was found that farmers who have more family labour (even though it is not significant) do not choose the marketing of berries. This signifies that in these households, the availability of family labour enables the processing berries into dry coffee as this can be done in terms of daily household chores. The coefficient of hired labour on the other hand is significant and positive. It implies that farmers who have easy access to hired labour are more likely to produce berries.

Other significant production factors include access to inputs. The *Other crops dummy* has a positive coefficient meaning that farmers who have access to mulch are more likely to produce berries as it is associated with maintenance of the plantation thereby leading to good quality coffee. The livestock ownership dummy is negative implying that the use of manure is not restricted to coffee as indeed it is spread mainly under food crops such as beans, potatoes, etc. Similarly, pesticides are spread to other crops such as tomatoes and other vegetables.

The location dummy is significant and positive implying that in spite of unsuitable natural conditions in the Southern Province, farmers are more likely to produce only coffee berries.

### 7.2.2 Choice of transaction structure

Cooperatives and traders are the transaction structures or the farmers’ partners in coffee transactions. The choice of trading partner is studied through a binary choice model:

\[
Y_{s1} = \begin{cases} 
1: \text{cooperative; with probability } P_{s1} \\
0: \text{otherwise i.e. trader; with probability } 1 - P_{s1}
\end{cases}
\]

Cooperatives buy berries only and traders buy berries and dry coffee. There are transaction costs associated with each structure. These transaction costs are a function of asset specificity, uncertainty and frequency (Ménard, 2005 citing Williamson, 1991). Elements associated with the above were estimated as shown in table 7.8.
**Table 7.8 Estimates for choice of transaction partner**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimates</th>
<th>Standard errors</th>
<th>Marginal effects (dy/dx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership status</td>
<td>1.57</td>
<td>-0.86*</td>
<td>0.48</td>
</tr>
<tr>
<td>Asset specificity-coffee plantation</td>
<td>-0.00</td>
<td>-0.00*</td>
<td>-0.00</td>
</tr>
<tr>
<td>Asset specificity-perishability</td>
<td>0.00</td>
<td>0.00***</td>
<td>0.00</td>
</tr>
<tr>
<td>Distance to washing station</td>
<td>0.00</td>
<td>-0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Distance to collection point</td>
<td>-0.03</td>
<td>-0.01*</td>
<td>-0.01</td>
</tr>
<tr>
<td>Distance to trading centre</td>
<td>0.02</td>
<td>0.01**</td>
<td>0.00</td>
</tr>
<tr>
<td>Access to mulch</td>
<td>0.19</td>
<td>-0.16</td>
<td>0.05</td>
</tr>
<tr>
<td>Access to manure</td>
<td>0.11</td>
<td>-0.19</td>
<td>0.03</td>
</tr>
<tr>
<td>Access to chemical fertiliser</td>
<td>0.01</td>
<td>-0.16</td>
<td>0.00</td>
</tr>
<tr>
<td>Access to pesticides</td>
<td>-0.05</td>
<td>-0.15</td>
<td>-0.01</td>
</tr>
<tr>
<td>Access to labour</td>
<td>-0.28</td>
<td>-0.15*</td>
<td>-0.07</td>
</tr>
<tr>
<td>Price score</td>
<td>-0.17</td>
<td>-0.13*</td>
<td>-0.04</td>
</tr>
<tr>
<td>Payment score</td>
<td>-0.11</td>
<td>-0.15</td>
<td>-0.02</td>
</tr>
<tr>
<td>Frequency of transaction</td>
<td>0.00</td>
<td>-0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Location dummy</td>
<td>-0.35</td>
<td>-0.33</td>
<td>-0.09</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.74</td>
<td>-0.89</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
<th>148</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR $\chi^2$ (14)</td>
<td>74.33***</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-56.09</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>39.9%</td>
</tr>
</tbody>
</table>

* *** significant at 1% level, ** significant at 5% level; * significant at 10% level, + significant at 15% level.

Given the above explanatory variables, the average probability of choosing the cooperative as a transaction structure was computed as 0.83 at which 71.6 percent correct predictions. Among these, 63 percent are correct classification of those who would choose the cooperative (specificity) and 90 percent are those who would choose traders (sensitivity).

Membership status is the first significant variable in the choice of transaction structure. As could be expected cooperative members are more likely to trade with the cooperative.

Asset specificity, the key factor in the choice of governance structure according to Williamson (2001), was found significant in this study. The influence of ownership of coffee plantation in choosing the cooperative is negative contrary to the expectations that large owners would consider more advantageous to transact with a cooperative compared to the real cost of processing dry coffee or transaction costs of transacting with traders.
In case of perishability, the sign of the coefficient estimate is positive suggesting that farmers who face higher specificity associated with the risk of losing the production due to perishability, the higher the likelihood of transacting with the cooperative. This goes in line with Williamson’s determination of the choice of governance structure (Williamson, 1991) where the cooperative (as the hybrid) would be chosen because of the higher asset specificity. The influence of similar dimensions of the ‘product systems’ and ‘market context’ conditions that include purchase conditions and distance to market were found in previous studies such as in Zuniga and Ruben (2007).

Among the elements of distance to selling point, are significant the coefficients of distance to collection point and trading centre. The effect of distance to the collection point is negative implying that farmers transact with the cooperative as long as its collection points are closer to their villages/neighbourhoods. The above is attached to the infrastructural problem in terms of the bad state of roads and carriages requirements (for instance the need to buy baskets or sacks) especially in context of quality requirements associated with supplies of berries. This need not be the situation with traders with whom farmers would continue to transact even at farther distances because selling coffee-mainly dry with no risk of perishability- can be done in the farmer’s own time at the trading centre.

Another significant variable relates to access to labour. Farmers with easier access to labour are more likely to transact with traders. This can be associated with the previous finding on the influence of family labour whereby it is associated with more likelihood to produce dry coffee that will be obviously sold to traders.

Last but not the least, is the effect of price score. Farmers who are more interested in higher prices are less likely to transact with the cooperative. As explained in section 5.2.2 the price of dry coffee is 5 times that of berries. Therefore, even though cooperatives offer steady prices, the fact might be that farmers are prepared to accept the higher price in their mindset that it makes them to prefer traders.

As shown in figure 6.7, each farmer is not restricted to transacting in one structure and not the other depending on the type of produce. The category of farmers selling to both the cooperative and traders include 61 farmers which constitute more than one third of the study sample, therefore a non-negligible proportion. The 3 choices open available to farmers were estimated in a multinomial logit model\(^\text{21}\). These are:

\[
Y_{s2} = \begin{cases} 
0: \text{cooperative} \\
1: \text{trader} \\
2: \text{both cooperative and trader}
\end{cases}
\]

\(^{21}\text{Refer to Greene, 2003: p721}\)
Estimation results are detailed in Output 2.6. Table 7.9 shows the marginal effects on the probability that the \( j \)th choice will be made.

### Table 7.9 Marginal effects from the multinomial choice of transaction partner

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cooperative only</th>
<th>Traders only</th>
<th>Both cooperative and trades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership status</td>
<td>0.35*</td>
<td>-0.39*</td>
<td>0.04</td>
</tr>
<tr>
<td>Asset specificity-coffee plantation</td>
<td>-0.00</td>
<td>0.00</td>
<td>-0.00</td>
</tr>
<tr>
<td>Asset specificity-perishability</td>
<td>0.00</td>
<td>-0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Distance to washing station</td>
<td>-0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Distance to collection point</td>
<td>0.01**</td>
<td>0.00</td>
<td>-0.01***</td>
</tr>
<tr>
<td>Distance to trading centre</td>
<td>0.00</td>
<td>-0.00*</td>
<td>0.00*</td>
</tr>
<tr>
<td>Access to mulch</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Access to manure</td>
<td>-0.02</td>
<td>0.05</td>
<td>-0.03</td>
</tr>
<tr>
<td>Access to chemical fertiliser</td>
<td>0.02</td>
<td>-0.05</td>
<td>0.02</td>
</tr>
<tr>
<td>Access to pesticides</td>
<td>-0.11*</td>
<td>0.07*</td>
<td>0.05</td>
</tr>
<tr>
<td>Access to labour</td>
<td>-0.09**</td>
<td>0.03</td>
<td>0.06*</td>
</tr>
<tr>
<td>Price score</td>
<td>0.04</td>
<td>-0.07*</td>
<td>0.03</td>
</tr>
<tr>
<td>Payment score</td>
<td>-0.04</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Frequency of transaction</td>
<td>-0.00*</td>
<td>0.00*</td>
<td>0.00</td>
</tr>
<tr>
<td>Location dummy</td>
<td>0.09</td>
<td>0.16*</td>
<td>-0.26***</td>
</tr>
<tr>
<td>Average probabilities</td>
<td>0.38</td>
<td>0.27</td>
<td>0.35</td>
</tr>
<tr>
<td>N</td>
<td>148</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LR ( \chi^2 ) (28)</td>
<td>47.40**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-137.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudo R(^2)</td>
<td>14.7 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** significant at 1% level, ** significant at 5% level; * significant at 10% level, + significant at 15% level.

The average probability for choosing to transact only with the cooperative is 0.38; that of choosing traders is 0.27 whereas that of transacting with both is 0.35.

It should be noted that the variables have a differential impact on the choices. Among the significant variables, membership status has a positive effect on the choice of cooperative but negative on that of traders meaning that as expected members are more likely to transact with cooperative and not traders.

Considering the distance to the collection point, farmers closer to the collection point are transacting with both the cooperative and traders. However, even far-off farmers would be willing to trade with the cooperative alone.

With regard to accessing inputs, similar to the previous probit results, farmers with easier access to pesticides are less likely to transact with the cooperatives and choose
traders. In case of labour, easier access leads to choosing both the cooperative and traders whereas the cooperative alone would be less likely to be chosen.

On the perceptions regarding the price, findings differ from those of the probit estimation. Here, traders are less likely to be chosen. The frequency of transactions gets significance: the importance of traders gets recognized as farmers are more likely to choose them whereas cooperatives are not.

On location grounds, farmers in the Southern province are more likely to choose traders, whereas those in the Western province are less likely to choose both the cooperative and traders.

From the above analysis it can be concluded that the functional form of choice of governance structure proposed by theory (from Williamson, 1991) gives mixed results in this study. This convinces us to reflect on traders, not as spot market in regard to coffee transactions but also as another form of hybrid.
CHAPTER 8 SUMMARY OF FINDINGS AND CONCLUSIONS

The main objective of this study is to analyse factors influencing farmers’ choice towards cooperative membership status in the Rwandan coffee sector. The rationale is that the membership status affects other decisions (directly or not) taken by farmers with regard to the type coffee marketed and the transaction structure. The Transaction Cost Economics Theory provides the basis for the study where the choice is studied through the lenses of transaction costs. In coffee marketing, traders are other transaction structures besides cooperatives that operate in the coffee supply chain in Rwanda. Subsequently, the choice between cooperatives and traders is expected to be guided by levels of asset specificity, uncertainty and frequency as determinants of transaction costs.

With respect to each set of decisions, hypotheses were formulated as study guides. Specifically, these hypotheses relate to determinants of production per type of coffee (berries or dry coffee), transaction costs and contractual relations associated with the different trading partners (cooperatives and traders) and commitment factors to the transaction structure of farmers’ choice.

- **Membership status**

Farmers make the choice of adhering to the cooperative and becoming its members depending on different reasons.

It was found that the influential factors include both the easy access to labour as reflected by the size of household size; expectations regarding access to cheap and reliable credit; access to land so that investments in coffee investments can be securely made. Evidences on distance to the cooperative showed that there might be free-riding problems as farmers who are closer to the cooperative do not largely become its members. In connection to this, another negative influence to the choice is the participation of other relationships-family ties, neighbours, etc., which can be regarded as a reflection of free-riding since farmers can still obtain benefits offered by the cooperative without officially becoming its members. Trust in the cooperative is another important factor leading to membership especially the higher levels of trust. Other positive influences include the image of stability provided by the cooperative in terms of its belongingness to a larger network such as a marketing union. The cooperative acts as a security to farmers who are faced with higher risk of being cheated at sale or stolen during coffee storage.

Farmers do not simultaneously make the choice with regard to membership status. Some are early joiners whereas others are laggards. It was found that the highly educated farmers, those belonging to larger households or face higher risk of being stolen in any way are more likely to become early members. Late adherence is caused

...
mainly by low trust levels, the existence of relatives by which farmers can obtain the same benefits without committing themselves to the cooperative and a cautious attitude with regard to the cooperative’s participation in a larger network.

- The type of coffee

Decisions regarding the type of berries are mainly influenced by membership status where members are more likely to produce only berries that will be processed at the cooperative washing station.

The choice for the supply of berries only is constrained by experience in coffee growing, the availability of family labour that facilitates the processing in dry coffee. On the other hand, positive influences include the availability of hired labour and that of mulch.

- Choice of transaction structure

Membership is the most important determinant of the choice of transaction structure. In addition to this, transaction costs and contractual relationships play a major role. These differ according to the type of coffee but also with respect to governance structures. Cooperatives are associated with high asset specificity due to their requirements in terms of ownership of coffee trees and quality of marketed berries. The proxy elements for these are respectively the number of coffee trees, perishability and distance. The latter depends on the location of selling points (washing station, collection point or rural trading centre) relative to the farmers’ location. This location specificity is also high for transaction with traders. Furthermore, traders are linked with high uncertainty for what relates to access to inputs and price variations whereas delays in payment are more found in case of cooperatives.

Associated with the above sources of uncertainty are the structures’ responses such as general incentives provided by the transaction structures: cooperatives are engaged in the provision of inputs, market and price security whereas traders are active participants in the daily life of the society and therefore are more responsive to farmers’ needs of cash in the rural area. Since coffee production is a long-term enterprise, frequency of transaction is high both for cooperatives and traders. However there are reservations regarding the survival of the latter to the government policy of promoting cooperatives.

Transaction costs elements that move farmers’ choice towards transacting with the cooperative are the quantity of berries produced associated with perishability and shorter distances to the collection point. However, the ownership of coffee plantation and easier access to labour move the farmers’ choices in the opposite direction towards traders.
Farmers’ choices are not exclusive to one type of structure or the other. Farmers can transact with the cooperative together with a trader. Distance to the trading centre and access to labour are the significant variables that increase the likelihood of making transactions in both structures.

- **Conclusions**

From the perspective of farmers and cooperatives there are factors that positively influence the choice of cooperative membership. These include the farmers’ ability to assess their decisions as gained from years of coffee growing and education. From the cooperative’s side, some of the positive influences are its regular monitoring and constant technical advices. For farmers who aim at increasing production and improving their incomes, membership to cooperatives signifies security of accessing inputs especially chemical fertiliser, security of market for the produced coffee and security of income since cooperatives offer steady prices. Furthermore, cooperatives are to members sources of reliable and cheaper credit which is another incentive for farmers who have short term money requirements for consumption and investments.

However, coffee cooperatives are one among the many types of cooperatives operating in the rural areas. Therefore, if farmers have to make the choice particularly in favour of coffee cooperatives, these should offer relatively higher comparative advantage especially because these other cooperatives might be able to impact farmers’ livelihoods in a short-time by responding to their needs rather the once-per-year income from coffee.

Membership also increases with farmers’ perception of risk sharing for the loss of produce due to highly perishable coffee and burden sharing in terms of coffee processing. In addition to this, other incentives such as offering rebates after coffee sales and distribution of dividends from the realized profits might increase the cooperative’s attractiveness.

There are other factors constraining coffee cooperative membership. At the outset, a distinction between cooperatives and traders should be carefully considered: while cooperatives are closer in features and performance to the hybrid described in theory, traders in coffee transactions on the other hand behave like spot markets since they are autonomous in buying-and selling relationships. But traders also act as hybrids, as they are involved in repeated transactions related to daily living requirements and in bearing building long-term relationships in the community as they have been doing so before the advent of cooperatives. In this context, a distinction of coffee by type shows that some farmers are attached to the tradition of doing their own processing and selling to traders. These are closer to them in the society as the latter are responsive to their immediate needs and no matter that traders behave opportunistically, they are preferred because of these relationships they already have.
with farmers. Changing this tradition may not be easy for cooperatives, but there are prospects as these offer incentives’ to farmers and gain their trust through long-term relationships arising from continued transactions.

Corresponding to the needs for increasing the quality and quantity of coffee berries that will be processed at the washing stations, cooperatives impose requirements that have to be met by farmers such as ownership of coffee trees and timely delivery of berries. Accordingly farmers may not adhere to a cooperative because the above requirements are not met nor are costless. Associated to this is the market location where cooperatives establish different collection points at which farmers sell their berries. If these are not situated closer to the farmers, these will prefer to process berries and sell their coffee as dry. Furthermore, ownership of coffee trees requires ownership of land, but this factor is often ignored. Similarly, quality of berries implies maintenance in production where problems of accessing organic fertiliser and pesticides may be prohibitive. Moreover, the number and location of selling points is an obstacle added to existing problems in transport especially for farmers who have to carry their coffee for selling purposes.

Another factor is the absence of an exclusion mechanism: due to high cost of monitoring, organisational problems within the cooperative or otherwise, non-members do not realize the need for subscribing to the cooperative. This might be due to the fact that they can gain the same price and incentives offered by cooperatives to the members are not as high or their impact is not visible. Non-members would therefore prefer to remain free-riders.

- **Further research**

The fact that cooperatives are promoted through the Government policy does not guarantee immediate and satisfactorily membership as shown by evidences from this study through the lenses of transaction costs.

Further research could therefore focus on the cooperatives’ organisations with the aim of identifying proper and feasible exclusion mechanisms in combination with strategic actions for enforcing them and a reward system of incentives to substantiate the superiority of cooperative membership.

Traders act as an important structure in coffee transaction. But they have received little or no attention; this trend could be reversed with an understanding of their activities and interactions.

There are other institutional arrangements that need intensive attention in subsequent researches. They could enable an overall assessment of membership problems. These include (1) informal rules including traditions in the society that influence or prevent action and impact of social networks on membership decisions; (2) formal rules
including laws and regulatory measures pertaining to land use, agriculture in general and coffee in particular and cooperatives; (3) role of other actors in the coffee supply chain including input providers, marketing unions and exporters. Research should also be oriented towards consumers in such a way that domestic and international markets for Rwandan coffee are investigated.
REFERENCES


Bandiera Oriana and Rasul Imran, 2003, *Complementarities, Social Networks, and Technology Adoption in Mozambique*, London School of Economics and CEPR

Bijman J., 2002: Essays on Agricultural co-operatives-Governance Structure in Fruit and Vegetable Chains, Ph.D. Series Research in Management 15, Erasmus Research Institute of Management (ERIM)


Fulton M and Sanderson K, 2002, *Cooperatives and farmers in the new agriculture*, Centre for the Study of Co-operatives, University of Saskatchewan


Klein P. G., 1999, New Institutional Economics, Department of Economics, University of Georgia, 0530, p.456-463


Ministry of Agriculture and Animal Resources, 2006, Self Evaluation of the PRSP by the Agricultural sector working group of the Rural Cluster, Republic of Rwanda, Kigali


Rwandex 2006, Coffee Washing stations fact sheets, Unpublished

Sogestal, 2001, COOPAC Business Plan pour les trois prochaines années, COOPAC, Gisenyi

Sogestal, 2002, Abahuzamugambi Specialty Coffee producers and exporters-Business Plan, PEARL, Butare


Twin Trading, 2004, Business Plan and Loan application for KOAKAKA Cooperative-New washing station Karaba District, PDCRE, Kigali


## Membership choice from a transaction cost economics perspective

### APPENDICES

**Appendix 1. Farmers’ questionnaire**

### 1. General information

<table>
<thead>
<tr>
<th>Variable name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewer (Initials):</td>
</tr>
<tr>
<td>Date of interview:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>District:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Western</td>
</tr>
<tr>
<td>1- Southern</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of respondent:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Male</td>
</tr>
<tr>
<td>1- Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-No formal schooling</td>
</tr>
<tr>
<td>1- Primary school</td>
</tr>
<tr>
<td>2- Secondary school</td>
</tr>
<tr>
<td>3- Technical school</td>
</tr>
<tr>
<td>99- Other: specify</td>
</tr>
</tbody>
</table>

### 2. Farming system

<table>
<thead>
<tr>
<th>Crops(other than coffee) and livestock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main food crops:</td>
</tr>
<tr>
<td>Other cash crops:</td>
</tr>
<tr>
<td>Livestock Owned</td>
</tr>
<tr>
<td>Cows</td>
</tr>
<tr>
<td>Goats</td>
</tr>
<tr>
<td>Poultry</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Area planted (crops)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nb of heads (animals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nucows</td>
</tr>
<tr>
<td>Nugoats</td>
</tr>
<tr>
<td>Napoul</td>
</tr>
<tr>
<td>Nuoth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of years growing coffee</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- No other alternative</td>
</tr>
<tr>
<td>1- Tradition</td>
</tr>
<tr>
<td>2- Best money-making</td>
</tr>
<tr>
<td>3- All the above</td>
</tr>
<tr>
<td>99- Other (specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purpose of growing coffee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cogryrs</td>
</tr>
<tr>
<td>Cogrpur</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of coffee plots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of years growing coffee</td>
</tr>
<tr>
<td>If you acquired a plot of coffee this year</td>
</tr>
<tr>
<td>Cost:</td>
</tr>
<tr>
<td>Number of trees:</td>
</tr>
<tr>
<td>Costplot</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of your coffee trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- This year-Reproducible trees</td>
</tr>
<tr>
<td>2- This year-Irreproducible trees</td>
</tr>
<tr>
<td>Irreproducible trees that are small</td>
</tr>
<tr>
<td>Irreproducible trees-cut for regeneration</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If seedlings were bought</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost per seedlings</td>
</tr>
<tr>
<td>Total costs</td>
</tr>
<tr>
<td>Seedp</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variety of coffee grown</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Arabica only</td>
</tr>
<tr>
<td>1- Robusta only</td>
</tr>
<tr>
<td>3- Do not know</td>
</tr>
</tbody>
</table>
### Membership choice from a transaction cost economics perspective

#### Amount of labour supplied for coffee?

<table>
<thead>
<tr>
<th>Number per season</th>
<th>Ordinary</th>
<th>Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Family labour</td>
<td></td>
<td>Falabo,falabha</td>
</tr>
<tr>
<td>2- Hired part-time</td>
<td></td>
<td>Hilabo,hilabha</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>Labo,labha</td>
</tr>
</tbody>
</table>

#### For the hired Labour

<table>
<thead>
<tr>
<th>Wage type</th>
<th>0-Daily</th>
<th>1-Weekly</th>
<th>2-Monthly</th>
<th>99-Other:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage amount</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordinary</th>
<th>Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dayso,daysha</td>
<td>Costlao, Costlaha</td>
</tr>
</tbody>
</table>

#### If you have seedlings that are still irreproducible, where did you get them?

<table>
<thead>
<tr>
<th>0- Public nursery (OCIR, MINAGRI)</th>
<th>1- Nursery of cooperative</th>
<th>2- Grew them by myself</th>
<th>3- Collected them from the field (wild)</th>
<th>99- Other(specify)</th>
</tr>
</thead>
</table>

#### Coffee fertilization

<table>
<thead>
<tr>
<th>0- Mulch</th>
<th>1- Manure/compost</th>
<th>2- Chemical</th>
<th>3- Mulch and manure</th>
<th>4- Mulch and chemical</th>
<th>5- Manure and chemical</th>
<th>6- All the 3</th>
<th>7- None</th>
<th>99- Other</th>
</tr>
</thead>
</table>

#### If the fertiliser is bought, amount and quantity used(this year)

<table>
<thead>
<tr>
<th>Type</th>
<th>Specifications</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Manure</td>
<td>Baskets per tree:</td>
<td>Fermabas/Ferchekg</td>
</tr>
<tr>
<td></td>
<td>Num of baskets:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price per basket:</td>
<td></td>
</tr>
<tr>
<td>2-Chemical</td>
<td>Kgs per tree:</td>
<td>Fermap/Ferchep</td>
</tr>
<tr>
<td></td>
<td>Num of kgs:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price per kg:</td>
<td></td>
</tr>
<tr>
<td>3- Mulch</td>
<td>Type:</td>
<td>Fermuloa/Fermup</td>
</tr>
<tr>
<td></td>
<td>Num of loads1:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price per load1:</td>
<td></td>
</tr>
<tr>
<td>99- Other</td>
<td>1bas=kg.....</td>
<td>Fermutr Costfer</td>
</tr>
<tr>
<td></td>
<td>Num of loads2:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price per load2:</td>
<td></td>
</tr>
</tbody>
</table>

#### Are the inputs available in sufficient quantities?

<table>
<thead>
<tr>
<th>0- Yes</th>
<th>1- Not always</th>
<th>2- Never</th>
<th>3- We don’t use</th>
<th>99- Do not know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td>Organic fertiliser</td>
<td>Chemical</td>
<td>Pesticides</td>
<td></td>
</tr>
<tr>
<td>Avlseed</td>
<td>Avlorgf</td>
<td>Avlchf</td>
<td>Avlpest</td>
<td></td>
</tr>
</tbody>
</table>

#### Do you face problems in the maintenance of your coffee trees?

<table>
<thead>
<tr>
<th>Access of labour</th>
<th>Access to mulch</th>
<th>Access to manure</th>
<th>Access to chemical fertiliser</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Options</td>
<td>Code</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td><strong>If you ever sell dry coffee</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pesticides</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of funds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Method of depulping coffee after harvesting?</strong></td>
<td>0- Depulp using a stone</td>
<td>Deplmth</td>
<td></td>
</tr>
<tr>
<td>1- Depulp using my own depulping machine at home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Depulp using paying machines of other people or traders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3- Depulp at a depulping centre of cooperative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99- Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Payment for depulping</strong></td>
<td>1- Amount paid in Rwfs per kg of cherries</td>
<td>Dplcash</td>
<td></td>
</tr>
<tr>
<td>2- Payment in kind: Number of cups(mironko) per sack of cherries(1 sack=60kgs)</td>
<td></td>
<td>Dplkind</td>
<td></td>
</tr>
<tr>
<td><strong>Days for depulping:</strong></td>
<td>Quantity</td>
<td>Price/kg</td>
<td>Total amt</td>
</tr>
<tr>
<td>1- Dried coffee</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Red cherries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>When is the sale amount received</strong></td>
<td>0- Immediately after sale</td>
<td>Pytdate</td>
<td></td>
</tr>
<tr>
<td>1- Much later</td>
<td>Average number of days between sale and payment:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Combined</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>If the per kg price of coffee is less than 600F (dried coffee), what is the reason offered for paying lower amount?</strong></td>
<td>0- Low quality – true</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1- Low quality – not true</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Took advantage of limited market opportunities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3- To repay a debt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4- He did not give a reason</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99- Other(Specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What is the price (cherries/dry coffee) that would have covered all your costs and burden?</strong></td>
<td></td>
<td>Breakp</td>
<td></td>
</tr>
<tr>
<td><strong>Average amount of money made from coffee</strong></td>
<td>1- This year</td>
<td>Inc06</td>
<td></td>
</tr>
<tr>
<td>2- Last year</td>
<td></td>
<td>Inc05</td>
<td></td>
</tr>
<tr>
<td><strong>Have you ever taken credit to be repaid by coffee</strong></td>
<td>1- Last time you did it (year)</td>
<td>Credyr</td>
<td></td>
</tr>
<tr>
<td>2- Amount needed</td>
<td></td>
<td>Credamt</td>
<td></td>
</tr>
<tr>
<td>3- Purpose</td>
<td>0- Investment in coffee</td>
<td>Credpurp</td>
<td></td>
</tr>
<tr>
<td>1- Consumption smoothing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- School fees/ Health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99- Others (Specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4- Interest charged</td>
<td></td>
<td>Int</td>
<td></td>
</tr>
<tr>
<td>5- Other collateral provided</td>
<td></td>
<td>Credcol</td>
<td></td>
</tr>
<tr>
<td>6- Source of credit</td>
<td>0- Cooperative</td>
<td>Credsrce</td>
<td></td>
</tr>
<tr>
<td>1- Trader</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Bank/COOPEC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3- Relationship/neighbour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99- Other(specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3. Transaction partner

**To whom did you sell your coffee this year?**
What type of coffee did you sell?

<table>
<thead>
<tr>
<th>Type of coffee sold</th>
<th>0- Cherries</th>
<th>1-Dried</th>
<th>2-Both</th>
<th>Partner/Trader</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Cooperative(s’ washing station)</td>
<td></td>
<td></td>
<td></td>
<td>partn/trad</td>
</tr>
<tr>
<td>1- Trader</td>
<td></td>
<td></td>
<td></td>
<td>Coop</td>
</tr>
<tr>
<td>99- Other (Specify)</td>
<td></td>
<td></td>
<td></td>
<td>Oth</td>
</tr>
</tbody>
</table>

**What is the distance from your home?**

<table>
<thead>
<tr>
<th>Distance in kms</th>
<th>In minutes-one way</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- To get the seedlings</td>
<td>Dist-minseed</td>
</tr>
<tr>
<td>1- To get the chemical fertiliser</td>
<td>Dist-minfert</td>
</tr>
<tr>
<td>2- To the farthest plot of coffee</td>
<td>Dist-minplot</td>
</tr>
<tr>
<td>3- Cooperative office</td>
<td>Dist-mincoop</td>
</tr>
<tr>
<td>4- Cooperative washing station</td>
<td>Dist-minwas</td>
</tr>
<tr>
<td>5- Collection point</td>
<td>Dist-mincoll</td>
</tr>
<tr>
<td>6- Depulping center</td>
<td>Dist-mindepc</td>
</tr>
<tr>
<td>7- Trader</td>
<td>Dist-mintrad</td>
</tr>
<tr>
<td>8- Other buyer</td>
<td>Dist-minoth</td>
</tr>
</tbody>
</table>

**Do these factors influence your preference for transaction partnership?**

<table>
<thead>
<tr>
<th>With the coop</th>
<th>Not at all (1)</th>
<th>No (2)</th>
<th>Neutral (3)</th>
<th>Yes (4)</th>
<th>Very much (5)</th>
<th>Pref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Payment date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1- Trust</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3- Relationship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4- Credit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5- Distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6- Burden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7- Quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8- Cheating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9- Other(Specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>With the trader</th>
<th>Not at all (1)</th>
<th>No (2)</th>
<th>Neutral (3)</th>
<th>Yes (4)</th>
<th>Very much (5)</th>
<th>Pref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Payment date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1- Trust</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2- Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3- Relationship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4- Credit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5- Distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6- Burden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7- Quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8- Cheating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99- Other(Specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**What do you plan to do with your coffee in the near future?**

<table>
<thead>
<tr>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Nothing in particular</td>
</tr>
<tr>
<td>1- Replace it with another crop</td>
</tr>
<tr>
<td>2- Maintain the same area but practice mixed cropping with other crops</td>
</tr>
<tr>
<td>3- Evaluate better whether it’s necessary to keep the coffee</td>
</tr>
<tr>
<td>4- Increase the area of coffee-add on more trees</td>
</tr>
<tr>
<td>99- Other-specify</td>
</tr>
</tbody>
</table>
### Membership choice from a transaction cost economics perspective

<table>
<thead>
<tr>
<th>Main source of information</th>
<th>General</th>
<th>Government</th>
<th>Coffee</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Neighbours</td>
<td></td>
<td>Infoge</td>
<td></td>
</tr>
<tr>
<td>2- Local market</td>
<td></td>
<td>Infogvt</td>
<td></td>
</tr>
<tr>
<td>3- National newspaper</td>
<td></td>
<td>Infoco</td>
<td></td>
</tr>
<tr>
<td>4- Radio/ Television</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5- Cooperative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6- Community leaders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7- Government agents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99- Others</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 4. Coop members

<table>
<thead>
<tr>
<th>Year of membership:</th>
<th>Year of starting transaction with coop:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coopnam</td>
</tr>
<tr>
<td></td>
<td>Coopyr</td>
</tr>
<tr>
<td></td>
<td>Coopamt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contribution to coop</th>
<th>1- Money:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>99- Other(specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Decision to join the coop</th>
<th>Coopdec</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- Compulsory</td>
<td></td>
</tr>
<tr>
<td>1- Expected benefits</td>
<td></td>
</tr>
<tr>
<td>2- Followed others</td>
<td></td>
</tr>
<tr>
<td>99- Other(specify)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Has the coop helped you get access to any of the following services or reach the following benefits? Choose 3 by order of importance</th>
<th>Coopben</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Improves my household’s current livelihood</td>
<td></td>
</tr>
<tr>
<td>2- Important in times of emergency</td>
<td></td>
</tr>
<tr>
<td>3- Reduced burden/risk</td>
<td></td>
</tr>
<tr>
<td>4- Access to technical advice and training</td>
<td></td>
</tr>
<tr>
<td>5- Higher prices</td>
<td></td>
</tr>
<tr>
<td>6- Access to inputs</td>
<td></td>
</tr>
<tr>
<td>7- Job</td>
<td></td>
</tr>
<tr>
<td>99- Other</td>
<td></td>
</tr>
</tbody>
</table>

#### 5. Non-members

<table>
<thead>
<tr>
<th>Reasons for not joining the coop</th>
<th>Nmembr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- No real benefits</td>
<td></td>
</tr>
<tr>
<td>1- No clear idea about the coop functions</td>
<td></td>
</tr>
<tr>
<td>2- High membership fee</td>
<td></td>
</tr>
<tr>
<td>3- The coop is far away</td>
<td></td>
</tr>
<tr>
<td>4- Requirements are high</td>
<td></td>
</tr>
<tr>
<td>5- Bad coop leadership</td>
<td></td>
</tr>
<tr>
<td>6- Will think about it</td>
<td></td>
</tr>
<tr>
<td>99- Other(specify)</td>
<td></td>
</tr>
</tbody>
</table>
## TRUST AND SOLIDARITY

### In general, do you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Response code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Most people who are in this cooperative can be trusted.</td>
<td>trust1</td>
</tr>
<tr>
<td>2. In this coop one has to be alert or someone is likely to take advantage of you.</td>
<td>trust1</td>
</tr>
<tr>
<td>3. Most people in this coop are willing to help if you need it.</td>
<td>trust2</td>
</tr>
<tr>
<td>4. In this coop people generally do not trust each other in matters of lending and borrowing money.</td>
<td>trust3</td>
</tr>
<tr>
<td>5. Over the last five years, the level of trust and solidarity in this district has become better</td>
<td>trust4</td>
</tr>
<tr>
<td>6. Compared to 5 years ago, the access to information on coffee production has greatly improved</td>
<td>trust5</td>
</tr>
<tr>
<td>7. The feeling of togetherness or closeness in my coop is becoming distant</td>
<td>trust6</td>
</tr>
<tr>
<td>8. There are people in our community who are excluded from joining the coop without reason.</td>
<td>trust7</td>
</tr>
<tr>
<td>9. Being in the coop reduces uncertainty with regard to the returns from coffee</td>
<td>trust8</td>
</tr>
<tr>
<td>10. I would like to leave my coop but I feel I do not have any other option but staying.</td>
<td>trust9</td>
</tr>
<tr>
<td>11. I wish I could be a big coffee farmer without being in the coop.</td>
<td>trust10</td>
</tr>
<tr>
<td>12. Coop membership results in improved quality and quantity of coffee</td>
<td>trust12</td>
</tr>
<tr>
<td>13. I implicitly trust the decisions made by the coop leaders</td>
<td>trust13</td>
</tr>
<tr>
<td>14. I feel that my voice is always considered while deciding on important matters affecting the coop.</td>
<td>trust14</td>
</tr>
<tr>
<td>15. Overall, I am satisfied with the results of my membership in my co-op.</td>
<td>trust15</td>
</tr>
</tbody>
</table>

### RISK

#### 1. Risk sources

<table>
<thead>
<tr>
<th>Potential effect on farmer’s income</th>
<th>Variable Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low =1; Low=2; Medium=3; High=4; Very high=5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) (2) (3) (4) (5)</td>
</tr>
<tr>
<td>1. Changes in agricultural and export policy</td>
<td>risk1</td>
</tr>
<tr>
<td>2. Changes in consumer preferences (about drinking habits)</td>
<td>risk2</td>
</tr>
<tr>
<td>3. Injury, illness, death</td>
<td>risk3</td>
</tr>
<tr>
<td>4. Yield uncertainty</td>
<td>risk4</td>
</tr>
<tr>
<td>5. Land reform policy</td>
<td>risk5</td>
</tr>
<tr>
<td>6. Cost of capital equipment of washing stations</td>
<td>risk6</td>
</tr>
<tr>
<td>7. Finding a market</td>
<td>risk7</td>
</tr>
<tr>
<td>8. Pests and diseases</td>
<td>risk8</td>
</tr>
<tr>
<td>9. Crop prices variability</td>
<td>risk9</td>
</tr>
<tr>
<td>10. Hired labour cost and availability</td>
<td>risk10</td>
</tr>
</tbody>
</table>
11. Credit availability and situation  
12. Rainfall availability and soil fertility  
13. Social conflicts  
14. Availability and prices of inputs  
15. New cash crops

### 2. Risk coping strategies

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Response code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Grow more than one crop</td>
<td>Strate1</td>
</tr>
<tr>
<td>2. Work and invest off-farm</td>
<td>Strate2</td>
</tr>
<tr>
<td>3. Use pesticides and agronomy services</td>
<td>Strate3</td>
</tr>
<tr>
<td>4. Join the cooperative</td>
<td>Strate4</td>
</tr>
<tr>
<td>5. Collect information</td>
<td>Strate5</td>
</tr>
<tr>
<td>6. Networks for sharing (as informal credit)</td>
<td>Strate6</td>
</tr>
<tr>
<td>7. Reduce and avoid debt</td>
<td>Strate7</td>
</tr>
<tr>
<td>8. Risk reducing technologies</td>
<td>Strate8</td>
</tr>
<tr>
<td>9. Diversifying customers</td>
<td>Strate9</td>
</tr>
<tr>
<td>10. Migration</td>
<td>Strate10</td>
</tr>
</tbody>
</table>

**Effectiveness in reducing the risk**

| Very low =1; Low=2; Medium=3; High=4; Very high=5 | Variable Name | Response code |
|--------------------------------------------------|---------------|
| (1) (2) (3) (4) (5)                              |               |

**OPEN QUESTIONS**

1. What changes in farming practices might contribute most to an improvement in product quality and quantity?

2. (For coop-members) Describe in details the benefits you have got from the coop.

3. Problems which may hinder the coop in attaining its objective.

4. (For non coop-members) Describe in details what prevents you from joining a coop.

5. Do you perceive any lost advantage for not having joined the cooperative?

6. General recommendations for improving coffee

THANK YOU
Appendix 2. STATA outputs

2.1 Probit: Membership vs. Non-membership status

* probit memb_sta age_dec gender educ hhsize dist_coo motivati cred lan_sec network prov plan tru_sco1 tru_sco2 tru_sco3 relat_d1 risk_d1

Iteration 0: log likelihood = -86.851475
Iteration 6: log likelihood = -38.732654

Probit regression                                Number of obs   =        153
LR chi2(16)     =      96.24
Prob > chi2     =     0.0000
Log likelihood = -38.732654                      Pseudo R2       =     0.5540

--------------------------------------------------- ---------------------------
memb_sta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+------------------------------------- ---------------------------
age_dec |  -.0113867   .0190627    -0.60   0.500     -.048749    .0259755
gender |  -.2200026   .3571598    -0.62   0.538     -.920023    .4800174
educ |   .4271307   .6564051     0.65   0.515     -.8593996    1.716661
hhsize |   .1913035   .0869232     2.20   0.028     .0209372    .3616699
dist_coo |   .0185198   .0049218     3.76   0.000     .0088733    .0281664
motivati |   .2557626    .298833     0.86   0.392    -.3299394    .8414645
cred |   .5394054   .3832689     1.41   0.159     -.2402174    1.319027
lan_sec |   .9328106   .4049129     2.30   0.021     .1391958    1.726425
network |   3.157094   .7797668     4.05   0.000     1.628779    4.685409
prov |  -1.287491   .5043568    -2.55   0.011    -2.276012   -.309455
plan |   .6295059   .5696603     1.11   0.268     -.487007    1.746019
tru_sco1 |  -.0962855   .4557635    -0.21   0.833    -.9895656    .7969434
tru_sco2 |   .1889668   .5145789     0.37   0.713    -.8195894    1.197523
tru_sco3 |    1.28159   .5902961     2.17   0.030     .1246306    2.438549
relat_d1 |  -.7889561   .3141215    -2.51   0.012    -.404623   -.1732892
risk_d1 |   1.511839   .3100210     4.88   0.000     .904209    2.121966
_cons |   -4.89995   1.601624    -3.06   0.002    -8.039074   -1.760825

--------------------------------------------------- ---------------------------

• mfx compute

Marginal effects after probit
  y  = Pr(memb_sta) (predict)
       = .93338609

variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+----------------------------------------- ---------------------------
age_dec |  -.0014715      .00258   -0.57   0.568  -.006526  .003583   41.1242
gender*|  -.0301517      .05073   -0.59   0.552  -.129583   .06928   .326797
educ*|   .0439865      .05353    0.82   0.411  -.060921   .148894   .143791
hhsize |   .0247217      .01313    1.88   0.060  -.001022   .050465   6.44444
dist_coo |   .0023933      .00086    2.78   0.005   .000704   .004083   65.9477
motivati |   .0330516      .04009    0.82   0.410  -.045526   .111629   .666667
cred*|   .0676793      .05007    1.35   0.176   -.030448   .165806   .444444
lan_sec*|   .1168318      .05589    2.09   0.037   .007292   .226372   .444444
network*|   .8161692      .14495    5.63   0.000   .532065   1.10027    .777778
prov* |  -.1746136      .07792   -2.24   0.025  -.327332  -.021895    .51634
plan* |   .117384      .13651    0.86   0.390   -.150168   .384936   .915033
tru_sco1*|  -.0128699     .03604   -0.35   0.727   -.136425   .110866   .267974
tru_sco2*|   .0223698      .05611    0.40   0.690   -.087604   .132344   .189542
tru_sco3*|   .1176139      .05306    2.22   0.027   .013617   .221611   .27451
relat_d1 |  -.1019548      .04133   -2.47   0.014   -.182961  -.020949   -.24183
risk_d1 |   .1953712      .06002    3.26   0.001   .077731   .313011   .45098

(*) dy/dx is for discrete change of dummy variable from 0 to 1
• **estat classification, cutoff(0.9)**

Probit model for memb_sta

<table>
<thead>
<tr>
<th>Classified</th>
<th>+</th>
<th>~ +</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>86</td>
<td>1</td>
<td>87</td>
</tr>
<tr>
<td>~D</td>
<td>28</td>
<td>38</td>
<td>66</td>
</tr>
<tr>
<td>Total</td>
<td>114</td>
<td>39</td>
<td>153</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .9

True D defined as memb_sta != 0

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Pr( +</td>
<td>D)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Pr( -</td>
<td>~D)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>Pr( D</td>
<td>+)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>Pr(~D</td>
<td>-)</td>
</tr>
</tbody>
</table>

False + rate for true ~D | Pr( +|~D)       | 2.56%          |
False - rate for true D  | Pr( -| D)       | 24.56%         |
False + rate for classified + | Pr(~D| +) | 1.15%          |
False - rate for classified - | Pr( D| -)   | 42.42%         |

Correctly classified | 81.05%        |

• **testparm tru_sco2 tru_scol**

( 1) tru_sco2 = 0

( 2) tru_scol = 0

\[
\text{chi}^2(2) = 0.30
\]

\[
\text{Prob > chi}^2 = 0.8625
\]

### 2.2 Probit: Early vs Late members

• **probit time_me2 age_dec gender educ hhsize dist_coo motivati plan cred lan_sec network prov tru_sco1 tru_sco2 tru_sco3 relat_d1 risk_d1 if memb_sta>0**

Iteration 0: log likelihood = -76.473462
Iteration 5: log likelihood = -55.282793

Probit regression

| time_me2 | Coef.  | Std. Err. | z   | P>|z| | [95% Conf. Interval] |
|----------|--------|-----------|-----|-----|----------------------|
| age_dec  | .0067121 | .0145544 | 0.46 | 0.645 | -.021814 | .0352382 |
| gender   | -.109647 | .3309792 | -.33 | 0.740 | -.7583542 | .5390602 |
| educ     | -.301369 | .4285563 | -0.70 | 0.482 | -1.141324 | .538586 |
| hhsize   | .147346 | .0659052 | 2.24 | 0.025 | .0181743 | .2765178 |
| dist_coo | -.0026564 | .0033965 | -0.78 | 0.434 | -.0093135 | .0040006 |
| motivati | .0763016 | .3124408 | 0.24 | 0.813 | -.6824356 | .9350397 |
| plan     | -.596982 | .3540127 | -1.69 | 0.092 | -1.290834 | .09687 |
| cred     | -.2731736 | .2961314 | -0.92 | 0.356 | -.8536386 | .3072914 |
| lan_sec  | .3289371 | .3124408 | 1.05 | 0.292 | -.2834356 | .9413097 |
| network  | -.1883737 | .7015106 | -2.59 | 0.010 | -.3193308 | -.4434372 |
| prov     | -.596982 | .3540127 | -1.69 | 0.092 | -1.290834 | .09687 |
| tru_sco1 | -.6596389 | .4255809 | -1.55 | 0.121 | -1.493762 | .1744843 |
| tru_sco2 | .1609855 | .4843307 | 1.16 | 0.247 | -.3882851 | 1.510256 |
| tru_sco3 | .5663972 | .4227559 | 0.94 | 0.347 | -.2278182 | .9599836 |
| relat_d1 | -.1883737 | .3384131 | -1.41 | 0.158 | -.4901247 | .0729895 |
| risk_d1  | .267147 | .1523134 | 1.76 | 0.079 | -.0310251 | .5531919 |
| _cons    | -.0066478 | 1.2631155 | -.01 | 0.996 | -2.482308 | 2.469012 |

Log likelihood = -55.282793
Marginal effects after probit
\( y = \Pr(\text{time\_me2}) \) (predict)
\[ = .3846986 \]

| variable | dy/dx | Std. Err. | z    | P>|z| | [    95% C.I.   ] | X |
|----------|-------|-----------|------|------|-----------------|---|
| age_dec  | .0025651 | .00556 | 0.46 | 0.645 | -.008334 | .013464 | 40.5 |
| gender*  | -.0416157 | .1246 | -0.33 | 0.738 | -.285821 | .20259 | .307018 |
| educ*    | -.1109117 | .0715 | -0.43 | 0.664 | -.16077 | .102451 | .75386 |
| hhsize   | .05631 | .02521 | 2.23 | 0.025 | .006902 | .105718 | 6.65789 |
| dist_coo | -.0010152 | .0013 | -0.78 | 0.433 | -.003555 | .001552 | .743421 |
| motivati | .0290156 | .06715 | -0.43 | 0.664 | -.16077 | .20259 | .75386 |
| plan*    | .0002291 | .0013 | 0.84 | 0.48 | -.428729 | .428721 | .921053 |
| cred*    | -.1039542 | .1246 | -0.84 | 0.433 | -.323616 | .115707 | .482456 |
| lan_sec* | .125704 | .11937 | 1.05 | 0.292 | -.108259 | .359667 | .45614 |
| network* | -.6159186 | .15239 | -4.04 | 0.000 | -.914607 | .31723 | .824561 |
| prov*    | .0290156 | .06715 | -0.43 | 0.664 | -.16077 | .20259 | .75386 |
| tru_sco1*| -.2332951 | .1352 | -1.73 | 0.084 | -.498318 | .031728 | .245614 |
| tru_sco2*| .0194573 | .18332 | 1.17 | 0.244 | -.149649 | .588564 | .184211 |
| tru_sco3*| .2640657 | .16374 | 0.39 | 0.696 | -.258688 | .384999 | .315789 |
| relat_d1 | -.0720868 | .0511 | -1.41 | 0.158 | -.172244 | .02807 | .253509 |
| risk_d1  | .1020934 | .05819 | 1.75 | 0.079 | -.011965 | .216152 | 4.0614 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Probit model for time\_me2

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>33</td>
<td>16</td>
<td>49</td>
</tr>
<tr>
<td>-</td>
<td>12</td>
<td>53</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>69</td>
<td>114</td>
</tr>
</tbody>
</table>

Classified + if predicted \( \Pr(\text{D}) \geq .38 \)

True D defined as \( \text{time\_me2} \neq 0 \)

| Sensitivity | \( \Pr(\text{+} | \text{D}) \) | 73.33% |
|-------------|-----------------|--------|
| Specificity | \( \Pr(\text{+} | \text{~D}) \) | 76.81% |
| Positive predictive value | \( \Pr(\text{D} | \text{+}) \) | 67.35% |
| Negative predictive value | \( \Pr(\text{D} | \text{+}) \) | 81.54% |

| False + rate for true ~D | \( \Pr(\text{+} | \text{~D}) \) | 23.19% |
| False - rate for true D  | \( \Pr(\text{+} | \text{D}) \) | 26.67% |
| False + rate for classified + | \( \Pr(\text{+} | \text{+}) \) | 32.65% |
| False - rate for classified - | \( \Pr(\text{+} | \text{+}) \) | 18.46% |

Correctly classified | 75.44%
2.3 Poisson: Year of membership

- `poisson year_mem age_dec gender educ hhsize dist_coo motivati plan cred lan_sec network prov tru_sco1 tru_sco2 tru_sco3 relat_d1 risk_d1 if memb_sta>0`

Iteration 0:  log likelihood = -242.68676
Iteration 1:  log likelihood = -242.68625
Iteration 2:  log likelihood = -242.68625

Poisson regression  
Number of obs   =        113  
LR chi2(16)     =      35.61  
Prob > chi2     =     0.0033  
Log likelihood = -242.68625  
Pseudo R2       =     0.0684

|             | Coef.  | Std. Err. | z     | P>|z|    | 95% Conf. Interval |  |
|-------------|--------|-----------|-------|--------|-------------------|---|
| year_mem    | 0.0004493 | 0.0043926  | 0.10  | 0.919 | -.0081602          | .0090587 |
| age_dec     | -.00436561 | .0103023   | -0.42 | 0.672 | -.2455774          | .1582653 |
| gender      | .1643658  | .1223139   | 1.34  | 0.179 | -.0753649          | .400966 |
| educ        | -.0465214  | .0188075   | -2.47 | 0.013 | -.0838384          | -.006594 |
| hhsize      | -.00004676 | .00009652  | 0.48  | 0.628 | -.0014241          | .0023593 |
| dist_coo    | .0107838   | .0042369   | 0.25  | 0.799 | -.0722581          | .0938256 |
| motivati    | -.1036656  | .1682891   | -0.62 | 0.538 | -.4335063          | .2261751 |
| plan        | -.0197349  | .0908692   | -0.22 | 0.828 | -.1980313          | .1585615 |
| cred        | -.0394684  | .0933198   | -0.42 | 0.672 | -.2223719          | .143435 |
| lan_sec     | .5479684   | .2154523   | 2.54  | 0.011 | .1256896           | .9702472 |
| network     | .1815663   | .1113263   | 1.63  | 0.103 | -.0366293          | .3997618 |
| prov        | .1126227   | .1304703   | 0.89  | 0.373 | -.1394892          | .3719449 |
| tru_sco1    | -.1259577  | .1546633   | -0.81 | 0.415 | -.4290222          | .1771769 |
| tru_sco2    | -.0199778  | .1295784   | -0.15 | 0.878 | -.2343439          | .2742995 |
| tru_sco3    | .0536129   | .0403865   | 1.33  | 0.184 | -.0255431          | .1327689 |
| relat_d1    | .0434157   | .0460509   | -0.75 | 0.454 | -.1245856          | .0557543 |
| _cons       | 1.339401   | .4042622   | 3.31  | 0.001 | .5470616           | 2.13174 |

Marginal effects after poisson  
`y  = predicted number of events (predict)`  
= 4.6548976

| variable   | dy/dx   | Std. Err. | z     | P>|z| | 95% C.I. | X |
|------------|---------|-----------|-------|--------|----------|---|
| age_dec    | .0020913 | .02045    | 0.10  | 0.919 | -.037984  | .042166 | 40.6283 |
| gender     | -.2014716 | .4713    | -0.43 | 0.669 | -.1.1252     | .722256 | .300885 |
| educ       | .0890808  | .63517    | 1.27  | 0.203 | -.436008     | 2.05383 | .168142 |
| hhsize     | -.2165524  | .0871    | -2.49 | 0.013 | -.387268     | -.045836 | 6.67257 |
| dist_coo   | .0021768   | .04949    | 0.48  | 0.628 | -.006628     | .100981 | .748673 |
| motivati   | .0501974   | .19722   | -0.25 | 0.799 | -.33634      | .436735 | .761062 |
| plan       | .5042712   | .8548    | -0.59 | 0.555 | -.2.17965     | 1.17111 | .920354 |
| cred       | .0918415   | .42323   | -0.22 | 0.828 | -.92136      | .73768  | .486726 |
| lan_sec    | -.1833808  | .43271   | -0.42 | 0.672 | -.103148     | .664722 | .415327 |
| network    | .2163795   | .71498   | 3.03  | 0.002 | .762466      | 3.56512 | .823009 |
| prov       | .8402364   | .5138    | 1.64  | 0.101 | -.1.62865     | 1.84334 | .539823 |
| tru_sco1   | .5580104   | .64567   | 0.86  | 0.387 | -.707483     | 1.8235  | .238938 |
| tru_sco2   | -.5639446  | .66564   | -0.85 | 0.397 | -.1.86857     | .740686 | .185841 |
| tru_sco3   | -.093338   | .60842   | -0.15 | 0.878 | -.1.09915    | 1.28582 | .318584 |
| relat_d1   | .2495625   | .18769   | 1.33  | 0.184 | -.118297     | .617421 | 2.53982 |
| risk_d1    | -.1602015  | .23399   | -0.75 | 0.454 | -.579608     | .292025 | 4.0708 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1

- `estat gof`

Goodness-of-fit chi2  =  114.6541  
Prob > chi2(96)  =  0.0942
2.4 Probit for coffee type: Only_Berries vs Not Only_Berries

• probit coffee_type_OB_NOB memb_sta gender educ corenu_m lab_rati hire_avl
cogyrs minplot crops livesto uncertainty_prochem uncertainty_propest prov

Iteration 0:   log likelihood = -74.049883
Iteration 1:   log likelihood = -59.959337
Iteration 2:   log likelihood = -59.275215
Iteration 3:   log likelihood = -59.268511
Iteration 4:   log likelihood = -59.26851

Probit regression  Number of obs   =        107
LR chi2(13)     =      29.56
Prob > chi2     =     0.0054
Log likelihood =  -59.26851                       P seudo R2       =     0.2131

--------------------------------------------------- ---------------------------
|         | Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval] |
--------------------------------------------------- ---------------------------
coffee_type_OB_NOB |      memb_sta |    1.326315   .6578058     2.02   0.044      .037039     2.61559
|        | gender      |  -.0191204   .3216704    -0.06   0.953      -.6113419    .6495828
|        | educ        |    .166259   .3696343     0.45   0.653     -.5582109   .8907288
|        | corenu_m    |  .0001333   .0002976     0.45   0.654     -.0000499    .0001666
|        | lab_rati    |  -.1099418   .2224744    -0.49   0.621     -.5459836   .3261001
|        | hire_avl    |    .4119842   .2828143     1.46   0.145     -.1662901   .1505527
|        | cogyrs      |  -.0294062    .012199    -2.41   0.016     -.0533157   -.0054967
|        | minplot     |  .0010547   .0002976     0.45   0.654     -.0004499    .0005599
|        | livesto     |  -.0554203   .3116802    -0.18   0.856     -.3768458    .2661052
|        | crops       |   .5254203   .3168856     1.69   0.092     -.0854617   1.136302
|        | livesto     |   .4593766   .3688856    -1.25   0.213     -.181824    .1744593
|        | uncertainty_prochem |  .0456082   .1498064     0.30   0.761     -.248007    .3392334
|        | prov        |   .7168921   .3057781     2.34   0.019      .1175779   1.316206
|        | _cons       |  -.1857912   .5277247    -0.35   0.725     -.8432115    .4716305
--------------------------------------------------- ---------------------------

• mfx compute

Marginal effects after probit
y  = Pr(coffee_type_OB_NOB) (predict)
    = .4632115

   variable |   dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
   ---------+----------------------------------------- ---------------------------
   memb_sta* |   .4661645   .18379    2.54   0.011   .105942   .826387   .700935
   gender*   |  -.007598    .12786   -0.06   0.953    -.243006   .258203   .299065
   educ*     |  .0661978   .14715     0.45   0.654     -.222207   .354602   .166164
   corenu_m  |  .000053    .00012     0.45   0.654     -.000179   .000285   352.514
   lab_rati* |  -.0436738   .08837   -.49   0.621    -.216885   .129538   .727529
   hire_avl* |   .1624895   .10997     1.48   0.140     -.37803    .653052   .495327
   cogyrs*   |  -.0116815   .00483   -2.42   0.016     -.021158   -.002205   23.1121
   minplot*  |  -.000419    .00012   -0.10   0.919     -.000762   .000845   15.7944
   livesto*  |  -.179203   .13949    -1.28   0.199     -.452603   .094197   .336449
   uncertainty_prochem |  .0181176   .05951    0.30   0.761     -.098527   .143762   1.26822
   prov*     |  -.1525494   .07919   -1.93   0.054     -.30775    .002651   1.20561
   _cons*    |   .2796713   .11452     2.44   0.015      .055223   .504152   .439252
--------------------------------------------------- ---------------------------

(*) dy/dx is for discrete change of dummy variable from 0 to 1
• estat classification, cutoff (0.46)

Probit model for coffee_type_OB_NOB

<table>
<thead>
<tr>
<th>Classified</th>
<th>D</th>
<th>~D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>36</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>-</td>
<td>15</td>
<td>39</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>56</td>
<td>107</td>
</tr>
</tbody>
</table>

Classified + if predicted Pr(D) >= .46
True D defined as coffee_type_OB_NOB != 0

- Sensitivity: Pr( +| D) = 70.59%
- Specificity: Pr( -|~D) = 69.64%
- Positive predictive value: Pr( D| +) = 67.92%
- Negative predictive value: Pr( ~D| -) = 72.22%

- False + rate for true ~D: Pr( +|~D) = 30.36%
- False - rate for true D: Pr( -| D) = 29.41%
- False + rate for classified +: Pr(~D| +) = 32.08%
- False - rate for classified -: Pr( D| -) = 27.78%

Correctly classified: 70.09%

2.5 Probit for transaction structure: Cooperative vs Traders

• probit trans_pa memb_sta specificit1 specificity_per minutes_wash
  minutes_collection minutes_trader uncertainty_promu uncertainty_proma
  uncertainty_prochem uncertainty_propest uncertainty_prolab date price freq prov

Iteration 0: log likelihood = -93.252749
Iteration 7: log likelihood = -56.088268

Probit regression

| trans_pa      | Coef.  | Std. Err. | z     | P>|z|   | [95% Conf. Interval] |
|---------------|--------|-----------|-------|-------|----------------------|
| memb_sta      | 1.57277 | .86143 | 1.83  | 0.068 | -.1155998 to 3.261146 |
| specificit1   | -.0003854 | .0003275 | -1.18 | 0.159 | -.0010274 to .0013628 |
| specificit-r  | .00065 | .0003637 | 1.79  | 0.074 | .0000628 to .0013628 |
| minutes_wash  | .0045052 | .0045189 | 1.00  | 0.319 | -.0043518 to .0133622 |
| minutes_co-n  | -.0268073 | .0144358 | -1.86 | 0.063 | -.0014864 to .0551009 |
| minutes_tr-r  | .0164579 | .0081532 | 2.02  | 0.044 | .0004779 to .032438 |
| uncertainty-l | .1923453 | .1582182 | 1.22  | 0.224 | -.1177566 to .502447 |
| uncertainty-a | .1105754 | .1867784 | 0.59  | 0.554 | -.2555035 to .4766542 |
| uncertainty-m | .010349 | .1598102 | 0.06  | 0.948 | -.3028733 to .3255713 |
| uncertainty-t | -.052986 | .1825007 | -0.29 | 0.772 | -.4106809 to .3047088 |
| uncertainty-b | -.2840081 | .1496988 | -1.90 | 0.058 | -.5774124 to .0093963 |
| date          | -.105942 | .1485068 | -0.71 | 0.476 | -.3970099 to .185126 |
| price         | -.1702797 | .1339979 | -1.27 | 0.164 | -.4329107 to .0923513 |
| freq          | .0003671 | .0008529 | 0.43  | 0.667 | -.0013044 to .0020387 |
| prov          | -.3516605 | .3261153 | -1.08 | 0.281 | -.9908347 to .2875338 |
| _cons         | -.7369946 | .8984615 | -0.82 | 0.412 | -.2.497947 to 1.023958 |

Note: 0 failures and 4 successes completely determined.
### Marginal effects after probit
\[ y = \Pr(\text{trans}_pa) \] (predict) = 0.83431845

| variable   | dy/dx   | Std. Err. | z    | P>|z| [    95% C.I.   ] | X |
|------------|---------|------------|------|----------------------|--|
| memb_sta* | 0.4834791 | 0.29021    | 1.67 | 0.096                | .716216 |
| specif-1   | -0.0000959 | 0.00007   | -1.32 | 0.188                | .535,899 |
| specif-r   | 0.0001618 | 0.00006   | 2.64 | 0.008                | .000282 |
| minute-h   | 0.0011213 | 0.00118   | 0.95 | 0.341                | .48,1622 |
| minute-n   | -0.0066722 | 0.00359   | -1.86 | 0.063                | .013705 |
| uncert-l   | 0.0040963 | 0.00047   | 1.94 | 0.052                | .008224 |
| uncert-a   | 0.00275218 | 0.000233 | 0.60 | 0.549                | .000233 |
| uncert-m   | -0.003188 | 0.000359 | -0.95 | 0.341                | .48,1622 |
| date       | -0.0263685 | 0.03714   | -0.71 | 0.478                | .099171 |
| price      | -0.0423819 | 0.0344   | -1.23 | 0.168                | .109808 |
| freq       | -0.000914 | 0.000213 | 0.43 | 0.671                | .000513 |
| prov*      | -0.0882995 | 0.083687  | -1.06 | 0.291                | .252281 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1

### Estat classification, cutoff (0.83)

Probit model for trans_pa

<table>
<thead>
<tr>
<th>Classified</th>
<th>True</th>
<th>False</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>63</td>
<td>5</td>
<td>68</td>
</tr>
<tr>
<td>-</td>
<td>37</td>
<td>43</td>
<td>80</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>48</td>
<td>148</td>
</tr>
</tbody>
</table>

Classified + if predicted \( \Pr(D) \geq 0.83 \)

True D defined as trans_pa != 0

| Sensitivity          | Pr( + | D) | 63.00% |
|----------------------|------|-------|
| Specificity          | Pr( - | D) | 89.58% |
| Positive predictive value | Pr( D | +) | 92.65% |
| Negative predictive value | Pr(-D | -) | 53.75% |

| False + rate for true -D | Pr( + | -D) | 10.42% |
| False - rate for true D  | Pr( - | D) | 37.00% |
| False + rate for classified + | Pr(-D | +) | 7.35% |
| False - rate for classified - | Pr( D | -) | 46.25% |

Correctly classified 71.62%
2.6 Multinomial logit for transaction structure: Only_Cooperative vs Only_Traders vs Both-Cooperative-and-Traders

* mlogit partner_structure memb_sta specificity1 specificity_per_minutes_wash minutes_collection minutes_trader uncertainty_promul uncertainty_proma uncertainty_prochem uncertainty_propest uncertainty_prolab date price freq prov

Iteration 0:  log likelihood = -160.86335
Iteration 1:  log likelihood = -138.0695
Iteration 2:  log likelihood = -137.17882
Iteration 3:  log likelihood = -137.16367
Iteration 4:  log likelihood = -137.16366

Multinomial logistic regression                   Number of obs   =        148
LR chi2(30)     =      47.40
Prob > chi2     =     0.0227
Log likelihood = -137.16366                       P seudo R2       =     0.1473

--------------------------------------------------- ---------------------------
partner_structure |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+------------------------------------- ---------------------------
1            |
  memb_sta   |  -2.39378   1.416737    -1.69   0.091    -5.170534    .3829744
  specificity1 |   .0002899   .0004401     0.66   0.510    -.0005727    .0011524
  specificity-r |  -.0000719   .0001326    -0.54   0.588    -.0003317    .0001879
  minutes_wash |   .0059806   .0072918     0.82   0.412    -.0083112    .0202723
  minutes_co-n |  -.0139049    .021642    -0.64   0.521    -.0563225    .0285126
  minutes_tr-r |  -.0124139   .0271099    -0.46   0.645    -.0654928    .0406651
  uncertainty-l |  -.0204028   .2725858    -0.07   0.940    -.5546613    .5138556
  uncertainty-m |  -.2239682    .257284    -0.87   0.381    -.7282357    .2809992
  uncertainty-a |   .2213386   .2850604     0.78   0.437    -.3373696    .7804647
  uncertainty-t |   .5589482   .3033266     1.84   0.065    -.0355272    1.153465
  date        |   .1887264   .2270114     0.83   0.406    -.2562078    .6336607
  price       |  -.3637526   .2240745    -1.62   0.105    -.8029305    .0754252
  freq        |   .0028944   .0013974     2.07   0.038     .0001556    .0056333
  prov        |    .362465   .5424521     0.67   0.500    -.7007216    1.425452
  _cons      |   .1794307   1.422249     0.13   0.900    -2.608126    2.966988

--------------------------------------------------- ---------------------------
2            |
  memb_sta   |  -1.082776   1.405642    -0.77   0.441    -3.837783    1.672232
  specificity1 |  -.0001511   .0004535    -0.33   0.739    -.0010399    .0007377
  specificity-r |  -.0000505   .0000858    -0.59   0.557    -.0002187    .0001187
  minutes_wash |   .0054477   .0068308     0.80   0.425    -.0079404    .0188397
  minutes_co-n |  -.0660099   .0233972    -2.82   0.005    -.1118675    -.0201523
  minutes_tr-r |   .0068338   .0083515     0.84   0.401    -.0091106    .0227782
  uncertainty-l |  -.0820755   .2567257    -0.32   0.749    -.5852487    .4210976
  uncertainty-m |  -.048895   .2793266    -0.18   0.861    -.596365     .498575
  uncertainty-t |   .4286959   .2945832     1.46   0.146    -.1486749    1.005067
  date        |   .1537008   .2277724     0.67   0.500    -.2927249    .6001266
  price       |  -.0237953   .2137029    -0.11   0.911    -.4426454    .3950548
  freq        |   .0018565   .0013572     1.37   0.171    -.0008036    .0045167
  prov        |  -.012812   .4995982    -0.20   0.838    -.992007    .9663878
  _cons      |   .067259    1.417027     0.05   0.962    -2.710064    2.844582

--------------------------------------------------- ---------------------------
(partner_structure==0 is the base outcome)
### Marginal effects after mlogit

#### (outcome(0))

\[
y = \Pr(\text{partner\_structure}=0) \text{ (predict, outcome(0))}
\]

| variable  | dy/dx   | Std. Err. | z     | P>|z|  | [95% C.I. ] | X   |
|-----------|---------|-----------|-------|-------|------------|-----|
| memb_sta*| .3474915| .19078    | 1.82  | .069  | -.026439   | .721422 | .716216 |
| specif-l | -.9.50e-06| .00009 | -0.11 | .915  | -.0000184 | .0000165 | 535.899 |
| specif-r | .0000141| .00002   | 0.69  | .493  | -.000026   | .000054  | 1108.04 |
| uncert-b | -.0911966| .0443   | 2.06  | .040  | -.178024   | -.004369 | 2.27027 |
| uncert-l | .013058| .05388   | 0.24  | .808  | -.092539   | .118655  | 2.65541 |
| uncert-a | -.0161332| .05703  | -0.28 | .777  | -.127914   | .095648  | 2.33108 |
| uncert-m | .0209241| .05035   | 0.42  | .678  | -.077769   | .119617  | 2.20946 |
| uncert-t | -.1145332| .06179  | 1.85  | .064  | -.235649   | .006582  | 1.31081 |
| date     | .0398682| .0456    | 0.87  | .382  | -.129241   | .049504  | 3.92568 |
| price    | .0404323| .04397   | 0.92  | .358  | -.045753   | .126618  | 3.97973 |
| freq     | .0005445| .0029    | 1.85  | .064  | -.00112    | .000031  | 159.368 |
| minute-h | .0013405| .00145   | 0.93  | .354  | -.004176   | .000226  | 48.1622 |
| minute-n | .0102456| .00441   | 2.33  | .020  | .001609    | .018882  | 18.4865 |
| minute-r | .0003581| .00461   | 0.08  | .937  | -.087567   | .094963  | 2.27027 |
| prov*    | .0932501| .10662   | 0.93  | .354  | -.103959   | .290459  | 1.472937 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1

#### (outcome(1))

\[
y = \Pr(\text{partner\_structure}=1) \text{ (predict, outcome(1))}
\]

| variable  | dy/dx   | Std. Err. | z     | P>|z|  | [95% C.I. ] | X   |
|-----------|---------|-----------|-------|-------|------------|-----|
| memb_sta*| -.3906554| .28095    | -1.39 | .164  | -.941302   | .159991 | .716216 |
| specif-l | .000711 | .00008    | 0.90  | .368  | -.000084   | .000226 | 535.899 |
| specif-r | -.9.37e-06| .00002   | 0.38  | .701  | -.000057   | .000038 | 1108.04 |
| uncert-b | .0317902| .00437    | 0.79  | .431  | -.047325   | .110905 | 2.27027 |
| uncert-l | .003698| .04656    | 0.08  | 0.937 | -.087567   | .094963 | 2.27027 |
| uncert-a | .0480269| .04949    | 0.97  | .332  | -.049874   | .145027 | 2.33108 |
| uncert-m | -.0453679| .04499    | -1.01 | .313  | -.133489   | .042754 | 2.20946 |
| uncert-t | .0694657| .04951    | 1.40  | .161  | -.027569   | .1665  | 1.31081 |
| date     | .026146| .0401     | 0.56  | .573  | -.055979   | .101208 | 3.92568 |
| price    | -.0691547| .0385     | -1.80 | .072  | -.144622   | .006312 | 3.97973 |
| freq     | .0003938| .00021    | 1.88  | .061  | -.000017   | .000805 | 159.368 |
| minute-h | .0006625| .00122    | 0.54  | .588  | -.001735   | .00306  | 48.1622 |
| minute-n | .0034656| .00393    | 0.88  | .378  | -.004422   | .011173 | 18.4865 |
| minute-r | -.0030776| .00232    | -1.33 | .185  | -.007628   | .001473 | 29.1622 |
| prov*    | .163419| .0926     | 1.76  | .078  | -.018065   | .344903 | 4.72937 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1
Marginal effects after mlogit
\[ y = \Pr(\text{partner_structure} = 2) \] (predict, outcome(2))

\[
\begin{vmatrix}
\text{variable} & \text{dy/dx} & \text{Std. Err.} & z & \text{P>|z|} & \text{[ 95% C.I. ]} & \text{X} \\
\hline
\text{memb_sta} & .0431639 & .27256 & 0.16 & 0.874 & -.491038 & .577366 & 716216 \\
\text{specific} & -0.0000616 & 0.00009 & -0.66 & 0.512 & -.000042 & .000033 & 1108.04 \\
\text{uncert} & -4.73e-06 & .00002 & -0.25 & 0.805 & -.000042 & .000033 & 2.65541 \\
\text{date} & 0.0594064 & 0.0446 & 1.33 & 0.183 & -.028005 & .146818 & 535.899 \\
\text{price} & 0.0172536 & 0.0466 & 0.37 & 0.711 & -.074073 & .108581 & 3.92568 \\
\text{freq} & 0.0001507 & 0.00024 & 0.63 & 0.528 & -.0000318 & .0000619 & 159.365 \\
\text{minute} & 0.000678 & 0.00133 & 0.51 & 0.609 & -.000192 & .0003276 & 48.1622 \\
\text{prov} & -0.0318937 & 0.05618 & -0.57 & 0.570 & -.142 & .078213 & 2.33108 \\
\text{uncert} & 0.0244438 & 0.04955 & 0.49 & 0.622 & -.072668 & .121555 & 2.20946 \\
\text{uncert} & 0.0450675 & 0.05594 & 0.81 & 0.420 & -.064578 & .154713 & 1.31081 \\
\text{minimum} & 0.0172536 & 0.0466 & 0.37 & 0.711 & -.074073 & .108581 & 3.92568 \\
\text{minute} & -0.0137112 & 0.00479 & -2.86 & 0.004 & -.023094 & -.004328 & 18.4865 \\
\text{minimum} & 0.0027195 & 0.00018 & 1.46 & 0.143 & -.000923 & .006362 & 29.1622 \\
\text{prov} & -0.0256691 & 0.09352 & -2.74 & 0.006 & -.43996 & -.073378 & 472973 \\
\end{vmatrix}
\]

(*) dy/dx is for discrete change of dummy variable from 0 to 1