Wageningen University – Department of Social Sciences

MSc Thesis Proposal Development Economics

Potato Supply Chain In Ethiopia: Access To Market Information, Farmers' Cooperatives and Margin in West Arsi Zone, Ethiopia

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EXECUTIVE SUMMARY

In Ethiopia governmental policies are focusing attention to the agricultural sector, aiming at moving farmers from subsistence farming to commercial farming, producing cash crops; according to the "Accelerated and Sustained Development to End Poverty" programme potato is one of the root crops, which was given high priority. Potato farming in Ethiopia is characterized by smallholder farmers, sometimes organized in small local peasant associations; looking at ware potatoes we can identify three chains, all of them showing difficulties in marketing the products because of scarce quality, high transaction costs and lack of price information. Often the supply chain includes intermediaries who stipulate agreements and contracts with the farmers in order to buy and re-sell their potatoes. Intermediaries often fix prices causing constraints to the marketing instead of facilitating it. The bargaining position of farmers and traders is not equal because of lack of market information among farmers. The main critical points of the potato supply chain are: shortage of input supply, fluctuating prices, interference of middlemen, lack of market information, lack of formal arrangements and efficiency of farmers' cooperatives. The objectives of this research are: to investigate the access to market information of potato farmers and their gross margin in relation to the membership in cooperatives, the type of buyer and the type of contract farmers have; to investigate which factors influence farmers' choice to engage in cooperatives. To reach these objectives I defined a number of hypotheses based on the literature and I carried out correlation tests, logistic and linear regressions as well as Propensity Score Matching. The data were collected on 146 households in 2010 and 2011.

The results show that the potato supply chain is for some aspects similar to such chains in other developing countries, especially when we look at farmers' organization among themselves and with the buyers; on the other hand most of the hypotheses I formulated had to be rejected. Farmers' choice of engaging in a cooperative affects positively the access to market information and their margin (as a consequence we can assume that it affects bargaining power); on the other hand type of contract and type of buyer affect the margin but do not affect the access to market information. When looking at the forces that drive farmers choice of becoming member of a cooperative we find only the experience in agriculture and in potato farming, together with the total wealth, as significant predictors.

1. INTRODUCTION

1.1 BACKGROUND

Potato (*Solanum Tuberosum L.*) is both a food and a cash crop in sub-Saharan Africa. Ethiopia, together with Kenya and Uganda, is among the ten countries with the largest area for potato production, where potato remains an important crop for the rural population. It is grown by one million farmers and is considered a high-potential crop. Potato can be grown on a vast area in Ethiopia, about 70% of the arable land in the country (Hirpa et al. 2010).
Potato production (525 657 tons in 2007)[1] is expected to grow by 2.6% per year in Ethiopia, which is due to increase in area cultivated rather than to the increase in yields (Gildemacher et al. 2009b).
Potato is therefore rapidly growing due to the high potential of the country, which has large portion of arable land and because of the high potential yields and high nutritional value of the crop, which can ensure food security. Due to the short production cycle potatoes have good potential for the trading within the region. Around 80% of potatoes are sold as ware tubers and 85% of them is consumed fresh (Lemaga, 2010).

In Ethiopia governmental policies are focusing attention to the agricultural sector, aiming at moving farmers from subsistence farming to commercial farming, producing cash crops. This is one of the main points included in the programme "Accelerated and Sustained Development to End Poverty" (PASDEP); according to this plan potato is one of the root crops, which was given high priority by the Ethiopian government. PASDEP has the objectives of developing market infrastructures, improving credit markets for agricultural sector, specializing extension services in different zones, developing business plans for specialized export crops, improving land tenure security, market information services and increasing the role of the private sector participating in agricultural marketing. The programme also aims at strengthening the cooperative system, research in agriculture, water management and agricultural techniques, through capacity building of labour force. All this improvements are needed in order to move the agricultural sector towards market orientation (Emana & Gebremedhin, 2007).

[1] FAOSTAT, http://www.potato2008.org/en/world/africa.html

Although government is giving increasing relevance to this crop, there is still a lack of market information, weak linkage between stakeholders, lack of skills in both production and marketing. Farmers face difficulties in accessing market price information, especially when looking at future prices. Information problems have to do with quality as well: there are no standards and quality identification is difficult for both buyers and sellers. Because of this lack of quality standards, the market doesn't pay to farmers a premium for higher quality produce; smallholder farmers don't have any incentive in improving the quality of their agricultural products (Newai, 2006).

In addition to these problems there is a lack of marketing institutions, lack of coordination among farmers, causing reduced bargaining power, lack of transparency in marketing information and scarce skills and knowledge in the transport, storage and packaging of horticultural products (Emana & Gebremedhin, 2007).

Research has been conducted on the potato seed sector in Ethiopia, but only few studies focus on ware potatoes, which are mostly consumed by farm households: only 10.4% of root crops is sold on the market (CSA 2010c as cited by Agiro 2011).

1.1.1 CoQA Programme

The CoQA programme is an "interdisciplinary research and capacity building programme to improve quality in agrifood chains in Benin, Ethiopia and South Africa" (www.coqa.nl). CoQA stands for "Co-innovation for quality in African Chains" and it has the objective of designing a set of quality innovations that can support smallholder farmers, strengthening their market access and competitiveness within national and international supply chains (Bijman & Royer, 2009-01). CoQA will have three main results: capacity building of scientists in both African Countries and Wageningen; academic publications and recommendations for policy makers, businesses, NGOs and producer organizations on policies and strategies for the improvement of quality in agrifood chains.

The organizations involved in the programme are: Wageningen University; Radboud University Nijmegen; Université d'Abomey-Calavi (UAC) in Benin; Hawassa University in Ethiopia; University of Fort Hare in South Africa; International Institute of Tropical Agriculture; Benin Office International Food Policy Research Institute; Markets Trade and Institutions Division International Potato Centre; Sub Sahara Africa Regional Office (www.coqa.nl).

1.2 PROBLEM STATEMENT

In Ethiopia potato farming is conducted by smallholder farmers, who occupy around 96% of the currently cultivated land. Most farmers use potatoes for household consumption or for seed and only a small part of it is sold on the market. However, the value of ware potatoes is higher than the value of seed potatoes (Greenhalgh and Havis 2005 as cited by COQA 2009).

Wolde (2001) presents a classification of the marketing channels for horticultural products in Ethiopia: direct selling from farm to the nearest local market to wholesalers, retailers and consumers; direct selling in small shops or outlets; traditional selling where brokers visit farmers and stipulate verbal agreements and contracts in advance, before the harvesting season.
According to Gildemacher et al (2009a), very few farmers in Ethiopia sell their potatoes through farmers' cooperatives or non-governmental organization and, compared to Kenya and Uganda, the marketing system is still less developed. One of the main issues found by Gildemacher et al. (2009a) was the difficulty in getting production and market information, which most of the time was provided by own experience, family members and farmers from the same community. NGOs and extension programmes played an important role as well, but traders seemed not to provide any information on potato varieties and production techniques.

Potato farmers are organized in small local peasant associations. However, farmers were found to be reluctant to be organized due to past experience, when governmental influence was very invasive and affecting the organizations (Gildemacher et al. 2009a). In the past, government played a big role in cooperatives and unions of farmers in Ethiopia, leading to high levels of inefficiency and bad reputation because of the lack of transparency and of the limited consideration of farmers' interests.

Looking at the chain I will focus on ware potato farmers and buyers/traders. Already a number of studies have been conducted on seed potato farmers and on the chain, but only few studies focus on ware potatoes. This is the reason why I decided to narrow down my research, looking at the potato supply chain only from the point of view of ware potatoes and focusing on two actors: farmers and buyers/traders.

Ware production is carried out by smallholder farmers, who use predominantly family labour. Farmers tend to have difficulties in marketing their products because of the lack of storing facilities and the perishability of the product; but the main problems they face are: poor quality of the

produce, high transportation and transaction costs and lack of price information (Emana & Gebremedhin, 2007). Brokers, who buy from farmers and play the role of intermediary between producers and wholesalers and traders, play a crucial role in the marketing of ware potatoes in Ethiopia. Often brokers buy directly from farmers after a verbal contract or directly without any type of formal or informal contract. They tend to control and fix prices but are incline to create benefits for processors and wholesalers rather than for farmers, causing constraints to the marketing of the product rather than facilitating it (Emana & Nigussie, 2011).

The bargaining position of farmers and buyers/traders in not equal; middleman often set the prices because of the lack of information among farmers, who traditionally are price takers. There is then the need for them to access clear and transparent market information in order to increase their bargaining power (Mulatu et al., 2011).

According to Hoermann & Shawel (1985) peasants that live far from urban centres have no market information; therefore buyers, brokers and wholesalers have competitive advantage and can impose lower prices to farmers.

In Agiro (2010) and in Emana & Gebremedhin (2007), we find the main critical points of the potato chain as:

- shortage of input supply
- fall in price of ware potatoes
- interference of middleman/brokers who manipulate prices
- lack of market information
- lack of formal arrangements (contracts) regarding quality and quantities
- inefficiency of farmers' cooperatives and associations, when present (Agiro, 2011; Emana & Gebremedhin, 2007).

In the text above only the points related to the marketing aspects were described, but there are of course other critical points at other stages of the chain.

1.3 SIGNIFICANCE OF THE RESEARCH

Ethiopia has a high potential for the improvement of the potato sector. However, many constraints affect the supply chain and are preventing its development to occur. In the document of MOFED (2006), about the PASDEP programme the following constraints to agricultural development have been identified: predominance of subsistence agriculture; climate change; inappropriate management of land and land use; poor information base; lack of input supplies and of technology; lack of capacity to move towards a more market oriented agriculture.

The Ethiopian government is implementing policies that are supposed to push farmers to engage in commercial market rather than producing for subsistence; extension services have been implemented by research institutes, NGOs and governmental institutions (MOFED, 2006). There is however lack of market information and of formal contracts between farmers and buyers/traders, resulting in weak bargaining position of farmers and in a fragmented and inefficient supply chain. Traders themselves often lack information, but are always the ones who are better off in the negotiation (Emana & Gebremedhin, 2007).

This thesis will focus on the main actors of the supply chain: farmers, buyers/traders, focusing the attention to farmers' cooperatives and the type of contracts between potato farmers and buyers/traders in relation to the access to market information. As mentioned in the previous sections, marketing problems are not the only ones affecting the chain but, as the government is willing to move the sector to commercial orientation, there is increasing need for farmers to organize themselves in farmers' associations to improve their bargaining position. Two sides of the problem are faced: the lack of bargaining power, due to market structure's inefficiency and lack of market information.

1.4 OBJECTIVES OF THE RESEARCH

For this research I defined several objectives, all related to the main problems stated in the previous sections. We can identify two main streams of problems: lack of bargaining power of farmers, related to the market structure, and lack of market information, which has to do with the contracting issues.
The objectives of this research are:

- to investigate the access to market information of potato farmers in three zones of Ethiopia, in relation to the type of buyers they sell to, the type of contracts they have with them and their membership in cooperatives;

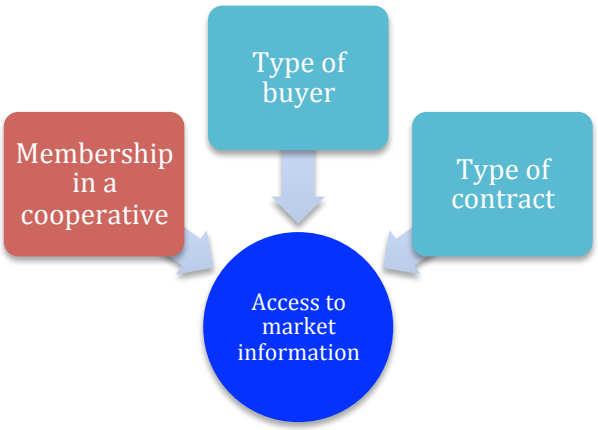
- to investigate which factors influence the choice of farmers to engage in cooperatives;

- to investigate farmers' gross margin in relation to their membership in cooperatives, the type of buyers they sell to and the type of contracts they are engaged in.

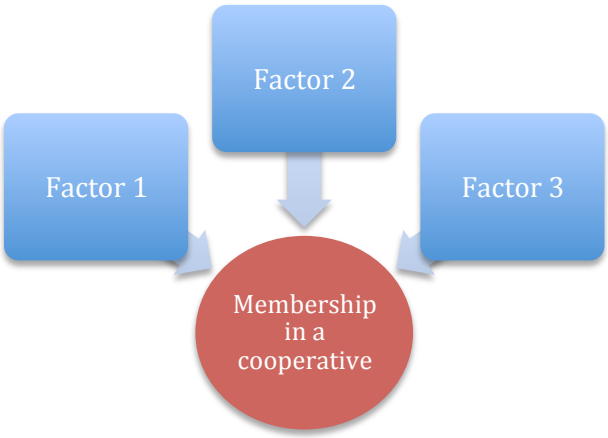
1.4.1 Research Questions

Below I state the research questions that I will try to answer through this research.

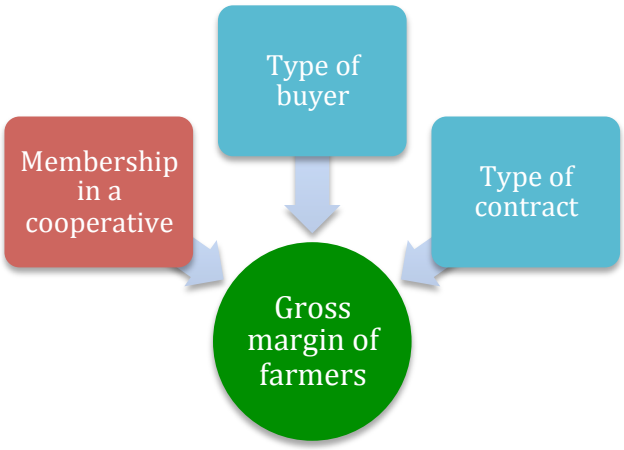
1. What is the relationship between farmers' membership in a cooperative, the type of buyer they sell to, the type of contract they stipulate, and the access to market information?



2. What are the factors influencing the choice of farmers to become members of a cooperative?



3. What is the relationship between farmers' membership in a cooperative, the type of buyer they sell to, the type of contract they stipulate, and their gross margin?



1.4.1.1 Specific Research Questions

To better understand the research questions stated above, I decided to write some specific research questions.

1.1. Does the membership in a cooperative have an impact on farmers' access to market information?

1.2. Does the type of buyer that farmers sell to have an impact on farmers' access to market information?

1.3. Does the type of contract that farmers stipulate with buyers have an impact on their access to market information?

2.1. Which explanatory variables can we identify to explain the engagement of farmers in a cooperative?

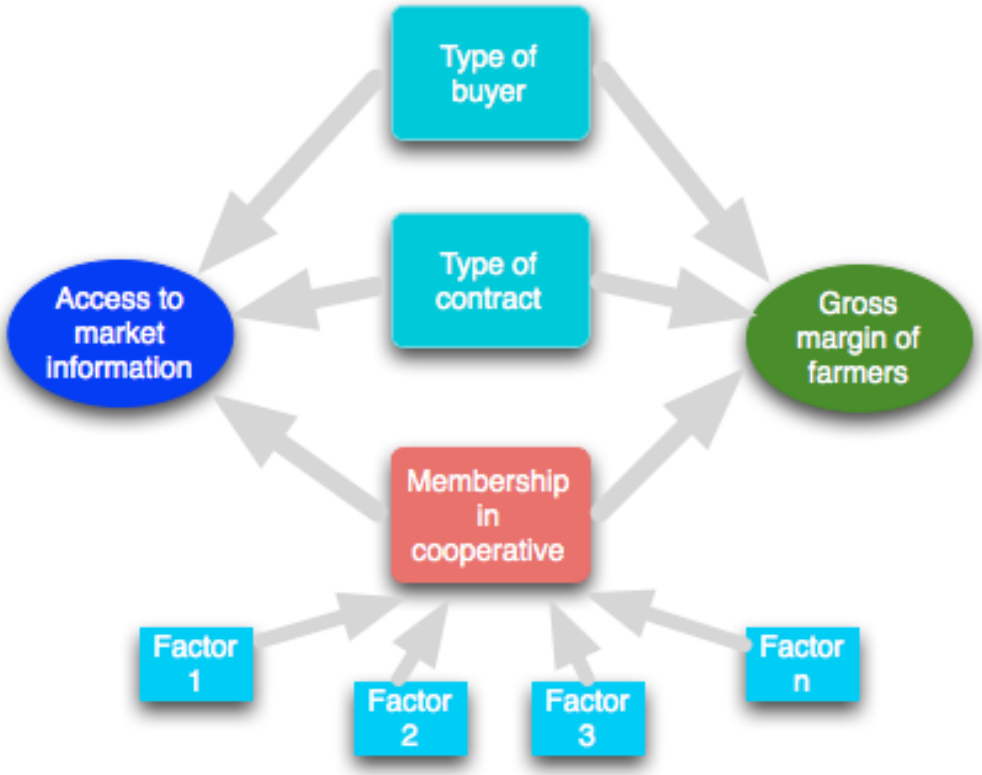
3.1. Does the membership in a cooperative have an impact on farmers' gross margin?

3.1.1 How bigger/smaller is the margin of members of a cooperative compared to the margin of non-members?

3.2. Does the type of buyer that farmers sell have an impact farmers' gross margin?

3.3. Does the type of contract that farmers stipulate with buyers have an impact on their gross margin?

Figure 1.1: Scheme of the three RQs summarized in one single model.



2. LITERATURE REVIEW

2.1 CONCEPTS

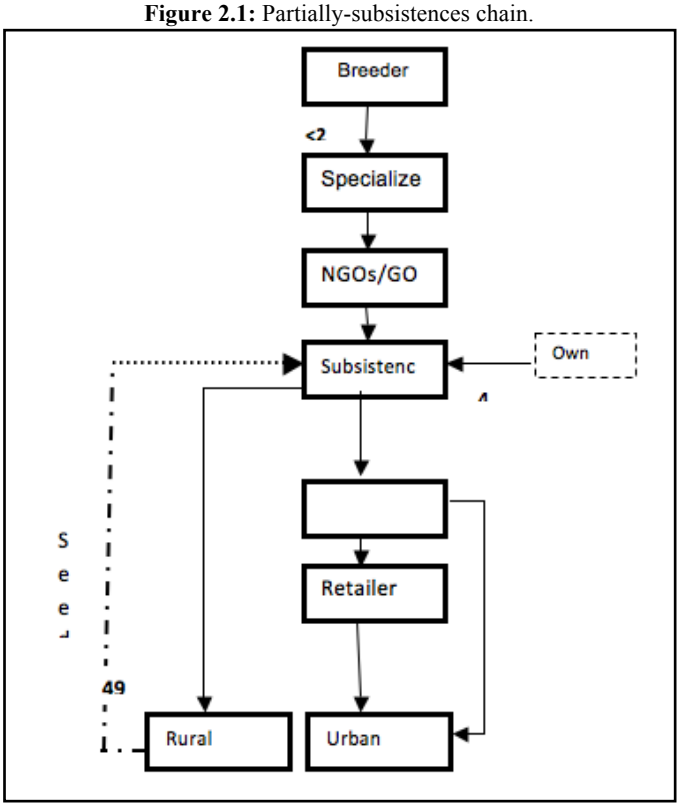
Supply chain

Several definitions of *supply chain* can be found in the literature. In Chopra & Meindl (2010) supply chain is described as consisting of all the parties involved directly or indirectly to fulfil consumer demand. It includes suppliers, transporters, warehousing services, retailers and customers; it is dynamic as it consists of continuous flows of information, products and funds at different stages of the chain.

According to Chandra & Gabris (2007), a *supply chain* is "a network of suppliers, manufacturers, warehouses, distributors, and retailers who, through coordinated plans and activities, develop products by converting raw materials to finished goods inventory". Along the chain there is sharing of information, materials and financials; the chain performs as a unit made up of single business entities. A supply chain can then be seen as a system.

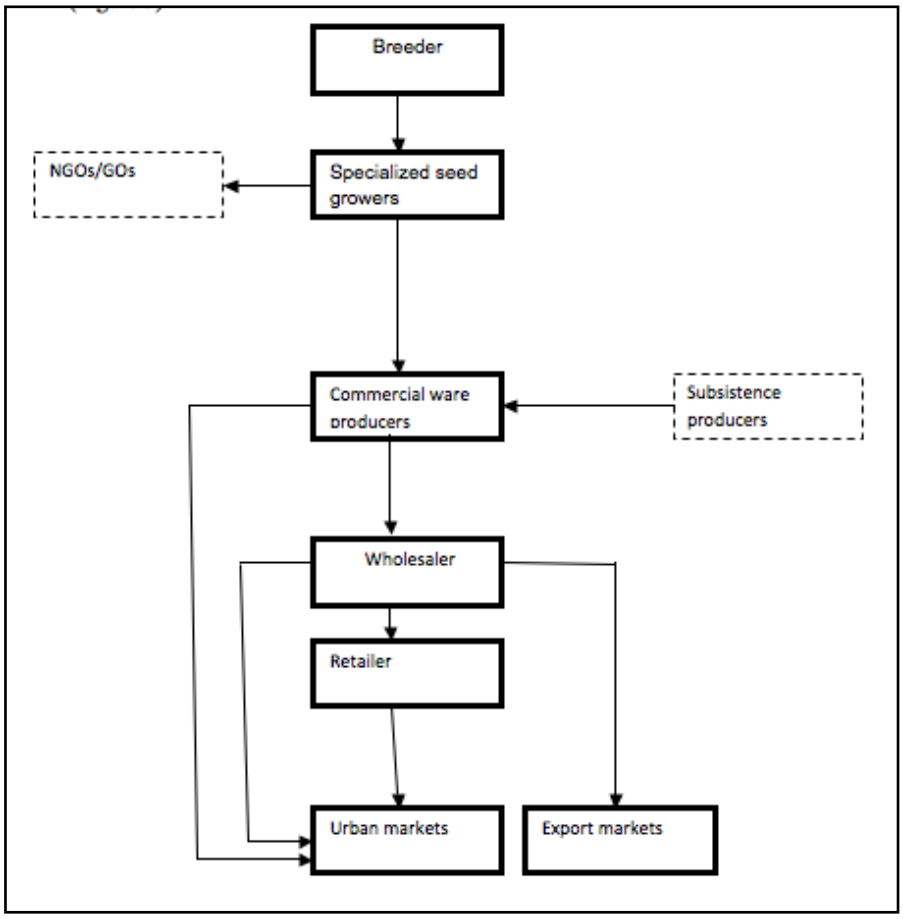
In Ethiopia potato chain can be identified by three different chains according to the stakeholders involved and the final product outlet: partially-subsistence, commercial and niche chains.
In Figures 2.1, 2.2 and 2.3 are reported schemes of the three different supply chains.

Figure 2.1: Partially-subsistences chain.



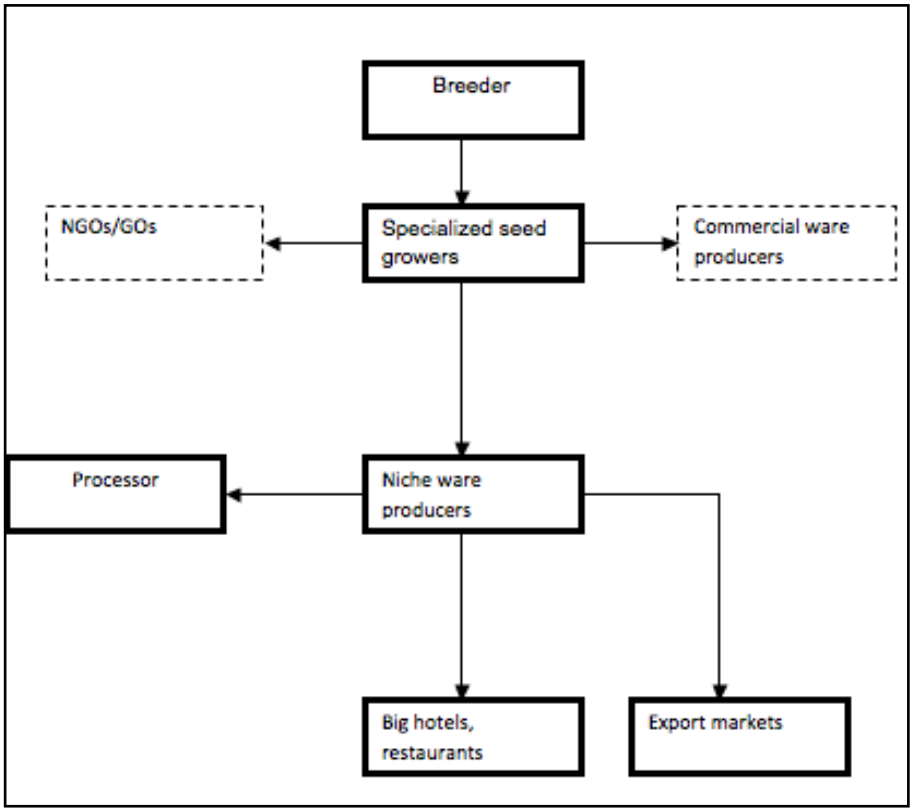
Source: CoQa, 2009.

Figure 2.2: Commercial chain.



Source: CoQA, 2009.

Figure 2.3: Niche chain.



Source: CoQA, 2009.

Access to Market Information

According to Shepherd (1997), the term *market information* "is likely to include details of potential market channels, payment requirements, packaging, quality and a whole host of information required by a producer to make successful sale, including market information".
When considering market information usually we refer to information on market prices for the output and information about market outlets, including information on quality of the product. From the data available for this study I also decided to consider as part of the chain also those information concerning the supply of input needed for farmers (i.e. price of fertilizers, input providers and where to find inputs etc.).

Improving information for farmers should enable them to plan their production to respond to market demand, schedule the harvesting according to market conditions and weather forecast, choose the market channel and gain a better position when bargaining with traders. On the other hand traders are expected to benefit from information as well, being able to sell from a surplus market to a

deficit market, and to store produce when the market is not favourable for selling.
Being able to access market information can have several impacts:

- efficient allocation of resources,
- improved bargaining position of farmers,
- reduction of transaction costs and risks,
- increased competition,
- make farmers aware of market opportunities,
- more efficient marketing,
- enable policy makers to base policies following changes in the market. (Shepherd, 1997)

In order to bring the mentioned benefits, market information must be:

- relevant; information should respond to the trend requirements,
- meaningful; information should be precise and specific in time, place and for the specific target,
- reliable and impartial; information should be collected objectively by a third party and regularly transmitted,
- promptly available; information should be published within a short time lag,
- easily accessible; everyone should be able to get those information. (Schubert, 1983)

Accessing market information enables farmers to gain a better bargaining position, it reduces transaction costs and can change farmer's marketing strategies.

Bargaining Power

In Ladd (1964) we find *bargaining power* defined as "the ability to influence the results the other party will experience if he makes the first or second choice". It means that according to the bargaining power the farmer is able to make a choice or not so he is either free to choose the buyer or the conditions to which sell the product or he is forced to accept the conditions of the buyer.
Two types of bargaining power have been identified:

- opponent-gain power; this type of power creates an advantage in the other party to engage with you (i.e: the buyer gets an advantage when trading with the farmer and so does the farmer);
- opponent-pain power; this type of power makes you worse off if you refuse to engage with

the other party (i.e: the farmers is worse-off if he refuses to engage with the buyer).

Ladd states that the only way for producers to impose opponent-pain power to another party (i.e. traders) is to organize themselves in organizations. Producer cooperatives then, can have a strong power if they have the ability to make the other party worse off, withholding product that the other party wants.

Bargaining power is also related to market information: we can expect bargaining power to increase when market information is available (Shepherd, 1997; Kohls & Uhls, 1998; Hoerman & Shawel, 1985).

Contract

We can distinguish two typologies of contracts: complete and incomplete contracts. The former includes all the possible future events that can trigger the relationship; it specifies the distribution of costs and benefits, which should be divided equally by the two parties.

The latter is the most common case: it is impossible to forecast all the events, it is difficult to negotiate in advance all possible situations, and it would require too much time and effort to discuss and insert in the contract all contingencies. These contracts arise when facing lack of information, bounded rationality and high transaction costs. Complete contracts theoretically can be made by providing the right incentives, according to the principal-agent theory.

In developing countries written contracts are not often the case, even though in recent years vertical integration and contract farming[2] are becoming more and more popular, to reduce transaction costs and ensure food quality and food safety (Bijman & Wollni, 2008).

When looking at contract farming, in Eaton & Shepherd (2001) we find several models:

- ℘ centralized model; it involves a centralized buyer or trader, common for products that require some processing before getting on the market, is vertically coordinated and the involvement of the buyer can be either very limited (i.e. providing some inputs), or predominant in the decision making of the production,

[2] Contract farming can be defined as "an agreement between farmers and processing and/or marketing firms for the production and the supply of agricultural products under the forward agreements, frequently at predetermined prices" (Eaton & Shepherd, 2001).

- nucleus estate model; it is very similar to the previous model, but the buyer/trader also owns some land where he grows some products to guarantee minimum quantity for his business and it involves a big role in providing inputs to the farmer,
- multipartite model; it involves several parties and can move from the centralized type to nucleus estate type,
- informal model; is characterized by small entrepreneurs, engaging in informal production contracts and with this contract it is very likely to occur extra-contractual marketing,
- intermediary model; it is an engagement with farmers, intermediaries and buyers/traders, with the risk of losing control of the production for the buyer.

All these models can be based on formal agreements, simple registrations or verbal agreements.

In Bijman (2008) and Minot (1986) we find other typologies of agricultural contracts, according to Mighella & Jones (1963):

- market-specification contract; it is an agreement made ex-ante the harvesting, it reduces farmers' uncertainty while farmers maintain the decision rights over their production; farmers bear most of the risk of the production activities;
- production-management contract; the buyer has higher control on the production as he decides which inputs should be used and which production methods to apply, the farmer has less decision rights,
- resource-providing contract; the buyer/trader provides inputs and commits to buy market output.

Producer Organizations

A *producer organization* is "a formal, voluntary membership organization set up for the economic benefit of agricultural producers with services that support the farming activities, such as bargaining with customers, providing inputs, providing technical assistance, providing processing and marketing services" (Bijman & Wollni, 2008).

A distinction can be made between two types of organizations, according to Traxler and Unger (1994):

- producer organizations with primarily economic functions,
- producer organizations with primarily political functions.

Those organizations with economic functions can be divided in two categories:

- ℘ organizations that process or market agricultural products, or that produce and purchase farm products,
- ℘ organizations that coordinate the marketing and selling of agricultural products (i.e. bargaining associations[3]).

In Developing Countries often these two last types of organizations are integrated, and "multi-purpose organizations" can be found, when combining social, political and economic functions (Bijman & Wollni, 2008).

Cooperatives in Ethiopia

In Ethiopia cooperatives have had a long history, and through all the past century they faced the raise of a bad reputation.

In the Imperial era (1930-1974) and in the Derg regime (1974-1991) cooperatives had a predominant role in agricultural sector but after Derg regime, due to their inefficiency and the negative reputation, most of them dissolved. In 1994 the Government started the promotion of a bigger participation of smallholders, through collective action and several plans that were implemented. In the PASDEP, cooperatives were given a key role in rural development of the Country. In 2002 government formed the Federal Cooperative Agency of Ethiopia in order to promote and organize cooperatives. However, the number of cooperatives still hasn't reached the expected growth (Bernard et al., 2008).

[3] In Hueth and Marcoul (2003) some example of bargaining association in the U.S are discussed.

2.2 THEORETICAL FRAMEWORK

2.2.1 Bargaining Theory

Based on the definition of bargaining power stated in the previous section, we can expect bargaining power of farmers to increase when they engage in a producer organization (i.e. farmers' cooperative).

Hypothesis 1: *Farmers have larger bargaining power in the negotiation with the buyers when they are members of a farmers' cooperative.*

According to Shepherd (1997) bargaining position of farmers can increase due to the access to market information. In fact he states, "the bargaining position of farmers with traders can be improved" due to the impact of market information services.

Kohls & Uhls (1998) hold the same position: "information is power that can be used to take advantage of market situations […] firms with the greatest amount of market information have superior market power".

In Borgel et al. (1980) as cited by Hormann & Shawel (1985) we find "[…] one producer is hardly visited by more than one broker; thus he cannot get better market information by comparing various offers"; this clearly represents the idea of weak bargaining position of farmers.
Hormann & Shawel (1985) believe that farmers' lack of information leads to lower prices paid by traders and brokers, even if the market has a deficit of product.

Hypothesis 2: *Improved access to market information will increase farmers' bargaining power.*

2.2.2 Principal Agent (PA) Theory

Principal-agent relations are in place when a person, the principal, has a contractual relationship with another individual, the agent. Agents can be individuals or groups of people who perform actions, which are not observable by the other party, the principal. The principal often can only measure the output.

Several assumptions define the principal-agent theory:

- conflict of interest between the parties involved in the relationship (i.e. buyer and farmer),
- asymmetric information and uncertainty,
- contracts or agreements are stipulated.

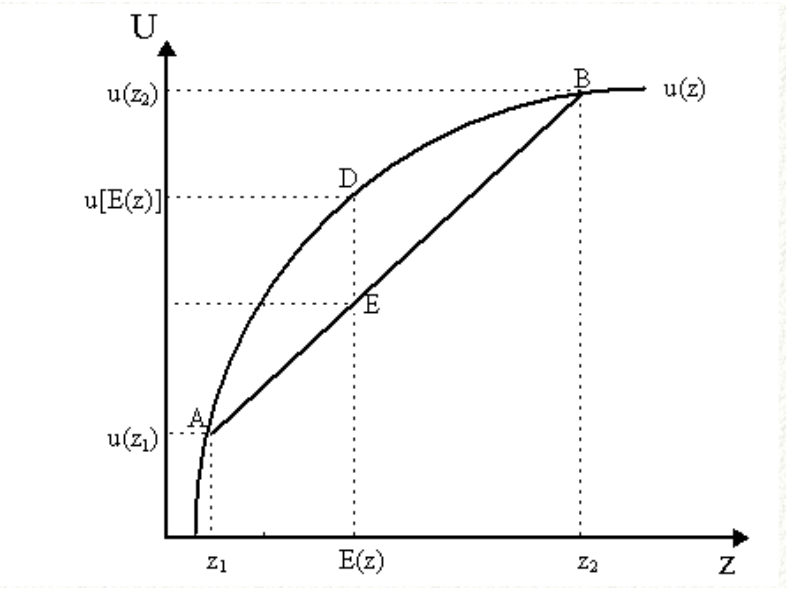
Whenever these conditions are present, we face a principal-agent situation.

With this theory we investigate cases in which a lack of information on the parties involved is the crucial problem; often both the principal and the agent have scarce information on the partner of the negotiation, leading to uncertainty, risk and higher transaction costs. When one party has more information than the other we face an "*ex-ante*" information problem (i.e. this is the case of buyers who have often more information about the market than farmers do). Often this situation is found in the case of an agent who has private information that is not accessible by the principal, who faces the risk of adverse selection. "*Ex-post*" information problem (moral hazard) is faced after the agreement or contract between the parties involved (Slangen et al., 2008).

In our case the principal, the buyer, has information that the agent, the farmer, doesn't have, which increases the farmer's uncertainty and risk. I am considering for my research the buyer as principal, even though we could look at the problem with a different perspective: farmers can be principals as well and hide information on quality to the agents (buyers). Going back to the original theory, knowing that farmers are risk-averse, they are willing to reduce risk and uncertainty. Risk-aversion is represented by a concave utility function U, where the utility of the expected value of income Z is larger than the expected utility in Z:

$$U(E(Z))>E(U(Z))$$

Figure. 2.4: Utility function for a risk-averse individual.



Source: Frank, 2010

According to the above graph, farmers will tend to choose the least risk choice, and this can be done by accepting a buyer's offer without refusing it even when the price is lower than expected (Hoerman & Shawel, 1985).

Providing farmers with market information can reduce the information asymmetry between the parties involved in the transaction, reducing farmers' risk and leading to higher revenues.

Hypothesis 3: *Farmers are more likely to become members of a cooperative when they are risk-averse. On the other hand, risk-neutral and risk-taker farmers are less likely to be members of a cooperative.*

2.2.3 Contract Theory

This theory, as the previous ones, is based on *rationality*, "individuals are depicted as choosing the best means to pursue their goals given the information they have" (Bogetoft & Olesen, 2004).
We assume all contracts to be incomplete, as they are based on bounded rationality[4].

Contract theory has its roots in two other popular theories, mentioned above: principal-agent theory and transaction cost theory.

Three main problems have been identified by Bogetoft & Olesen (2004):

- coordination of production and minimization of the costs of risk and uncertainty,
- motivation; to reduce cost of opportunism, to save cooperation, to engage in long-term agreements and to balance costs of renegotiation,
- transaction costs; contracts aim at reducing direct costs of contracting.

When looking at developing countries it is more difficult to find written formal contracts, as often buyers buy directly at the farm without any agreement or engage in verbal agreements. In case of formal contracts, either written or oral, we can talk about contract farming. In the potato supply chain in Ethiopia, farmers don't have contracts or agreements with processors, but just with buyers and traders, who sometimes provide them inputs and credit. This type of contract is called "contract farming".

Considering Mighell and Jones (1963) in Minot (1986) we identify different types of contracts, which can be very useful when analysing contract farming in developing countries.
Market-specification contracts can improve the flow of market information, solving some of the constraints faced in spot markets; producers can more easily access information on market demand and prices and, on the other hand, buyers get to know production conditions that otherwise would be unobservable when buying without a contract or an agreement. However, although price information can reduce risk, there will still be potential risk due to fixing prices and the chance of scarce competitiveness on the market. This type of agreement works out better when both parties involved in the transaction are risk-averse.

[4] "The limitations on human mental abilities, that prevent people from foreseeing all possible contingencies and calculating their optimal behaviour" (Slangen et al., 2008).

***Hypothesis 4**: Farmers have better access to market information when they engage in market-specification contracts, compared the engagement in other type of contracts or when they don't engage in a contract at all.*

Resource-providing contracts can take place when input markets have some imperfections. The buyer can then provide inputs to growers. Information on the input market is asymmetrically distributed between the two parties. Farmers are dependent on the buyers to get key inputs, diminishing their bargaining position towards buyers when entering the negotiation.

***Hypothesis 5**: Farmers' access to market information is lower and biased when they engage in resource-providing contracts.*

Production-management contracts not only provide inputs to farmers, they also instruct them on how to use the inputs and on the methods of production. Like the previous type of contract, it takes place when there is an imperfect market and when there is information asymmetry. Sometimes farmers accept this type of contract even if they have good information, but they lack credit or other key inputs. On the other hand, often buyers don't know the quality of the output so they provide inputs to farmers and also they train them and require certain production methods. Again farmers have a little market information, coming from the buyers, and they have a reduced bargaining power.

***Hypothesis 6:** Farmers' access to market information is lower and biased when they engage in production-management contracts.*

2.2.3.1 Producer Organizations

In Bijman and Wollni (2008), according to Staatz (1987), a producer organization can reduce risk associated with agricultural investments; a cooperative can buy its members' products, reducing marketing risk and the risk of opportunistic behaviour of the buyers.
Asymmetric information can also be solved when farmers are members of a producer organization, and transaction costs will be reduced as there will be few hidden information and the transaction between farmers and buyers will be facilitated by the cooperative.

In Sykuta and Cook (2001) the relationship between the farmer and the cooperative is characterized by three aspects: "the allocation of uncertainty, the allocation of value and the allocation of property rights".

Williamson and Menard, in Pascucci et al. (2012), identify the choice of using a cooperative as governance solution in the increase of asset specificity and uncertainty and in the decrease in the transactions' frequency. When the asset specificity is low, the most common solution for farmers is not becoming a cooperative member; on the other hand, when the degree of specificity increases solutions like vertical integration are necessary. Farmers' specificity identified in this paper is described by three dimensions: location specificity, asset specificity and relational specificity. The location specificity is linked to the structure of the market, the institutional environment and the geographical location. The social context is also included in this type of specificity, considering social embeddedness and issues like trust, reciprocity and attitude to cooperate; moreover ideological, cultural and political preferences can influence the choice of farmers to participate in cooperatives. The second dimension of specificity is the asset specificity: it depends on the type of farm and specialization scale. When farmers are specialized and have large-scale farms, they have higher asset specificity, therefore they are more likely to join agricultural cooperatives. The variables related to asset specificity are: size of the farm, level of specialization, farmer's experience and the management style. The third dimension is the relational specificity, described by the membership of farmers in other non-agricultural organizations; if alternative social network are used, farmers are more likely to be members if these organizations are complements for the cooperative; on the other hand, if these organizations are substitutes for cooperatives, farmers are less likely to joining the cooperative.

Hypothesis 7: *Farmers choice of cooperatives is linked to the location specificity: farmers are more likely to join a cooperative if their farm is far from the market or in a rural area, in order to increase their bargaining power on the market; moreover lack of trust can affect the choice of farmers not to choose cooperatives.*

Hypothesis 8: *Farmers choice of cooperatives is linked to the asset specificity: farmers are more likely to choose cooperatives when the size of the farm is large and when the specificity of the farm is higher.*

Hypothesis 9: *Farmers choice of cooperatives is linked to the relational specificity: farmers participating in other organizations, which provide substitute services to those provided by the cooperative are less likely to join the cooperative.*

Hypothesis 10*: Buyers and traders have more information than farmers with whom they negotiate, but when farmers are members of a cooperative the information gap is smaller.*

2.2.4 Evidence from the literature of farmers' cooperatives

Bernard et al. (2008) provide evidence on cooperatives of farmers in Ethiopia; they found that, among farmers producing cereal crops, the price paid to members of cooperatives was 7-8% higher than the price paid to non-members. On the other hand cooperative members don't increase their output for commercialization, as the authors expected. Small farmers, despite the higher prices paid when they are members of cooperatives, tend to sell less on the market; larger farmers increase their supply as consequence of the higher prices.

Kimball (1988) interpreted cooperative membership as behaviour toward risk; according to his analysis peasant associations were able to provide insurance at a low cost for risk-averse farmers. However, cooperatives were not successful in every village; many factors could have had an impact on the success of the cooperative, such as altruism and friendship, while free-rider problem could have brought negative effect to other cooperatives.

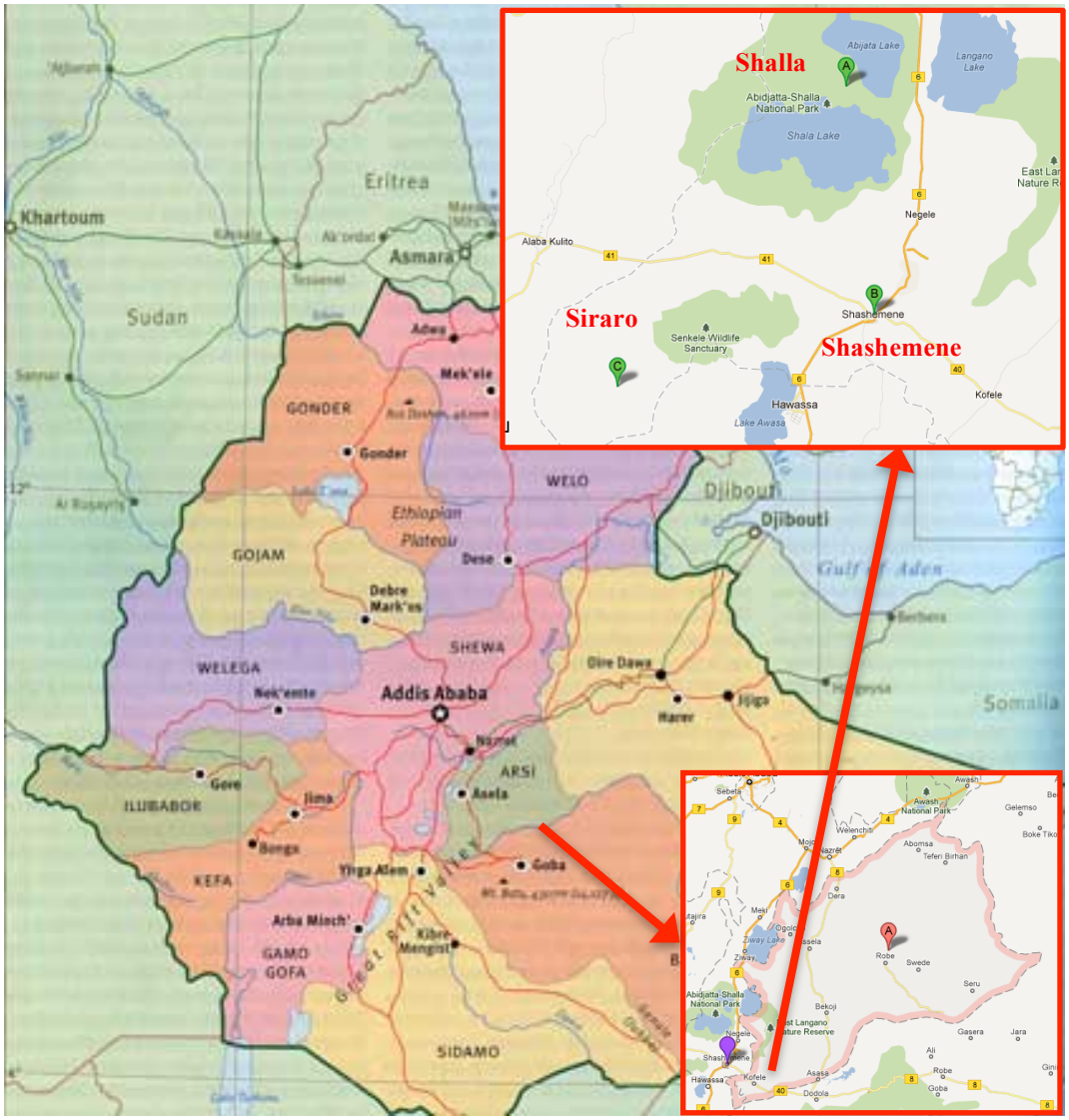
Pascucci et al. (2012) found evidence that farm size in terms of total assets has a positive effect on the choice of farmers to engage in cooperatives; also human and managerial indicators such as the farmer's experience have a positive impact. Pascucci's paper concludes saying that farmers running their farm in a more professional way are more likely to join a cooperative. Again, positive impact on cooperative membership is also due to the participation in training programmes or extension services.

3. METHODOLOGY

3.1 STUDY AREA

The area, which I am focusing on, is the West Arsi Zone, located in the South of Ethiopia, where the potato production has a high potential. Data were collected in three counties: Shashemene, Shalla and Siraro, as I highlighted in Fig. 3.1.

Figure 3.1: Map of Ethiopia with focus on Arsi Zone.



Source: Afropop Worldwide, http://www.afropop.org/multi/interview/ID/106/Francis+Falceto-Ethiopia%3A+Empire+and+Revolution

3.1.1 Shashemene County

It's located in the Oromiya region, at about 250km distance to the capital city Addis Ababa.
The land area is 56.617 ha, 21% of them are highland, 50% is dry midland and 29% is humid midland. Out of the total of hectares, 46.854 ha are allocated to agricultural production.
The climate of this county is characterized by temperature ranging from 12°C to 27°C across the year; rainfall vary between 700 and 950 mm, in two raining seasons.
The major crops grown in this area are: maize, wheat, barley, teff, haricot beans and root crops, like potato.
The total production of potato in years 2009-2010 was estimated to be 88.700 tons. (Agiro, 2011)

3.1.2 Shalla County

It's located in the Great Rift Valley, about 30km far, at north, from Shashemene.
Total land area of the country is about 74.538 ha out of which 90% is midland and 10% is lowland; total land allocated to agriculture is 45.432 ha.
About 85% of the land is flat, with only 5% of mountains. Annual rainfall vary between 300 and 900 mm with average temperature ranging from 18°C to 25°C.
The major crops grown in the area include: maize, sorghum, teff, barley, wheat, finger millet and root crops like potato.
Total potato production in years 2009-2010 was estimated to be 62.019 tons. (Agiro, 2011)

3.1.3 Siraro County

It's located in Oromyia region, in East Shoa area, about 30km far, at left, from Shashemene and Hawassa.
Total land area is about 116,255.5 ha, 70.227 of them are allocated to agricultural production.
The average temperature across the year vary between 13°C and 25°C with annual rainfall ranging from 900 to 1500 mm.
The major crops grown in the area are: maize, haricot beans, potato, teff, finger millet and sorghum.
The total production of potato in the county in years 2009-2010 was estimated to be 111.078 tons. (Agiro, 2011)

3.2 DATA COLLECTION

Qualitative and quantitative data from secondary sources have been used for this research. I carried out a literature research in order to base my study on existing theories; the literature review was also used to define the key issues of this thesis: supply chain, access to market information, bargaining power, contracts and farmers' cooperatives. I started reading the thesis of Bezawit Agiro, which was carried out in the same area and within the CoQA program; then I read an internal document of the CoQA program, which gave me an overview of the situation of the potato supply chain in Ethiopia. Second step was to read some literature on supply chain in developing countries, starting from the literature available in WUR library and then I looked for more literature using Google Scholar and Scopus databases, inserting as key words my main concepts mentioned above. The literature gave me the background information I needed to base my research on existing theories and helped me developing the hypothesis, which I will answer through this thesis.

Primary data were collected by PhD student Gumataw Abebe in 2010, using a questionnaire targeting potato producers. The questionnaire consisted of "yes or no" type of questions, scale measurement questions and "fill-in the blank space" questions. The questions were focusing on the market aspects of potato production as well as some questions on the characteristics of the households. In a second time master student Bezawit Agiro carried out a second questionnaire in the same study area to a smaller sample, 150 respondents, and from this sample 146 producers matched the ones interviewed by Gumataw Abebe. Her questionnaire consisted of the same type of questions as the ones mentioned above, but focused more on the production aspects and on the risk coping strategies of farmers. I selected the significant parts of their questionnaires that would allow me to respond to my RQs and I then merged the two datasets in one single dataset, consisting on 146 households. I then created smaller datasets including the variables needed for my models, including new synthesis variables, which I explain in detail in the next section of this chapter.
I did not conduct any field research because of time constraints and because I had background information on Ethiopia and on its cooperative system due to the ACT project on "Dairy business hubs to support value chain in Ethiopia".

DATA ANALYSIS

I used descriptive statistics, using Excel, to have an overview of the potato sector and potato farmers in Ethiopia: I made some graphs where I highlighted some of the important issues, studied more in depth using the IBM SPSS 20 software.

To answer RQ n. 1 (*What is the relationship between farmers' membership in a cooperative, the type of buyer they sell to, the type of contract they stipulate, and the access to market information?*) and RQ n.2 (*What are the factors influencing the choice of farmers to become members of a cooperative?*) I used a qualitative choice model, as my dependent variable is a dichotomous variable, meaning that it can have two values, i.e. member and non-member of a cooperative. Binary choice models assume that "individuals are faced with a choice between two alternatives and that the choice depends on identifiable characteristics" (Pyndyck & Rebinfeld, 1998). Binary choices can be represented by a standard 1-0 dummy variable. I decided to use a Binary Logistic Regression model for my analysis. Logistic regression models predict the probability of an event occurring for a given person, $P(Y_i)$ where this is the probability that Y occurs for the *i*th person, based on the observations of whether the event did or didn't occur ($E(Yi) = 1(Pi) + 0(1 - Pi) = Pi$). Y will be either 1 or 0, where 1 says that the event will occur while 0 says that the event has no chance of occurring. (Field, 2009)

To study how the model fits the data several methods can be used to substitute the R^2, which cannot be used in logistic models; we consider the -2Log-Likelihood and the Cox and Snell's R^2_{CS}.

To assess the contribution of the predictors in the model, the Wald statistics is used as substitute for the standard t-tests on coefficients used in linear regressions; keeping in mind that Wald statistics is not a good predictor in case the b coefficients are large, since the SE tends to become larger and the Wald tends to be underestimated. For logistic regression we assume linearity, no multicollinearity and independence of the error terms.

To study the importance of a predictor in the model I carried out Log-Likelihood Ratio Tests, which allowed me to build the best model including only the variables, which make an effective contribution to the model:

$$\chi^2 = 2[LogLikelihood\ (Restricted\ model) - LogLikelihood\ (Unrestricted\ model)]$$

where the unrestricted model is the initial model, including all the variables I wanted to study, and the restricted model is the new model, which excludes the variables that are expected to make no contribution to the model.

To answer RQ n. 3 (*What is the relationship between farmers' membership in a cooperative, the type of buyer they sell to, the type of contract they stipulate, and the gross margin?*) I used a Linear Regression model (OLS. The basic model is:

$$Y_i = \alpha + \beta X_i + \varepsilon_i \qquad i = 1, \dots, N \; when \; more \; explanatory \; variables \; are \; included$$

where Y is the dependent variable, β is the coefficient of the explanatory variable and ε is the error term.

To estimate the goodness of fit of this model the R^2 is used. However, also the parameters (b coefficients) are tested for their significance. (Field, 2009)
In order to write the best model that predicts the outcome I carried out some F-tests in order to study the contribution of the variables; variables that don't bring any contribution to the model have been removed in order to have a more effective model:

$$F = \frac{\frac{[RSS\ (Restricted\ model) - RSS\ (Unrestricted\ model)]}{df\ (Unrestricted\ model) - df(Restricted\ model)}}{\frac{RSS\ (Unrestricted\ model)}{N - df(Unrestricted\ model)}}$$

where *df* are the degrees of freedom and N is the total number of observations.

3.3.1 Conceptual Framework RQ n.1: Access to market information

With this RQ I wanted to test the correlation between selected variables. I carried out a logistic regression where the dependent variable (Y) is "availability of information" in relation to three different independent variables: "membership in cooperative", "type of contract" and "type of buyer" the farmers sell to. Before carrying out the regression I had to create synthesis variables, to define three typologies of contracts (market-specification, production-management and resource-providing) and the availability of information (complete and incomplete information). To define the three types of contracts I considered variables already in the dataset, concerning the specific characteristics of the contract:

- Pre-agreed price
- Pre-agreed quality
- Pre-agreed quantity
- Pre-agreed delivery location
- Provision of fertilizers
- Provision of seeds
- Provision of credit

To these variables I added the form of contract (oral, written and no contract at all). Matching these variables using Excel, I could derive a new variable for the type of contract, where 0=no contract, 1=complete market-specification contract, 2=incomplete market-specification contract, 3=incomplete resource-providing contract, 4=nothing provided. Other types of contracts were not present, but complete and incomplete types of contracts were identified. I then aggregated the "nothing provided" with the incomplete market specification contracts as only one household had nothing provided to avoid collinearity problems due to the limited number of respondents belonging to that category. In order to implement the logistic regression I created a series of dummy variables:

- Complete Market-Specification (*DcompleteMktSpec*)
- Incomplete Market-Specification (*DincompleteMktSpec*)
- Incomplete Resource-Providing (*DincompleteResource*)

A similar procedure was used to define the access to market information, transformed in availability of information variable, defined as complete and incomplete according to the availability of information on:

- Price before selling
- Quality before selling

- Quantity before selling

The variable is represented by 0=incomplete information, 1= always have complete information; no respondent answered that he never had information.

The type of buyer was identified by a categorical variable where 1=via middleman to preferred trader, 2=via middleman to unknown trader, 3=directly to preferred wholesaler, 4=directly to preferred retailer, 5=anonymous buyer, 6=other (farmers). As for the type of contract I created a two dummy variables in order to carry out a logistic regression:

- Via middleman (*DviaMiddleman*)
- Directly to preferred wholesaler/retailer (*Ddirectly*)

Membership in cooperative was already present in the dataset as binary variable, 1=member of cooperative, 0=non-member of cooperative.

The model I built is:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \varepsilon_i$$

Y= Dummy information available (complete & incomplete information)
X_1= Dummy cooperative membership
X_2, X_3, X_4= Dummy type of contract
X_5, X_6= Dummy type of buyer

The model will be adjusted according to the results in order to build the best model that allows to predict the final outcome (availability of information). Important and significant variables will be selected computing Log-Likelihood Ratio Tests.

Before carrying out the regression I calculated a simple correlation using Chi-Square tests looking for Phi and for Cramer's V according to the type of variables: when two dichotomous variables were analysed I looked for Phi value of correlation, when the two variables were both categorical (one dichotomous and one categorical) I looked for Cramer's V value. The correlations analysed are:

1. Availability of information and cooperative membership
2. Availability of information and type of contract
3. Availability of information and type of buyer.

The correlation is used to investigate the relationship between two variables; however, through correlation tests we cannot derive a causality effect, we can only see the dependency or independency of these variables.

3.3.2 Conceptual Framework RQ n.2: Cooperative membership

For the model used in this context, the dependent variable (Y) is "membership in the cooperative", which is described by some covariates variables. It is a dichotomous variable, described by a binary choice (1, 0); logistic regression is therefore used to carry out this analysis.

I chose the explanatory variables based on the literature, although most of the literature focuses on the risk-aversion of farmers as indicator of the choice of engaging in a cooperative (Kimball, 1988).

I decided to consider variables, which don't allow any endogeneity problem, except for wealth, whose direction of causality can be more difficult to define, since wealth of the household can affect his decision in participating in a cooperative, but on the other hand the membership in the cooperative can affect the amount of wealth of the household.

In table 3.1 I present the variables that will be used to explain the outcome (Y), describing their measures, the type of variable it is and the expected sign.

As already mentioned, in the literature there are not many studies on factors affecting farmers' choice of engaging in cooperatives, except for the risk awareness. A recent study by Pascucci et al. (2012) found other variables influencing the choice of farmers to engage in cooperatives; looking at location specificity, asset specificity and relational specificity matters (see literature review chapter 2).

In the literature other three variables were taken into consideration as significant for the choice of farmers to engage in cooperatives: the primary activity of the household, the position of the respondent within the household and the membership in other associations. However, the mentioned variables had to be left out because they were causing collinearity problems.

Table 3.1: Explanatory variables for the Logistic Regression Model.

VARIABLES	MEASURES	TYPE OF VARIABLE	EXPECTED SIGN
Age	Years	scale measure	(+)
Dummy for the gender	male/female	categorical	(+/-)
Dummy for the highest level of education	Dummy primary education Dummy secondary education	categorical	(+/-)
Dummy for the location (County-Wereda)	Dummy Shashemene Dummy Siraro	categorical	(+/-)
Dummy for the secondary activity	Dummy cattle rearing	categorical	(+/-)
Total wealth	Land holding + Livestock number	scale parameter	(+)
Dummy for the risk awareness (Uncertainty)[5]	Dummy risk-taker Dummy risk-averse	categorical	(+)
Household experience in potato farming	Years	scale measure	(-)
Household experience in agriculture	Years	scale measure	(+/-)
Dummy for the training programmes	yes/no	categorical	(+/-)
Dummy for the extension service programmes	yes/no	categorical	(+/-)
Landholdings	0.25 hectares	scale measure	(+)

[5] Questions on risk mitigation strategies and on the chance of a certain risk to occur were measured (see Appendix 2); respondents had to score in a range of 1-5. Specific questions have been asked on marketing risks, financial risk etc. Three categories have been created by Bezawit Agiro according to farmers' scores.

The variables included in the model were in the dataset except for the dummies, which I created starting from the categorical variables included in the merged dataset. The model I built for the linear regression is:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + \beta_9 X_8 + \beta_{10} X_9 + \beta_{11} X_{10} + \beta_{12} X_{11} + \beta_{13} X_{12} + \beta_{14} X_{13} + \beta_{15} X_{14} + \beta_{16} X_{15} + \beta_{17} X_{16} + \varepsilon_i$$

Y= cooperative membership
X_1= age
X_2= gender
X_3= experience in potato cultivation
X_4= experience in agriculture
X_5= total wealth
X_6,X_7=dummy education (primary & secondary education)
X_8,X_9=dummy risk/uncertainty (risk averse & risk taker)
X_{10},X_{11}=dummy region (Shashemene & Siraro)
X_{12}=landholdings
X_{13}= dummy secondary activity (cattle breeding or other)
X_{14}= dummy training services
X_{15}=dummy extension services

3.3.3 Conceptual Framework RQ n.3: Gross margin

The RQ n.3 tests the correlation between gross margin of the producers, dependent variable (Y) described by three independent variables: "membership in cooperative", "type of contract" and "type of buyer" the farmers sell to. I carried out a linear regression, as explained in the introduction of the data analysis section. I used the dummy variables I created for the RQ n.1 (see Conceptual Framework RQ n.1[6] for detailed explanation of the methodology). The model used for the linear regression is:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \varepsilon_i$$

Y= gross margin (unit price of potato – unit cost of producing potato[7])
X_1= cooperative membership
X_2, X_3, X_4= dummy type of contract
X_5, X_6= dummy type of buyer

Even though in the dataset the gross margin was already included, I decided to use a proxy for it, to avoid interaction of other factors influencing the gross margin. Using the proxy, I will be able to test the hypothesis on bargaining power that I wrote in my theoretical framework, which I wouldn't have been able to answer if I used the gross margin variable. The model will be adjusted after carrying out the F-Test in order to include in the model only the variables needed to predict in the best way the outcome (gross margin).

Before running the linear regression I computed a point-biserial correlation for the three relations, as one variable is continuous and the other is categorical:

1. Farmers' gross-margin and cooperative membership
2. Farmers' gross margin and type of contract
3. Farmers' gross margin and type of buyer.

I also carried out a point-biserial correlation between the availability of information and the proxy of the gross margin.

[6] shortened as (CFRQ1).
[7] The cost is calculated summing the pre and post-harvesting costs, input costs and costs of labour for hired and family labour, measured in Birr. The gross margin here is a normalized measure and it contains the cost of family labour at the market price of labour.

3.3.4 Propensity Score Matching

In addition to the econometric analysis just described, in order to measure the impact of cooperative membership in RQ n.3 I carried out a Semi-parametric Propensity Score Matching, as in Pufahl & Weiss (2009), where members in cooperative will be the treated group and those farmers not belonging to a cooperative will be the control group. The method chosen compares the outcomes of programme participants with those of matched non-participants, where matching is done based on similarity in observed characteristics. This method has several advantages: it doesn't require a randomization or baseline data and it doesn't require a parametric model that links outcomes to participation in a program. On the other hand, selection bias can only be taken into account for observables, while the observations that lie outside the region of common support are excluded from the evaluation. Limitations to this approach are the restricted number of data and the selection bias of farmers into cooperatives, and moreover the fact that the data available where not collected with this purpose so there might be big heterogeneity among farmers which could make this approach difficult to carry out and results not very reliable and robust. The most important evaluation parameter is the average treatment on the treated (ATT = $E(Y^1 - Y^0 | P=1) = E[Y^1 | P=1] - E[Y^0 | P=1]$), to answer the question: "How bigger/smaller is the margin of members of a cooperative compared to the margin of non-members?"[8]. This procedure assumes that after imposing the check for controlled characteristics, outcomes are conditionally mean independent of programme participation (membership in cooperative).

The propensity scores are the estimated probabilities of participation obtained from the logistic model in RQ n.2, selected after the Log-likelihood Ratio tests (see results chapter). Only the significant variables were included in order to derive the probabilities of the best model able to explain the choice of farmers to become members of the cooperative:

$$Y = \beta_1 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + \beta_{14} X_{13} + \varepsilon_i$$

Y= dummy cooperative membership
X_3= experience in potato cultivation
X_4= experience in agriculture
X_5= total wealth
X_6,X_7=dummy education (primary & secondary education)
X_{13}= dummy secondary activity (cattle breeding or other)

[8] See specific research question n. 3.1.1 in Chapter 1.

3.3.4.1 Matching of the Households

We consider the matching successful when the significant differences of the covariates (independent variables for the households' characteristics) among treated and non-treated are removed. Before the matching analysis the means of the covariates were calculated using Excel software, and they were nearly all significantly different.[9] To test the difference between the means I carried out some t-tests. Second step was to match the treated and non treated households which had standard deviation of the propensity scores <0.05. After the matching I analysed the means of the margin, comparing it with the means calculated before the matching. This will show whether the membership in cooperatives makes a difference in the margin of potato farmers.

3.4 LIMITATION OF THIS METHODOLOGY

The data I used for this research were collected by two other students, MSc student Bezawit Agiro and PhD student Gumataw Abebe, who designed their questionnaires with their own questions in mind. I had to adapt my RQs to fit the data available, which can be seen as a limitation for my research. One of the dataset available is a sub-sample of the households interviewed by Abebe so for some questions I only have limited number of answers (146) considering the households interviewed in both questionnaires. For the propensity score matching I could only take into account 68 households, which is a small number; this leads to scarce external validity of the results. Moreover, I didn't do field research so my understanding of the situation of potato farmers in Ethiopia cannot be complete. I couldn't investigate transaction costs, which would have been an interesting issue, due to lack of data that measure that issue; I therefore suggest further research on this topic.

[9] Details on the PSM can be found in Appendix 4.

4. RESULTS

This chapter presents the results in four sections. First I will present some results from descriptive statistics, to give an overview of the current situation among potato farmers in Ethiopia as reflected by the sample interviewed, focusing on the types of contracts farmers have with the buyers, the different buyers they sell to, the membership in cooperatives as well as the sources and availability of information. In the following sections I will discuss the results responding to RQ n.1, RQ n.2 and RQ n.3, presented in the introduction chapter. For the methodology used to answer these questions see chapter 3.

4.1 DESCRIPTIVE STATISTICS

Among the respondents (146) none of them has a written agreement with the buyer; however most of them have an oral agreement, while a small percentage of the farmers sell directly without any type of agreement, as can be seen in Fig. 4.1. In developing countries it's rare to find written contracts, especially in rural areas, where trust and embeddedness[10] are key characteristics of social life; therefore there is no need to stipulate written contracts unless the buyer is a big company, which we will see is not our case.

Looking at Fig. 4.2 considering the oral agreements the farmers have, we see that almost all of them specify pre-agreed price, pre-agreed quality and quantity and over 85% define a pre-agreed delivery place. Over half of the agreements state that buyers have to cover the harvesting costs, and almost all of them are one-time delivery agreement. Looking at the inputs provided by these agreements, we see that very few of them provide fertilizers, and very few provide credit; on the other hand seeds are not provided by any agreement. In the literature (Hirpa et al., 2010) we see that farmers buy potato seeds from other farmers or neighbours; we can then understand why none of the agreements provides seeds to the farmers. We can assume very low demand for seeds to the buyers as farmers already have a consolidated channel of seeds providers.

[10] Embeddedness according to Williamson's framework (2000) is defined as the "informal rules that constrain human interaction" (Slangen et al., 2008).

Figure 4.1: Type of contract/agreement in %.

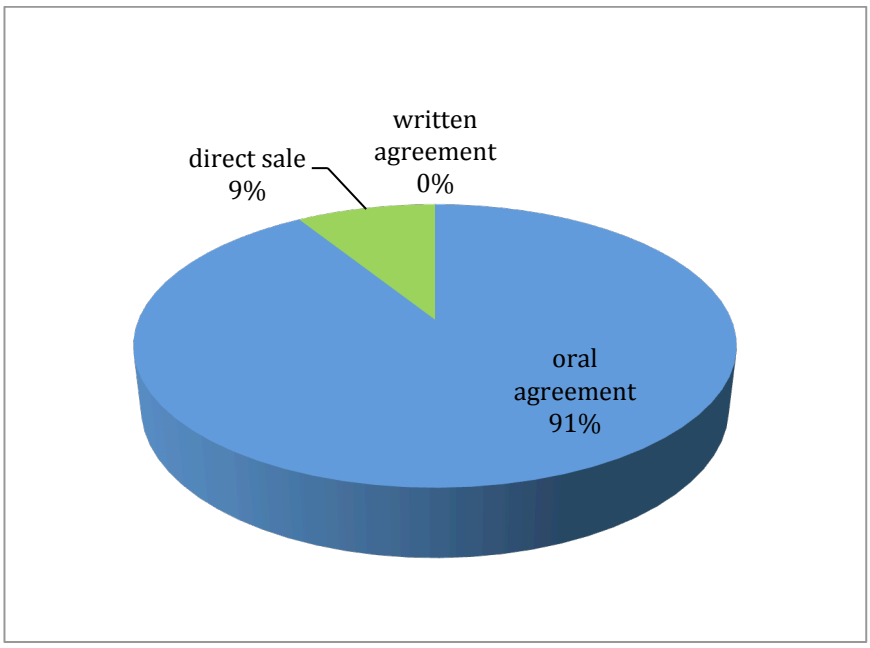
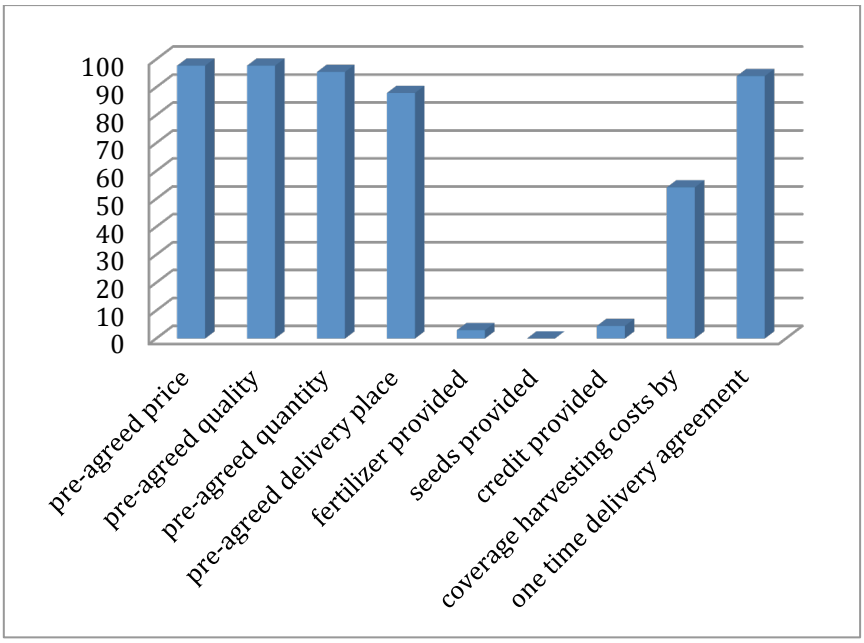


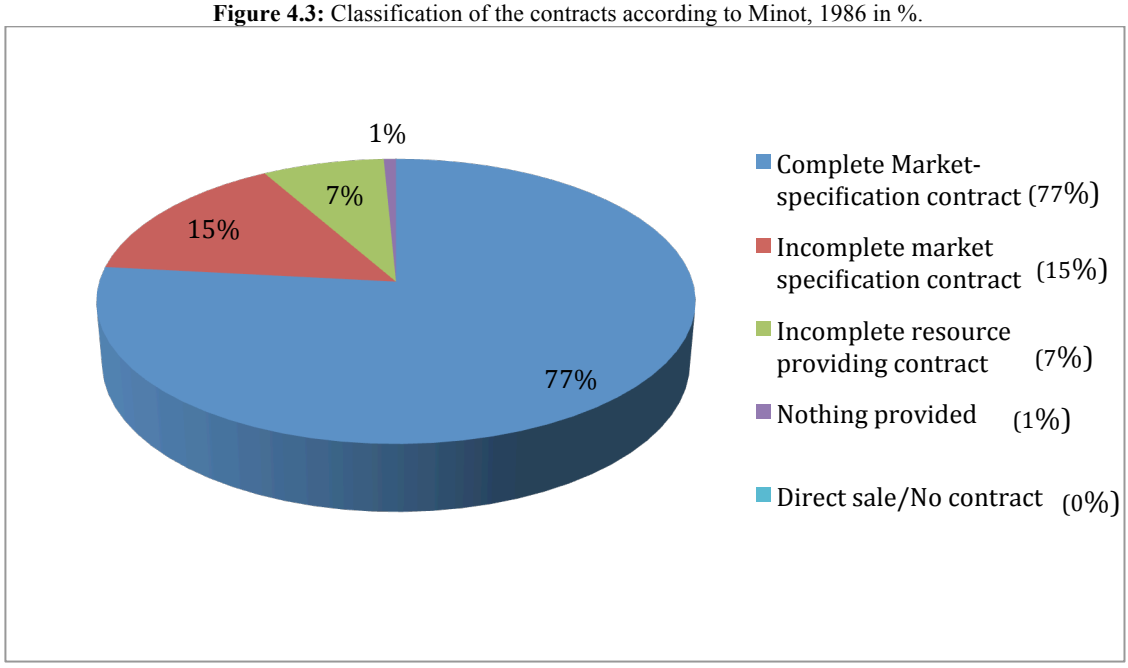
Figure 4.2: Specifications of the contracts/agreements in %.



According to Minot (1986) I classified the contracts in: market-specification contracts, resource-providing contracts and production-management contracts. From the analysis of the data, shown in Fig. 4.3, I found that there are no production-management contracts, more than half of the agreements are complete market-specification contracts, while a small part are incomplete market-specification contracts. Only a small portion of the agreements are incomplete resource-providing

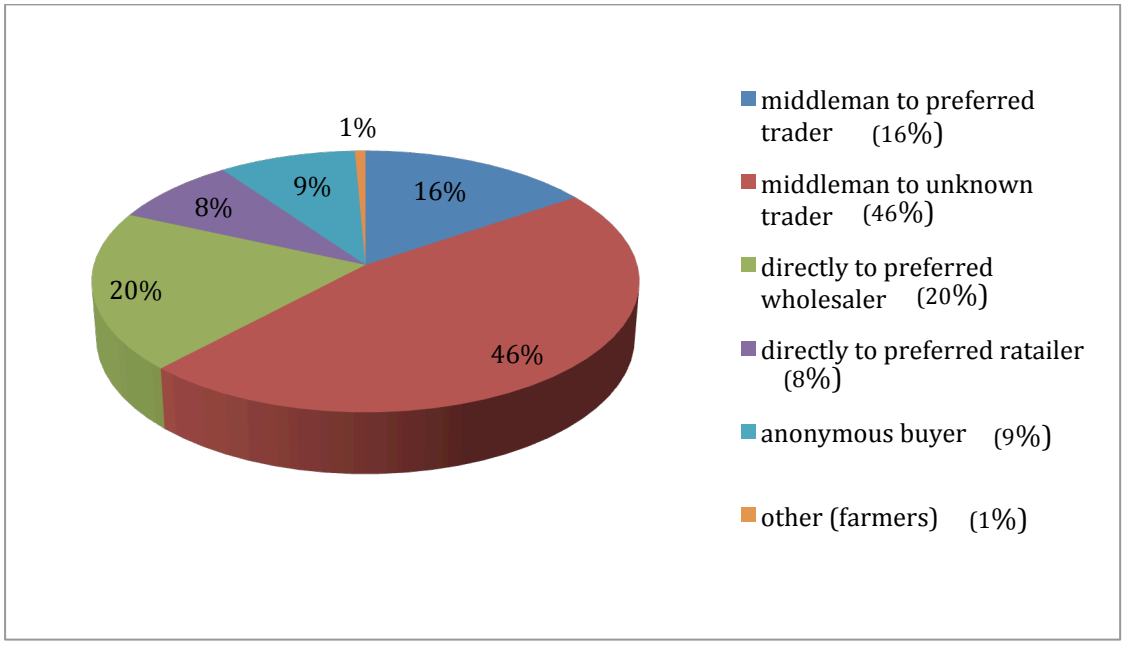
contracts, while 1% of them doesn't provide information nor inputs. Complete and incomplete contracts are defined according to the full inclusion of the specifications mentioned above. As none of the farmers have production-management contracts, we cannot test the "Hypothesis 7" (*Farmers' access to market information is lower and biased when they engage in production-management contracts*), which assumes that farmers have biased information provided by the buyer due to information asymmetry. Markets are imperfect and farmers cannot access market information on their own, they receive inputs and information only provided by the buyer with whom they stipulated the agreement.

Figure 4.3: Classification of the contracts according to Minot, 1986 in %.



Looking at the number of buyers engaged in transaction with the households interviewed, I found that a bit over than half of the farmers sells to one buyer, while the rest sells to more buyers. Among the farmers that sell to a single buyer, we can see in Fig. 4.4 that the majority of them sells via middleman to an unknown trader, the rest of them sells directly to a preferred wholesaler, via middleman to a preferred trader, while others sell to a preferred retailer, to an anonymous buyer and 1% of them sell to other farmers. Multiplicity of buyers allows farmers to reduce risk, as losing one buyer if it is the only one would cause loss of revenue but when more buyers are buying the potatoes there will be some revenue even if one buyer cancels the transaction.

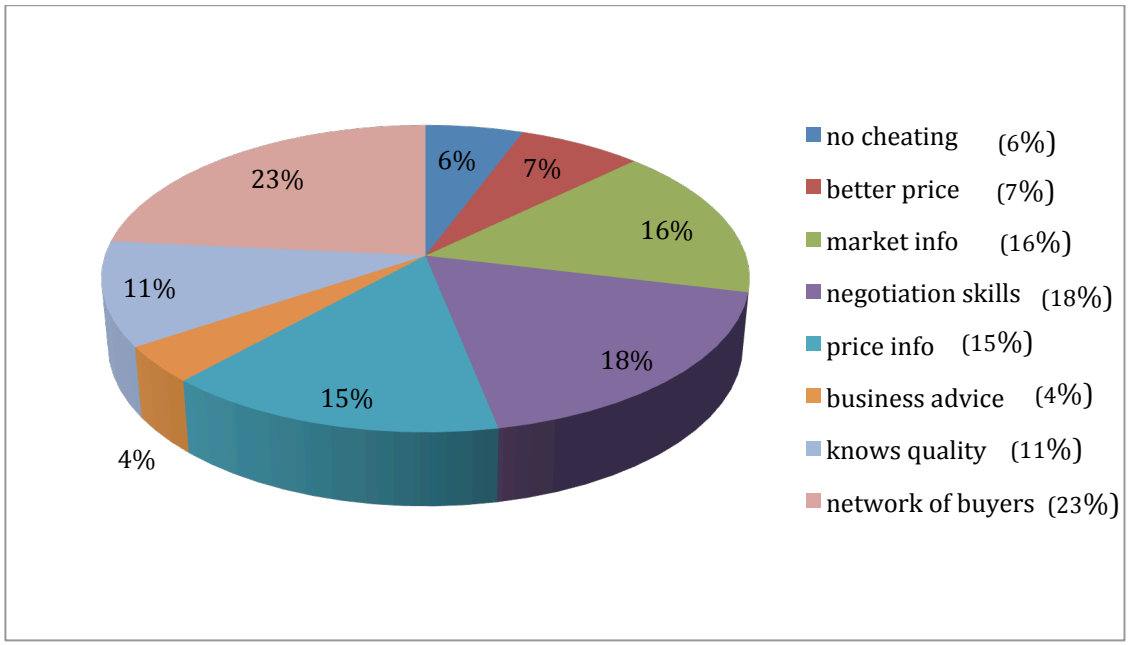
Figure 4.4: Type of buyers/ Channel choice of farmers in %.



Analysing the relationship with the main buyer, farmers are mostly pleased with it and over half of the respondents is satisfied with the services provided by the main buyer, few of them are neutral about it and less than half of the farmers is not satisfied with those services. Again, at the question "Are you happy with the relationship you have with the main buyer", 70% of the farmers replied that they are happy and totally happy. However, despite the positive feedbacks on the relationship with the main buyers, only one third of the farmers expects to continue trading with that buyer, another third is neutral about it and the rest have low expectation about this trading relationship. From these data we see that even though farmers are happy with the main buyer, they don't have high expectation about trading with him again; this could be due to the fact that farmers are not the ones choosing to trade again with the buyer, but buyers are the ones that choose who to trade with.

From the data concerning the decisions and services provided by the middleman I found that: middleman tend not to provide inputs and storage facilities, while a very small part of them provides credit, training and transportation. Farmers declared that the main reason why they choose to sell via middleman is the network of buyers they have, the better negotiation skills and the fact that middleman provides them market and price information. Fig. 4.5 shows the percentage of the results just described.

Figure 4.5: Reasons for farmers to choose middleman in %.



Availability of information is one of the key issues of this thesis. Data reveal that over two thirds of the respondents have incomplete information and almost one third have complete information. None of them has never had information. To determine whether the information is complete or not I analysed the information on price, quality and quantity before selling. I will now analyse the sources of information shown in Fig. 4.6 and Fig. 4.7: price information comes mainly from neighbours, middlemen, personal observations and buyers; media are not used to obtain such information. Very similar is the situation of getting quality information, where personal observations are predominant and media play a marginal role. Neighbours and personal observation play the major role in getting input information, while middleman and buyers have a much smaller role; radio plays a marginal role in this type of information, while in the previous cases it wasn't used at all as can be seen in Fig. 4.8. In Fig. 4.9 we see that households obtain outlet information mainly from neighbours, personal observation and middlemen; buyers don't play any role as sources. Media are more important means of outlet information compared of their importance in the other type of market information. Due to poor infrastructures information are provided only for a smaller part by technological devices such as radio and mobile phones; however in recent years mobile phones started playing an important role in developing countries concerning the spread of information concerning price, harvesting issues and weather information.

Figure 4.6: Sources of price information in %.

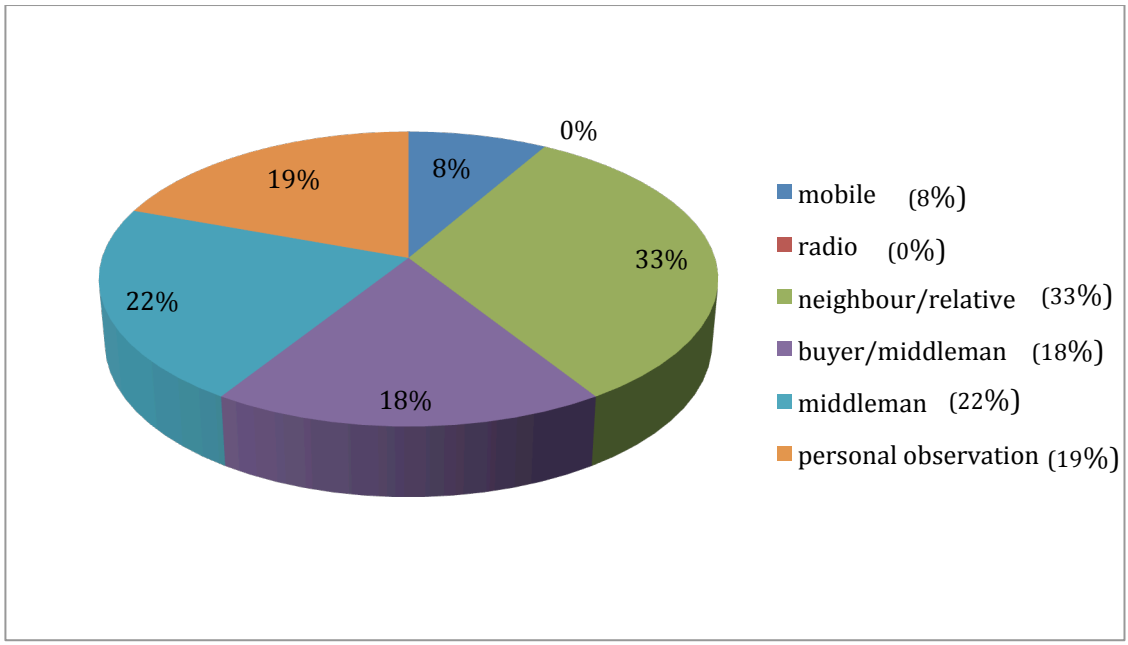


Figure 4.7: Sources of quality information in %.

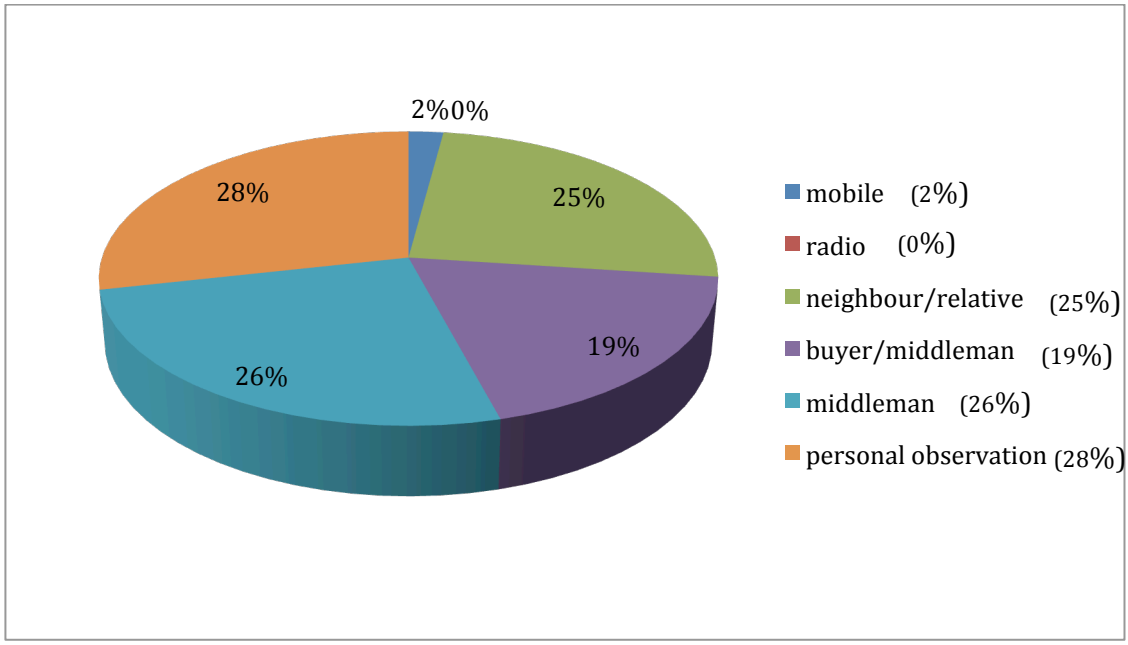


Figure 4.8: Sources of input information in %.

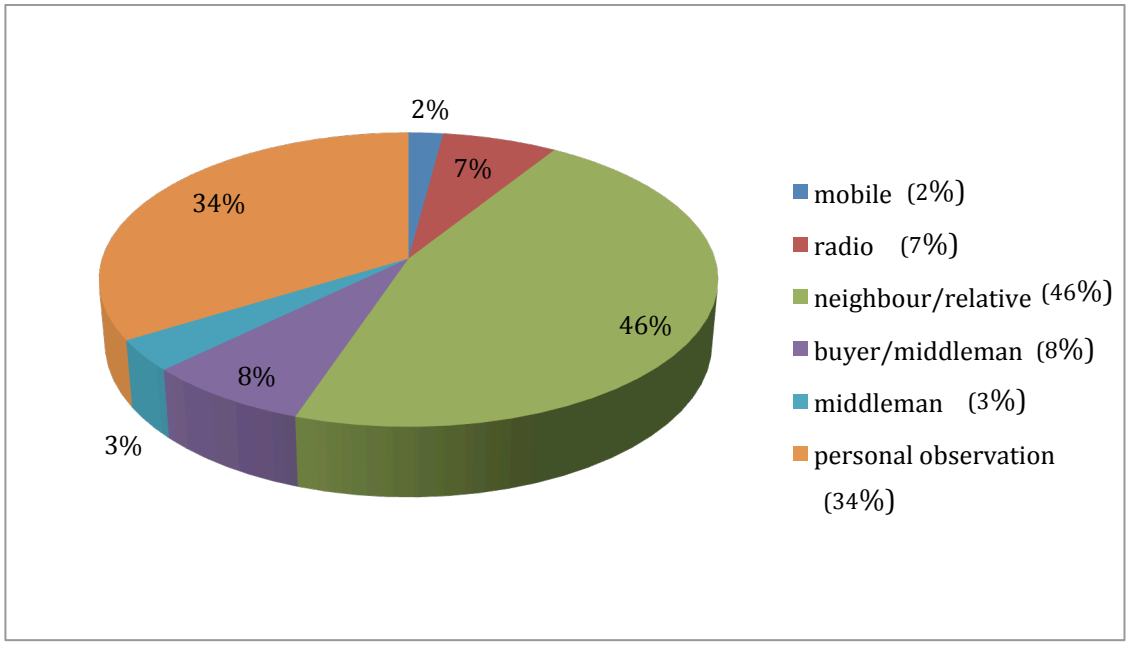
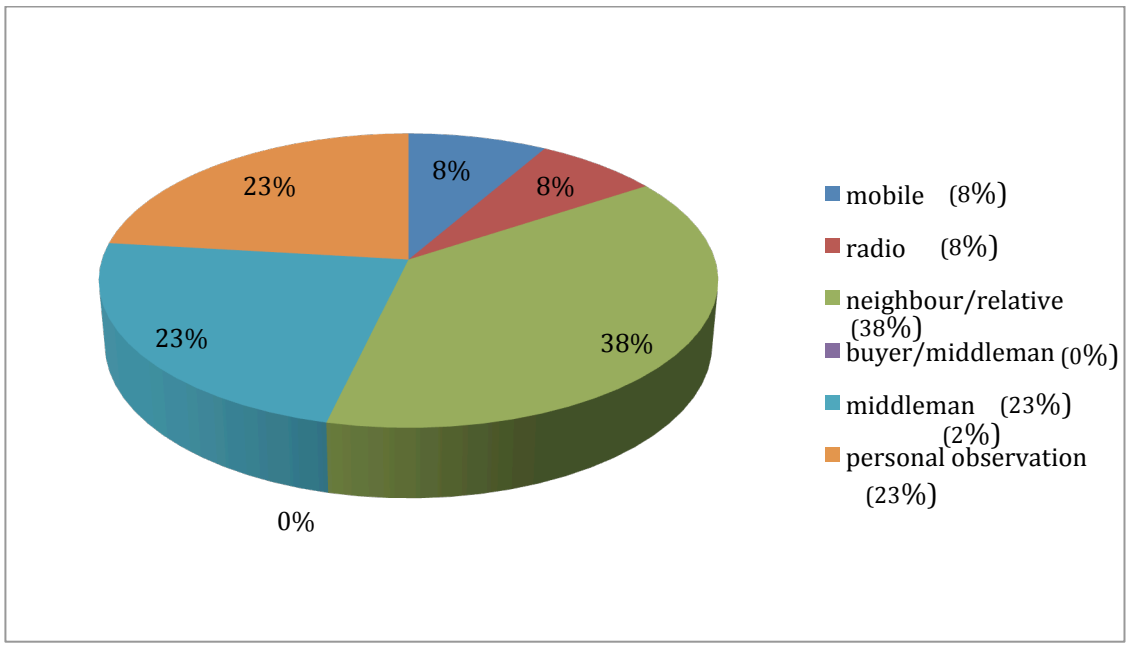


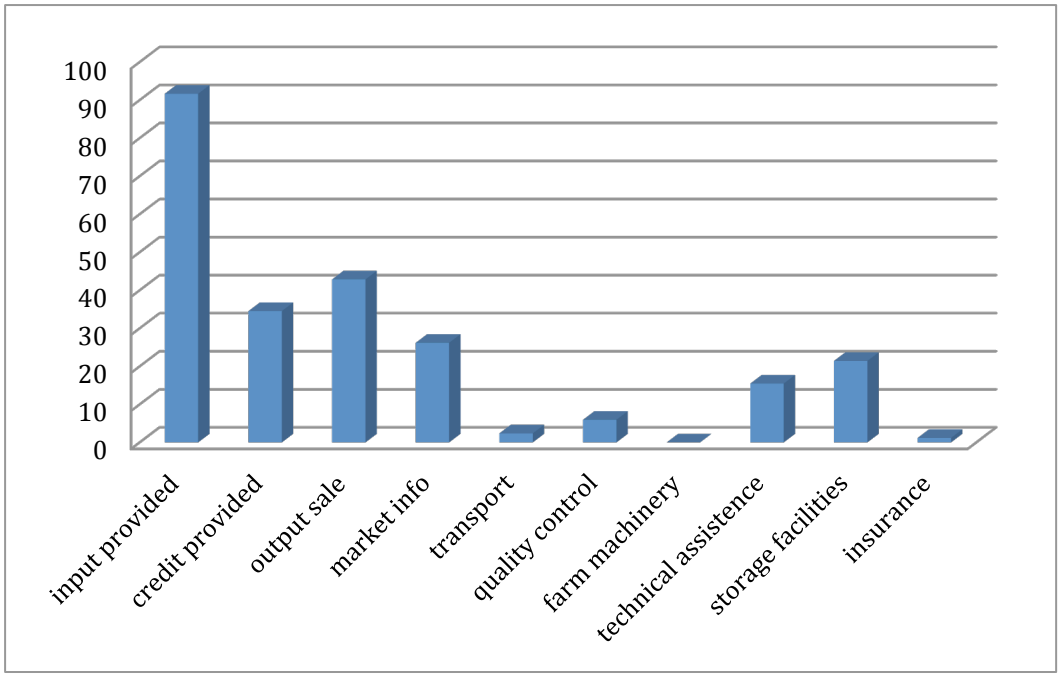
Figure 4.9: Sources of outlet information in %.



Another key issue of this research is the issue of cooperatives; more than half of the households are member of a farmer's cooperative or union, while the rest is not member (at the time the questionnair was done). One third of those belonging to a cooperative is also members of the cooperative's board. Most of the members have positive confidence toward the board of the cooperative and trust the intentions of the board; over two thirds of them is satisfied of the cooperative/union.

Cooperatives provide several services to their members, such as input, credit, output sale, market information, technical assistence etc…Most of the services, according to the respondents, concern the input provision and the output sale. In Fig. 4.10 we can see the services provided by cooperatives more into detail.

Figure 4.10: Services provided by cooperatives/unions in %.



4.2 ECONOMETRIC ANALYSIS

4.2.1 ACCESS TO MARKET INFORMATION

The first RQ I answered is: *"What is the relationship between farmers' membership in a cooperative, the type of buyer they sell to, they type of contract they stipulate, and their access to market information?"*

I first tested the correlation calculating a cross-tabulation, the chi-square test and the Phi and Cramer's V indicators, because the variables I have are categorical, and then I carried out a logistic regression where the dependent variable (Y) is a dichotomous variable, information available, and the predictors (X_i) are dummy variables: membership in cooperatives, type of buyer farmers sell to and type of contract they stipulate with the main buyer. Through the analysis I will test some of the Hypothesis I stated in the theoretical framework (Chapter 2 of this research).

4.2.1.1 Correlation

In this section I will discuss the findings from the correlation tests between the variables mentioned above. The tables from the SPSS output show the cross-tabulation, which contains the number of cases that fall in each combination of categories, similar to a contingency table. From the tables in the Appendix we can see that 84 respondents are members of a cooperative, and among them, 67 have incomplete information (79.8% of them); moreover, 61 respondents are not members of any cooperative and among them 41 have incomplete information (67.2% of them). The difference in proportions test gave a result of $t = 1{,}678$ ($t\ critic = 1{,}65$), which tells us that there is a slightly significant difference between members and non-members in their access to market information. The second variable for which I tested the correlation is the type of contract, for which I built three dummy variables. The dummies are analysed separately in the cross tabulation. From the SPSS output, in the Appendix, we see that among the farmers with complete information (37), 75,7% have complete market-specification contracts, while among farmers with incomplete information (108) 68,5% of them have complete market-specification contracts. Looking at the incomplete market-specification contracts we see that among farmers with complete information, none of them has an incomplete market-specification contract, while 19 of those that have this type of contract

have incomplete information (17,6%); the rest of the farmers (89) don't have incomplete market-specification contract and have incomplete information. The last type of contract I considered is the incomplete resource-providing contract; 10 farmers have this type of contract and they equally divided themselves in those having complete and incomplete information. We see on the other hand that among farmers that don't have this type of contract over 76% have incomplete information and over 23% have complete information. The last variable for which I tested the correlation is the type of buyer; I created two dummy variables: selling via middleman and selling directly to retailers or wholesalers. From the cross-tabulation, in Appendix, we see that 88 farmers sell via middleman; among them 25% have access to complete information while the rest have incomplete information. Looking at the farmers selling directly to retailers or wholesalers (39) we see that 30% of them has complete information while 70% have incomplete information.

Table 4.1 shows the results of the Chi-Square tests, and in case of categorical variables we consider the Pearson Chi-Square statistic tests, which shows us whether two variables are independent or are somehow related. To this measure we add the Symmetric measures looking at Phi. In order to have correlation between the variables the value of significance should be $Sig < 0{,}05$ for the Pearson Chi-Square and for Phi.

Table 4.1: Results from the Chi-Square test and Symmetric measures between the variables included in RQ1.

Variable 1	Variable 2	Pearson Chi-Square	Phi	Significance
Information Available	Dummy Coop. Membership	2,928	0,142	0,087
	Dummy Compl. Mkt-Specification	0,677	0,068	0,411
	Dummy Incompl. Mkt-Specification	7,491	-0,023	0,006**
	Dummy Incompl. Res-Providing	3,387	0,153	0,066
	Dummy via Middleman	0,032	-0,015	0,859
	Dummy Directly	0,774	0,073	0,379

** Sig <0,01

As we can see in Table 4.1 cooperative membership is not significantly related to the access to market information; the type of contract seems not to be correlated except for the incomplete market-specification contract, which is highly correlated. Information available and type of buyer (middleman or selling directly to a retailer or wholesaler) are independent variables as well, as the correlation turned out to be not significant.

4.2.1.2 Logistic Regression

To better see whether the availability of information can be explained by the three predictors mentioned above (cooperative membership, type of contract and type of buyer) I ran a logistic regression.

To see whether the model fits the data, and how well, we look at the Cox and Snell's R^2, in the Model Summary of SPSS output; the highest the value (closer to 1), the better the model is to fit the data. The model has value of $Cox\ and\ Snell\ R^2 = ,091$, which is a low value, showing that the model is not able to explain the determinants of the availability of information. For this reason we expect to be able to have a better model removing or adding other variables, after carrying out a series of Log-Likelihood Ratio tests. To assess the contribution of the predictors we look at the Wald statistics, which tells us whether the b coefficient is significantly different from zero, and therefore makes a good contribution to predict the outcome. In the model we see that the only slightly significant predictor for the model is cooperative membership. The coefficient B has positive sign ($b = ,842$) so we can see that cooperative membership has a positive effect on the access to market information and that being member of a cooperative can increase the information farmers have on price, quantity, quality and delivery place of their potato. From the model we can therefore see that the type of buyer and the type of contract are not good predictors of the access to market information. Table 4.2 shows the estimated parameters included in the Logistic regression.

Table 4.2: Estimated parameters of the Logistic regression (dependent variable INFORMATION AVAILABLE).

Variables	B coefficient	Wald	Significance
CoopMembership	0,842	4,075	0,044*
DcompleteMktSpec	-0,06	0,005	0,941
DincompleteMktSpec	2,083	2,599	0,107
DincompleteResource	-0,904	0,802	0,371
DviaMiddleman	-0,683	0,694	0,405
Ddirectly	-0,787	0,931	0,334
Constant	-0,851	0,2	0,655

* Significant at $p < 0{,}05$

At this point it is necessary to test whether the model would improve its significance removing the variables that are apparently not significant. I ran two new logistic regressions, one removing the variables concerning the type of contract and one removing the variables concerning the type of buyer. The model from which we start is:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \varepsilon_i$$

Y= Dummy information available (complete & incomplete information)
X_1= Dummy cooperative membership
X_2, X_3, X_4= Dummy type of contract
X_5, X_6= Dummy type of buyer

1. H0: β3=β4=β5=0
   H1: β3≠β4≠β5≠0

$X_2 = 9{,}348$ (critical value = 7,8149) which means that we reject the null hypothesis and we cannot remove these variables from the model. Even though apparently these variables are not significant, still they make a contribution to the model.

2. H0: β6=β7=0
   H1: β6≠β7≠0

$X_2 = 0{,}989$ (critical value = 5,991) which means that we don't reject the null hypothesis and we can remove the variables concerning the type of buyer from the model. The model without those variables will be a better predictor of the output.

We can then re-write the model as:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \varepsilon_i$$

Running now this model using a Logistic regression we can see in Table 4.3 that even now the only variable that is significant in predicting the outcome is the cooperative membership, while the type of contracts farmers have doesn't affect their access to market information. As before, cooperative membership has a positive coefficient, meaning that being a member improves farmers' access to market information.

Table 4.3: Estimated parameters of the Logistic regression (dependent variable INFORMATION AVAILABLE).

Variables	B coefficient	Wald	Significance
CoopMembership	0,800	3,896	0,048*
DcompleteMktSpec	-0,392	0,305	0,581
DincompleteMktSpec	1,812	2,180	0,140
DincompleteResource	-1,196	1,661	0,197
Constant	-1,902	1,081	0,298

* Significant at $p < 0{,}05$

4.2.2 COOPERATIVE MEMBERSHIP

To answer this question (*What are the factors influencing the choice of farmers to become members of a cooperative?*) I carried out a logistic regression where the dependent variable (Y) is membership in the cooperative (dichotomous variable), described by several predictors, defined in the methodology chapter.

The goodness of fit of a logistic regression is analysed through the Cox and Snell R^2, which for this model is: $Cox\ and\ Snell\ R^2 = ,169$, which tell us that the model can predict around 17% of the outcome (membership in the cooperative). This value shows a low goodness of fit of the model, with 15 predictors included in the model. Looking at the significance of the predictors we consider the Wald statistics, which tells us whether the b coefficient is significantly different from zero, and therefore makes a good contribution to predict the outcome. In Table 4.4 we see the estimated parameters included in the model; as indicated with the asterisk, the predictors significant in predicting the outcome are the years of experience in potato farming and the total wealth. Experience in potato farming has a negative coefficient meaning that farmers with few years of experience tend to choose to become members while experienced farmers would rather not engage in a cooperative. This can be due to the services that cooperatives provide, such as inputs and output sale, as well as information on the market, which an experienced farmer already has and knows where to get; on the other hand an inexperienced farmer needs help from the cooperative for the input provision, output sale and market information.

Total wealth has a positive coefficient; an increase in total wealth encourages the farmer to choose to become member of a cooperative; this maybe due to the fact that the bigger the size of the farm, the higher the chance of farmers to become members. As total wealth is calculated as landholdings plus livestock number, we can use it as measure of the size of the farm.

Among the variables I choose to include in the model no other variable is significant; therefore I decided to re-write the model including only the variables significantly contributing to the model. To do so I ran some Log-Likelihood Ratio tests, as for RQ n.1. I removed the variables aggregating them according to the type of variables: age & gender, education variables, risk variables, training variables, geographical location variables, landholding and secondary activity. I defined a series of null hypotheses, which will guide me through the definition of the best model, including in the model only those variables that make a contribution to it.

Table 4.4: Estimated parameters of the Logistic regression (dependent variable MEMBERSHIP IN COOPERATIVE).

Variables	B coefficient	Wald	Significance
Age	0,011	0,095	0,758
Gender	-1,096	1,059	0,303
ExperiencePotato	-0,082	3,899	0,048*
ExperienceAgriculture	0,078	2,904	0,088
Training1	-0,09	0,035	0,852
Extension	0,305	0,346	0,557
TotalWealth	0,067	5,206	0,023*
Dprimaryedu	-0,987	0,624	0,43
Dsecondaryedu	-1,428	1,204	0,272
Drisktaker	-0,592	0,962	0,327
Driskaverse	-0,23	0,156	0,693
Dshashemene	-0,152	0,051	0,82
Dsiraro	-0,344	0,194	0,659
Dsecondaryactivity	0,6	1,234	0,267
Landholdinghectare	0,131	0,145	0,704
Constant	1,34	0,422	0,516

* Significant at $p < 0{,}05$

I will now go through the Log-Likelihood Ratio tests, starting from this model:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + \beta_9 X_8 + \beta_{10} X_9 + \beta_{11} X_{10} + \beta_{12} X_{11} + \beta_{13} X_{12} + \beta_{14} X_{13} + \beta_{15} X_{14} + \beta_{16} X_{15} + \beta_{17} X_{16} + \varepsilon_i$$

Y= cooperative membership
X_1= age
X_2= gender
X_3= experience in potato cultivation
X_4= experience in agriculture
X_5= total wealth
X_6,X_7=dummy education (primary & secondary education)
X_8,X_9=dummy risk (risk averse & risk taker)
X_{10},X_{11}=dummy region (Shashemene & Siraro)
X_{12}=landholdings
X_{13}= dummy secondary activity (cattle breeding or other)
X_{14}= dummy training services
X_{15}=dummy extension services

1. H0: β2=β3=0
   H1: β2≠β3≠0

$X_2 = 2{,}326$ (critical value = 5,991) which means that we cannot reject the null hypothesis and we can say that age and gender don't make any contribution to the model and therefore they can be left out from the model.

2. H0: β7=β8=0
   H1: β7≠β8≠0

$X_2 = 26{,}166$ (critical value = 5,991) which means that we reject the null hypothesis and we should leave the dummies of the education level in the model as even though they are not significant in the original model, they make a contribution to the overall model.

3. H0: β9=β10=0
   H1: β9≠β10≠0

$X_2 = 2{,}33$ (critical value = 5,991) which means that we don't reject the null hypothesis and the variables concerning the risk aversion of the households are not predictors to be included in the model as they don't bring any contribution to the model and as a consequence to the outcome.

4. H0: β15=β16=0
   H1: β11≠β12≠0

$X_2 = 0{,}714$ (critical value = 5,991) which means that the trainings and extension services don't contribute significantly to the model and should be left out in order to have a better model to predict the choice of farmers to engage in cooperatives. We don't reject the null hypothesis.

5. H0: β11=β12=0
   H1: β11≠β12≠0

$X_2 = 0{,}714$ (critical value = 5,991) which means that geographical location doesn't add anything to the model so the dummies concerning the location can be removed from the original model. We don't reject the null hypothesis.

6. H0: β13=0
   H1: β13≠0

$X_2 = 0{,}296$ (critical value = 5,991) which tells us that the landholdings of the households are not significant for the model and therefore can be excluded from the original model in order to improve its goodness of fit. We don't reject the null hypothesis.

7. H0: β14=0
   H1: β14≠0

$X_2 = 6{,}75$ (critical value = 3,841) which means that the null hypothesis is rejected and the secondary activity contributes to the model, even though its significance is not directly visible from the B coefficient in the output. The variable has to be included in the model.

I can now re-write the model according to the results of the tests:

$$Y = \beta_1 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + \beta_{14} X_{13} + \varepsilon_i$$

Running the new model we can now see in Table 4.5 that in addition to the two variables significant in the previous regression model, the years of experience in agriculture are significant. The coefficient is positive, so opposite to the one of experience in potato farming; this means that the

more experience a farmer has in agriculture the more he will choose to become a member of the cooperative. This could be due to the cooperative system in Ethiopia, in which many farmers were engaged in the last decades of the 20th century; farmers were forced by the government to become members of farmers' cooperatives and farmers' associations. As mentioned in the introduction of this thesis, the potato sector doesn't have a long tradition of cooperatives, which is on the other hand the case for other horticultural crops and livestock. It means that cultural factors such as traditions might affect farmers' choice of engaging in a cooperative.

Table 4.5: Estimated parameters of the Logistic regression (dependent variable MEMBERSHIP IN COOPERATIVE)

Variables	**B coefficient**	**Wald**	**Significance**
ExperiencePotato	-0,081	4,195	0,041*
ExperienceAgriculture	0,087	6,399	0,011*
TotalWealth	0,065	8,323	0,004**
Dprimaryedu	-0,408	0,126	0,723
Dsecondaryedu	-0,785	0,440	0,507
Dsecondaryactivity	0,494	1,017	0,313
Constant	-596	0,250	0,617

* Significant at $p < 0{,}05$ and ** Significant at $p < 0{,}01$

4.2.3 GROSS MARGIN

My third RQ is: *"What is the relationship between farmers' membership in a cooperative, the type of buyer they sell to, they type of contract they stipulate, and their gross margin?"* I first ran a simple Pearson-r correlation between the margin-per-unit and the three predictors. The second step I took was to carry out a linear regression where the dependent variable (Y) is the margin-per-unit of farmers, and the predictor variables (X_i) are the membership in cooperatives, the dummies of the type of contract farmers have with buyers and the dummies of the type of buyer farmers sell to.

4.2.3.1 Correlation

First of all we look at the correlation between the cooperative membership and the margin-per-unit (proxy of the gross margin): from Table 4.6 we see that there is positive correlation between the two variables meaning that they move with the same tendency. In the same table we can also see that one out of three types of contracts (complete market-specification) is positively significantly correlated with the margin per unit. Looking at the type of buyers we see a negative significant correlation between farmers selling via middleman and positive significant correlation selling directly to a retailer or wholesaler. To these correlations I added one between availability of information and the margin-per-unit, which turned out to be not significant.

Table 4.6: Point Biserial Correlation between the variables included in RQ n.3.

Variable 1	Variable 2	Pearson r	Significance
Margin-per-unit	Dummy Coop. Membership	0,231**	0,005
	Dummy Compl. Mkt-Specification	0,168*	0,043
	Dummy Incompl. Mkt-Specification	-0,114	0,17
	Dummy Incompl. Res-Providing	0,021	0,797
	Dummy via Middleman	-0,236**	0,004
	Dummy Directly	0,299**	0

* Significant at $p < 0{,}05$ and ** Significant at $p < 0{,}01$

4.2.3.2 Linear Regression

From the simple correlation analysis we cannot make direct conclusions about causality. Thus, we need to run a linear regression where the dependent variable (Y) is the margin-per-unit of farmers, and the predictor variables (X_i) are the membership in cooperatives, the dummies of the type of contract farmers have with buyers and the dummies of the type of buyer farmers sell to.

Looking at the R square we can see that the model is not a very good predictor of the margin, as the variables included can explain 21.1% of the variation in margin. This means that there might be other predictors that can explain what's left of the variation. Moving to the next table of the output, which presents the analysis of variance (ANOVA), we can look at the F-ratio: $F = 6{,}224$ and significance value $p = {,}000$. Again we see that the model is good in predicting the margin in a significant way.

We now look at the contribution of the singe predictors to the model, analysing Table 4.7. Cooperative membership has high significance and the corresponding coefficient is positive, meaning that cooperative membership contributes positively to the gross margin. We can assume that being member of a cooperative has a positive impact on the margin; however, other factors may influence the margin such as bad management skills, inability to reduce costs etc.… Looking at the other predictors, the regression model shows the significance of two out of three dummies of the type of contract, with positive coefficient meaning that the type of contract has positive contribution to the outcome. Having a complete market-specification contract can affect the margin of farmers, who have pre-agreed prices and quantities, reducing the influence of fluctuation of prices on the price paid for their produce. Last, there is significant correlation between the dummy of the buyer (middleman) and the margin, with negative coefficient meaning that selling via middleman affects the margin in a negative way. We can assume that a longer supply chain, with intermediaries, reduces the margin of the farmers.

Table 4.7: Estimated parameters of the Linear regression (dependent variable GROSS MARGIN).

Variables	B coefficient	Significance
CoopMembership	313,319	0,001**
DcompleteMktSpec	455,460	0,009**
DincompleteMktSpec	325,997	0,092
DincompleteResource	543,628	0,019*
DviaMiddleman	-320,536	0,038*
Ddirectly	151,196	0,338
Constant	472,427	0,023*

* Significant at $p < 0{,}05$ and ** Significant at $p < 0{,}01$

4.2.3.3 Propensity Score Matching (PSM)

In applying PSM to the sample of 146 households, I could match 68 of them, in 34 pairs, based on a difference in the propensity scores <0,05. The means were calculated for all the relevant variables before and after the matching, taking into account only the matched households, (i.e. two groups of 34 treated and non-treated households, respectively). The margin-per-unit has been included as well and its mean has been calculated and tested for differences between treated and non treated households. All means have been tested with t-test for equality at the 5% level, to see whether they were significantly different.

We can consider the matching successful as the significant differences of the covariates' means among treated and non-treated are removed. In the table below we can see that for two out of three scale parameters (years of experience in potato, years of experience in agriculture and total wealth) the means are not significantly different anymore even if they were significantly different before the matching. Table 4.8 and table 4.9 show the means of the covariates before and after the matching.

Table 4.8: Unadjusted means of selected variables and count for dummy variables before the matching.

Means Before Matching	Treated (Coop. Members)	Untreated (Non-members of Coop.)
Experience in Potato (years)	11,37	11,49
Experience in Agriculture (years)	19,28	16,65[a]
Total Wealth (landholdings+livestock number)	21,40	11,16[a]
Dummy Primary Education (frequency)	56	37
Dummy Secondary Education (frequency)	25	18[a]
Dummy Secondary Activity (frequency)	67	47[a]

[a] Significantly different means between observations from the potential treatment group and from the potential control group in a t-test for equality of means at 5% level and chi-square test for dummy's frequencies at 5% level.

Table 4.9: Adjusted means of selected variables and count for dummy variables after the matching.

Means After Matching	Treated (Coop. Members)	Untreated (Non-members of Coop.)
Experience in Potato (years)	11,21	11,21
Experience in Agriculture (years)	17,02	16,70
Total Wealth (landholdings+livestock number)	12,05	11,63
Dummy Primary Education (frequency)	20	21
Dummy Secondary Education (frequency)	12	12
Dummy Secondary Activity (frequency)	29	26

[a] Significantly different means between observations from the treatment group and from the control group in a t-test for equality of means at 5% level and chi-square test for dummy's frequencies at 5% level.

After testing the matching and seeing that the matching is correct I considered the means of the margin-per-unit before and after the matching for both the treated group (members) and the control group (non-members). From the table below we can see that for both cases there is a significant difference between the margin of members and non-members.

Table 4.10: Unadjusted and adjusted means of the variable margin-per-unit (in Birr[11]) before and after the matching.

Means	Treated (Coop. Members)	Untreated (Non-members of Coop.)
Margin-per-unit (Before Matching)	386,52	133,92[a]
Margin-per-unit (After Matching)	296,39	158,47[a]

[a] Significantly different means between observations from the treatment group and from the control group in a t-test for equality of means at 5% level.

[11] 1 Euro (EUR) = 22,52 Birr (ETB), May 19th 2012, http://it.finance.yahoo.com/valute/convertitore/#from=EUR;to=ETB;amt=1

We can see that the margin-per-unit of the cooperative members is higher than the one of non-members of the cooperative, even though after the matching the difference is reduced (47%). The PSM confirms the positive effect membership in cooperative has on farmers' margin. Being a member leads to higher margin-per unit so it's profitable for farmers to be engaged in a cooperative.

5. DISCUSSION

In this chapter I will discuss the findings from the results, looking at the hypotheses I formulated in the theoretical framework (see Chapter 2), which I tested using econometric analysis, answering to the original RQs stated in the first chapter. I divided this chapter in sections, according to the topic of the discussion.

5.1 BARGAINING THEORY

Hypothesis 1: *Farmers have larger bargaining power in the negotiation with the buyers when they are members of a farmers' cooperative.*

Hypothesis 2: *Improved access to market information will increase farmers' bargaining power.*

To test the following hypothesis I should have calculated the Lerner Index, which describes a firm's market power; to do so the price and the marginal costs are needed ($L = \frac{P-MC}{P}$). It is however very difficult to calculate the marginal costs and the information I had in my dataset did not allow me to calculate such index. As I explained in the methodology chapter, I calculated the margin as a normalization of the gross margin, which I will approximate in order to use it as a measure of the bargaining power of farmers. It is important to keep in mind that the margin can be due to either the fact that farmers have better price paid for their produce, or because they are able to reduce and minimize costs. This said, we saw in the results chapter, in the regression model, that cooperative membership has a positive impact on the margin and we can assume that it has a consequence on the bargaining power; this was confirmed by the propensity score matching analysis, from which we saw that farmers belonging to the cooperative have a higher mean of the margin-per-unit. According to the data I had and the analysis I carried out I cannot confirm the Hypothesis n.1, as I did not measure the Lerner index, but I can assume that belonging to a cooperative may increase farmers bargaining power. It is important to take into account that there might be an interaction effect of cooperative membership and bargaining power, and I can only assume the causal effect that I stated above, but I cannot conclude that being member of a cooperative leads to higher

bargaining power of the farmer. Moreover other factors can influence the bargaining power of farmers such as the distance to the market; this variable was not included in the model I built because I wanted to focus on the organizational aspects (contracts, buyers, cooperative membership) of the chain.

Looking at the second hypothesis we might reject it; the correlation between the access to market information and the margin is not significant so we cannot confirm that improving the access to market information will lead to an increase in bargaining power. Despite the literature found on the topic (Sheperd, 1997; Kohls & Uhls, 1998; Borgel et al., 1980), stating that market information improve farmers bargaining power, in the Ethiopia potato supply chain we cannot say that farmers with access to the market information have higher bargaining power than farmers with scarce market information. This might be due to the measurement of the bargaining power, as I mentioned I didn't use the Lerner index, and moreover the bargaining power definition I used doesn't consider the price paid to farmers for their produce.

5.2 PRINCIPAL-AGENT THEORY AND UNCERTAINTY

Hypothesis 3: *Farmers are more likely to become members of a cooperative when they are risk-averse. On the other hand, risk-neutral and risk-taker farmers are less likely to be members of a cooperative.*

Even though for my thesis I formulated the hypotheses talking about risk, as in the data the three categories were classified in this way, it is important to keep in mind that the uncertainty can better represent the current situation farmers' face when talking about their production and the marketing of their produce. To test the above hypothesis I used the RQ n.2, for which I carried out a logistic regression. I was expecting uncertainty (risk) to play a role in the choice of farmers to engage in cooperatives; from the SPSS output I could see that the variables of risk (classification of farmers as risk-averse and risk-neutral) were both not significant in predicting the outcome (cooperative membership). After controlling using the Log-Likelihood test I found that these predictors were not significant at all for the model and the model would have been better in describing the outcome without the dummies of the risk. I therefore reject the Hypothesis 3 and I can say that risk is not a decisional factor that can influence the choice of Ethiopian potato farmers when they choose to become members of a cooperative. Historically in Ethiopia the cooperatives were politically

involved and farmers were quite reluctant; cultural aspects such as this one might affect farmers' choice despite the risk-aversion or risk-neutrality. Moreover, farmers' uncertainty (and risk) might already be reduced by participating in the cooperative; therefore we need to consider the possibility of endogeneity problem. Endogeneity has not been tested as to test it I would have needed instrumental variables.

5.3 CONTRACT THEORY

Hypothesis 4: *Farmers have better access to market information when they engage in market-specification contracts, compared the engagement in other type of contracts or when they don't engage in a contract at all.*

Hypothesis 5: *Farmers' access to market information is lower and biased when they engage in resource-providing contracts.*

Hypothesis 6: *Farmers' access to market information is lower and biased when they engage in production-management contracts.*

For these three hypotheses I used the RQ n.1; as I explained in the methodology I classified the contracts according to the definition of chapter 2 (Bijman, 2008 and Minot, 1986) so to facilitate the test of the hypothesis. From the results we can say that the type of contract is not significantly contributing to the access to market information, however these dummy variables are predictors that contribute to the goodness of the model in predicting the outcome. I can now reject the Hypothesis n.4 and n.5 as those types of contracts turned out to be not significant. Concerning the Hypothesis n.6 I couldn't test it due to lack of households engaged in such type of contract; I can say that in the Ethiopian potato supply chain the production-management contracts are not commonly used between buyers and farmers. No vertical integration is in place among the potato supply chain in Ethiopia; on the other hand if we recall Eaton & Shepherd, 2001 we can say that we are facing an informal model of farming, characterized by small enterprises (farms), engaging in informal contracts.

5.4 PRODUCER ORGANIZATIONS

Hypothesis 7: *Farmers choice of cooperatives is linked to the location specificity: farmers are more likely to join a cooperative to increase their bargaining power on the market; lack of trust can affect the choice of farmers not to choose cooperatives.*

Hypothesis 8: *Farmers choice of cooperatives is linked to the asset specificity: farmers are more likely to choose cooperatives when the size of the farm is large and when the specificity of the farm is higher.*

Hypothesis 9: *Farmers choice of cooperatives is linked to the relational specificity: farmers participating in other organizations, which provide substitute services to those provided by the cooperative are less likely to join the cooperative.*

Hypothesis 10*: Buyers and traders have more information than farmers with whom they negotiate, but when farmers are members of a cooperative the information gap is smaller.*

The above hypotheses have been tested in RQ n.2, where I tried to identify the variables affecting farmers' choice of participating in cooperatives. Location specificity (Hypothesis n.8) doesn't affect farmers' choice and moreover the model is a better predictor of the outcome when the dummies of the geographical location are excluded from the model. We can say that even though living on the hills rather than living close to a major city doesn't increase or decrease farmers' choice of being members; the hypothesis is rejected. Once again distance to the market was not included in the model as well as distance to the input providers; these information should be studied when considering transaction costs farmers face when they choose to become members of the cooperative or when they choose not to become members.

Hypothesis n.8 concerns the asset specificity; I could only test half of the hypothesis, concerning the size of the farm. I couldn't measure asset specificity with the information available but I could consider the size of the farm, which can be approximated by the total wealth, which is calculated as the sum of the landholding and the livestock number. Looking at the part of hypothesis on size I do not reject it: the size of the household might affect the choice of becoming a member of a cooperative. As for Hypothesis n. 3 I cannot exclude endogeneity between the variable of total wealth (used to derive the size of the farm) and the membership in cooperative due to lack of

instrumental variables. Therefore I cannot give conclusions on the causality interaction between size and choice of becoming member but I can say that there is a relation between the two variables. Hypothesis n.9 has not been tested including the variable "member of other association" in the model as that variable was creating a collinearity problem due to the fact that nearly all households were members of other associations (church, youth, credit associations).

For the last hypothesis, n.10, I looked at the RQ n.1: cooperative membership is slightly significant in predicting the access to market information of farmers. I expected members of the cooperative to have larger access to market information, the positive coefficient of the dummy shows that there is positive correlation and members of the cooperative tend to have larger access to market information. Not being a member of the cooperative leads to smaller access to market information. I couldn't test the information gap between buyers and traders, as I didn't have enough information on that aspect.

6. CONCLUSIONS

The Ethiopian potato supply chain seems to be very similar to other supply chains in developing countries: potato farmers are mostly smallholders, they belong to peasant associations (farmers' cooperatives); formal written contracts never take place while most of the farmers have oral agreements with the main buyers. Almost half of the farmers sell via middleman so a short supply chain is not the rule, even though the supply chain only includes one or two intermediaries. Farmers have difficulties in accessing market information and 80% of them only have partial information concerning price, quality demanded on the market and delivery places; the information are gathered mostly from neighbours, relatives and personal observations, while technological means such as mobile phones and radio are not widely used to access market information. Focusing on farmers' cooperatives, we see that more than half of the farmers belong to a cooperative or union, which provides mostly farmers input, some output sale services and sometimes credit services.

While the mentioned characteristics are similar to other developing countries scenarios, looking into more detail in the potato sector, we see that many hypotheses made have to be rejected and the potato supply chain in Ethiopia has some peculiarities. Farmers do not choose to become members of a cooperative because of the uncertainty (risk-aversion), the land-size, the geographical location, training programmes, nor because of the demographic variables. Their choice of becoming members seems to be due to the years of experience in agriculture (positive coefficient), which we can assume is due to the fact that farmers that have been into agriculture in the past decades were used to be engaged in cooperatives as they were pushed by the government; and especially in potato farming (negatively affecting the choice), due to the fact that farmers with experience and skills think they can produce and market their potatoes without the need of being member of a cooperative. On the other hand total wealth (and as a consequence farm size) might positively affect farmers choice (causality is difficult to state due to the possibility of endogeneity problem). Not significant but still contributing to farmers' choice are the secondary activity (cattle rearing) farmers do and the level of education. Being part of a cooperative turned out to be positively affecting both the access to market information and the farmers' margin; as a consequence we can assume that farmers' bargaining power is also positively affected by the membership in the cooperative.

Looking at the access to market information, we can say that the type of buyer doesn't affect it and it's not correlated to it in any way; on the other hand, even though the type of contract is not significantly related to the information available, still it makes a contribution to the model that describes it. As mentioned above, cooperative membership affects positively the information availability.

Considering farmers' gross margin I found that cooperative membership affects it positively while selling via middleman affects it in a negative way, probably due to the length of the chain, which would involve intermediaries and therefore increase the costs. Even though Ethiopian cooperatives are found to be inefficient due to the history of cooperatives and the predominant role the government had in them, the data show that cooperatives in the potato sector can be partly efficient bringing some benefit to the famers. Modern cooperatives (born in the last decade) tend to be freer from the government and to be more farmers' addressed. However there might be some interaction between the two variables: is it the cooperative membership to influence the margin or are the farmers with high margin those who choose to become members? Once again endogeneity seems to influence the causality conclusions. Two out of three types of contracts (complete market-specification and incomplete-resource providing contracts) affect the margin positively. Using the propensity score matching (PSM) I could derive 34 pairs, which were used to better analyse the impact of farmers' cooperatives on farmers' margin: the means of the margin after the matching were significantly different and the margin of members turned out to be bigger than the one of non-members.

The last issue discussed in this thesis is the bargaining power. Lerner index couldn't be calculated so the margin has been used to analyse the bargaining power, making some assumptions. I expected bargaining power to increase due to the access to market information, but this is not the case; I also expected farmers' bargaining power to increase when farmers are members of a cooperative, and from the regression analysis we see that we can accept this hypothesis. Moreover, looking at the PSM, we can see that members of the cooperative have a bigger margin and therefore a bigger bargaining power.

6.1 RECOMMENDATIONS

Further research is needed in order to give external validity to this research. A bigger sample should be investigated and PSM should be carried out on a bigger number of matched pairs, if possible. More detailed information on marginal costs should be gathered in order to investigate bargaining power using the Lerner index. Transaction costs should also be investigated through a questionnaire, which involves questions that will allow the measurement of such costs (i.e. number of hours spent in meeting with the buyer); they couldn't be analysed within this thesis but they would be very interesting for a deeper understanding of the potato supply chain. The results could be compared to other potato supply chains in other developing countries, to see whether there are similarities or big discrepancies. From these results the case of Ethiopian farmers seems peculiar but we can expect other countries with similar institutional environment and geographical characteristics to have some commonalities. Moreover further research is needed to understand which other factors affect farmers' choice of becoming members of farmers' cooperatives, such as political factors. A new questionnaire should be submitted to the potato farmers investigating transaction costs and marginal costs.

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APPENDIX

1. Part of the Questionnaire for Potatoes Producers Survey, 2010

Household characteristics

1. **Name** of the respondent: _____

2. **Position** of the respondent:

a.	Head of the household
b.	Spouse of head of the household
c.	Other ( )

3. **Age** of the respondent (year): _____

4. **Gender** of the respondent:

a.	Male
b.	Female

5. **Location**

a.	Kebele:
b.	Wereda:
c.	Zone:

6. **Age and size of the family**

	Age range (year)	<15	15-64	>64
a.	Number of family members			
b.	Total family size			

7. **Education** (head of household) _____

8. **Annual revenue** (in ETB) during the previous year

8.1 What was your total annual revenue?

a.	From farm activities	
b.	From non-farm activities	

8.2 What was the revenue generated by selling **potatoes** in the previous year?_____ (ETB)

9. **Farm size** in "Timad[12]" for **potatoes on:**

		Sep.2009 - Aug. 2010	Sep.2008 - Aug. 2009	Sep.2007 - Aug. 2008	Expected next year

[12] One Timad is a 50 x 50 m^2 plot (1/4 of a hectare)

a.	own plot				
b.	rented in plot				

10. **Wealth**

11.1	**House**	Roof: 1=corrugated iron sheet, 2= grass	Wall: 1=bricks, 2=mud, 3=other	Floor: 1=tiles, 2=concrete, 3=none of them
a.				
b.				

		Unit	Total
11.2	**Livestock**		
a.	Oxen	Pcs	
b.	Cow	Pcs	
c.	Other cattle	Pcs	
d.	Sheep	Pcs	
e.	Goat	Pcs	
f.	Mule/horse	Pcs	

Channel choice for potatoes

28.	**Type of buyer** in the previous growing season	% sales	**Main destination**: 1=Shashemene, 2=Hawassa, 3=Ziway/Meki, 4=Addis Ababa, 5=Adama, 6=Harar/Dire Dawa, 7=Jijiga, 8=Djibouti, 9=Borena, 10=Moyale, 11=Other, 12=don't know
a.	To/via the main middlemen		
b.	Directly to a preferred wholesaler		
c.	Directly to a preferred retailer		
d.	To a cooperative (union)		
e.	To an anonymous buyer		
f.	Other ( )		
		100%	

29. To how many buyers did you sell your potatoes last season?

_____

30. If you had more than one buyer for your **potatoes** per season, why did you have several buyers?

1=one buyer didn't buy everything	2=Difference in quality	3=to reduce price risk	4=Other ( )

Transactional characteristics

Duration of exchange with the main buyer

31. For how long have you been selling **potatoes** to the main buyer you mentioned in # 30?
_____ (year)

32. Did you switch to a new **potatoes** buyer in the previous two growing seasons?

1= yes	2= no

33. If your answer is yes to #34, what was the main reason?		1=totally disagree	2= disagree	3= neutral	4= agree	5=totally agree
a.	New buyer offered me a better price					
b.	Disagreement about quality					
c.	Disagreement about quantity					
d.	Buyer no longer wanted my product					
e.	Lack of trust in future relationships					
f.	Other ( )					

Level of satisfaction with the main buyer (indicated in # 30)

34. Please indicate to what extent you agree with the following statements.		1=totally disagree	2= disagree	3= neutral	4= agree	5=totally agree
a.	I am very pleased with the trading relationship I have with the main buyer of my **potatoes**.					
b.	I am very satisfied with the overall services of the main buyer of my **potatoes**					
c.	The trading relationship with the main buyer of my **potatoes** has been an unhappy one (R)					

Source: Ik-Whan G. Kwon and Taewon Suh, 2004, 2005

Expectation of continuing trading with the main buyer (indicated in # 30)

35. What is your level of expectation about continuing trading with your main **potatoes** buyer?

1= very low	2=low	3=neutral	4=high	5=very high

Contract characteristics (considering the previous growing season)

With the main potatoes buyer (indicated in # 30)

36.	**The sales agreement was made in:** (choose one)	
a.	the form of written/formal contract	
b.	the form of oral /verbal agreement	
c.	direct sales	
37.	**The agreement specified a:**	
a.	Pre-agreed price level	
	1=yes	2=no
b.	Pre-agreed quality level	
	1=yes	2=no
c.	Pre-agreed quantity level	
	1=yes	2=no
d.	Pre-agreed delivery place	
	1=yes	2=no
38.	**The agreement included:**	
a.	Provision of fertilizer by the buyer	
	1=yes	2=no

b.	Provision of seed by the buyer	
	1=yes	2=no
c.	Provision of credit by the buyer	
	1=yes	2=no
d.	Other ( )	
39.	**Duration of the contract was:** (choose one)	
a.	Only for one time delivery	
b.	For two or more time deliveries	
40.	**Conflict resolution was usually through:** (choose one)	
a.	Local/community arbitrator	
b.	Mutual understanding	
c.	Legal authority	
d.	No conflict occurred	

Level and type of information exchange with potatoes buyer - consider the previous season

41. Did you receive the following information prior to date of selling?		1= never	2= sometimes	3= often	4= always
a.	Price				
b.	Quality requirements				
c.	Volume				

42. What was your main source of information prior to date of selling?		1= Mobile	2= Radio	3= Neighbor /relative	4=Buyer /other than middleman	5= Middleman	6=Personal observation
a.	Price						
b.	Quality						
c.	Inputs						
d.	Outlets						

Relational characteristics

Consider your relationship with your main **potatoes** buyer in # 30 to answer the following.

Embeddedness

43. How long have you known the current **potatoes** main buyer?
_____ (year)

44. Do you and your **potatoes** main buyer belong to the same		1= Yes	2=no	99=don't know
a.	Ethnic group			
b.	Religion			
c.	Clan			
d.	Family			
45.	Where does your main **buyer** live?			
a.	In the same Peasant association (PA) with you			
b.	In the same Wereda (district) with you			
c.	In the same Zone with you			
d.	Other ( )			

Level of trust with the main buyer

	46. To what extent do you agree or disagree with the following statements (consider your main buyer indicated in # 30)	1=totally disagree	2= disagree	3= neutral	4= agree	5=totally agree
a.	The buyer is well respected for his fair dealings					
b.	The buyer keeps promises					
c.	I expect my buyer to continue working with me					
d.	Whenever the buyer gives me advice on my production decisions, I know that he is sharing his best judgment					
e.	Even when the buyer gives me a rather unlikely explanation, I feel confident that he is telling the truth					
f.	I can count on my buyer to be sincere.					
g.	Selling the right quality product is important to keep my relationship with the buyer					
h.	I am happy selling my product to this buyer					
i.	When an unexpected situation arises about market conditions, we prefer to work out a new deal as opposed to holding each other to the original agreement/promises					

Source: Ik-Whan G. Kwon and Taewon Suh, 2005

Participation in cooperative

47. Are you a member of a cooperative?

1=yes	2=no

(If your answer is **yes**, **continue** to the following questions; if no go to Q. 76)

48. How long have you been in this cooperative?

_____ (year)

49. Are you a member of the management committee (or board)?

1=yes	2=no

	50. Please rate your level of agreement on the following statements	1=totally disagree	2= disagree	3= neutral	4= agree	5=totally disagree
a.	I have full confidence on the leadership quality/competence of the management committee					
b.	The intention of the management committee is good					

	51. Generally, what is your level of satisfaction with your cooperative performance?
a.	Dissatisfied
b.	Partly dissatisfied
c.	Have no opinion
d.	Partly satisfied
e.	Satisfied

52. Type of services the coop provide		Not provided	How important is the service provided by this coop to your potatoes growing activities?				
			1=not important	2=little importance	3= neutral	4= important	5=very important
a.	Inputs supply						
b.	Credit						
c.	Output sale						
d.	Market information						
e.	Transport						
f.	Grading/sorting						
g.	Farm Machinery						
h.	Technical assistance on the farm						
i.	Storage facilities						
j.	Insurance						
k.	Certification						
l.	Other						

The power of middleman in the producer – trader relationship

Main decision variables

53. Please rate to what extent you have influence on the following main decision areas compared to the main middleman you have been working with in relation to potatoes sales		1=totally disagree	2= disagree	3= neutral	4= agree	5=totally agree
a.	This middleman decides the price of my potatoes					
b.	This middleman decides type of potato varieties I grow on my farm					
c.	This middleman decides the amount of commission for his services					
d.	This middleman decides the payment conditions, delivery place, timing of delivery, etc					
e.	This middleman decides the quality level of my potatoes					
f.	This middleman decides the type of buyer (channel) for my potatoes					

Source of power

Consider the main middleman that you have used to sell your potatoes. What motivated/encouraged you to sell to or via this middleman rather than directly selling to a trader, processor, or a cooperative?

*54. **Reward power***		1=yes 2=no	If yes, what would be the level of importance for your production/trading decisions?				
			1=not important at all	2= Not important	3= neutral	4= important	5=very important
a.	This middleman provides me with credit						
b.	This middleman provides me with training						
c.	This middleman provides me with inputs (fertilizer, seed, etc)						
d.	This middleman provides me with storage						
e.	This middleman organizes transportation						

f.	This middleman guarantees that I will not be cheated						
g.	I get better price when I sell via this middleman						
55.	***Expert power***						
a.	This middleman provides me market information						
b.	This middleman has better negotiation skill in selling my potatoes						
c.	This middleman provides me information on current potato price						
d.	This middleman provides me business advice						
e.	This middleman better knows the quality of my potatoes						
f.	This middleman has a wide network of buyers						
g.	This middleman provides me grading/inspection services						
56.	***Referent power***						
a.	I like to do business with this middleman because s/he is well respected in the community						
b.	I consider this middleman an ideal trading partner for me						
c.	I have great respect for this middleman						
d.	I trade with this middleman because I had good past experiences with him						
e.	I trade with this middleman because he has a good reputation						

What would be the consequences should you opt to sell directly to a trader, processor, or a cooperative instead of using the main middleman?							
57.	***Coercive power (imposition of punishments)***	1=yes 2=no	If yes, what would be the impact on your income/profit from trading this product?				
			1=highly insignificant	2= insignificant	3= neutral	4= significant	5= highly significant
a.	This middleman reacts by temporarily refusing to buy my product						
b.	This middleman reacts by permanently excluding me to do business with him						
c.	This middleman reacts through violent act/intimidation						
d.	This middleman reacts by telling other buyers not to buy from me						

Level of asymmetric information (*Jaleta and Gardebroek / Agricultural Economics 36 (2007) 245–251*)

58. Do you follow price information on your potatoes at the central market (Addis Ababa?)

1=yes	2=no

59. Do you follow price information on your potatoes at the nearby market (Shasheme/Hawassa)?

1=yes	2=no

2. Part of the Questionnaire on Potato Producers Survey 2011.

PART 2: HOUSEHOLD Characteristics

1. **Name** of the respondent: _____

2. **Position** of the respondent:

1.	Head of the household
2.	Spouse of head of the household
3.	Children
4.	relative
5	Other ( )

3. **Age** of the respondent (year): _____

4. **Gender** of the respondent:

1	Male
2	Female

5. Total size of the family =

6. Highest level of formal education attained by the respondent =

7. Highest level of formal education attained in the family as a whole=

8. Primary activity of the respondent

   a. Crop cultivation

   b. Cattle rearing

   c. Other off-farm activities

Part 4: Membership in organizations

S/N	Are you a member of any of the following organizations/associations? Yes=1 No=2		When did you join this organization?	Year stopped being member (if applicable)	Why did you decide to culminate the membership (if applicable) a I didn't see any use of being member b. I didn't have enough money for contribution, etc c. I didn't have enough time d. I had a conflict with the leaders e. Other (specify)	If you are not a member of any of the above associations, what is the reason for it? a. I didn't see any use of being member b. I didn't have enough money for contribution, etc c. I didn't have enough time d. I had a conflict with the leaders e. Other (specify)
1	Farmers' Co-operatives					
2	Unions					
3	Youth Associations					
4	Women's saving and credit					
5	FBOs (like Church and mosque)					
6	Ekub					
7	Idir					
8	Other (specify)					

PART 5: HOUSEHOLD WEALTH INCLUDING LAND

	House	**Roof: 1=corrugated iron sheet, 2= grass**	**Wall: 1=bricks, 2=mud, 3=wood**	**Number of rooms in the house**	**Floor: 1=tiles, 2=cement, 3=mud**
a.					
b.					
	Livestock	**Unit**	**Total**		
c.	Oxen	No.			
d.	Cow	No.			
	Goat	No.			
	Mule/horse	No.			
	Other cattle	No.			
	Physical items	**Unit**	**Total**		
	Bicycle	Pcs			
	Motor cycle	Pcs			
	Car/truck	No.			
	Mobile phone	Pcs			
	Radio	Pcs			
	TV	Pcs			
	Irrigation pump	Pcs			
	Fridge	Pcs			
	Grinding mill (for grain)	Pcs			
	Bajaj	pcs			
	Wagen(cart)	Pcs			
	Total Arable land (owned)	**hectare**			

PART 6: INCOME

Income sources in 2002 (E.C) [*Exclude income from potato production*].

Income source	**Form of income 1=cash 2=kind**	**Quantity**	**Value per unit in Birr**	**Total Income received birr**
Remittance income from family members				
Assistance from				

relatives or friends				
Sale of animals and animal products				
Income from other off-farm activities like sale of purified water, sale of beverages, sale of firewoods,etc				

Income from other farm activities (*excluding* income from potatoes)

Crop type	**Season**	**Amount produced in quintals**	**Amount sold in quintals**	**Unit price in birr**	**Total value sold in birr**
	1st season				
	2nd season				
	1st season				
	2nd season				
	1st season				
	2nd season				
	1st season				
	2nd season				
	1st season				
	2nd season				
	1st season				
	2nd season				

6. What is the total land size you have for farming (i.e both owned and rented)?

	In possession/ under command (in hectares)	**Used for farming ?(in hectares)**
Owned		
Rented-in		
Total		

7. What is the total land size you rent out (in hectares)?

8. How much do you earn from this rent per year (in birr)?

PART 9: Potato production and sales in 2002 (E.C) (consider production and sale of potatoes in both owned and rented land)

Variety	Season(please state the month for which each season applies)	Amount produced in quintals (owned)	Amount sold in quintals (owned)	Amount produced in quintals (rented)	Amount sold in quintals (rented)	Unit Price in Birr	Total value for the sold amount(in birr)	Where sold (e.g, at farm level to a trader, local market, etc)
Agazer (white)	1st season							
	2nd season							
Nechi Ababa	1st season							
	2nd season							
Key Dinich (Shul)	1st season							
	2nd season							
Key Ababa (China)	1st season							
	2nd season							
Gudane	1st season							
	2nd season							
Jallenee	1st season							
	2nd season							
Bule (red round)	1st season							
	2nd season							

PART 15: AGRICULTURAL MARKETS

9. ***From whom or from which organization do you primarily obtain price information?_____***

   a. Other farmers b. Wholesalers c. Neighbours d. Unions e. co-operatives f. processors g. personal observation h. family and friends i. public sector j. middlemen k. Radio l. Newspaper m. Do not obtain price information n. others (Specify)_____

10. ***From whom or from which organization do you primarily obtain other market information like input provision and market outlets?_____***

   a. Other farmers b. Wholesalers c. Neighbours d. Unions e. co-operatives f. processors g. personal observation h. family and friends i. public sector j. middlemen k. Radio l. Newspaper m. Do not obtain price information n. others (Specify)_____

PART 16: RISK IN AGRICULTURE

Section 1. Major types of risks faced by households

Types of risks	Chance s of		Sev erit

	occurrence						y of consequences				
	1=Very unlikely	2= Unlikely	3= sometimes	4=likely	5=Very likely		1=Very mild	2 = mild	3=Somehow serious	4= serious	5=Catastrophic
Production risk											
Crop failure											
Bad weather											
Incidence of pests											
Incidence of diseases											
Other natural hazards											
Market risk											
Unreliable market for inputs											
Unreliable market for output											
Inability to predict prices of input and output before making decisions on how much input to buy and output to sell											
Institutional risks											
Land redistribution											
Increase in tax											
Human risks											
Death of head of household and people who work in the farm											

Divorce of husband and wife owning the farm in partnership											
Prolonged and serious illness of people who work in the farm and household head											
Carelessness of the people who work in the farm											
Financial risk											
Difficulty in paying borrowed money											
Difficulty in ensuring collateral											
Unavailability of loan when needed											

Section 2: What kind of measures have you been taking to reduce the incidence and effects of the risks mentioned above?

a. Selling off productive assets like livestock and other assets to smooth consumption

b. b. Planting low yielding but rapidly maturing varieties to reduce crop failure

c. Practising irrigation instead of depending only on rain-fed agriculture

d. Using pesticides and fungicides

e. Doing different types of activities including off-farm activities instead of specializing only on potato production

f. Engaging in contracts like share cropping

g. Sending family members elsewhere to generate more income

h. Saving

j. Others

PART 16 Section 3:
Risk in crop cultivation

With respect to potato and the 3 other most important crops, we would like to ask about the expected yields in the next two seasons under normal conditions, under bad or adverse conditions, and under good conditions.

Table 1 YIELDS OF CROPS UNDER NORMAL, GOOD AND BAD CONDITIONS

Potato and 3 other crops		Annual crops									
1 Name of crop	2 Unit of measurement of production	What yield would you expect in the next season under 3 conditions			6 Area to which the yield refer	7 Unit of measurement of area	What yield would you expect in the season after the next season under 3 conditions			11 Area to which the yield refer	12 Unit of measurement of area
		3 normal	4 good	5 bad			8 normal	9 good	10 bad		
Potato											

Table 2. PRICES OF CROPS UNDER NORMAL, GOOD AND BAD CONDITIONS

Potato and 3 other crops		Annual crops					
1 Name of crop	2 Unit to which the price refers	What price do you expect in the next season under 3 conditions			What price do you expect in the season after the next season under 3 conditions		
		3 Normal	4 good	5 bad	6 Normal	7 good	8 bad
Potato							

PART 16 Section 4: Risk aversion measurement

Please indicate the extent to which you agree with the following statements. ***Positive responses for the following questions indicate that the respondent is more risk averse.***

	1= Totally disagree	**2=Disagree**	**3= Neutral**	**4= Agree**	**5. Totally agree**
I engage in growing different types of crops instead of specializing only in one type of crop					
I usually store some of the harvest and sell them later on during the year when price increases					
I usually have oral/written contracts with my buyers before I sell my products					
I participate in food for work and safety net programs					
I usually save some amount of money					
I invest in off-farm activities like selling handicrafts, selling firewood, selling beverages, etc					

3. Cross-Tabulation for the correlation between the variables included in RQ 1 and in RQ 3

Crosstab

			DcoopMembership		
			non member	member	Total
InfoAvailable	Incomplete information	Count	41	67	108
		% within InfoAvailable	38,0%	62,0%	100,0%
		% within DcoopMembership	67,2%	79,8%	74,5%
		% of Total	28,3%	46,2%	74,5%
	Complete Information	Count	20	17	37
		% within InfoAvailable	54,1%	45,9%	100,0%
		% within DcoopMembership	32,8%	20,2%	25,5%
		% of Total	13,8%	11,7%	25,5%
Total		Count	61	84	145
		% within InfoAvailable	42,1%	57,9%	100,0%
		% within DcoopMembership	100,0%	100,0%	100,0%
		% of Total	42,1%	57,9%	100,0%

Crosstab

			DcompleteMktSpec		
			no	yes	Total
InfoAvailable	Incomplete information	Count	34	74	108
		% within InfoAvailable	31,5%	68,5%	100,0%
		% within DcompleteMktSpec	79,1%	72,5%	74,5%
		% of Total	23,4%	51,0%	74,5%
	Complete Information	Count	9	28	37
		% within InfoAvailable	24,3%	75,7%	100,0%
		% within DcompleteMktSpec	20,9%	27,5%	25,5%
		% of Total	6,2%	19,3%	25,5%
Total		Count	43	102	145
		% within InfoAvailable	29,7%	70,3%	100,0%
		% within DcompleteMktSpec	100,0%	100,0%	100,0%
		% of Total	29,7%	70,3%	100,0%

Crosstab

			DincompleteMktSpec		
			no	yes	Total
InfoAvailable	Incomplete information	Count	89	19	108
		% within InfoAvailable	82,4%	17,6%	100,0%
		% within DincompleteMktSpec	71,2%	95,0%	74,5%
		% of Total	61,4%	13,1%	74,5%
	Complete Information	Count	36	1	37
		% within InfoAvailable	97,3%	2,7%	100,0%
		% within DincompleteMktSpec	28,8%	5,0%	25,5%
		% of Total	24,8%	0,7%	25,5%
Total		Count	125	20	145
		% within InfoAvailable	86,2%	13,8%	100,0%
		% within DincompleteMktSpec	100,0%	100,0%	100,0%
		% of Total	86,2%	13,8%	100,0%

Crosstab

			DincompleteResource		
			no	yes	Total
InfoAvailable	Incomplete information	Count	103	5	108
		% within InfoAvailable	95,4%	4,6%	100,0%
		% within DincompleteResource	76,3%	50,0%	74,5%
		% of Total	71,0%	3,4%	74,5%
	Complete Information	Count	32	5	37
		% within InfoAvailable	86,5%	13,5%	100,0%
		% within DincompleteResource	23,7%	50,0%	25,5%
		% of Total	22,1%	3,4%	25,5%
Total		Count	135	10	145
		% within InfoAvailable	93,1%	6,9%	100,0%
		% within DincompleteResource	100,0%	100,0%	100,0%
		% of Total	93,1%	6,9%	100,0%

Crosstab

			DviaMiddleman		
			no	yes	Total
InfoAvailable	Incomplete information	Count	42	66	108
		% within InfoAvailable	38,9%	61,1%	100,0%
		% within DviaMiddleman	73,7%	75,0%	74,5%
		% of Total	29,0%	45,5%	74,5%
	Complete Information	Count	15	22	37
		% within InfoAvailable	40,5%	59,5%	100,0%
		% within DviaMiddleman	26,3%	25,0%	25,5%
		% of Total	10,3%	15,2%	25,5%
Total		Count	57	88	145
		% within InfoAvailable	39,3%	60,7%	100,0%
		% within DviaMiddleman	100,0%	100,0%	100,0%
		% of Total	39,3%	60,7%	100,0%

Crosstab

			Ddirectly		
			no	yes	Total
InfoAvailable	Incomplete information	Count	81	27	108
		% within InfoAvailable	75,0%	25,0%	100,0%
		% within Ddirectly	76,4%	69,2%	74,5%
		% of Total	55,9%	18,6%	74,5%
	Complete Information	Count	25	12	37
		% within InfoAvailable	67,6%	32,4%	100,0%
		% within Ddirectly	23,6%	30,8%	25,5%
		% of Total	17,2%	8,3%	25,5%
Total		Count	106	39	145
		% within InfoAvailable	73,1%	26,9%	100,0%
		% within Ddirectly	100,0%	100,0%	100,0%
		% of Total	73,1%	26,9%	100,0%

4. Propensity Score Matching

I used a logistic regression to get the propensity scores. The model I used is the model in RQ2, after applying the Log-Likelihood ratio tests:

$$Y = \beta_1 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + \beta_{14} X_{13} + \varepsilon_i$$

Y= cooperative membership
X_3= experience in potato cultivation
X_4= experience in agriculture
X_5= total wealth
X_6,X_7=dummy education (primary & secondary education)
X_{13}= dummy secondary activity (cattle breeding or other)

Using the function "pivot table" in Excel I obtained the means and the frequencies (for the dummy variables) of the above independent variables. Using t-tests I could see whether there was a significant difference in those variables between members and non-members of the cooperative. I then compared the propensity scores of member and non-member farmers, with propensity scores that had a difference in standard deviation <0,05. I could pair up 68 households in 34 pairs. At this point I calculated again the means and frequencies using the "pivot table" function in Excel. The t-test showed after the matching that there was no significant difference in the independent variables' means showing that the matching was successful. At this point I looked at the margin, before and after the matching and I saw that both before and after the matching it was significantly different between members and non-members. Members have a margin 47% higher than non-members after the matching.

Example of the matching

Propensity Scores	Match	Standard Deviation
0,19996	0	
0,30726	1	0,005