Modern supply chains, social networks, and income effects among blackberry farmers in the Ecuadorian Andes

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Nico Kurt Herforth,
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1. Referentin/Referent: Prof. Dr. Ludwig Theuvsen

2. Korreferentin/Korreferent: Jun.-Prof. Dr. Meike Wollni

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SUMMARY

Over the past two decades, agrifood markets in developing countries have undergone structural changes from the consumption of food staples towards growing demand for fresh fruits and vegetables (FFV) and processed food with higher safety and other quality attributes. Agribusiness firms operating in these markets have reacted to these structural changes with a modernization of their procurement practices leading to the transformation or placement of new modern supply chains. The particular feature of these modern supply chains as compared to traditional ones is the more explicit coordination of vertical supply relationships through lead firms with upstream supply chain actors. These vertical coordination mechanisms specify how, how much, in what quality, and when agricultural products are to be produced and delivered aligned to the demands of the companies governing agrifood supply chains. As supply chain modernization in agricultural product sectors gains importance, farmers face changing market and supply conditions for their agricultural outputs. On the one hand, it is widely believed that modern supply chains offer broader and more beneficial marketing opportunities to farmers. The benefits farmers may achieve include higher prices, risk reduction, or better access to farm inputs and extension services. On the other hand, it is argued that particular types of farmers may face high barriers to participate in these chains as they may lack the technical, managerial, and organizational abilities necessary to meet the more complex requirements of modern agribusiness firms.

The present dissertation builds upon this background and analyzes various implications of farmers' exposure to modern supply chains. This dissertation comprises three main parts. First, we review the conceptual approaches cluster and global value chain (GVC) that originate from the field of development studies. Both are useful tools to study firm relationships, competitiveness and industrial organization along modern agrifood supply chains in developing countries. We emphasize the potential of linking these approaches to more comprehensively assess the development implications of modern supply chains in developing countries. Second, we explore factors that influence farmers' participation in modern supply chains. Previous research has mainly focused on a household and farm level perspective in order to elucidate patterns of participation among farmers. We advance this understanding and include a social network dimension to the existing empirical knowledge base. The specific objective of the second part is to scrutinize whether individual farmers' social networks matter for their integration in modern supply chains. Third, we assess the impact of modern supply chain participation on different income specifications. The study in this dissertation contributes to this debate deviating from previous research in the specific setting, i.e. the prevalence of verbal agreements as more flexible types of vertical coordination mechanisms compared to contracts in prior studies, and the peri-urban study setting which creates more options to farmers for different income generating activities.

We combine a number of research methods in order to address these research objectives. For the first part, we rely on a comprehensive literature review. The analysis in the second and third section is based on original survey data that we collected from 364 blackberry farmers in the Ecuadorian highlands.

Our findings are as follows: for the first part, we show that cluster and global value chain (GVC) concepts are useful tools to study firm relationships and industry organization in the agricultural sector of developing countries. We present evidence from a cluster in the wine sector of Chile and the snow peas value chain in Guatemala and argue that despite of their respective strengths, conceptually and empirically linking cluster and GVC analysis can help to overcome their individual shortcomings and to more comprehensively assess developing country agrifood sectors and their implications for smallholder farmers.

The key finding in chapter two is that farmers' individual social networks indeed affect farmers' participation in modern supply chains. We differentiate between two specifications of social network. First, we estimate the endogenous social network effect measured through the number of farmers already supplying to modern supply chains in the individual farmers' social network. Our results demonstrate that the social network size has a positive and significant effect on the probability that the farmer participates in modern chains. Second, we computed an exogenous social network index (SNI) to take account of the multidimensionality of social networks. We find that the SNI has a positive and highly significant effect on participation. Another important finding of our study is that farm size and farm technology does not matter for participation which in many previous studies have been identified as the main determinants of participation. The reason for this is that the blackberry farm sector in this study is homogenously composed of a large number of small farmers which implies that agrifood companies must source from small farmers. Another rationale refers to the specific technology which farmers apply to cultivate blackberries. Blackberry cultivation practices in the Ecuadorian Andes are typically very labor-intensive which implies that endowment with specific agricultural assets is not a major barrier to entering modern supply chains. Companies procuring blackberries also do not demand such investments from their farmer suppliers. Furthermore, our study confidently shows that older, more educated, late adopters of blackberry and farmers also marketing other FFV are more likely to participate.

In the third part, we investigate income effects of modern supply chain participation. We conclude with a number of unexpected findings. First, as a starting point, we compare profitability defined as net blackberry income between farmers participating in modern supply chains and their counterparts, i.e. farmers participating exclusively in traditional supply chains. The results suggest that traditional chain participants have a significantly higher net blackberry income which is inconsistent with the vast majority of previous studies that identified at least a modest positive gain from modern supply chain participation. This outcome is mainly driven by lower blackberry production

costs and higher sales volumes of traditional marketing channel participants. Second, we analyze the composition of household income by marketing channel and find that modern supply chain farmers earn a significantly higher household income than the comparison group. This finding, however, is not a cause of modern supply chain participation as previous research predicts, but a result of a different income diversification strategy. Blackberry farmers with access to modern supply chains are able to generate an off-farm income which is about two times that of the control group. Third, we use different regression and impact evaluation techniques, such as ordinary least squares (OLS) and propensity score matching (PSM) to more precisely measure and isolate the effect of modern supply chain participation on incomes. The results suggest – conditional on model specification – a neutral or negative effect on blackberry and household income. We conclude that selling to modern markets alone is not a panacea for raising incomes of farm households. The specific agronomic, supply chain and incentive conditions have to be met in order for modern supply chain participation to bear fruit.

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As I am writing these lines I am on a very good way to finish my PhD that I have started in April 2011. Four very intense, but enriching years lie behind me in which I was able to (mostly) successfully overcome the scientific, methodological, psychological, emotional challenges that I faced during my PhD. Support, advice and encouragement of a lot of people have been very critical for this achievement.

First, I am sincerely grateful to my first supervisor, Prof. Dr. Ludwig Theuvsen, for choosing me among a great number of applicants to join the Research Training Group (RTG) GlobalFood. Right from the start, Ludwig has put a lot of trust in me and my work. Working together with Ludwig has helped me a lot to develop an 'outside of the box' thinking and the creation of a critical mind about what good research actually means and how it should be measured. Prof. Theuvsen has shown flexibility and willingness to compromise on the choice of my research topic. Being able to pursue my personal research interests which not necessarily laid in the research directions of his working group should not be taken for granted. I am very thankful for this opportunity and for the support and guidance throughout! I would also like to thank my second supervisor Jun.-Prof. Meike Wollni. I got to know Meike already during the first GlobalFood Symposium in May 2011, when we first discussed about possible collaboration. This collaboration has evolved and continues till today. Even beyond research, Meike always had an open ear for any kind of problem that I came up with. Thanks also go to Prof. Bernhard Brümmer for serving as the third member of my thesis committee.

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In recent years, I was extremely privileged to be able to visit a number of beautiful countries in the world for work and travel purposes. I was very excited to get to know Ecuador, as it was the first time that I travelled to Latin America. I was not disappointed: it was the warmth, patriotism, cultural diversity and hospitality of the Ecuadorian people that touched me and made me feel comfortable throughout. The rich intercultural experiences I gathered were priceless. I returned home to Germany with a suitcase full of wonderful memories and impressions.

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ABBREVIATIONS

ATT	Average treatment effect on the treated
BDH	Bono de desarrollo humano
CI	Conditional independence
CIA	Conditional indepencence assumption
FFV	Fresh fruits and vegetables
GVC	Global value chains
INIAP	Instituto Nacional de Investigaciones Agropecuarias
KM	Kernel matching
KMO	Kaiser-Meyer-Olkin
MAGAP	Ministerio de Agricultura, Ganadería, Acuacultura y Pesca
MSC	Modern supply chain
NNM	Nearest neighbor method
OLS	Ordinary least squares
PCA	Principal component analysis
PI	Participation intensity
PMCA	Participatory market chain approaches
PS	Propensity scores
PSM	Propensity score matching
RTG	Research Training Group
SN	Social network
SNI	Social network index

1 GENERAL INTRODUCTION

1.1 The role of agriculture for poverty reduction

Nowadays, some 700 million people worldwide live in extreme poverty (UNDP, 2014), the majority in rural areas depending on agriculture for their livelihoods. Agricultural development is therefore often considered a key strategy by policy-makers, researchers, and the development community to alleviate poverty and to work toward meeting the Millennium Development Goals (World Bank, 2007). Agriculture has not always played such a central role. In recent decades, rural development paradigms have undergone significant shifts from modernization, state intervention, and market liberalization to notions of participation and empowerment (Ellis & Biggs, 2001). Much of this development thinking - in particular the structural adjustment policies in the 1980s in accordance with the Washington Consensus - has neglected the needs and constraints of the many farmers that are at the heart of the agricultural sector in developing countries (Barrett et al., 2011).

Since the turn of the millennium, the central and multiple role of agriculture for development and sustainable growth has been widely acknowledged and strengthened by governments, researchers and the development community (De Janvry, 2010). Special emphasis has been placed on the micro-level (Barrett et al., 2011) and the role of farmers that are severely affected by recent developments and trends in the agricultural sector towards rising "globalization, integrated value chains, rapid technological and institutional innovations and environmental constraints" (Byerlee, De Janvry, & Sadoulet, 2009, p. 15). One of the priority areas of the agriculture for development paradigm is the integration of farmers into different agrifood markets. Among the various markets in which farmers can sell their agricultural outputs, the emergence of high-value market has gained growing attention as a potentially profitable marketing opportunity (World Bank, 2007). The structural changes in agricultural markets that have led to the emergence of high-value markets are more explicitly addressed in the following chapter.

1.2 Transformation of global agrifood systems

Agrifood systems in developing countries have been undergoing fundamental changes since the midst of the 20th century. These changes can be divided into three phases that differ according to the affected segment in a value chain.

In the early phase (1960s until late 1990s), market liberalization policies in developing countries have led to consolidation, multinationalization, and specialization of formerly public wholesale marketing systems. The second phase from the 1970s until 1990s involved deep changes in the agro-processing sector. The privatization of large-scale parastatal processors as a result of market

liberalization implied a consolidation and multinationalization of the agro-processing sector (Wilkinson, 2004).

The third stage (since 1990s) is concerned with the transformation of the retail sector and the spread of fast-food chains. Early pioneers excited about this observation have exuberantly debated about a 'supermarket revolution' that would unfold in the developing world (Reardon, Barrett, Berdegué, & Swinnen, 2009; Reardon, Timmer, Barrett, & Berdegué, 2003). The emergence of modern retail formats is associated with a shift in consumer demands from staple foods towards higher quality and safer fresh produce, semi-processed and processed food products (Reardon, Barrett, Berdegué, & Swinnen, 2009). For example, between 1981 and 2005 food consumption expenditures in Indonesia augmented for meat, fish and dairy products, fruits and vegetables, while expenditures for traditional food staples, such as cereals and tubers shrank (World Bank, 2007).

There is a set of demand- and supply-side drivers which have triggered this change in consumer demands. On the demand side, income and population growth in developing countries has led to rising demand for non-staple food products and increasing ownership of cars and refrigerators which favors the purchase of high-value and processed products from modern retailers (Reardon & Berdegué, 2002). In addition, rising urbanization rates especially among young people have broadened the potential consumer base of supermarkets and exposed consumers to global diets and lifestyles (World Bank, 2007). The entry of women into labor markets reduced time availability for home cooking at the expense of purchasing convenience and processed food (Reardon, Timmer, Barrett, & Berdegué, 2003).

On the supply side, market liberalization policies in developing countries have promoted foreign direct investments (FDI) targeting the agro-processing and retail sector in order to offset saturating demand and fierce competition in the investors' host economies. Trade liberalization policies have facilitated imports of food products in the developed world. Innovations in retail logistics technology and inventory management have facilitated the introduction of private quality standards and norms for agricultural products (Reardon, Timmer, Barrett, & Berdegué, 2003). As a result, supermarkets have become a major format of the retailing landscape in most parts of the developing world that may reach up to 60 percent of food retail sales in some Latin American countries (World Bank, 2007).

The restructuring of agrifood markets in developing countries have raised important questions about the implications for the farm sector and downstream stages in supply chains. An analysis of these effects requires consideration of the changes in firms' procurement for agricultural produce that were undertaken as a reaction to the changes in consumer demands. According to Biénabe, Berdegué, and Peppelenbos (2011), the reorganization of procurement practices encompasses three elements: i) the proliferation of private standards, ii) a shift from spot-market transactions to verti-

cal coordination mechanisms (e.g. contracts) and iii) the establishment of centralized distribution systems. These changes are commonly referred to as the modernization of agrifood supply chains which involves new and more complex sets of requirements related to quality, quantity and consistency of agricultural produce and timeliness of supplies. This necessitates adjustments of farm management with regard to cultivation, harvest, post-harvest or marketing practices which might pose major challenges for farmers.

1.3 Problem statement

The modernization of supply chains refers to a systematic adjustment and reorganization of procurement practices for agricultural produce carried out by modern retailers and agro-processors that govern agrifood supply chains in developing countries (Biénabe, Berdegué, & Peppelenbos, 2011; Reardon, Timmer, Barrett, & Berdegué, 2003). Modern procurement practices entail a priori reached agreements on quality, quantity and consistency of agricultural produce and timeliness of supplies that are coordinated by verbal agreements or written contracts. This has placed new and more complex demands on those farmers who cultivate and sell agricultural produce under these altering market conditions (Reardon, Barrett, Berdegué, & Swinnen, 2009).

Advocates of the modernization of supply chain paradigm tend to highlight the broader and more profitable marketing opportunities for farmers that are associated with more favorable prices or better access to farm inputs and agricultural extension services. This has positive implications for farm profitability, productivity, and poverty reduction (Miyata, Minot, & Hu, 2009; Rao & Qaim, 2010). On the other hand, concerns have been raised about the extent to which certain types of farmers, such as smallholder or asset-poor producers, might become excluded from these emerging marketing channels (Reardon, Barrett, Berdegué, & Swinnen, 2009). From a development perspective, it is therefore of high relevance to understand who these farmers are that decide to participate in modern supply chains, and how they were are able to respond to these structural changes in market conditions that may have consequences for farm profitability, poverty outcomes, and wider rural development perspectives.

Against this background, an extensive body of literature has examined the determinants of farmers' participation in modern supply chains. The major part of this discussion has been centered on smallholder farmers who might be excluded due to their inability to provide the necessary volumes (Stringer, Sang, & Croppenstedt, 2009). The empirical evidence on the role of smallholder farmers is much more mixed than widely believed (e.g. Escobal & Cavero, 2011; Hernández, Reardon, & Berdegué, 2007). A possible strategy for smallholder farmers to compensate for missing individual economies of scale is to engage in collective marketing activities by forming farmer groups (Moustier, Thi Giac Tam, The Anh, Trong Binh, & Thi Tan Loc, 2010). Likewise, the role of agricultural assets has been emphasized as a major determinant of modern supply chain participation.

Ownership of irrigation systems and other more capital-intensive farm technologies can support farmers to produce year-round and consistent produce that can help farmers to meet the requirements of the modern food industry (Escobal & Cavero, 2011; Berdegué, Hernández, & Reardon, 2008). The geographic location of farmers also matters for integration in modern supply chains. For example, Berdegué, Hernández, and Reardon, (2008) find that the distance of farmers' homestead to agro-processing plants negatively affects participation in these marketing channels. Previous research has mainly considered household- and farm-level differences in order to explain patterns of modern supply chain participation among farmers. Common sense and scientific evidence suggests that participation in these chains may not only be the result of an individual decision but also depend on the behavior of social network members. For example, Matuschke and Qaim (2009) and Bandiera and Rasul (2006) find a positive relationship between the seed adoption decision of farmers and the adoption decision of their network members. Other empirical evidence demonstrates that social networks can play an important role for access to credit (Wydick, Hayes, & Kemp, 2011) and for participation in non-farm employment (Mano, Yamano, Suzuki, & Matsumoto, 2011).

The number of studies that investigate the economic impacts of modern supply chain participation is growing. The vast majority of researchers seem to have an optimistic view on these impacts; the underlying impact pathways are not fully understood. In some studies, prices in modern supply chains are highly superior to those in traditional chains, and therefore often create an important incentive to participate (Escobal & Cavero, 2011; Neven, Odera, Reardon, & Wang, 2009). Other studies attribute these effects to higher crop yield and production volumes that are obtained by an intensification of production practices which can compensate for almost equal prices paid in modern and traditional channels (Hernández, Berdegué, & Reardon, 2012). A closer look at available impact assessments of modern supply chain participation suggests applying a more nuanced view on the overly generalized positive effects. Hernández, Reardon, and Berdegué (2007), Schipmann and Qaim (2010), and Narayanan (2014) find that selling agricultural produce to differentiated marketing channels does not necessarily imply positive income gains.

1.4 The case of blackberry in Ecuador

For the purpose of this study the blackberry sector in Ecuador was chosen, because the cultivation and marketing of blackberries is an important livelihood strategy for a large number of farmers. Blackberry products are traditionally highly appreciated by Ecuadorian consumers and have experienced growing demand in the national market. The organization of the blackberry sector further allows sufficient variation in marketing channels that is crucial for the design of this study. The blackberry sector is characterized by modernizing supply chains coordinated by supermarkets and agro-processors that compete with a variety of traditional market segments. It thus serves as a rea-

sonable example for the rise of high-value markets in developing countries and the induced changes in market conditions.

Blackberry plants originate from cold and moderately warm climates of the Andean mountains in Ecuador and Colombia from where it was much later introduced to Guatemala, Panamá and México. The latter is today the biggest exporter of the fruit (INIAP, 2010). The Ecuadorian Andes offer the necessary agro-climatic growing conditions for cultivating blackberries. These include reliable precipitation of 600-800 mm per year, an average temperature between 12 and 13°C that can be found in elevations of 2,400-3,100 m. These favorable conditions allow a year-round production of blackberries. The major blackberry cultivation areas in Ecuador are situated in the inter-Andean valley which comprises nine provinces (INIAP, 2008).

Table 1 presents statistics on blackberry production in Ecuador gathered from the most recent agricultural census executed in 2000. The total national area under blackberry cultivation amounts to 5,247 ha distributed over 14,700 blackberry producers. The sector is thus dominated by small-scale farmers that produce blackberry on 0.38 ha on average.

Table 1. Regional distribution of blackberry production in Ecuador

Provinces	Growers	Area cultivated (ha)	Farm size (ha)	Output (t)	Yield/ha (t)
Bolívar	1,211	1,199	0.99	1,491	1.24
Tungurahua	9,665	2,223	0.23	4,715	2.12
Imbabura	193	79	0.41	67	0.85
Cotopaxi	2,193	1,360	0.62	5,072	3.73
Chimborazo	339	132	0.39	91	0.69
Pichincha	138	62	0.45	75	1.21
Azuay	960	192	0.20	266	1.39
National	14,699	5,247	0.38	11,777	2.25

Source: MAGAP (2014)

The cultivation of blackberry is geographically concentrated in the inter-Andean valley. The three central Andean provinces Tungurahua (2,223 ha), Cotopaxi (1,360 ha) and Bolívar (1,098 ha) alone already account for nearly 90% of the national blackberry area under cultivation. Our study region Tungurahua is by far the most important. 68% of all blackberry farming households and 42.4% of the area under blackberry cultivation can be found in this province. Blackberry is commonly combined with the cultivation of a wide range of other fruits and vegetables.

1.5 Research objective and outline

The aim of this dissertation is to contribute to the scientific discussion on the modernization of agrifood supply chains in developing countries and the socio-economic implications for farmers.

More specifically, we address the following three objectives:

1. To theoretically and conceptually review cluster and global value chain (GVC) approaches and integrate their application to the agrifood sector.
2. To analyze the determinants of modern supply chain participation with special focus on the role of social networks.
3. To analyze the impacts of modern supply chain participation on various income indicators.

The first paper builds on an extensive literature review. The objectives two and three correspond to the second and third paper that form the core part of this dissertation. These are based on empirical data that was collected in Ecuador between December 2012 and April 2013.

The dissertation is structured as follows: chapter 2 presents the first paper titled "Cluster and Global Value Chains: conceptual approaches and case-study evidence of the agri-food sector". It aims at integrating cluster and global value chain approaches. Chapter 3 titled "Understanding participation in modern supply chains under a social network perspective – evidence from blackberry farmers in the Ecuadorian Andes" discusses the role of social networks for farmers' participation in modern supply chains. Chapter 4 presents the results of the impact evaluation of participating in modern supply chains on incomes. This paper is titled "Income effects of modern supply chain participation – the case of blackberry farmers in the Ecuadorian Andes". Chapter 5 summarizes the main findings and concludes with implications for managers and policy-makers and presents prospective research directions.

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2 CLUSTER AND GLOBAL VALUE CHAINS: CONCEPTUAL APPROACHES AND CASE-STUDY EVIDENCE OF THE AGRI-FOOD SECTOR[1]

Abstract. The cluster and global value chain (GVC) concepts have been widely applied to study firm-relationship and industry organization in developing countries in order to infer implications for competitiveness and poverty reduction. In this article, we explain and review the evolution of these two notions against the background of the agri-food sector by presenting case-study evidence from the wine sector in Chile and snow peas value chain Guatemala. We argue that despite of their strength, conceptually and empirically linking cluster and GVC analysis can help to overcome their individual shortcomings and to more comprehensively assess development implications. Further research is needed to combine these two salient concepts in the context of the agricultural sector in developing countries.

Keywords. Clusters, global value chains, poverty reduction strategies, Chile, Guatemala

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2.1 Introduction

Global agri-food systems are experiencing a profound transformation towards growing demand for high-value agricultural products in developing and developed countries, trade liberalization of agricultural products, more stringent food safety and quality requirements, and intensified vertical coordination exercised by global lead firms (Reardon, Barrett, Berdegue, & Swinnen, 2009). There is a considerable debate on whether these developments include or exclude developing country firms' from participating in emerging export supply chains that offer new and attractive marketing opportunities (Henson & Reardon, 2005; Henson, Masakure, & Boselie, 2005; Hernández, Reardon, & Berdegue, 2007; JaVee & Masakure, 2005; Maertens & Swinnen, 2009; Maertens, 2009).

An emerging business concept that can help developing country firms to enhance their competitiveness, to access export markets and thus to link to remunerative global agricultural value chains is clusters (FAO, 2010). Initially applied to developed countries, the cluster concept was lately introduced into a developing country context (FAO, 2010; Humphrey & Schmitz, 2000). Cluster research is used to analyze the *local* sources of competitiveness that emanate from spatial proximity of inter-related firms by identifying joint action and local external economies benefits (Nadvi, 1999). Dynamic clusters often participate in export markets and are thus integrated into value chains driven by global lead firms. The global value chain (GVC) concept enables to analyze the degree of vertical coordination pursued by global buyers and thus the type of chain governance the cluster is exposed to. This has significant implications for local development and local firms, where clusters are inserted global value chains (Humphrey & Schmitz, 2000).

Hence, the objective of this paper is first to conceptually describe the concepts cluster and global value by shedding a light on their commonalities and differences. Second, we call for the necessity to link these two concepts, where clusters are integrated into GVC and provide theoretical and empirical evidence. The remainder of the paper is organized as follows: section 2 will introduce and critically review the main concepts of this paper, cluster and global value chains. The subsequent section is concerned with possibilities on how to link the two concepts. The fourth section provides some empirical evidence on clusters and global value chains in the agri-food sector of developing countries by presenting case-studies from Chile and Guatemala. The paper closes with concluding remarks and directions for further research in section 5.

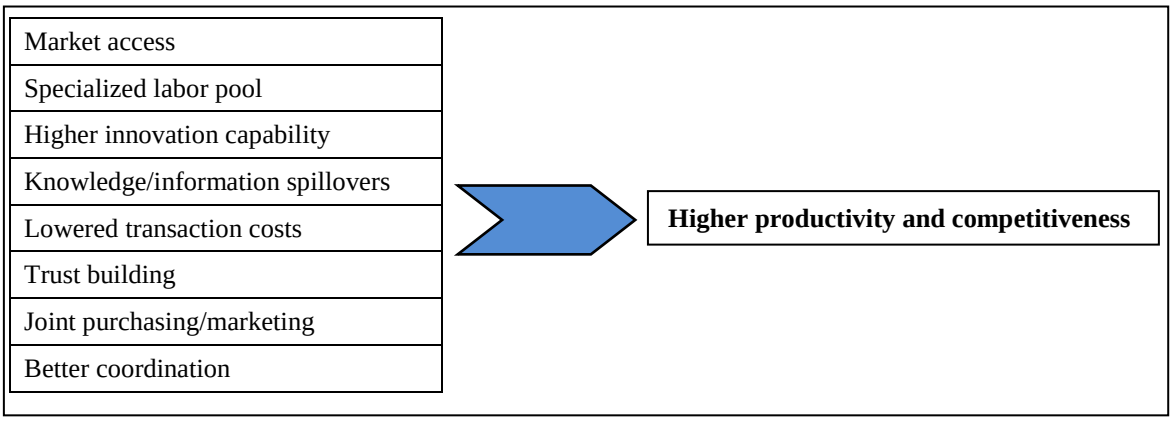
2.2 A review of cluster and global value chain research

2.2.1 Clusters – local panacea or fuzzy concept?

Since the beginning of the 1990s cluster is a well-known term among scholars and policy-makers. At this point, Michael Porter (1990) as the most influential representative examined determining

factors for location competitiveness in his milestone 'The competitive advantage of Nations'. He found that the world map is dominated by specific regions with unprecedented economic success in specific industrial subsectors like the shoe industry in Italy, the high-tech-industry in the Silicon Valley or the automobile industry in Southern Germany. Porter termed these peculiar spatial agglomerations clusters and defines them as a "geographic concentration of interconnected companies and institutions in a particular field" (Porter, 1990). Interconnected companies are complementarily engaged in providing a related product or group of products or services and create value networks. Companies can range from producers, specialized suppliers to processors and service providers. Therefore, clusters can be seen as a special form of the spatial organization of a value chain in which interconnected firms are spatially concentrated (Porter, 1998). In his theoretical framework, Porter argues that clustered firms reach a higher level of firm performance and competitiveness as compared to firms that are not clustered (Porter, 2000). The driving force for this is mainly seen in the firms' higher productivity (Ketels & Memedovic, 2008). Determining factors that enable higher productivity stem from advantages inherent in clusters summarized in figure 1.

Figure 1. Theoretical cluster advantages as drivers for higher productivity



Sources: Ketels & Memedovic (2008); McCormick (1999); Porter (2000); Schmitz & Nadvi (1999b)

The cluster concept is, however, not an entirely new phenomenon. Its roots date back to Alfred Marshall (1890), who found that spatially concentrated firms in the textile and metalworking regions of England, Germany and France enjoy local external economies like knowledge and technology spillovers or a pool of specialized workforce. Moreover, Adam Smith (1904) looked into the specialization of firms on a single stage of the production process, which also predominates in clusters. His study reveals that firms specialized on only one stage of the production process obtain economic gains. Another important theoretical argument in favor of clusters is its link to the endogenous growth model developed by Romer (1986). Romer integrated innovation capability and knowledge spillover in the model as the key determinants for economic growth. Consequently, it is possible to consider clusters which enhance innovation capability and knowledge spillover as engines for regional growth.

Over the last three decades the ideas of Marshall and other influential scientist were rediscovered by numerous scholars, who build up a substantial body of cluster literature (Kukalis, 2010). This enthusiasm aroused in a wide array of scientific disciplines such as economic geography, business economics or development studies (Humphrey & Schmitz, 2000). Initially, cluster research was mainly focused on the industrial sectors of *developed countries* (FAO, 2010; Schmitz & Nadvi, 1999b). At a later point, however, the cluster model became increasingly popular among development researchers and practitioners. Hence, a special issue of World Development (Humphrey, 1995) was devoted to applying the successful European industrial district model to *developing countries*. As compared to clusters, the industrial district concept stronger highlights the importance of horizontal inter-firm networks and institutions (Bair & Gereffi, 2001). A research agenda entirely devoted to industrial clusters in developing countries lead to another special issue in World Development in 1999 (Schmitz & Nadvi, 1999a).

So far, this paper did not address the question why clusters matter in the context of developing countries and poverty reduction. Although being a relatively underdeveloped topic, the literature points to a number of reasons for this. Primarily, the positive relationship between clusters and poverty reduction can be understood from direct impacts through a private sector development (PSD) perspective. Cluster theory assumes that clustered firms are more competitive and can achieve a higher level of firm performance than isolated firms. This in turn fosters growth prospects for those firms. It is implicitly assumed that such growth will lead to rising levels of employment and incomes for the poor. In addition, vibrant clusters can ease the access to global markets and can thus offer prospects for higher export earnings and the acquisition of technology and knowledge through global lead firms. Clusters can also have indirect impacts on growth in the local economy through raising demand for local products through higher incomes (UNIDO, 2004). Using a broader perspective of poverty, the degree of poverty reduction through cluster development also depends on whether the poorest, most vulnerable groups can benefit. In addition, factors like labor intensity of production and remoteness (rural or urban cluster) have to be beard in mind when analyzing poverty impacts. The greatest limitation for measuring poverty implications is the lack of evidence on counterfactuals (UNIDO, 2004).

Despite of the enthusiasm about cluster development in developing countries, surprisingly little attention has been paid to *agricultural clusters* (AC). This is particularly noteworthy against the background of widespread poverty among agricultural and rural households. It is assumed that AC can help to raise competitiveness and to advance the agricultural sector with direct and indirect implications for poverty reduction (FAO, 2010; UNIDO, 2004). Drawing on Porter's initial definition, AC[2] can be defined as "concentration of producers, agribusiness and institutions that are engaged in the same agricultural or agro-industrial subsector, and interconnect and build value net-

[2] The technical term "agricultural clusters" and FAO terminology "agro-based cluster" are used interchangeably.

works when addressing common challenges and pursuing common opportunities." (FAO, 2010). Similar to industrial clusters, AC enable small-scale farmers and agribusiness to lift productivity and to participate in more remunerative markets. Moreover, competitive clusters offer great potential to access agri-food export markets and to link to global agricultural value chains. Thus, due to better firm performance of clustered as compared to isolated firms, these are very attractive suppliers for national or global buyers (FAO, 2010).

When applying the cluster concept on the agricultural sector in developing countries, there are a number of aspects that have to be taken into account. Due to higher knowledge- and technology intensity of production in *developed countries,* cluster advantages like technology spillover or enhanced innovation capability (see also figure 1) might not be easily transferable. Agricultural and agribusiness production processes are usually less sophisticated and technology-intensive, but more labor-intensive. Therefore, for developing country ACs, the reduction of transaction costs, trust building through repeated transactions, better coordination of market transactions, rapid exchange of information, better access to inputs and services, and joint actions (joint purchasing or marketing for example) are more likely to yield the primary benefits of clustered firms in the agricultural and wider agribusiness sector (FAO, 2010).

In particular, the reduction of transaction costs can be a major factor in clusters. The spatial proximity of firms and their repeated market transactions foster trust and better coordination which is a major advantage as compared to isolated firms. Accordingly, the institutional arrangements of market transactions between clustered firms are in between the extremes of open spot-markets and hierarchies (Porter, 1998). Thus, the prospects for engaging in institutional arrangements as verbal agreements or contracts with which firms will potentially capture a higher price and a reliable income are much higher (FAO, 2010).

The development of the cluster concept by Michael Porter in the early 1990s brought along great enthusiasm by researchers and policy-makers alike (Thomi & Sternberg, 2008). Despite of this growing interest, a great deal of criticism was expressed on the ambiguity and vagueness of the cluster definition and the claims of its theoretical framework (Martin & Sunley, 2003). Likewise, there is neither a clear and consistent approach for empirically proving the existence of clusters nor for the determination of the geographical scale (Thomi & Sternberg, 2008). The result is "conceptual and empirical confusion". (Martin and Sunley, 2003). As Martin and Sunley (2003) put it: "The situation in the cluster literature seems to be reverse: we know what they're called, but defining precisely what they are, is much more difficult." The biggest concern, however, relates to proving the existence of clusters. In many studies, researchers criticize that often times there is no effort being made to identify clusters. Instead, the existence of clusters is simply assumed or asserted. In these cases researchers would often rely on lists of clusters set up by local cluster development initiatives, without empirical inspection using a set of adequate criteria. This gave authors and poli-

cy-makers unlimited scope for the definition and application of the cluster concept (Martin & Sunley, 2003).

Nevertheless, for the empirical identification of clusters, a few studies suggest two methods: a top-down and a bottom-up approach. The top-down approach utilizes secondary data in order to investigate whether economic (sub-) sectors (agriculture for example) are concentrated in certain areas (a district for example). As statistical measure for this operation the coefficient of localization is mostly be applied. Bottom-up approaches rely on qualitative approaches as interviews with key-informants in order to carry out social network analysis. This can help to understand the density of the cluster and the intensity of inter-firm relationships (Thomi & Sternberg, 2008). The application of the top-down approach requires the availability of aggregated employment and production data on the local, respectively regional level. For *developed countries* these data is often compiled in statistical yearbooks. Obtaining this data in *developing countries* is, however, quite a challenge. Therefore, the top-down approach in developing countries is in most cases unfeasible. Even if adequate data was available on the local level, with the help of statistical measures we would solely find concentrations of a specific economic subsector, i.e. the agricultural sector. This is not surprising since agriculture is by far the most important economic sector in terms of employment and land use. It is therefore more adequate to identify ACs for a specific product as has been done in several studies on the avocado cluster in Kenya (Knopp & Smarzik, 2008) or the Lake Victoria fishing cluster in Uganda (World Bank, 2008) for example. Finding adequate data on the local level on employment or production for a specific agricultural product is challenging.

To sum up, the current state of research on *agricultural* clusters in developing countries exhibits only few empirical studies as most cluster studies were targeted at the manufacturing sector. In addition, a lack of counterfactual evidence is obvious. Cluster research is mainly focused on descriptive and qualitative analysis which points to the lack of rigorous econometric techniques inferring causal relationships. The biggest weakness is surely the absence of clear and consistent approaches on the empirical identification of clusters. Most studies simply claim their existence, which leads to arbitrary applications of the cluster concept. Further research is thus needed to find consistent indicators with which the existence of clusters can be proved, in particular against the background of limited data availability in developing countries.

2.2.2 Global Value Chains – a conceptual approximation

Global Value Chains (GVC) has become a dominant topic in social and economic sciences among a variety of disciplines including business studies, economic geography, development studies and agricultural economics. In the context of a wide range of applications of GVC research the overall objective of this chapter is to clarify the central concepts of GVC. Therefore, we will trace the development of GVC research and describe the underlying theories and disciplinary influences. We

will focus on a developing country context where GVC are applied to study the agricultural sector. Due to intensified globalization processes, we simultaneously observe an increasing vertical disintegration of transnational companies that comes along with more stringent vertical coordination. In this context, GVC research seeks to explain patterns of industrial and economic organization.

A GVC describes „the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final disposal after use." (Kaplinsky & Morris, 2001). The focus is on all value-adding activities in and between firms. Value chains "produce value-added products or services, by transforming resources and by the use of infrastructures – within the opportunities and constraints of its institutional environment." (Trienekens, 2011).

Humphrey (2005) sees four advantages of the chain metaphor:

1) Chains stress that products and services are produced and brought to markets in a sequence of processes by different companies.
2) It draws attention to the way these processes are linked, i.e. the organization of economic processes.
3) It points to the obvious flow of goods and services, which is accompanied by the exchange of information about prices, production and process requirements, power, knowledge etc.
4) It makes clear that the efficiency of the whole system depends on the efficiency of every single actor and the linkages between them (systemic competitiveness). This perspective allows considering the embeddedness of economic actors in an institutional system (local, regional, global) and the construction and management of network relationships. GVC describe the whole production system and does not look at isolated sectors or industries (contextualization of economic activities).

One main focus of GVC research is to clarify how globally fragmented economic activities are coordinated and regulated. Traditionally, the relationships and transactions in GVC were organized and coordinated through either purely market-based mechanisms or vertical integration. Increasingly, explicit coordination through network governance can be observed. Governance in the context of GVC describes the exercise of control of powerful lead firms over the other actors in the chain. Without direct ownership these firms set parameters for products, processes and logistics (Humphrey & Schmitz, 2004). Firms and producers have to adjust to the "rules of the game" set by powerful chain actors.

Those parameters have to be enforced – hence governance in GVC includes monitoring and enforcement mechanisms (Humphrey, 2005). Governance takes place in the form of standard systems (public and private), contractual arrangements or other forms of explicit coordination. Firms incur

the costs of explicit coordination due to product differentiation and risk management strategies (Humphrey, 2006). This is in line with the tendency in the global agrifood system to source differentiated products with food quality and safety as one of the most important factors of competitiveness.

Several approaches theoretically attempt to capture theoretically the governance of activities in globally dispersed economic activities. In the 1980s, Hopkins and Wallerstein introduced the concept of Global Commodity Chains (GCC) that is strongly influenced by world systems theory (Sturgeon 2008). The concept emphasizes the role of the state in shaping global production systems with instruments like tariffs and defines a GCC as a "network of labor and production processes whose end result is a finished commodity" (Gereffi & Korzeniewicz, 1994). A GCC interlinks households, firms and states in the global economy and the approach has a strong process-orientation. The analysis of a chain allows referring on the power of social relations and organizations in shaping production, distribution and consumption.

Another stream of literature dealing with chain and network concepts is related to business studies and supply chain management. Michael Porter introduced the concept of the value chain in the 1980s (Porter, 1986). This approach focuses on the value-adding activities within a firm or a network of firms and entails a strong strategic management component. Power, institutions and spatial embeddedness is not considered in this concept. Instead the literature is more concerned with management processes, logistics, supply chain efficiency and is strongly customer oriented (Stamm, 2004; Trienekens, 2011).

In 1994, Gereffi and Korzeniewicz (1994) refined the GCC concept by distinguishing between *producer-* and *buyer-driven chains*. In *producer-drive chains*, producers have the power to control and impose parameters on the other actors in the chain. In *buyer-driven chains* the buyers influence the shape of the production system while at the same time not directly being engaged in manufacturing activities. By introducing this distinction, they focused on the firm-level recognizing the limited ability of the nation state to regulate international trade in the time of increasing globalization. Power and power asymmetries between economic actors play a central role in the cross-border organization of economic activities. GCC analysis allowed to link processes on the macro and micro level and introduces a specific spatial component into the analysis of economic inequalities. Special emphasis is given to the governance of cross-border economic activities.

The concept of GCC is very static in nature and does not capture the variety of network forms that are governing globalized production chains. The *buyer vs. producer-driven* dichotomy was overcome by the work of (Gereffi, Humphrey, & Sturgeon, 2005): they developed a dynamic and operational theory of governance in GVC by identifying five governance types that range from market to hierarchy. The complexity of transactions, the ability to codify transactions and the compe-

tencies in the supply base determine the dominant governance form between the chain actors. The degree of explicit coordination and power asymmetries increases from market to hierarchy.

The governance form of a GVC chain is dynamic and different forms of coordination may coexist in the same chain. Changes in producers' capabilities may reduce the necessity for direct intervention by the buying firm. At the same time, this may further induce more value capture by the producer. Better farm-level capabilities may lead to more balanced power relationships and less information asymmetries in the chain (Trienekens, 2011).

The GVC approach is a useful tool to analyze the pathways through which firms in developing countries participate in global markets, their benefits and risks (Gereffi, Humphrey, & Sturgeon, 2005). Yet, several weaknesses of the described approach can be claimed. The empirical application of the model is difficult as it is questionable how the key variables can be measured. The concept does not consider the embeddedness of value chain actors in a specific institutional setting on the local or national level. Value chains do exist in space. The horizontal relationships with other actors and the specific institutional environment influence the coordination and development of the chain and its actors.

Nadvi highlights that the GVC methodology allows to scrutinize the effects of world market participation on firms, farms and other actors (e.g. households), particularly the vulnerable small and informal economic actors. Mapping GVC can give insights on risks, vulnerabilities and possible gains. In the context of pro-poor growth strategies these insights may be useful for the policy debate. Smallholders have difficulties to be integrated in and benefit from GVC. Trienekens (2011) identifies three patterns that hinder GVC development in developing countries.

1) *Market access and market orientation:* usually in developing countries different food-subsystems with different quality demands do co-exist. The coexistence of these weakly connected subsystems poses challenges on the development of and compliance with food quality and safety standards. GVC access is influenced by market orientation (to serve the end users demand) and market knowledge. Therefore, producers' access is constrained by missing market information and the absorptive capacity to of such information.
2) *Resources and physical infrastructure:* physical resources, geographical position, education level of the labor force, distribution and communication infrastructure constrain GVC development.
3) *Institutional voids:* regulative, normative and cognitive institutions influence GVC development. Many developing countries face a weak institutional environment that is not market supportive, e.g. the lack of an adequate food quality and safety infrastructure.

In the context of an increasing complex agrifood system, these three areas of constraints to value chain development in developing countries call for further research. Deeper insights are needed to

develop policies and programs that help private sector development and smallholders' integration into the chains.

2.3 Linking cluster and global value chain research

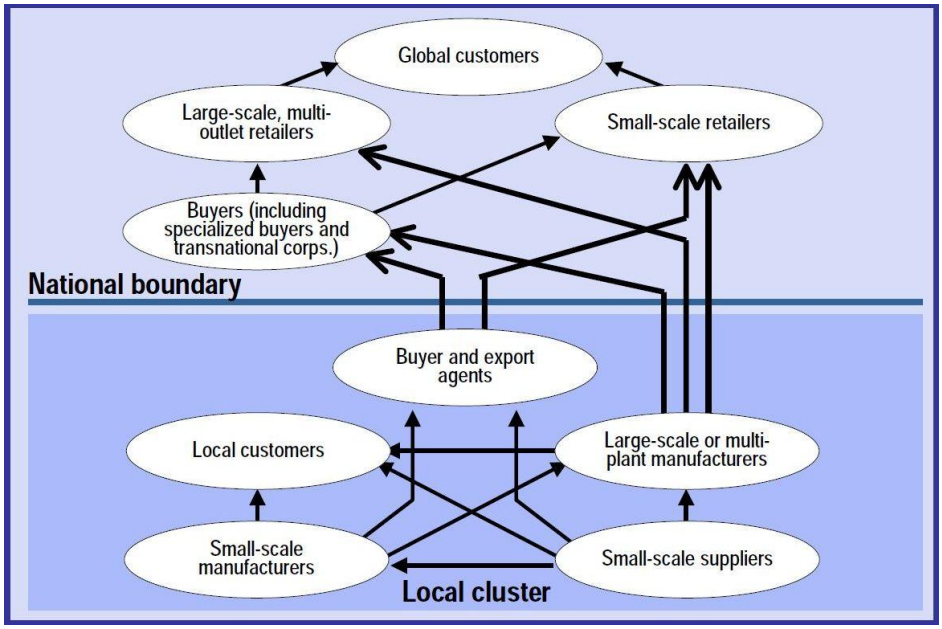
Over the past two decades or so, clusters and global value chains have become common concepts in development studies and related disciplines (Bair & Gereffi, 2001; Giuliani, Pietrobelli, & Rabellotti, 2005; Humphrey & Schmitz, 2000; Humphrey & Schmitz, 2002). Although both are concerned with inter-firm relationships and ways to enhance competitiveness of firms, several distinctions stand out that touch upon their strengths and weaknesses.

Probably the most striking difference between clusters and global value chains is the geographical scope. On the one hand, clusters are concerned with interactions on the *local* level. Global value chains on the other hand focus on the *global* level. This first distinction becomes unequivocal when considering the different stages of value adding of a specific product. In a global value chain the focus is on *all* value adding activities from raw material production to distribution and marketing that are carried out by a complex network of globally dispersed firms. This implies that global value chains are not limited to a certain location, but in fact cover global cross-border linkages between inter-related firms (Humphrey & Schmitz, 2000; Schmitz & Knorringa, 2000).

As opposed to the GVC concept, the focus in clusters is not on *all* value adding stages of production, but only the ones that take place within the boundaries of the cluster. Thus, clusters do not necessarily incorporate all value adding activities from raw material production to marketing. For instance, clustered firms may produce an intermediate agri-food product which is exported and processed in a different country. Clusters can then be considered as a specific node of a global value chain (see figure 2 on the next page for a theoretical example). In addition, clusters focus not only on vertical inter-firm relationships, but also on horizontal linkages between intra-cluster firms and with supporting institutions. In a nutshell, in cluster research we are exclusively interested in inter-firm activities confined to the local level (Bair & Gereffi, 2001; Giuliani, Pietrobelli, & Rabellotti, 2005; Humphrey & Schmitz, 2002).

Consequently, the major strength of the cluster concept is to analyze the local sources of firm competitiveness. The collective efficiency framework helps to identify the main determinants for competitiveness. This framework is divided into advantages emanating from joint actions (deliberately pursued activities between firms) and local external economies (unintended, passive benefits). As a result, cluster research can help to identify constraints for local competitiveness, to derive policy measures to improve the local business environment or to strengthen firm-level cooperation (Nadvi, 1999; Schmitz, 1995; Schmitz & Nadvi, 1999b).

Figure 2. Local cluster inserted into global value chain



Source: UNIDO (2003)

As thoroughly as the collective efficiency framework stresses the importance of local drivers for competitiveness, it fails to capture external linkages with the outside world. This is particularly noteworthy for vibrant clusters that are export-oriented and thus have access to the world market. Yet, the cluster concept acknowledges global marketing relationships assumed to be coordinated by arm's length relationships. Transactions with the outside world, however, are not organized by arm's length relationships: clusters are rather integrated into global value chains controlled and coordinated by global buyers that set parameters for what, when, how and at which prices has to be produced. Hence, the specific governance form of these chains can have far-reaching consequences for local firm strategies, firm performance and opportunities for upgrading which is not sufficiently captured by the cluster concept (Giuliani, Pietrobelli, & Rabellotti, 2005; Humphrey & Schmitz, 2002). Hence, the limitation of focusing on local interactions is considered to be the main weakness of the cluster concept by many authors (Bair & Gereffi, 2001; Giuliani, Pietrobelli, & Rabellotti, 2005; Humphrey, 1995; Humphrey & Schmitz, 2000; Schmitz & Nadvi, 1999b).

Conversely, the global value chain concept draws attention to a whole chain perspective incorporating all vertical value-adding processes from raw material production to marketing, irrespective of the geographic location of the value chain actors. Thus, clusters can be considered as nodes of a GVC or a global network of inter-related firms. The global value chain concept can be used as an analytical tool to map the interrelations between clusters and globally dispersed firms in a specific value chain (Giuliani, Pietrobelli, & Rabellotti, 2005; Humphrey & Schmitz, 2000; Humphrey & Schmitz, 2002; Nadvi & Halder, 2005). Obviously, while focusing on the vertical inter-firm relationships in a specific global value chain, the biggest weakness of this concept is the neglect of the local space in terms of relationships between firms, and between firms and the surrounding institu-

tional environment (Humphrey & Schmitz, 2000; Humphrey & Schmitz, 2002). Instead, the GVC concept focuses on the vertical relationships between suppliers and buyers and the corresponding channels for knowledge, technology and skills transfer as the main benefits (Schmitz & Knorringa, 2000). Additionally, local clusters can gain access to distant markets through global buyers (Murphy, 2007).

The neglect of local inter-firm cooperation and local external economies as sources of competitiveness has some important implications. It is argued that enhancing these local forces can improve firm capabilities and thus lead to a more equally based type of chain governance which allows better opportunities for upgrading and thus more favorable development outcomes. Such cluster studies should be linked to the GVC approach which explicitly considers the role of and relationships with global buyers. In doing so, we can examine the effect of global chain governance on local level trajectories of firm performance, business strategies and upgrading. In addition, by providing counterfactual evidence we can investigate the effect of clusters inserted into global value chains on specific firm-level determinants as learning, innovation capability or capacity development (Bair & Gereffi, 2001; Giuliani, Pietrobelli, & Rabellotti, 2005; Humphrey & Schmitz, 2000). Despite of this necessity, however, there is limited empirical evidence on linking cluster and global value chain research. The available literature integrating the two concepts in a developing country context is exclusively tailored to the industrial sector as the following explanations will show.

Bair & Gereffi (2001) examine the Torreon blue jeans cluster in Mexico and the local developmental implications using a global value chain approach. More specifically, they investigate the effects of the arrival of new buyers from the US market with different sourcing demands on the organizational structure of the cluster and local development. They find that this new sourcing systems focusing on full-package production restructured the intra-cluster production and inter-firm networks. The study further reveals that the establishment of full-package production significantly enhances upgrading opportunities at firm- and industry-level. In addition, they observe major positive outcomes for the local labor market.

Humphrey & Schmitz (2002) scrutinize local upgrading opportunities for developing country clusters that are integrated into global value chains. Similar to Bair & Gereffi (2001), they argue that the type of chain governance and thus the role of the global lead firms have extensive implications for upgrading efforts in local clusters. Using GVC and upgrading as analytical tools the authors show that quasi-hierarchical chains are advantageous for rapid product and process upgrading, but hinder functional upgrading. Chain governance marked by even networks offer the most favorable opportunities for upgrading, but are rarely found among developing country firms due to lower firm capabilities.

Giuliani, Pietrobelli & Rabellotti (2005) apply a comparable approach in their study on clusters and global value chains in Latin America. The authors investigate the impact of global value chain governance on upgrading opportunities in local clusters by distinguishing between different sectoral patterns of innovation. For the sectoral patterns of innovation they use the Pavitt taxonomy which classifies different sectoral groups according to their pattern of technological, innovative and learning behavior. They find the type of global value chain governance strongly affects local firm-level upgrading. In addition, the authors demonstrate that also the degree of collective efficiency in the cluster has significant implications for upgrading prospects at the local level.

2.4 Case-studies

2.4.1 The Chilean wine cluster – external linkages and knowledge absorption

The Chilean wine industry has a longstanding tradition. It was introduced by the Spanish-Mexican Jesuits in the nineteenth century, who sought to capitalize on Chile's excellent natural endowment for wine production. Until the 1960s Chile's wine production tailoring the low-end domestic market grew significantly, but only a fraction was exported. This changed dramatically over the upcoming thirty years, in which Chile rose as a new global player for premium wines (Giuliani & Bell, 2005). Until the end of the 1990s, the share of exported wine increased to almost half of the total production. Simultaneously, the value of the countries' wine exports increased sharply indicating a ramp-up in quality. Since the 1990s, also domestic consumer preferences shifted from low to high-quality wine (Giuliani, 2011). Chile's success story in export-oriented high-value wine production continued in the new millennium, when rapid economic success took place within this sector (Giuliani & Bell, 2005).

Currently, wine is produced in fourteen different regions of the country. This case-study focuses on the Valle de Colchagua cluster. It is located about 180 kilometers southwest of Santiago de Chile. The cluster consists of mainly micro and small-scale grape growers and wine producers, whereas further downstream and upstream value chain actors are located outside of the clusters' boundaries or abroad. In addition, the cluster accommodates supporting institutions like a business association, a training institute and a technology transfer office connected to the University of Talca (Giuliani, 2011). This unprecedented economic success of the wine industry in Chile, termed the 'wine revolution' also reached the Valle de Colchagua cluster. Cluster firms invested heavily over the past decades and could thus catch up with global competitors (Giuliani, 2007). The main reason for the dynamic development of the cluster is continuous firm-level product and process innovation like new wine blends, more advanced pruning, irrigation and canopy management or new marketing strategies (Giuliani, 2011). For those intra-cluster innovations to take place, acquisition of new knowledge and learning is essential. There are three channels through which new knowledge was

absorbed and diffused in the cluster. First, many firms had linkages with domestic research and technology institutions and with universities. Second, the country spawned a large number of highly-qualified oenologists and agronomists which gave advice to cluster firms. Third and most importantly, the external openness of the cluster and thus the linkages with external actors and the benefits through their specialized knowledge and technological capabilities has been critical (Giuliani & Bell, 2005).

In order to benefit from external sources of knowledge and technology, clusters need to have a high cluster absorptive capacity. This is defined as "the capacity of clusters to absorb, diffuse and exploit extra-cluster knowledge." (Giuliani & Bell, 2005) The authors have shown that due to the different firm-level absorptive capacities, linkages established with external actors are unevenly distributed. In particular, what they call technological gatekeepers (TG) are crucial in order to absorb this new knowledge, ideas and technologies. TG are externally oriented and technologically advanced firms which with their role as primary connectors enable to broaden the intra-cluster knowledge network. In addition, the function of TG is to avoid technological lock-ins to an increasingly obsolete technological trajectory by interacting with external actors (Giuliani, 2011).

The specific characteristic of clusters – the spatial concentration of inter-related firms – is essential for the dissemination of absorbed knowledge from outside by the TG. The major channel for transfer of knowledge and technology within the cluster are social networks of workers based on spontaneous, informal talks. These workers usually share common values and trust in stable and reciprocal relationships that are established through the economic activities and functioning of the wine cluster (Giuliani, 2007). This paper shows the emergence of an organizational model where extra-cluster knowledge is bridged into the cluster through foreign as well as domestic firms. It is absorbed primarily by technologically advanced firms that are crucial for disseminating knowledge to other firms such that the whole cluster can upgrade in product and processes. These product and process innovations are considered as central for economic success story of the wine cluster. The clustering of firms enabled to form social connections which were the major driver for knowledge transfer from TG to smaller, less advanced firms. The Colchagua wine cluster is a good example on how clusters can help to absorb and disseminate new knowledge, upgrade and thus increase competitiveness in the context of globalization.

2.4.2 The snow peas export chain in Guatemala

In the late 1970s international and national development bodies started to promote the production and export of non-traditional agricultural products in developing countries. It was seen as a means to get the countries out of the commodity dependency and to reach poverty reduction and local economic development on the micro level. Integration into high-value horticulture chains is still considered a promising but also challenging development strategy: the labor-intensive production

patterns and the high demand for low-skilled workers may enhance smallholder's participation in GVC and lead to positive income gains. Horticulture was one of the fastest growing sectors in international agricultural trade in the past decade. Trade is highly globally integrated and big (western) retailers control the production and distribution system. The trend goes towards a tighter organization of the chain and a preferred supplier system. Buyers tend to hand over new tasks to the producer. Thus, production and trade is subject to a complex public and private regulatory framework: food quality and safety, but also environmental and social patterns increasingly lead to global competition. Compliance is the basic requirement for trade integration. The organizational and institutional changes in the horticulture GVC impact directly on developing countries farmers (Nadvi, 2009).

Since the introduction of non-traditional agricultural exports (NTAE) in Guatemala in the 1970s the sector remains dominated by smallholder farmers. Until today, the development of this sector is mainly donor driven (Díaz & Hartwich, 2009). Snow peas have been the main focus of this trend and are the main fresh vegetable export crop. Around 30,000 producers are involved in the snow pea export sector. Geographically, the production is concentrated in the highlands. 90% of the production is grown on plots with less than 1 ha with an average of 0.3 hectares per farmer (Carletto, Kirk, Winters, & Davis, 2007; Hamilton & Fischer, 2003).

Since the 1990s the sector has lost a lot of its competitiveness. Violations of sanitary and phytosanitary measures lead to high rejection rates in the importing countries (Henson & Blandon, 2007). The main problem is the overuse of pesticides and microbiological contamination. Statistics from 1998 to 2003 indicate a detention rate of up to 80% at the US border for Guatemalan snow peas (Henson & Blandon, 2007). Apart from these problems, Guatemala is still the world leading snow peas exporter in quantity and total value. Main markets are the US, 65.8% of snow peas imports came from Guatemala in 2006 (Henson & Blandon, 2007). The EU 27 is the most important extra-regional trading partner.

In the marketing of snow peas, individual producers or producer organizations work either directly with the exporter or with a middleman. In the context of increasing standard stringency (e.g. GlobalGAP is a quasi-mandatory standard for exports to Europe) exporters tend to have more direct relationships with the producers to guarantee product and process quality and traceability (Elbrächter, 2011). In order to foster standard compliance among smallholders, exporters assume new tasks like capacity building and the supply of monetary and technical inputs. As asset specific investments increase, exporters are interested in formalizing and strengthening the relationships to the producers by the use of contracts, offering fixed prices and increasing the switching costs (Elbrächter, 2011). Notwithstanding, contract breach is still an unsolved problem in the producer-exporter relationship. Trust seems to play a very dominant role in the coordination of the relationships.

Snow peas are a very good example for the introduction of a product, the development of a new sector and the insertion of small farmers into a highly competitive and regulated GVC. In the context of a still very high poverty rate among smallholder horticulture producers in Guatemala, a closer look at the development impact of the GVC integration seems convenient. From a development perspective, the value-added generated on the local level matters.

2.5 Conclusion

The concepts of cluster and GVC are two widely applied approaches when it comes to analyzing firm-level and sector competitiveness, development perspectives and global-local relationships in the agrifood sector in developing countries.

While clusters highlight the spatial agglomeration of economic activities on a local or regional level, GVC look at the vertical connection of globally dispersed firms. As outlined in our paper, the cluster concept does not sufficiently consider the possible insertion of the clustered firms in GVC and hence neglects important influences that result from vertical relationships. The GVC concept on the other hand, overemphasizes the vertical relationships between globally fragmented actors that disregard the embeddedness of GVC-actors in a local institutional setting. These reflections have important implications. Both concepts are popular in local economic development strategies. But is insertion in GVC sufficient if the local context is not considered? Is the development of clusters the solution if there are unobserved vertical global-local influences?

Our case studies from Chile and Guatemala show that the application of the concepts leads to fruitful insights, but cannot capture the whole picture. We propose a careful combination of the two concepts to outweigh the respective shortcomings. Hence, there is need for more conceptual work as well as empirical evidence using the combined approach in the context of agrifood industries in developing countries.

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3 UNDERSTANDING PARTICIPATION IN MODERN SUPPLY CHAINS UNDER A SOCIAL NETWORK PERSPECTIVE – EVIDENCE FROM BLACKBERRY FARMERS IN THE ECUADORIAN ANDES

Abstract. In this article, we use semi-structured interviews with firm representatives and original survey data to study the factors influencing farmers' participation in modern supply chains in the Ecuadorian blackberry sector. Previous research has emphasized the important role of farm size and non-farm assets enabling participation in these chains. Going beyond this scope of analysis, we argue that farmers' social networks can be an important avenue to facilitate inclusion. Using different probit model specifications, we find that individual farmers' social networks are important determinants for participation in modern supply chains in an environment characterized by a homogenous farm sector. Further research is needed to explore the specific pathways through which social networks exert their influence.

Keywords. Supply chains, social networks, blackberries, food markets, transaction costs, Ecuador

3.1 Introduction

Over the past two decades, developing country agrifood markets have undergone structural changes shifting from the consumption of staple foods towards growing demand for safer and higher quality fresh produce and processed food (World Bank, 2007). Lead firms[1] in agrifood supply chains have reacted to these new domestic market conditions with a systematic adjustment and reorganization of their procurement practices commonly termed as the modernization of supply chains (Biénabe, Berdegué, & Peppelenbos, 2011; Reardon, Timmer, Barrett, & Berdegué, 2003). Lead firms in agrifood supply chains have introduced explicit requirements on product quality, delivery schedules and supply volumes of agricultural products which they convey and supervise through close types of vertical coordination like verbal agreements or written contracts (Reardon, Barrett, Berdegué, & Swinnen, 2009). This system of modern supply creates broader marketing opportunities for farmers that offer a number of benefits such as higher prices (Rao & Qaim, 2010) or better access to farm inputs and extension services (Miyata, Minot, & Hu, 2009). Yet, access to these possibly more profitable markets is restricted such that only a fraction of farmers can overcome the barriers of meeting the more explicit product- and transaction-specific requirements imposed by the modern food industry (Reardon, Barrett, Berdegué, & Swinnen, 2009). From a development policy perspective, it is therefore essential to understand what kind of and how farmers are able to respond to these structural changes in market conditions which may have implications for their farm incomes and broader rural development perspectives.

Previous research has to a very large extent analyzed patterns of farmers' participation in modern supply chains from a household and farm angle. For example, Hernández, Berdegué, and Reardon (2012) document a positive relationship between farm size, Hernández, Reardon, and Berdegué (2007) of ownership of agricultural assets such as irrigation systems and integration in modern chains. Moreover, Moustier, Thi Giac Tam, The Anh, Trong Binh, and Thi Tan Loc (2010) emphasize the importance of memberships in farmer groups. Hernández, Berdegué, and Reardon (2012) focus on the geographic location of households.

In this article, we intend to broaden the existing analytical framework by drawing on theoretical and empirical considerations of the body of literature on social networks in developing countries. Research in this strand of literature has yielded strong evidence that the economic behavior of households – such as entering modern supply chains – may not only be the result of an individual decision but also depend on the behavior of individual social network members. For example, Matuschke and Qaim (2009) and Bandiera and Rasul (2006) find that farmers' decision to adopt a new seed variety positively influences the adoption decision of their network members. Further

[1] We consider a chain actor a lead firm, when it can exert sufficient power to exercise control over what, when, how and how much will be produced.

empirical evidence suggests that different forms of social networks can play an important role for access to credit (Wydick, Hayes, & Kemp, 2011; Okten & Osili, 2004) and for participation in non-farm employment (Mano, Yamano, Suzuki, & Matsumoto, 2011; Zhang & Ly, 2003). Despite of this overall consensus in the literature, there is surprisingly scant evidence on the influence of social networks on farmers' participation in modern supply chains.

We build on the heuristic model outlined in Reardon, Barrett, Berdegué, and Swinnen (2009) that was laid out under the assumption that farmers may *choose* to participate in modern supply chains. A *choice*, however, would require that farmers are aware of several marketing options – in particular the modern one(s) – in order to be able to make an informed decision where to sell. This might not be very realistic in many rural contexts in which farmers may simply not be aware of modern channels that to a large extent have only recently emerged and are usually much thinner in terms of volumes than traditional ones. As a result, modern supply chains might be hidden or invisible implying that farmers in fact cannot *choose* this channel. Farmers' social networks can help to overcome the problem of limited access to information about modern supply chains, for example through farmers that have already entered these chains or *bridging* contacts that can link farmers to sourcing agents of these particular chains.

To sum up, our contribution to the literature is twofold. First, we integrate the two literature strands on the determinants of farmers' participation in modern supply chains in developing countries and the influence of individual social networks on the decision-making of farm household. Second, we apply different model specifications and empirically explore whether farmers' social networks matter for participation in modern supply chains. We intend to motivate and spark follow-up studies which systemically scrutinize relationships between social connections and marketing behavior of farmers in general and between modern and traditional supply chains in particular.

Our study touches upon a number of important policy decisions. The allocation of funds and resources to policy interventions targeting the inclusion of farmers in modern supply chains presupposes a thorough understanding of famers' barriers to entry which will have to be removed subsequently. For example, tailor-made support programs that address limiting factors at the farm level such as the provision of irrigation systems might yield ineffective outcomes when the hurdle for participation in fact stems from frequently underestimated limited access to information and unawareness about modern marketing channels. In this case, different and more comprehensive strategies would have to be pursued. Moreover, we argue that a successful policy strategy of responding to the structural changes of agrifood market conditions in developing countries in a poverty reducing manner must more extensively consider the procurement decisions of agro-processors which in many cases absorb greater product volumes than the supermarket channels.

We will address our research questions by building on fieldwork conducted in the Ecuadorian Andes between November 2012 and March 2013. We carried out semi-structured interviews with key informants of up- and downstream actors operating at different nodes in the blackberry supply chain. In addition, we organized a household survey with blackberry growers in Tungurahua Province. We chose the blackberry sector, because the cultivation and marketing of blackberries is an important livelihood strategy for a large number of smallholder farmers. The organization of the blackberry sector further allows sufficient variation in marketing channels that is crucial for the design of this study. Blackberry products are traditionally highly appreciated by Ecuadorian consumers and have experienced growing demand in the national market. It thus serves as a reasonable example for the rise of high-value markets in developing countries and the induced changes in market conditions.

The article proceeds as follows. In section 3.2, we review the relevant literature on modern supply chains and social networks and combine these two streams of literature. Section 3.3 provides background information on the blackberry sector in Ecuador and the respective characteristics of the supply chains. Subsequently, we inform about the underlying data and methodology (section 3.4). The estimation strategy is presented in Section 3.5, before we discuss descriptive and econometric results in section 3.6. We conclude with policy recommendations in the last section 3.7.

3.2 Literature review

An extensive body of literature has documented the supply- and demand-side factors that have led to the shift in consumer preferences from the consumption of staple foods to higher value and safer food products such as FFV, meat, dairy, and other processed products that is commonly referred to as the transformation of agrifood systems in developing countries (Reardon, Barrett, Berdegué, & Swinnen, 2009; Berdegué, Balsevich, Flores, & Reardon, 2005; Reardon & Berdegué, 2002). The agrifood industry has reacted to these altering market conditions with a systematic adjustment and reorganization of procurement practices for agricultural products in order to provide food products with the specific attributes desired by consumers. This reorganization is commonly termed the modernization of procurement practices in the literature[2] (Reardon, Barrett, Berdegué, & Swinnen, 2009).

Modern procurement systems allow the modern agrifood industry[3] to lower transaction costs by exercising tighter control over cultivation techniques, product quality and transaction specifications (Hernández, Reardon, & Berdegué, 2007). It is characterized by four elements: (1) the introduction of private norms and standards to assure product quality and safety, (2) a shift from spot-market transactions to more explicit forms of vertical coordination like contracts specifying quality param-

[2] The supply chains in which procurement practices have been modernized is consequently referred to as the modern supply chain.
[3] In this article, modern agrifood industry refers to both sectors, retailing and agro-processing that have experienced modernization of procurement systems.

eters, volume and delivery times of farm products (3) reliance on specialized procurement agents – usually traders – that are commissioned with sourcing agricultural products from farmers (4) the implementation of centralized procurement through distribution centers (Berdegué, Balsevich, Flores, & Reardon, 2005). The degree of procurement modernization varies across sectors, products, and countries, but it is relevant for both, the agro-processing and retail sector (Reardon, Barrett, Berdegué, & Swinnen, 2009).

The implementation of modern procurement practices among the agrifood industry in developing countries may have profound implications for farm production and the incomes of farm households. On the one hand, it is argued that modern supply chains create opportunities for farmers to tap into markets that offer various incentives and benefits such as price premia (Hernández, Berdegué, & Reardon, 2012), more price stability and, thus, reduction of price risks (Michelson, Reardon, & Perez, 2011), better access to inputs and credit through resource-providing contracts, and transfer of technology and knowledge about farming practices through farm assistance programs (Miyata, Minot, & Hu, 2009). On the other hand, concerns are raised that particular groups of disadvantaged farmers might be crowded-out to traditional markets given the stringent requirements in modern markets and the limited access due to usually smaller product volumes demanded from the modern agrifood industry (Reardon, Barrett, Berdegué, & Swinnen, 2009).

Against this background, a number of studies have examined factors that influence farmers' access to these modern supply chains. The major part of this discussion has been centered on the extent to which small farmers can be included in these chains presupposing that the farm sector is scale-dualistic. One of the reasons for exclusion of small farmers from modern supply chains is their missing economies of scale in production. Neven and Reardon (2004) for supermarkets, and Stringer, Sang and Croppenstedt (2009) and Swinnen (2004) for the agro-processing sector show that firms operating in this industry prefer to source from large-scale and probably more capable and commercially oriented farmers to avoid the high transaction costs incurred when sourcing from numerous small farmers. Likewise, Hernández, Berdegué, and Reardon (2012) for guava supplied to modern markets in México and Escobal and Cavero (2011) for potatoes sold to agro-processors in Peru identify a positive effect of farm size on access to the particular chain under analysis. The empirical evidence on the influence of farm size on access to modern channels, however, is much more mixed than widely believed. Consequently, Dries and Swinnen (2004) for milk sales to agro-processors in Poland, Blandon, Henson, and Cranfield (2009) for FFV supplied to supermarkets in Honduras, Hernández, Reardon, and Berdegué (2007) for tomatoes delivered to supermarkets in Guatemala and Myata, Minot, and Hu (2009) for apples and green onions sold to packers in China find that farm size does not play a role for participation in modern supply chains.

A possible avenue to compensate for missing individual economies of scale is to engage in collective marketing activities through the formation of farmer groups. This is advantageous from the

perspective of modern agrifood companies, since entering supply relationships with farmer organizations would increase delivery volumes and therefore reduce transaction costs. Membership in a farmer group can thus be an important determinant of access to modern supply chains which some studies demonstrate (Escobal & Cavero, 2011; Moustier, Thi Giac Tam, The Anh, Trong Binh, & Thi Tan Loc, 2010).

Another factor that may cause farmers' exclusion from modern supply chains is related to the ownership of two types of assets: agricultural and non-farm assets. Ownership of agricultural assets such as irrigation systems or other more advanced farming technology can help farmers to produce year-round and consistent produce with the quality attributes demanded by the modern food industry. Empirical evidence suggests that irrigation systems (Escobal & Cavero, 2011; Hernández, Reardon, & Berdegué, 2007), plastic mulching (Berdegué, Hernández, & Reardon, 2008) and cooling tanks (Dries & Swinnen, 2004) can be crucial for access to modern supply chains. Other studies (Escobal & Cavero, 2011; Rao & Qaim, 2010) have shown that the availability of non-farm assets such as vehicles can be important, because firms may expect that farmers transport their farm products themselves to a collection point. When this is the case, in particular small farmers might be excluded, since acquiring a vehicle involves considerable costs (Reardon, Barrett, Berdegué, & Swinnen, 2009).

The geographic location and spatial proximity of farmers' homestead have been emphasized as important determinants of access to modern supply chains. Hernández, Reardon, and Berdegué (2007) and Hernández, Berdegué, and Reardon (2012) show that farmers are more likely to be included if their homestead is located closer to paved roads. Berdegué, Hernández, and Reardon (2008) find a strong and negative influence of the distance of farmers' homestead to agro-processing plants and participation in this channel. Likewise, Vásquez and Poole (2006) suggest that the local endowment with adequate physical infrastructure is an essential factor for the integration of potato farmers into supply chains of agro-processing firms in Ecuador. These observations reflect two issues: first, the importance of adequate road infrastructure to avoid fruit damage and quality losses during transport and second, the necessity of spatial proximity, since remoteness drives up transportation costs. Another geographic context that is advantageous for farmers' inclusion in modern supply chains is their location in specific districts. For example, Hernández, Berdegué, and Reardon (2012) reveal that farmers are more likely to enter these chains, when their farm is located in more commercially developed districts. Furthermore, Escobal and Cavero (2011) observe that farmers located in districts with a high concentration of medium- to large-scale growers are more likely to gain access.

At the same time as the modernization of agrifood supply chain literature has been evolving, there has been a rapid growth of studies that explore the effects of individual social networks. The underlying assumption of this research is that social network members are able to influence household

decision-making which in turn may directly affect welfare outcomes (Maertens & Barrett, 2012). Social network can be an important source of information and a welcome opportunity to engage in social learning. This is particularly important in the light of imperfect markets, weak public extension services and geographical remoteness that many poor households face in the rural areas of the developing world (Ma, Spielman, Nazli, Zambrano, Zaidi, & Kouser, 2014). A social network can be defined as "individual members (nodes) and the links among them through which information, money, goods or services flow" (Maertens & Barrett, 2012, p. 353). These links may be unidirectional (for example, from early to late adopters of agricultural technology) or bidirectional (for example, between two farmers that simultaneously adopt the same technology) (ibid., 2012).

The effects of social networks have become the focus of attention in different research directions. First, social networks have been integrated into models that explain agricultural technology adoption such as improved plant varieties. Despite of its potential for productivity increase and food security, improved technologies are not adopted uniformly, but depend on specific household and farm level factors (Maertens & Barrett, 2012; Matuschke & Qaim, 2009). Social networks are considered as important mechanisms for the diffusion of information about new agricultural technologies that offer the opportunity for network members to engage in social learning and compensate for missing or weak public extension and technology transfer services (Ma, Spielman, Nazli, Zambrano, Zaidi, & Kouser, 2014). Empirical evidence indeed suggests that the adoption decision of farmers' social network members positively influences the adoption decision the individual farmer. For example, Bandiera and Rasul (2006) demonstrate that the number of sunflower adopters among farmers' family and friends positively affects the individual farmer's propensity to adopt sunflower. Further survey-based evidence suggests that farmers' individual social networks are positively related to the adoption of hybrid seeds (Matuschke & Qaim, 2009) and Bt-cotton (Ma, Spielman, Nazli, Zambrano, Zaidi, & Kouser, 2014). Wollni and Andersson (2014) find that the adoption of organic agriculture is strongly influenced by the availability of information in farmers' neighborhood networks.

In a second literature stream, the notion of social networks has been used to explain diversification of income activities. Johny, Wichmann, and Swallow (2014) find that a higher diversification of income activities in households' social networks has a positive effect on the diversification strategy of that particular household. Likewise, Mano, Yamano, Suzuki, and Matsumoto (2011) examine employment processes in the cut flower industry of Ethiopia. They find that local and personal networks are important recruitment channels as they enable the dissemination of information about employment opportunities in this sector.

A third line of research explores the role of social networks for improved access to credits in developing countries. Wydick, Hayes, and Kempf (2011) analyze determinants of microfinance borrowing and discover that households are more likely to gain access to microfinance when members

of their church network and geographical neighbors have already obtained a microfinance credit. Similarly, Okten and Osili (2004) show that participation in community meetings and the number of economically active siblings positively affects an individuals' access to credit.

As there is general consensus in the literature that social networks play a role for household decision-making, we elaborate on potential underlying pathways that can support our assumption that social networks play a role for farmers' participation in modern supply chains. We draw on four hypotheses frequently built on in social network theory which we apply to our research question.

We begin our explanations with the '*information-cost hypothesis'* which postulates that social networks can help to reduce search costs and to circulate information on certain marketing opportunities (Mano, Yamano, Suzuki, & Matsumoto, 2011). Information on these chains, however, is not ubiquitous, but tends to circulate among certain groups of farmers – in particular farmers that have already entered modern supply chains. Social networks may be a source of information and promising avenue to share valuable experience through word-of-mouth about modern marketing channels other farmers were not aware of and the reliability or trustworthiness of the respective buyer (Wydick, Hayes, & Kempf, 2011). Particularly in traditional societies where cultural habits lead to mistrust and reluctance to do business with strangers, such indications might be essential. Farmers can learn how to adapt their production and harvest practices which would make it more likely to comply with the requirements in modern supply chains and accordingly to be chosen as supplier. Studies on farmers' access to modern supply chains, however, have been designed and modeled under the assumption of a marketing channel *choice* (Reardon, Barrett, Berdegué, & Swinnen, 2009). *Choice* implies that farmers have the chance to make a decision between more than one option, in this case marketing options. This might not be very realistic in many rural contexts, since farmers may simply not be aware of or lack information on marketing opportunities in modern supply chains which usually have limited access and are much thinner in terms of absorbed volume. Modern supply chains may appear to be hidden or invisible such that farmers essentially do not have a choice. Therefore, farmers' social networks can help to reduce search costs for more profitable marketing channels and to become aware of them.

The second underlying theoretical process behind the influence of social networks on participation in modern supply chains is called *'screening hypothesis'* (Mano, Yamano, Suzuki, & Matsumoto, 2011; Wydick, Hayes, & Kempf, 2011). Here we have to change the perspective from the farmer to the buyer that sources and delivers farm products along a modern supply chain. The farmers' capability to meet the stringent requirements in modern chains is usually unobserved for the buyer. This hidden information for the buyer arises from asymmetric information, because farmers are obviously better informed if they are capable of complying with the requirements than the buyer. Information asymmetry in turn increases uncertainty among the buyer and leads to a higher level of transaction costs. A potential solution to this is screening when buyers rely on the introduction of

the so far unknown farmer B as a potential supplier who belongs to the social network of farmer A, who is already a supplier. The buyer can be certain that A would recommend a motivated, capable and reliable fellow farmer, because A would not want to risk losing trust or even jeopardizing the existing supply relationship with the buyer. This might be of particular relevance in agricultural marketing systems in which farmers frequently breach previously agreed marketing relationship in order to take advantage of seasonally higher prices offered in alternative markets (Barrett et al., 2011). Under these circumstances, buyers may face unexpected shortfalls in supply volumes. The loss in produce volume incurred and the fear of jeopardizing marketing relationships with downstream actors requires a flexible and quick reaction of the buyer. In order to effectively reduce additional transaction costs, the buyer may rely on the recommendation of a farmer who belongs to the social network of an already supplying farmer.

The *'peer-pressure hypothesis'* assumes that buyers incur costs for monitoring the normally unobserved behavior of farmers *after* supply agreements have been made. This behavior is termed hidden action (Mano, Yamano, Suzuki, & Matsumoto, 2011). This situation can be circumvented or monitoring costs at least be reduced when farmer A has been accepted as supplier with the introduction through farmer B. Farmer A will then make sufficient effort to avoid that farmer B looses reputation or jeopardizes the supply relationships. Hence, it is advantageous from a buyer's perspective to select additional farmer suppliers from the social networks of already supplying farmers.

Piracha, Tani, and Varia-Lucero (2013) and Milagrosa and Slangen (2006) emphasize the *multidimensional nature* of social networks and compute an index in order to take account of this multidimensionality. Piracha, Tani, and Varia-Lucero (2013) explore the effect of their social capital index on the labor market performance. As this measures the overall social connectedness, we may infer to our study that farmers with higher social connectedness are more likely to be able to informally establish *bridging contacts* that can be key to link the farmer to a buyer of a modern supply chain. In order to be chosen by the buyer, the farmer has to be 'known' to buyers or their business and social contacts. For example, it could be that agricultural extension officers or other agricultural public employees closely interact with the agrifood industry to figure out their business constraints or to improve their business environment. Agrifood firms may rely on these employees in order to establish contacts with potential farmer suppliers, because they are usually well informed about the environment and capabilities of farmers and enjoy a good reputation among them. Therefore, it could be an efficient and transaction cost reducing strategy for the buyer to take advantage of the network of farmer contacts of public employees in order to select farmers as suppliers. This appears to be of particular importance in contexts of a homogenous small farm sector in which the larger and probably more commercial farmers are simply not present which would raise the buyer's transaction costs. In the case of potato growers in Peru, Escobal and Cavero (2011) show that

NGOs are able to provide such links and support farmers in negotiating contracts with agro-processing firms.

3.3 Ecuadorian blackberry sector

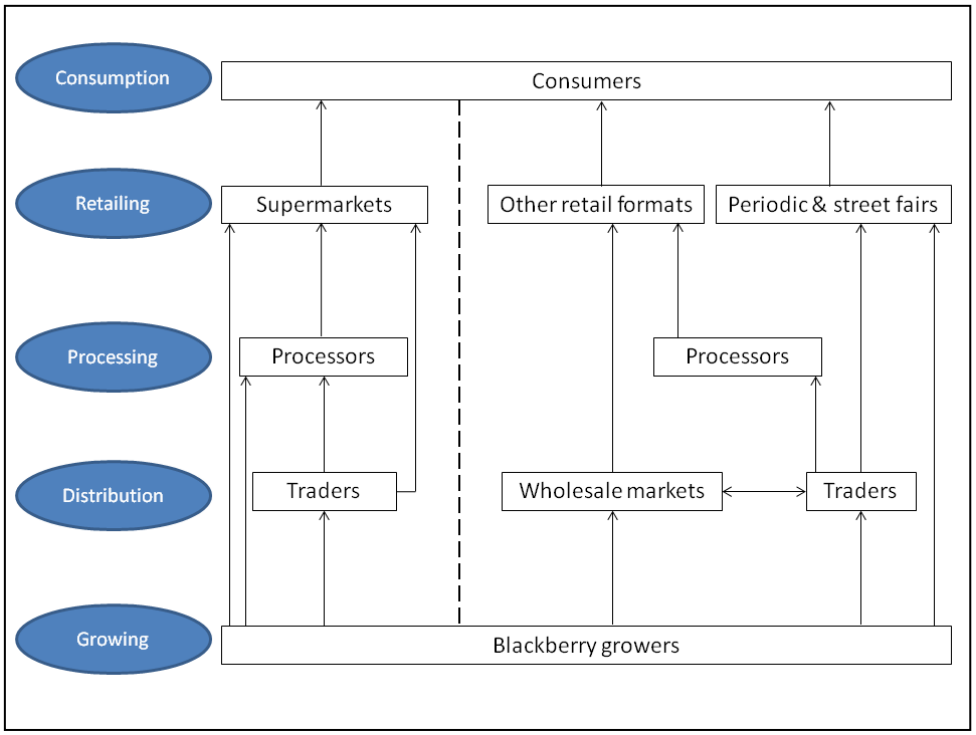
Most recent statistical information obtained from the latest Ecuadorian agricultural census of 2000 indicates that the total national area under blackberry cultivation amounts to 5,247 ha (MAGAP, 2014a). The cultivation of blackberry is geographically concentrated in the Andes which offer the necessary agro-climatic conditions. The three central Andean provinces Tungurahua (2,223 ha), Cotopaxi (1,360 ha) and Bolívar (1,098 ha) alone account for nearly 90% of the national area under blackberry cultivation (MAGAP, 2014b). Blackberry sector experts reported that the area under blackberry cultivation has shrunk considerably since the launch of the last agricultural census. Their estimates suggest that current national area under blackberry cultivation amounts to 2,200 ha. The blackberry farm sector is dominated by small farmers, who commonly combine blackberries with the cultivation of a wide range of other fruits such as apples, pears or strawberries and staple foods such as potatoes, beans or maize. Blackberry cultivation practices are highly labor-intensive as they involve a number of activities such as pruning or hand picking that can hardly be mechanized. Household members that participate in the cultivation techniques can be an important asset, because production costs are reduced as less farm laborers have to be recruited. Blackberry is inherently susceptible to physical damage and therefore requires careful handling during harvest and postharvest activities to avoid deterioration in quality. Furthermore, it is a highly perishable fruit which requires short storage time and rapid transport.

In the Ecuadorian market, the consumption of fresh blackberries and processed blackberry products is a cultural habit and long-standing tradition. This Ecuadorian custom ensures a stable albeit growing blackberry demand in the national market. Consumers are attracted by the fruit's aromatic taste, its excellent nutritional values and perceived health benefits, i.e. the high level of antioxidant capacity. Ecuadorian families consume fresh blackberry and processed blackberry products on a daily basis with an average weekly consumption of two kg per family (Corpei, 2009; INIAP, 2010). As opposed to the dynamic domestic market, recent years indicate only very marginal export volumes (Corpei, 2009).

Within the domestic market, farmers have a broad range of marketing opportunities and thus to participate in supply chains. Figure 3 provides an overview of the Ecuadorian blackberry supply chain. The map depicts two sets of themes. Vertically, we can differentiate between production and marketing functions that are sequentially performed along the chain by their respective actors. Second, horizontally we can differentiate between the modern supply chain on the left and the traditional supply chain on the right, both divided by a dotted line. We begin our supply chain description with the traditional format. The dominant agricultural market outlet in the country is the

wholesale market. Wholesale markets are located in the biggest market centers of the country such as Quito, Cuenca, Guayaquil and Ambato. Transactions are anonymously made out on the spot, typically coordinated by the price that is directly negotiated. This excludes prior agreement between transaction partners on product quality or other specifications and mostly rules out obligation to a long-term trading relationship.

Figure 3. Generic map of Ecuadorian blackberry supply chain



Source: Own elaboration based on INIAP (2010) and semi-structured interviews

The organization of the wholesale market is generally characterized by a high level of transaction costs for both sides, farmers and buyers. This is due to two reasons. First, the dearth of public grading regulations withholds incentives for the production of non-standardized and higher quality blackberries, for example through careful selection or value-adding activities. In particular, search and negotiation costs as two important categories of transaction costs will be affected. Second, the blackberry market price is volatile and subject to negotiations because of the absence of clear marketing agreements and the seasonality in blackberry harvest volumes. Wholesale market traders possess strong bargaining power due to low switching costs in finding alternative blackberry suppliers which enables them to strongly influence the selling price. This often results in enhanced price risks for farmers as the price formation in wholesale markets is fairly abstract and unobserved.

A second marketing opportunity in the traditional supply chain is to sell to traders. Traders directly pick-up blackberries at the farm-gate and frequently consolidate these purchases with the collection of additional fruits and vegetables to benefit from economies of scale in transport. Traders are fair-

ly diverse in their scale of operation, but essential in their function as distributors, because they are able to overcome long distances, for example between Ambato and market centers in the Coastal region. Figure 3 further depicts that farm-gate traders may also supply small-scale processors or open air and street fairs. Blackberry farmers may also directly sell to consumers in the popular periodic markets *plazas* or street fairs. Traditional retail formats such as kiosks or mini-marts typically offer fresh blackberries or blackberry products to consumers.

In the following, we will turn the discussion to the modern segment of the blackberry supply chain which can be set apart from the traditional chain in at least two characteristics. First, in farmers, traders, agro-processors, and modern supermarkets[4], we find fewer actors involved in the modern supply chain. This chain is usually shorter, largely because sourcing agents in this chain predominantly bypass the wholesale market[5]. Second and more importantly, marketing relationships are coordinated through closer vertical coordination which commonly includes prior verbal agreements between transaction partners. These agreements specify product quality, quantity, delivery times and frequently a stable price. Sporadically, transaction partners may also agree to sign written contracts. This basic shift from spot-market relationships that we can observe in the traditional chain to more explicit types of vertical coordination is considered as a central element of the modernization of procurement systems (Reardon, Barrett, Berdegué, & Swinnen, 2009).

In the agro-processing sector, blackberries are demanded as raw materials for the production of juice, marmalade and pulps. The most important market outlet for the large majority of these firms is the domestic market. Companies targeting this market have outlined clear requirements in terms of quality parameters – phytosanitary condition, appearance, sugar content –, and transaction specifications – post-harvest management, weekly target volume, fixed delivery times – that actors upstream in the blackberry supply chain have to comply with. In Ecuadorian supermarkets, blackberries are sold in fresh, semi-processed (e.g. frozen, canned) or processed (e.g. juice, marmalade) forms. For the case of semi-processed and processed products, supermarkets purchase the final product from agro-processing firms. Therefore, supermarkets have only limited influence on the supply chain coordination for this product category. The case is different for fresh blackberries where supermarkets specify explicit demands for fresh blackberry purchases. This allows supermarkets to exert greater influence on agronomic, harvest and post-harvest practices on the farm or trader level. The most important quality parameters relate to appearance – size, shape, freshness or firmness – which is inspected at the moment of delivery based on predetermined norms. Similar to agro-processing firms, supermarkets insist on a weekly target volume and delivery time which farmer suppliers must adhere to.

[4] In the following we will refer to supermarkets, when in fact we mean different forms of modern retail.
[5] Firm representatives we interviewed reported to entirely circumvent the wholesale markets. We cannot rule out, however, that firms we were not able to interview source from the wholesale market.

Based on the product and transaction specifications of blackberry supplies, we now focus on the effects of their procurement strategies on the organization of the modern supply chain. We differentiate between two supply models for the modern blackberry sectors: the farmer – firm and the farmer – specialized trader – firm model. Both models have in common that lead firms in the particular chain – supermarkets and agro-processing – have sufficient power to govern supply relationships from downstream. The majority of these supply relationships between either of these actors are mainly coordinated through verbal agreements, written contracts are only sporadically arranged. These agreements entail the requirements of modern lead firms which specify product quality, quantity, delivery times and a frequently fixed price. Farmers and specialized traders that enter into marketing relationships with lead firms must comply with these agreements in order to sustain their participation in this chain. The implementation of verbal agreements as governance structure of blackberry marketing transactions allows the modern agrifood industry to exercise tighter control about product attributes and transaction characteristics. Likewise, it will help to guarantee a constant supply volume at predetermined delivery times. Consequently, modern agrifood industry can reduce their transaction costs that incur when carrying out market transactions. Figure 3 further depicts that the wholesale market is mostly circumvented in modern supply chains. The reason for this is the high level of transaction costs in this market that originate from the prevalence of anonymous spot-market relationships. From the firms' perspective, these market relationships are associated with imperfect information about cultivation, harvest and post-harvest practices that is unobserved and cannot be controlled which leads to a high level of uncertainty. Identifying a suitable trading partner in wholesale markets can thus involve considerable costs which can be reduced through more intensive vertical coordination mechanisms such as verbal agreements or the rare conclusion of written contracts. The main reason for the unpopularity of written contracts are seasonal price spikes in the blackberry market which offer incentives to farmers to breach contracts and to side-sell to wholesale or local markets in order to benefit from higher prices.

The role of specialized traders is indispensable for the organization of the modern supply chain. It is advantageous from a company's perspective to commission the procurement of blackberries to specialized traders, because managing relationships with only few traders as compared to a large number of small farmers helps to lower the level of transaction costs. Traders are comprehensively trained about the requirements of the firms, before they receive the firms' orders. Dedicated traders address these orders by collecting blackberries directly from the farm where they carry out a first selection. In this context they can benefit from their large network of farmers and the familiarity with the local blackberry production zone. This enables them to flexibly and spontaneously react to shortfalls in blackberry supply that may occur when farmers harvest too small quantities. Traders

frequently consolidate the pick-up of blackberries with the purchase of other FFV in order to take advantage of economies of scale in transport.

3.4 Data

We carried out fieldwork in the Ecuadorian province of Tungurahua which is located in the Central Andes. This study area is suitable for our study design, because it is one of the major blackberry production zones in the country and the most important fruit catchment area of supermarkets and agro-processors as sector experts reported. Farm households engage in the cultivation of a variety of fruits and vegetables such as berries, apples, pears or onions in order to generate income and in the production of maize, potatoes or beans for subsistence. Another common and traditional livelihood activity in our study area is to keep livestock – in particular guinea pigs or rabbits – for sale or the production of manure.

Data collection was conducted in cooperation with the *Instituto Nacional de Investigaciones Agropecuarias* (INIAP). INIAP was particularly helpful in facilitating access to key informants in firms and to blackberry farmers. We collected data in two stages. First, between December 2012 and January 2013 we held personal semi-structured interviews with key informants. We interviewed representatives – usually purchasing managers – of three supermarket chains and seven agro-processing firms and eight traders that supply these firms. In addition, we held informal interviews with blackberry growers usually after they had completed specific training courses. The objectives of these interviews were twofold: first, to reconstruct the blackberry supply chain and to better understand the organization of marketing relationships along this chain. Second, we carefully requested supplier lists of farmers that were necessary for the second stage of data collection. In stage two, we collected original survey data from blackberry farming households between February and March 2013. The structured questionnaire contained several sections that elicited information on household and farm characteristics, agricultural production and production costs, social network activities, and asset ownership. In addition, farmers provided detailed information on blackberry production and quality, blackberry production costs and sales proportion to different buyers or markets. We collected this recall data for the year 2012. Interviews were conducted face-to-face with the help of carefully selected local fieldwork assistants, who participated in an intensive training course and the pre-test of the questionnaire.

For the cross-sectional design of our study we selected households based on a stratified random sampling technique. The two strata represent blackberry farmers that participate in modern supply chains and farmers participating only in traditional supply chains. We categorize farmers as participants of modern supply chains if they sold any blackberries in 2012 to a buyer that is either a modern lead firm such as a supermarket or an agro-processor or to a specialized trader that is commissioned as sourcing agents to supply to these firms. Despite of varying degrees of procurement mod-

ernization across the interviewed firms we observe a clear and common tendency towards modernization. Therefore, we can confidently treat the lead firms and their respective modernized procurement practices – which we explain in section 5 – as one homogenous group.

We used semi-structured interviews with agrifood sector companies in order to collect complete lists of blackberry farmers and traders operating in Tungurahua province. In case a farmer was a direct supplier to these companies we obtained the contact details of these farmers. In case a trader collects blackberries from farmers and delivers to these companies, the interview partner could only provide contact details of the traders. In a second step, we approached the traders and carefully asked for their preferred supplier lists of blackberry farmers. This has proven complicated, because several traders were simply not willing to disclose this information and some of the provided supplier lists were distorted. Yet, we managed to compile a list of 51 blackberry farmers that participate in modern supply chains. We oversampled this group of farmers and interviewed all of them in order to assure a sufficient coverage for the analysis. The second stratum is made up of blackberry farmers who exclusively participate in traditional supply chains. A compilation of contact details of all these farmers from which a random sample could have been drawn was not feasible due to budget and time constraints. Therefore, we first purposively chose the five *cantones*[6] that we already covered in first strata and added *cantones* Patate and Baños in order to ensure a representative and dispersed sample for the whole province. Second, we purposively selected *parroquias*[7] within the chosen *cantones* based on discussions with blackberry sector experts. The key criteria for selection was the presence of a sufficient number of blackberry farmers in *parroquias* and the possibility of compiling lists of these farmers with the help of blackberry sector experts, field-guides and enumerators. We interviewed 313 blackberry farmers that we categorize as traditional supply chain participants. Our full sample thus consists of 364 blackberry farming households.

3.5 Estimation strategy

Our first probit model estimates the probability of a farmer's participation in modern supply chains in the most general form:

(1) $MSC_i = \beta X_i + \varepsilon_i$

where MSC_i is a binary variable that equals one if a blackberry farmer participates in modern supply chains and zero otherwise. X_i refers to a set of explanatory variables that hypothetically influence participation and ε_i is the error term. The choice of explanatory variables is based on theoretical considerations in the literature review and field observations.

[6] Canton is the second lowest administrative unit in Ecuador.
[7] Parish is the lowest administrative unit in Ecuador.

In the second model, we are interested in the individual social network effect on participation. We build on the literature of agricultural technology adoption (Bandiera & Rasul, 2006; Matuschke & Qaim, 2009) and include a variable that captures the number of modern supply chain suppliers in a farmer's social network. We elicited this information from farmers by asking them how many other farmers they would know that sell to agro-processing firms and supermarkets or their dedicated traders and if they communicated with these farmers about blackberry marketing. This effect is commonly referred to as the endogenous social network effect in the literature (Bandiera & Rasul, 2006; Matuschke & Qaim, 2009; Wydick, Hayes, & Kempf, 2011), because it may capture the influence of the network on the individual farmer, but also the behavior of the individual that influences the network. Manski (1993) refers to this reverse causality issue as the reflection problem. Available studies suggest using an instrumental variable approach to address this problem (Okten & Osili, 2004; Matuschke & Qaim, 2009). The candidate instrument should be correlated with the potentially endogenous social network variable, but uncorrelated with any unobservable variables and the participation variable. Thus far, we were unfortunately not able to find a valid instrument. Furthermore, Matuschke and Qaim (2009) discuss exogenous social network effects on technology adoption among farmers. This refers to correlated unobservable characteristics of the farmer and their network members. In the case of agricultural technology adoption for example, it could be that the farmer and the network member share the same risk preferences or cultivate the same crops which would have an influence on network formation that may result in overestimation of the social network effect. As we do not have data on the characteristics of the social network members, we are not able to measure the exogenous effect. For the second model, we run the following regression:

(2) $MSC_i = \beta X_i + \gamma SN_i + \varepsilon_i$

where MSC_i is again the binary variable that equals one if a blackberry farmer participates in modern supply chains and zero otherwise. γ measures the individual social network effect. X_i refers to the same set of explanatory variables and ε_i is the error term.

It is conceivable, however, that the social network effect on participation in modern supply chains is not only established through farmers that already participate in these chains. There are potentially other key contacts among the farmers' network that are able to provide the necessary link to the buyer of modern marketing channels. For example, it could be that farmers socially or professionally interact with governmental employees in agricultural departments. These employees in turn may maintain contacts with the agrifood industry in order to be informed about or to influence their business environment and constraints. Agrifood firms may rely on these employees and their network of farmer contacts in order to select these farmers as potential suppliers. This could be an efficient and transaction cost reducing strategy for the buyer. The foregoing would call for a multi-

dimensional approach of social networks. Milagrosa and Slangen (2006) and Piracha, Tani, and Vaira-Lucero (2013) propose an index to account for this multidimensionality. This is plausible, because an index circumvents collinearity problems among the variables of interest which would occur when including them separately in the regression. We follow this proposition and use principal component analysis (PCA) to compute a social network index (SNI). PCA is a statistical procedure which reduces the number of variables into smaller combinations that best explains the common information of these variables (Filmer & Pritchett, 2001). The advantage of PCA is that it statistically and therefore more objectively determines the weights for each of the included variables that form the index. As no standard procedure for variable selection for SNI exists, we propose to use the following variables: (1) participation in farmer field day (dummy), (2) farmer associated with *cadena de la mora*[8] (lagged dummy), (3) membership in farmer group (lagged dummy), and (4) number of agricultural technicians in farmer's social network (lagged). The first three variables are dummy variables and take the values 0 or 1. Variable (4) is continuous and was therefore normalized by its mean and standard deviation to appear in the same range as the first three[9]. We are confident in using the first linear component to extract the scoring factor, because this component already explains 59% of the total variance. The scoring factors assigned to each variable are displayed in table 2.

Table 2. Scoring factors and impact factors of variables included in PCA

Variable	Scoring factor	Impact factor
Participation in farmer field day on blackberry (dummy)	0.512	1.043
Associated with *cadena de la mora* (dummy) (lag)	0.440	1.803
Membership in farmer group (dummy) (lag)	0.517	1.117
No. of agricultural technicians in SN (lag)	0.527	2.928

We also calculate the impact factor for each variable. This is calculated dividing the scoring factor of each variable by their standard deviation. The value of the impact factor describes the change in SNI if the variable moves from 0 to 1. For example, had a household participated in a farmer field day would increase its SNI by 1.043 points. In order to facilitate interpretation, we normalize the index result and obtain values ranging from 0 to 1. We test the reliability of our PCA by computing the Bartlett-Test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy.

The results of the Bartlett-Test show that we can be very confident (p-value = 0.000) to reject the null hypothesis that the selected variables are not intercorrelated. The overall Kaiser-Meyer-Olkin measure is 0.743 which is highly satisfactory. Our PCA thus proves to be reliable. Another ad-

[8] *Cadena de la mora en la Provincia de Tungurahua* is a public sector-led market linkage program with the objective of organizing and facilitating direct collective marketing with firms.

[9] We normalized variable (4) using the following formula: $x_i = \frac{x_i - x_{min}}{x_{max} - x_{min}}$ where x is the number of agricultural technicians in the social network of farmer i, x_{min} and x_{max} are the minimum and maximum values of x.

vantage of the SNI as opposed to the social network variable in model (2) is that the index is less prone to endogeneity, since variables are specified with a time-lag where necessary. Our third model is thus specified as follows:

(3) $MSC_i = \beta X_i + \gamma SNI_i + \varepsilon_i$

Farmers in our sample in Tungurahua province are fairly scattered across seven *cantons.* We recognize that there might be unobserved and heterogeneous *canton* characteristics such as spatial concentration of blackberry farmers, accessibility or agro-ecological conditions that may have an effect on farmers' inclusion in modern supply chains. Therefore, we include *canton* fixed effects in our estimations that capture heterogeneity of *canton* attributes in order to test the robustness of our results. These fixed effects also help to control for correlated unobservable variables at the *canton* level that might affect our measure of social networks in model (2). For example, it could be that buyers of modern chains prefer to source a specific *canton* that possesses favorable characteristics like accessibility that were mentioned earlier. This would increase the number of modern channel participants in that area. Consequently, the probably that a farmer who lives in the same *canton* has a high number of participants in his or her social network is much stronger. As a result, the social network effect in model (2) could be overestimated. We complement models (1), (2) and (3) with *canton* fixed effects *j* which are measured in δ:

(4) $MSC_i = \beta X_i + \delta C_j + \varepsilon_i$

(5) $MSC_i = \beta X_i + \gamma SN_i + \delta C_j + \varepsilon_i$

(6) $MSC_i = \beta X_i + \gamma ISNI_i + \delta C_j + \varepsilon_i$

3.6 Results

3.6.1 Descriptive statistics

Table 3 provides information on the differences in household characteristics between the group of blackberry farmers that participate in modern supply chains and the one that exclusively participates in traditional supply chains. A number of salient findings emerge.

Modern supply chain farmers are significantly older and more educated as their counterparts. On average, 75% of household heads of modern chain suppliers own a cell phone as opposed to 52% of traditional chain suppliers. Availability of a cell phone can be important for participation in modern chains, because traders or firms usually use cell phones in order to place orders and to quickly react to shortfall in supply that may occur due to farmers' incentives to side sell to traditional market formats or insufficient harvest volume. Household size and household labor capacity are fairly equal between the two groups. Another significant difference relates to the participation

in off-farm employment. Among modern chain suppliers, about 25% of all household members work in the off-farm sector as compared to roughly 16% in the traditional-channel group.

Table 3. Household characteristics by supply chain

	Full sample (N = 364)	Modern supply chain (N = 51)	Traditional supply chain (N = 313)
Male household head (dummy)	0.871	0.902	0.866
	(0.336)	(0.300)	(0.341)
Altitude in which farmer lives (m)	3011.508	2959.255	3020.022
	(324.113)	(250.254)	(334.163)
Age of household head (years)	50.319	54.059**	49.709
	(13.813)	(13.681)	(13.830)
Education household head (years)	6.451	8.922***	6.048
	(3.649)	(4.677)	(3.290)
Mother tongue of HH-head Spanish (dummy)	0.951	1.000*	0.943
	(0.217)	(0.000)	(0.233)
Household head owns cell phone (dummy)	0.555	0.745***	0.524
	(0.498)	(0.440)	(0.500)
Household size (members)	4.006	3.961	4.013
	(1.683)	(1.549)	(1.706)
Household labor capacity [a]	3.089	3.173	3.067
	(1.383)	(1.291)	(1.399)
Off-farm employment (% of HH-members)	0.174	0.253***	0.161
	(0.236)	(0.295)	(0.222)

Notes: Standard deviation in parentheses; * p<0.1, ** p<0.05, *** p<0.01; [a] Household members were converted to man-equivalent units following Runge-Metzger (1988): household member < 9 years olds = 0; 9 to 15 years or above 49 years = 0.7; 16 to 49 years = 1

In table 4 we compare farm characteristics between the two groups of farmers. The first prominent finding is that the farm sector in our study context is dominated by small farmers. The average owned farm size is only 0.98 ha. We also take into account the standard deviation in order to be more confident on the genuine homogeneity of the farm sector. The standard deviation of 2.7 ha is rather low and therefore underscores the existence of a homogenous and small-scale farming structure. The standard deviation is even strongly influenced by two extreme values (15 and 46 ha). Excluding these values would even yield a much lower standard deviation of only 1.1 ha. Furthermore, there is no systematic difference in average farm size between the two groups. This questions the common hypothesis which suggests that modern supply chains farmers are large-scale and therefore wealthier and less sensitive to risks as farmers participating in traditional channels (Neven & Reardon, 2004; Reardon, Barrett, Berdegué, & Swinnen, 2009). The area of land cultivated with blackberries[10] is a measure for the farmer's potential to achieve scale-effects in production that modern chain buyers prefer, because it would allow them to reduce transaction costs for their procurement strategies (Stringer, Sang, & Croppenstedt, 2009; Swinnen, 2004). Unexpectedly, the average blackberry cultivation area is equally distributed across the two groups. The black-

[10] This refers to total farm size that farmers are able to cultivate and subsumes owned, rented-in, shared-in, and shared-out land.

berry cultivation area of modern supply chain farmers is slightly above (0.36 ha), but not systematically different from traditional chain farmers' area (0.33 ha). This observation is reflected in the number of available blackberry plants in productive age which is another measure for the scale-effect.

Table 4. Farm characteristics by supply chain

	Full sample (N = 364)	Modern supply chain (N = 51)	Traditional supply chain (N = 313)
Farm size owned (ha)	0.983	1.095	0.965
	(2.722)	(0.933)	(2.912)
Blackberry specialization (% of farm size)	0.555	0.485	0.566
	(0.375)	(0.578)	(0.331)
Blackberry cultivation area (ha)	0.330	0.364	0.325
	(0.424)	(0.251)	(0.446)
Years growing blackberry	13.923	12.137	14.214
	(10.169)	(9.938)	(10.192)
No. of blackberry plants in productive age	589.148	453.980	611.173
	(2359.814)	(372.393)	(2540.334)
Marketing other FFV (dummy)	0.470	0.706***	0.431
	(0.500)	(0.460)	(0.496)
Ownership of livestock (dummy)	0.898	0.922	0.895
	(0.303)	(0.272)	(0.308)
Ownership of irrigation system (dummy)	0.731	0.902***	0.703
	(0.444)	(0.300)	(0.458)
Farm asset index	2.462	3.059***	2.364
	(0.898)	(0.988)	(0.844)

Note: Standard deviation in parentheses; * p<0.1, ** p<0.05, *** p<0.01

Likewise, there is no significant difference between the two groups. Farmers supplying modern markets more often (71%) market other fresh fruits and vegetables such as strawberries, tree tomatoes or apples in comparison with farmers supplying traditional markets (43%). The latter are probably more dedicated to growing lower-value staples such as potatoes, maize and other traditional Andean crops for home consumption and the local market. Participation in modern supply chains is associated with a more frequent application of irrigation systems (90% vs. 70%).

In table 4 we also compare the farm asset index which captures the technological level of farmers and therefore their capability to produce higher quality agricultural products that can be crucial for access to more quality-demanding channels. We use an index instead of including all assets separately in the regression, because that would probably result in collinearity problems and also because we could not discover a particular key asset that the interviewed firms would exclusively require. There are different procedures to compute this index. Related studies use monetary values such as median or index prices (Escobal & Cavero, 2011; Hernández, Berdegué, & Reardon, 2012) or factor analysis (Michelson, 2013). Factor analysis or PCA was not feasible in our case, because the variables had only low correlation and the KMO was unsatisfactorily small. We also do not use

prices, because we are not interested in the value of an asset, for example a crop sprayer, but the function that it performs and whether the particular farm household owns it or not. Therefore, we suggest using the unweighted summing of all assets.

The farm asset index is thus composed of a series of dummy variables indicating the households' holdings of pruning shears, grass cutter, motorized crop sprayer, manual crop sprayer, tractor, plow, and water pump. On average, we observe that the farm asset index is systematically higher among the modern chain participants. A higher score on farm assets and a higher proportion of farmers equipped with irrigation systems in the group of modern chain suppliers is expected and consistent with previous related studies (Escobal & Cavero, 2011; Hernández, Reardon, & Berdegué, 2007; Rao & Qaim, 2010). Although there is a marked structural difference in endowment of farm assets and irrigation, it is not clear yet whether this will also have an influence on access to modern supply chains.

Table 5 on the next page summarizes average socio-economic characteristics of the two groups of farmers. Several striking differences stand out. The *'bono de desarrollo humano'* (BDH) is a governmental conditional cash-transfer program targeting poor households and elders. It is a composite measure of household wealth that includes 27 variables such as access to infrastructure or household assets. Only one person in a household is eligible to receive the BDH (Ponce & Bedi, 2008). Therefore, we can use the dummy variable if the household has received BDH as a convenient measure for household wealth. Farmers that exclusively participate in traditional supply chains (59%) are poorer than modern supply chain farmers (24%). This is not surprising and in line with previous studies (Escobal & Cavero, 2011; Rao & Qaim, 2010). The direction of causality, however, is ambiguous, because it could be both, a result or a cause of participation in modern markets. We can also see that selling to modern supply chains is associated with better access to agricultural extension service.

In the following, we turn to our variables of interest that are subsumed under the category social network. It is obvious that the modern chain farmers differ greatly and systematically from traditional chain farmers in almost all social network characteristics. The former is more frequently member in farmer groups (73%) and a larger share of these farmers has already participated in a farmer field day targeted at blackberry farmers (80%). We list farmer field day in this category, because field observations have revealed that this can be an opportunity to make key contacts such as buyers that search for suppliers during these events or local government authorities that may be crucial for institutional support. In the blackberry sector, the role of farmer groups has to be interpreted differently from the more common function as facilitators of collective marketing. In only 9.9% of the cases, farmer group members indicated that collective marketing would be an important benefit. Therefore, we argue that farmer groups in our study context work as a platform for

exchange of information for example on marketing, cultivation practices and as an instrument for institutional support.

Table 5. Socio-economic characteristics by supply chain

	Full sample (N = 364)	Modern supply chain (N = 51)	Traditional supply chain (N = 313)
Wealth			
HH receives bono de desarrollo (dummy)	0.544	0.235***	0.594
	(0.499)	(0.428)	(0.491)
Access indicators			
Access to credit (dummy)	0.401	0.490	0.387
	(0.491)	(0.505)	(0.488)
Access to extension (dummy)	0.420	0.706***	0.374
	(0.494)	(0.460)	(0.485)
Distance to provincial capital Ambato (km)	21.618	17.176	22.342
	(20.849)	(15.294)	(21.552)
Social networks			
Membership in farmer group (dummy)	0.390	0.726***	0.336
	(0.489)	(0.451)	(0.473)
Participated in farmer field day (dummy)	0.401	0.804***	0.335
	(0.491)	(0.401)	(0.473)
Associated with *'cadena de la mora'* (dummy)	0.115	0.471***	0.058
	(0.320)	(0.504)	(0.233)
No. of modern chain suppliers in farmers SN	1.052	5.922***	0.259
	(3.107)	(5.837)	(1.124)
No. of agricultural technicians in SN	0.830	1.922***	0.652
	(1.384)	(1.659)	(1.249)
Social network index (SNI)	0.516	1.072***	0.425
	(0.529)	(0.597)	(0.458)

Note: Standard deviation in parentheses; * p<0.1, ** p<0.05, *** p<0.01

'Cadena de la mora en la Provincia de Tungurahua' is a public sector-led market linkage program with the objective of organizing and facilitating direct collective marketing with firms. The proportion of farmers associated with this program is significantly higher (47% vs. 6%) among the ones included in modern supply chains. This demonstrates that the market linkage program seems to reach its objectives. Table 5 reveals a structural difference on the size of farmers' social network. The size is measured by the number of blackberry farmers that have access to modern supply chains in the farmers' social network. There are on average 5.9 blackberry farmers in the social networks of modern supply chain participants and only 0.3 in the traditional farmer group. The interpretation is not straightforward, because farmers could have met *after* supplying individually to modern supply chains. This would imply that the decision to supply modern chain was made independently. Furthermore, we compare the number of governmental agricultural technicians in

individual farmers' social network across suppliers of modern and traditional chains. We incorporated agricultural technicians under social networks, because they are very familiar with the blackberry community, but simultaneously maintain many contacts in the private sector in particular to traders and purchasing managers of modern agrifood industry firms. We assume that these contacts can be crucial for informally linking farmers to modern supply chains. As table 5 displays, modern chain suppliers have a higher number of agricultural technicians in their individual social network as traditional supply farmers. Eventually, we can observe that selling to modern markets is associated with a higher score in our composite SNI.

3.6.2 Econometric results

Table 6 displays the result of the estimated probit models (1), (2) and (3) that are specified in section 3.5. We begin with the results of model (1) that we estimated without the social network variables of interest. There are a number of salient findings. Older farmers are more likely to participate in modern supply chains. This is unexpected, because field observations let us to assume that younger farmers are more innovative and willing to carry out the necessary changes at the farm level in order to comply with the requirements of the buyer. An explanation could be that younger household heads have better outside options such as off-farm employment while they consider the labor-intensive cultivation practices of blackberry for modern markets as a less important and attractive income source. In other words, older blackberry farmers might not have such income generating alternatives which would imply that the vast majority of household income is derived from farming. Yet, the effect of age is in line with Rao and Qaim (2010) who suggest that this would be associated with longer farming experience. We control for experience with blackberry farming in our model and find the opposite effect. Farmers with longer experience in blackberry farming are less likely to have access to modern supply chains which is consistent with findings in Bignebat, Koc, and Lemeilleur (2009). Conversely, late adopters of blackberry – the farmers that more recently have started to grow blackberries – are possibly more innovative and entrepreneurial and therefore more open to managerial and organizational changes at the farm level that are necessary to gain access to modern markets. This might also reflect the conventional harvesting and marketing habits of the farmers targeting the wholesale or local markets that are – according to some interview partners – difficult to breach.

Moreover, our results show that education of the household head is positively related to inclusion in modern supply chains. This is plausible, because more educated farmers might be more able to understand and to comply with the stricter requirements imposed in these chains. Higher education might also imply higher confidence among farmers which can be important for the decision to enter more serious, formal and sophisticated business relationships with buyers of modern supply chains. There is no scientific consensus as to whether education matters for participation. For example,

Rao and Qaim (2010) find a positive, and Miyata, Minot, and Hu (2009) a negative relationship between education and participation while many other studies cannot identify any significant relationship.

Table 6 also yields evidence of a positive influence of cell phone ownership on inclusion in modern channels. This makes sense, because verbal agreements that are the main governance mechanism in these channels involve constant and flexible communication. We further introduced a dummy variable specifying whether farmers sell additional FFV such as strawberries, tree tomatoes or apples to any market outlet. If they do, we find that their probability to sell to modern markets for blackberry is significantly higher. There are three potential explanations for this effect: first, experience with and awareness of how to cultivate, handle and market high-value crops helps farmers to develop confidence for entering into marketing relationships with more demanding buyers and for meeting their strict requirements. Second, this may signal a greater technological capability of farmers, because FFV marketing is highly correlated with ownership of irrigation systems ($r = 0.42$). Third, we may interpret this finding as a strong commercial orientation, because these farmers engage in the cultivation of crops that usually ensure higher margins as compared to staple crops like maize or beans. Table 6 also shows that wealthier farmers are more likely to participate in modern supply chains, since a household that receives the '*bono de desarrollo humano*' is less likely to have access to modern channels. This points to the exclusion of poor households that appears consistent with some previous studies (Escobal & Cavero, 2011; Neven, Odera, Reardon, & Wang, 2009; Rao & Qaim, 2010).

In this study, we deviate from the common proxy for household wealth - farm size -, because BDH more comprehensively predicts household wealth. We may treat it as an exogenous variable, because BDH comprises wealth indicators, such as household assets or access to infrastructure that are fairly stable over time. These indicators are unlikely to be affected by farmers' participation in potentially more remunerative modern supply chains. Our findings further indicate that farmers less prominently endowed with irrigation systems and agricultural assets are able to participate in modern chains which challenge widespread believes (Berdegué, Hernández, & Reardon, 2008; Hernández, Reardon, & Berdegué, 2007; Hernández, Berdegué, & Reardon, 2012; Neven, Odera, Reardon, & Wang, 2009). In our farm sector context dominated by small farmers, we cannot find exclusion of farmers with small blackberry farm size which measures the potential to produce higher volumes of blackberries. We use blackberry farm size instead of farm size, because it more precisely measures the scale effect in production. Although in a small farm environment, we cannot find evidence that supports the widespread assumption that modern agrifood companies source from farmers that can produce sufficiently large volumes which previous research has discovered and hypothesized (Hernández, Berdegué, & Reardon, 2012; Stringer, Sang, & Croppenstedt, 2009; Swinnen, 2004).

Table 6. Determinants of participation in modern supply chains

Explanatory variables	(1)	Marginal effect (1)	(2)	Marginal effect (2)	(3)	Marginal effect (3)
Household head male (dummy)	-0.197	-0.034	0.073	0.009	-0.084	-0.014
	(0.307)		(0.327)		(0.289)	
Age of household head	0.023***	0.004	0.018*	0.002	0.017**	0.003
	(0.008)		(0.009)		(0.009)	
Education household head	0.078***	0.014	0.012	0.001	0.049**	0.008
	(0.025)		(0.033)		(0.025)	
Cell phone ownership (dummy)	0.365*	0.063	0.327	0.040	0.285	0.047
	(0.214)		(0.253)		(0.215)	
Household labor capacity	0.082	0.014	0.057	0.007	0.087	0.014
	(0.068)		(0.072)		(0.070)	
Off-farm employment (dummy)	0.250	0.043	0.109	0.013	0.200	0.033
	(0.210)		(0.236)		(0.216)	
Blackberry production area (lag)	-0.159	-0.028	-0.442	-0.054	-0.145	-0.024
	(0.259)		(0.335)		(0.265)	
Blackberry specialization	0.056	0.010	0.287	0.035	0.099	0.016
	(0.248)		(0.344)		(0.251)	
Experience growing blackberry	-0.021**	-0.004	-0.023*	-0.003	-0.029***	-0.005
	(0.010)		(0.012)		(0.011)	
Farmer markets other FFV (dummy)	0.555***	0.096	0.429*	0.052	0.516**	0.085
	(0.214)		(0.253)		(0.217)	
Ownership of irrigation system (lag)	0.098	0.017	-0.015	-0.002	-0.004	-0.001
	(0.231)		(0.280)		(0.238)	
Agricultural asset index (lag)	0.016	0.003	-0.169	-0.020	-0.077	-0.013
	(0.101)		(0.116)		(0.095)	
Distance to provincial capital Ambato	0.004	0.001	0.006	0.001	0.008	0.001
	(0.006)		(0.006)		(0.006)	
Bono de desarrollo humano (dummy)	-0.603***	-0.105	-0.542**	-0.066	-0.466**	-0.077
	(0.222)		(0.265)		(0.237)	
Number of modern chain blackberry farmers in SN			0.317***	0.389		
			(0.060)			
Social network index (SNI)					1.475***	0.243
					(0.425)	
Constant	-3.181***		-2.629***		-3.029***	
	(0.706)		(0.735)		(0.711)	
Number of observations	364		364		364	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

We also interpret the marginal effects of model (1), because they may help to understand the magnitude of the effects which is necessary for prioritizing policies and programs. If farmers cultivate and market other FFV, they are 9.6% more likely to participate in modern supply chains. If farm households are poor according to the definition of the BDH, their probability to participate falls by 10.5%. The remaining marginal effects for other determinants are rather modest.

In model (2), we add the endogenous social network effect on participation in modern marketing channels. This variable turns out to be highly significant: A higher number of farmers participating in modern supply chains in the individuals' network are associated with a higher likelihood of that individual farmer to participate. Since we consider the endogenous effect in our estimation, we cannot establish a causal relationship. We can confidently say, however, that the network influences the farmer and the farmer may simultaneously influence his or her social network. The marginal effect of the endogenous social network is strong. It shows that having one additional participating blackberry farmer in an individual's social network increases the probability of that individual being chosen as a supplier to these markets by 39 percent. Model (2) further reveals that some of the effects we identified in model (1) are less pronounced. This is probably due to the fact that our social network variable, which was omitted in model (1), correlates with many of the significant variables of the first model. The positive effect of age and marketing other FFV and the negative influence of experience remain robust. The marginal effects, however, are smaller in most cases.

The third model specification includes the social network index (SNI) and omits the social network variable included in the second model. SNI is highly significant and thus suggests that overall social connectedness plays a prominent role in farmers' participation in modern supply chains. The marginal effects indicate that an increase from 0 to 100% of the index is associated with a 24.3% increase in the probability that a farmer will sell to modern markets. Factors that became insignificant in the second estimation become significant—albeit slightly less so than in model (1)—determinants in model (3).

Next, we included *canton* fixed effects in the three model specifications to test the robustness of our results. The results of the models (4), (5) and (6) are presented in table 7. In model (4), the effects – except for experience – remain robust to the inclusion of canton-fixed effects, but smaller. This suggests that geographic peculiarities such as *canton* characteristics matter for farmers' inclusion in modern supply chains. Moreover, it shows that some of the household and farm level characteristics interact with certain districts. For example, a decrease in the significance level of household wealth measured by BDH indicates a correlation between district level characteristics and BDH. Model (5) shows that the endogenous social network effect on participation remains robust. Hence, we can be more confident that this variable genuinely measures the network effect and not only correlated behavior on the *canton* level. Age, experience and the decision if a farmer markets

other FFV becomes insignificant. Model (6) confirms the robustness of our main variable of interest, SNI. Comparing the results to the corresponding model (3) that excludes fixed effects, we find that almost all explanatory variables remain significant determinants.

Table 7. Determinants of participation in modern supply chains (canton fixed-effects)

Explanatory variables	(4)	Marginal effect (4)	(5)	Marginal effect (5)	(6)	Marginal effect (6)
Household head male (dummy)	-0.086	-0.014	0.079	0.009	-0.026	-0.004
	(0.309)		(0.350)		(0.299)	
Age of household head	0.027***	0.004	0.014	0.002	0.022**	0.003
	(0.009)		(0.010)		(0.009)	
Education household head	0.062**	0.010	-0.008	-0.001	0.044*	0.007
	(0.026)		(0.031)		(0.026)	
Cell phone ownership (dummy)	0.388*	0.061	0.306	0.036	0.321	0.050
	(0.224)		(0.254)		(0.222)	
Household labor capacity	0.080	0.013	0.023	0.003	0.085	0.013
	(0.071)		(0.074)		(0.073)	
Off-farm employment (dummy)	0.260	0.041	0.162	0.019	0.205	0.032
	(0.222)		(0.245)		(0.227)	
Blackberry production area (lag)	-0.189	-0.030	-0.416	-0.049	-0.144	-0.022
	(0.288)		(0.368)		(0.281)	
Blackberry specialization	0.134	0.021	0.230	0.027	0.184	0.028
	(0.238)		(0.353)		(0.243)	
Experience growing blackberry	-0.015	-0.002	-0.016	-0.002	-0.021*	-0.003
	(0.010)		(0.012)		(0.011)	
Farmer markets other FFV (dummy)	0.404*	0.064	0.342	0.040	0.377*	0.058
	(0.228)		(0.266)		(0.229)	
Ownership of irrigation system (lag)	0.100	0.016	-0.014	-0.002	0.038	0.006
	(0.241)		(0.291)		(0.244)	
Agricultural asset index (lag)	-0.108	-0.017	-0.240**	-0.028	-0.161	-0.025
	(0.110)		(0.119)		(0.106)	
Distance to provincial capital Ambato	-0.049**	-0.008	-0.050**	-0.006	-0.042*	-0.007
	(0.023)		(0.025)		(0.023)	
Bono de desarrollo humano (dummy)	-0.430*	-0.068	-0.423	-0.050	-0.388	-0.060
	(0.261)		(0.308)		(0.269)	
Number of modern chain blackberry farmers in SN			0.312***	0.036		
			(0.063)			
Social network index (SNI)					1.084**	0.167
					(0.421)	
Constant	-2.978***		-1.770**		-2.759***	
	(0.803)		(0.855)		(0.806)	
Number of observations	364		364		364	

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

3.7 Conclusions

The emergence of modern supply chains in many developing countries offers opportunities for farmers to generate higher incomes and to upgrade farm technologies. High requirements of agrifood companies imposed on supply relationships with upstream suppliers pose considerable access barriers to farmers. Against this background, a number of studies have explored factors that influence farmers' capability to meet these requirements and to participate in modern markets.

We collected original survey data from blackberry farmers in the Ecuadorian Andes to examine the role of individual social networks for inclusion in these markets. The Ecuadorian blackberry sector is characterized by a large number of small-scale farmers that exclusively supply to the quality-differentiated domestic market. Modern agrifood firms that procure blackberries in this market face high levels of transaction costs associated with uncertainty about the small farmers' capability to comply with the firms' demands. As a result, firms decided to set up new and modernized supply chains using mechanisms such as verbal agreements or contracts to more closely control cultivation, harvest and delivery conditions.

It is conceivable, however, that the social network effect on participation in modern supply chains is not only established through farmers that already participate in these chains. There are potentially other key contacts among the farmers' network that are able to provide the necessary link to the buyer of a modern chain. For example, it could be that farmers socially or professionally interact with governmental employees in agricultural departments. These employees in turn may maintain contacts with the agrifood industry in order to be informed about or to influence their business environment and constraints. Agrifood firms may rely on these employees and their network of farmer contacts in order to select these farmers as potential suppliers.

In this article, we show that a farmer's individual social network plays an important role for participation in modern supply chains. We differentiate between two specifications of social network. First, we estimate the endogenous social network effect and control for correlated unobservable factors at the level of *cantons*. Our results suggest that the number of suppliers to modern markets in a farmers' network positively influences the probability that the farmer participates in modern chains. Second, we computed a social network index (SNI) to take account of the multidimensionality of the social network concept which consists of several proxies for the amount of contacts that can link farmers to supply chains. We find that SNI has a positive and highly significant effect on participation.

Our study also suggests more cautiousness about the role of farm size and farm technology for participation that have been singled out as the key determinants in previous research (Berdegué, Hernández, & Reardon, 2008; Escobal & Cavero, 2011; Hernández, Berdegué, & Reardon, 2012; Hernández, Reardon, & Berdegué, 2007; Reardon, Barrett, Berdegué, & Swinnen, 2009) and to

avoid overly general statements about their influence. In our study context, the blackberry farm sector is homogenously composed of a large number of small farmers that own around 1 ha on average. Consequently, agrifood companies must source from small farmers. We also cannot find evidence of exclusion of farmers based on their blackberry area under cultivation which proves that even farmers with lower production volumes can be included. Likewise, our results show that ownership of *threshold-assets* such as agricultural assets and irrigation systems are not significant determinants of participation. This is due to the different context in which farmers cultivate blackberries. Blackberry cultivation practices in the Ecuadorian Andes are typically labor-intensive where technology is not a major barrier to enter modern supply chains. Companies procuring blackberries also do not demand such investments from their suppliers. Moreover, our study confidently shows that older, more educated, late adopters of blackberry and farmers marketing other FFV are more likely to participate.

The findings of our study bear a number of implications for the design of policies and programs. We propose a two-step procedure: first, effective and sustainable interventions to support farmers' inclusion in modern supply chains should be embedded in a thorough and careful analysis of the market and the magnitude of market transformation towards modernization of the particular crop under analysis. This is essential given the continuing persistence of traditional retail outlets in many low-income countries (Cadilhon, Moustier, Poole, Giac Tam, & Fearne, 2006; Humphrey, 2007). Firm visits and semi-structured interviews with key representatives would be needed in order to better understand their sourcing preferences, constraints and resulting procurement decisions. Such an approach allows inference of the prospective growth dynamics of the modern market segment and the respective product volumes that will be channeled through these chains. This is important to know, because the potential scope to sustainably integrate farmers into modern supply chains is to a large extent contingent on the expansion of this modern market segment and the strategic decisions of firms.

Second, the results of our study lend support to the necessity to provide farmers with social ties that can facilitate participation in modern supply chains. This may involve better access to information and creation of awareness of these marketing opportunities in the form of information platforms such as farmer field days in which farmers can informally exchange experience. Such events could also be used to facilitate interactions between farmers and agrifood companies that can help to overcome prejudices and uncertainties originating from asymmetric information. This would also call for a re-definition of governmental support services that are predominantly targeted at improving cultivation practices or the adoption of agricultural technologies. Adapting these services to the requirements of modern markets may also help to induce behavioral change and to break traditional habits of harvest and post-harvest handling which might be barriers for early adopters of blackberries according to our estimations. Our findings also yield evidence that support to farmers tailored

to the expansion of irrigation systems and other technologically advanced agricultural assets would not guarantee their participation in modern channels. We argue here that such kind of support has to be carefully adjusted to the specific context of the farm sector, the state of farming technology and agro-ecological conditions in which farmers cultivate their agricultural produce. Our estimations further imply the need to make sure that these presumably more profitable marketing opportunities reach poor farm households and farmers that are – except for blackberry – engaged in the cultivation and marketing of lower value crops.

The link between social networks and supply chain participation remains a fairly unexplored research direction. In this contribution, we offer a first step into this direction and integrate these important research areas. We set out to prompt further research that investigates different facets of this interplay. A potential direction could be a more in-depth analysis of the underlying pathways through which social networks affect modern supply chain participation such as the *screening* or *information cost hypotheses*. In our study, we assume that farmers' social networks positively affect inclusion. We recognize, however, that social networks effects can also lead to dropouts from modern supply chains when farmers share bad experiences such as opportunistic behavior or payment delays of the buyer. Panel data can be a useful improvement of our study design that helps to explore the duration of supply relation under a social network perspective. In our estimations, we were only able to measure the endogenous social network effect. Future research should find ways to circumvent the endogeneity problem and identify a clearer direction of causality.

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4 INCOME EFFECTS OF MODERN SUPPLY CHAIN PARTICIPATION – THE CASE OF BLACKBERRY FARMERS IN THE ECUADORIAN ANDES

Abstract. In this article, we use original survey data to examine income effects of modern supply chain participation in the Ecuadorian blackberry sector. As opposed to previous studies, we do not find any evidence that participation has a positive effect on blackberry or household income. Modern supply chains do not create sufficient benefits for participants to intensify blackberry production which is why their livelihood strategy is premised on off-farm employment. Traditional supply chain participants have higher net income from blackberry farming derived from higher yields and sales volumes that modern supply chain participants cannot compensate by a higher price. Public policy should not *per se* support farmers in gaining access to modern supply chains, since our results did not show any sizeable positive effects.

Keywords. Modern supply chains, incomes, blackberry, propensity score matching, Ecuador

4.1 Introduction

Since the turn of the millennium, the modernization of agrifood supply chains in developing countries has attracted growing interest among researchers, governments and the development community alike (Reardon, Barrett, Berdegué, & Swinnen, 2009; Reardon, Timmer, Barrett, & Berdegué, 2003). Modernization has commonly been conceptualized as a systematic change in the way firms operating in the agrifood sector coordinate and organize the procurement of agricultural produce. These changing procurement systems often involve new types of marketing relationships between different actors along the supply chain, such as verbal agreements or contracts (Reardon, Barrett, Berdegué, & Swinnen, 2009), and the introduction of private standards and norms with clear quality, quantity, and transaction criteria that are more demanding than the ones prevailing in traditional supply chains (Berdegué, Balsevich, Flores, & Reardon, 2005; Biénabe, Berdegué, & Peppelenbos, 2011).

Against this background, a growing body of literature has studied the socio-economic implications of restructuring agrifood sectors for actors and segments situated upstream of modern retailers and agro-processors. Particular emphasis has been laid on the role of farm households that cultivate and sell agricultural produce under these altering market conditions. Previous research has taken a rather positive stance towards the interaction between farmers and modern supply chains, and consequently stressed the benefits of such linkages. The basic intuition is that companies that govern modern supply chains offer a more favorable price (Neven, Odera, Reardon, & Wang, 2009; Hernández, Berdegué, & Reardon, 2012) in order to reward farmers' compliance with their supply and quality specifications. A higher price is often complemented with price stability and guaranteed purchasing quantity that can reduce marketing risks and transaction costs from a farmers' perspective (Hernández, Reardon, & Berdegué, 2007). There are also potential indirect benefits that accrue to farmers integrated in modern supply chains, when firms seek to build the farmers' technical and managerial capacity to be entitled to sell to these markets. This may involve the provision of inputs (e.g. fertilizer, credit) and agricultural extension services (Miyata, Minot, & Hu, 2009) which can lead to an increase in productivity levels. Previous research has shown that these marketing benefits can translate into higher farm or household income (Andersson, Chege, Rao, & Qaim, 2015; Escobal & Cavero, 2011) for some farm households, while others remain excluded from these potentially more lucrative marketing options (Neven, Odera, Reardon, & Wang, 2009; Reardon, Barrett, Berdegué, & Swinnen, 2009). From a policy perspective, it is important to be aware of and to understand the socio-economic implications of the modernization of agrifood sectors for farm households which is ongoing in many parts in the developing world.

The aim of this article is to contribute to the debate on the welfare implications for farmers participating in modern supply chains. We present a new case-study from the Ecuadorian Andes where

blackberry growers engage in marketing linkages with buyers at downstream stages of the blackberry supply chain. This study distinguishes from previous research in two important facets. First, the vast majority of related studies have analyzed the effects of vertical marketing relationships coordinated under contractual arrangements (Andersson, Chege, Rao, & Qaim, 2015; Barrett et al., 2011; Escobal & Cavero, 2011; Myata, Minot, & Hu, 2009). These arrangements constitute a very tight form on the continuum of vertical coordination options to structure marketing relationships in a given supply chain. Contracts with small farmers involve intensive interaction between farmers and buyers that includes concerted assistance by the provision of inputs, technical support and a significantly higher price to incentivize farmers' participation in such tight relationships. In our study context, the main organizational form of market linkages is verbal agreements which embody a more flexible form of vertical coordination between trading partners. Our study sets out to advance the understanding on the income effects of modern marketing channel participation under such circumstances. Second, the major part of previous studies has analyzed the production and sale of annual plants such as fresh vegetables. Blackberry is a labor-intensive perennial plant with different input and investment costs. It is therefore critical to understand if selling such types of crops to modern markets also yields positive income effects. This question is of particular concern, since blackberry farmers in our sample live in peri-urban settings with reasonable access to road and communication infrastructure which exposes them to a broader set of opportunities for alternative income sources, especially off-farm employment.

We choose the Ecuadorian blackberry sector for the analysis, because blackberry is an important product in the domestic market that has experienced steady and growing demand. This has led to changes in the organization of the blackberry sector and the emergence of modern supply chains. Thus, we may anticipate significant effects on the incomes of farm households. We selected Tungurahua province, because it is characterized by a long-standing tradition of blackberry cultivation and a broad variation of marketing channels which was important for our study design. More importantly, Tungurahua province is the dominant FFV catchment area of modern supermarkets and agro-processors, such that we expected sufficient coverage of blackberry farmers participating in these supply chains.

This article proceeds as follows: we review the empirical evidence on the welfare impacts of modern supply chain participation in section 4.2. Subsequently, we present the study context of the Ecuadorian blackberry sector. Part 4.4 deals with a description of the data that we collected in Ecuador. The underlying estimation procedure for our analysis is explained in the following subchapter, before we discuss our findings in section 4.6. Finally, we conclude with policy recommendations.

4.2 Literature review

The majority of studies analyzing economic impacts of modern supply chain participation on farm households in developing countries demonstrate positive income effects. Monetary income measures used in these studies can be distinguished into profitability or net incomes of a specific crop that is sold to different marketing channels, and a more comprehensive measure of overall household income. We divide the existing body of literature along these two income measures.

Hernández, Reardon, and Berdegué (2007) for tomato in Guatemala, Hernández, Berdegué, and Reardon (2012) for guava in Mexico, and Neven, Odera, Reardon, and Wang (2009) for kale in Kenya examine mean differences in net incomes from selling the respective agriculture produce under study to modern or traditional markets using mean comparison tests. For the case of Mexico, they find that higher yields, better quality production, and lower production costs lead to higher net guava incomes for modern marketing channel participants. Likewise, Kenyan kale farmers selling to modern markets obtain higher incomes. The main mechanisms for these benefits, however, can be attributed to a sharp difference in prices between the two channels. Conversely, the investigation by Hernández, Reardon, and Berdegué (2007) demonstrates that farmers selling to traditional markets achieve higher incomes from tomato sales. This is due to the higher production costs among supermarket suppliers that are not fully compensated for by a more favorable price.

These studies, however, are not able to control for other factors that could have affected net incomes. As a result, a number of other studies have used econometric techniques to more confidently attribute the difference in incomes to participation. Escobal and Cavero (2011) explore the effects of entering into contractual relationships with agro-industrial firms on net potato income in the Peruvian highlands by applying endogenous switching regression techniques. The reported results indicate an increase in net potato income per ha when farmers contract with agro-industrial firms. The disaggregated profitability analysis shows that this results from a combination of higher sales volumes and prices in this channel. Narayanan (2014) opts for the same methodology analyzing net profits for gherkins, papaya, broiler and marigold under contracts in Southern India. He finds mixed effects of contractual relationships depending on the type of agricultural product and the particular firm farmers supply to. For the case of marigold, selling to the fresh local market would have yielded higher net profits per hectare than contracting with agro-processing firms. Narayanan (2014) demonstrates that this is caused by sharp price fluctuations in the local market for marigold which is responsible for a typically higher average price in this market segment.

Further research incorporates household income as a welfare indicator and can therefore provide a more comprehensive picture on the effects of modern supply chain participation. The main argument in this respect is that household income can more accurately take into account allocation of household labor to different income generating activities. We may anticipate, for example, that

selling agricultural produce to modern marketing channels requires allocating more family labor to these quality demanding and labor-intensive activities in a particular household which may come at the expense of, for instance, off-farm employment. Hence, it could be that selling to modern supply chains increases farm incomes which would overlook, however, that traditional market suppliers might have more household labor disposable for alternative income sources. The empirical evidence base is fairly consistent and strongly positive. Miyata, Minot, and Hu (2009) for the case of apple and onion farmers contracting with packers and supermarkets in China, and Wang, Moustier, and Nguyen (2014) for vegetable marketing under contract in Vietnam observe a positive and significant effect of participation in modern supply chains on household income. In two waves of data collection among farmers in the Kenyan vegetable sector, Rao and Qaim (2010) and Andersson, Chege, Rao, and Qaim (2015) show in both studies that participation in supermarket channels is associated with large income gains.

An exception with respect to the definition of household welfare to the above studies is Michelson (2013), who estimates effects of supplying to Walmart in Nicaragua on productive asset holdings using a quasi-panel study design to identify the impact before and after participation. The significant and positive effects on farmers' household assets and landholdings are in line with previous research.

4.3 Ecuadorian blackberry sector

The Ecuadorian Andes are well-known for its rich diversity of fresh fruits and vegetables (FFV) such as different types of berries, apples, peas, tree tomatoes, onions or potatoes. Blackberry is one of the most important fresh fruits and the production and marketing supports the livelihood of many farm households (INIAP, 2008). According to the latest official statistics - the Ecuadorian agricultural census of 2000 -, the national surface under blackberry cultivation amounts to 5,247 ha on which blackberry growers achieve average yield levels of 2,626 kg per hectare (MAGAP, 2013). In recent years, however, production levels have decreased as a result of shrinking blackberry cultivation area. Current estimates assume a national cultivation area of around 2,200 ha. The consumption of blackberry has a cultural tradition in Ecuador, and thus enjoys a fairly stable and flourishing demand in the Ecuadorian market. Blackberry is consumed on a daily basis and reaches weekly average consumption rates of two kg per Ecuadorian household. Ecuadorian consumers especially appreciate the nutritional value and perceived health benefits as blackberry is an important source of various vitamins and minerals with a high antioxidant capacity (INIAP, 2010). In the Ecuadorian Andes, blackberry is commonly cultivated on small areas and weekly harvested by hand. Once harvested, a short storage time and rapid transport are essential in order to avoid quality losses and adverse sanitary condition of the fruit. Blackberry farmers have several marketing opportunities that differ by quality requirements, type of final product, supply volume and price.

A prominent marketing channel is the agro-processing industry in which semi-processed and fully processed blackberry products such as juices, pulps, or yoghurts are manufactured using blackberries as raw materials. Their plants absorb a large amount of the blackberries which are supplied to the national market. In expert talks, firm managers expressed strong preferences for the variety *mora de castilla* that is predominantly grown in the central Andean province of Tungurahua. *Mora de castilla* unites the desired fruit characteristics of high sugar content and medium degree of acidity which is considered as most efficient from a process management perspective. In agro-processing supply chains, farmers commonly conclude verbal agreements with the respective company which specifies post-harvest practices, consistent quality parameters, supply volume, clear delivery schedules that farmers must adhere to.

Apart from the agro-processing sector, farmers may also enter into supply relationships with modern supermarket chains in which fresh blackberries are offered in small presentations to middle- or upper-class urban consumers. Supermarket managers reported to apply stringent quality requirements for blackberry supplies. These requirements largely relate to appearance as opposed to the more intrinsic characteristics in the agro-processing sector, since consumers will immediately inspect the product attributes in supermarkets. Blackberry suppliers to supermarkets must comply with predetermined norms and guidelines which both parties agree upon in usually verbal agreements. The main parameters are ripeness, size, shape, freshness and firmness. At the moment of delivery, these parameters become controlled and evaluated on the basis of predetermined norms. Pesticide residues are not inspected in neither of the supermarkets that we were able to visit. In addition, supermarkets specify a weekly target volume and delivery time that suppliers have to meet.

The dominant agricultural market in the Ecuadorian Andes, however, is the wholesale market in Ambato which is also the most important market outlet for blackberry farmers in our sample region Tungurahua. For many blackberry farmers in Tungurahua province, this wholesale market is the only plausible marketing option. Farmers that decide to sell to this market pack their berries into wooden baskets and use their own vehicles or public transport to bring their harvest to the market. Transactions are anonymously made out on the spot and typically governed by the price which is negotiated upon arrival in the market. Prior agreements on product quality or other specifications which we observe in the modern retail and agro-processing sector are not arranged. Traders that operate in this market have strong bargaining power which enables them to exercise pressure on the price exposing farmers to substantial price risk. The price for one kilogram of blackberries fluctuates considerably throughout the year given periodic supply and demand spikes in the national market. While this produces price risks for farmers as such, farmers regard the wholesale market as a secure market outlet, because it usually absorbs the full amount of supplied agriculture produce independent of product quality and quantities.

Blackberry farmers also have the opportunity to sell to traders and the local market that are less relevant than wholesale markets. Traders directly pick up blackberries at the farm-gate or a central collection point of a village and presumably supply larger distribution centers that are in most of the cases wholesale markets. The exact destination market of traders is mostly unknown, because traders normally represent first-buyers for farmers that are unaware of the exact trading partner or market downstream in the supply chain. Local markets in the Ecuadorian context refer to periodic markets - *plazas* - or street fairs and other traditional retail formats, such as kiosks or mini marts. The price is the central coordination mechanism in the spot-market relationships in these channels. Similar to wholesale markets, verbal or even written agreements are very exceptional institutional arrangements of supply relationships in these market outlets.

The description of the marketing options for blackberry producers is critical for our study design, because it helps us to categorize the various buyers into modern and traditional supply chains. The marked difference between these two can be shown taking buyers of supermarket and agro-processing supply chains as an illustration. In these channels, blackberry farmers have to comply with strict requirements and norms related to quality, consistency, quantity of blackberries and clear delivery schedules. These are safeguarded through commonly verbal - in a few cases written - agreements. Another striking feature is the use of superior post-harvest practices in order to preserve the quality characteristics of the fruit and to avoid physical damage. Consequently, specialized traders sourcing for supermarkets and agro-processors or the companies themselves can be classified as modern marketing channels. There is a clear difference to the traditional supply chains which in our sample includes traditional traders, local markets, and chiefly wholesale markets. Participation in these chains involves open spot-market relationships, in which stringent requirements on quality, quantity and other specifications do not play the decisive role for choice of the trading partner. As a result, marketing relationships are predominantly organized by the price.

4.4 Data

We collected primary data in the central Andean Province of Tungurahua applying a combination of qualitative and quantitative research methods. We held semi-structured interviews with purchasing managers of supermarkets and agro-processing firms, blackberry sector experts, and blackberry farmers. This was essential in order to grasp the organization of the blackberry sector and the specific quality, quantity, and transaction requirements associated with the different supply chains. In doing so, we also received a thorough insight into the constraints faced by blackberry farmers about crop management, entrepreneurial, and marketing decisions which was helpful in interpreting the econometric results. We collected original survey data from blackberry farmers using a standardized questionnaire eliciting information on different household and farm characteristics, farm output and production costs, incomes, access to information, and endowment with agricultural and

household assets. Farmers provided recall data for the year 2012 with the help of carefully selected and trained local research assistants.

Our sampling strategy rests on a stratified random sampling technique. The two strata are composed of farmers participating in modern supply chains and farmers exclusively participating in traditional supply chains. Thanks to the semi-structured interviews conducted, we were aware of the most important buyers, their preferred institutional arrangements and requirements pertaining in the particular chains. This allowed us to classify the buyers and therefore also blackberry farmers that were selling to these buyers into the two strata. For the first strata, we requested the full list of farmer suppliers and their contact details if blackberry farmers were direct suppliers to a modern firm. In case there was no direct marketing relationship between the farmer and the modern firm, we solicited the contact details of their specialized trader which we approached subsequently in order to obtain their preferred supplier lists of blackberry farmers. In some cases, traders were not willing to share any sensitive information with regard to their suppliers. Hence, we had to limit our sampling frame of farmers selling to modern supply chains to 51 blackberry farmers which are located in five *cantones*.[1] We interviewed all of them in order to assure a sufficient coverage of this group of farmers in the sample.

For the second strata, a reliable sampling frame that would contain a list of blackberry farmers selling to traditional supply chains was not available. Instead, we opted for the following procedure. First, we purposively chose the five *cantones* Ambato, Cevallos, Mocha, Píllaro, and Pelileo which we had already covered in first strata and added the two *cantones* Patate and Baños in order to ensure a representative and dispersed sample for the whole province. Second, we purposively selected *parroquias*[2] within the selected *cantones* based on discussions with blackberry sector experts. The critical condition for selection was the presence of a sufficient number of blackberry farmers in *parroquias* and the possibility to compile lists of these farmers with the assistance of local field guides and enumerators. We interviewed 313 blackberry farmers in these *parroquias* that we classify as traditional supply chain farmers. We dropped one observation where we detected substantial measurement error. The sample for our analysis consists of 363 blackberry farming households. For analytical purposes, we classify a farm household as participant of the modern supply chain, if the farmer sold blackberry quantity larger than 0 in the year 2012 to a buyer that is either a modern supermarket or agro-processing firm directly, or a specialized trader that acts as procurement agent for these firms.

[1] Canton is the second lowest administrative unit in Ecuador.
[2] Parish is the lowest administrative unit in Ecuador.

4.5 Estimation strategy

We are interested in exploring the effects of participation in modern supply chains on income of blackberry growing households. We differentiate between two income measures: income derived from blackberry farming only and total household income. For the former, we calculate blackberry net incomes as the product of blackberry quantities sold and the average price less the aggregated variable production costs of blackberry growing (blackberry plants, chemical fertilizer, manure, herbicides, insecticides and labor costs). For the latter, we aggregate different income sources namely farm income (already including blackberry incomes), income generated from livestock and off-farm income. An analysis of the impacts of marketing channel choice on total household income gives us a broader picture about the extent to which participation in modern supply chains affects household welfare. For example, it could be that selling blackberries to the allegedly more lucrative modern markets requires allocating more land and family labor to the cultivation of this plant. Consequently, the result of higher blackberry income might be a reduction in overall farm or off-farm income, such that a focus on blackberry income alone will probably not be meaningful to draw any conclusions about household welfare gains.

The literature on impact evaluation offers a broad range of different methods to estimate the *causal effect* of a treatment T - e.g. an intervention or a program - on a specific outcome of interest Y, say income (e.g. Gertler, Martinez, Premand, Rawlings, & Vermeersch, 2011). The main challenge of impact evaluations is approximating a counterfactual scenario, i.e. we have to answer the question on what would have happened to the program participant, if the program did not exist. As we cannot observe the outcome for the participant if he or she had not participated, we have to form a credible comparison group that comes as close as possible in observed and unobserved characteristics to the program participant.

Randomized assignments into treatment and control group would produce two groups that are very likely to be statistically identical in terms of observed and unobserved characteristics besides the treatment. This was not feasible in our observational study where assignment into treatment is non-random. Consequently, our treatment and control groups are very likely to differ in observed and unobserved characteristics. These differences are termed selection bias in the impact evaluation literature. In our case study, the treatment T selection bias would occur when modern supply chain buyers choose specific farmers as suppliers based on their farms size (commonly observed) or perceived superior entrepreneurial skills (commonly unobserved). Farmers may also self-select into modern supply chains for reasons such as marketing preferences, confidence or motivation. If this was the case, the estimated treatment effect on our outcome variables of interest would be the *combined* effect of modern supply chain participation and selection bias. Our treatment estimates would

be biased and inconsistent, thus probably leading to incorrect conclusions about the role of modern markets for stimulating income of farming households (Khandker, Koolwal, & Samad, 2010).

Several studies have used mean comparisons of net incomes generated from sales of a specific crop to modern and traditional marketing channels (e.g. Hernández, Berdegué, & Reardon, 2012; Hernández, Reardon, & Berdegué, 2007; Neven, Odera, Reardon, & Wang, 2009). Any observed difference, however, cannot be satisfactorily attributed to participation in a particular channel only, because we could expect that other factors, such as farm size or agricultural asset holdings can partly explain this difference in net incomes. Therefore, we have to control for these factors using more advanced impact evaluation techniques.

We build on Barrett et al. (2012) who propose a set of possible impact evaluation techniques for a similar study design. Our model specifications rest on the conditional independence assumption (CIA). This assumption implies that all factors which influence participation in modern supply chains can be observed. CIA would be violated, if there were unobserved factors (e.g. farmers' entrepreneurial skills, confidence) that not only affected participation, but were also correlated with our outcome variable, incomes. This would possibly result in biased and inconsistent estimates of the treatment effect – participation in modern supply chains. We are aware that conditional independence is a far-reaching assumption, because it is not unlikely that unobservable characteristics determine both, participation in modern supply chains and income (Barrett et al., 2012). As we could not identify a credible instrument, however, we control for as many observable characteristics as possible.

One standard way to estimate the impact of a treatment is ordinary least squares (OLS) regression which has been frequently used in related studies (e.g. Miyata, Minot, & Hu, 2009; Schipmann & Qaim, 2010; Wang, Moustier, & Nguyen, 2014). For blackberry income, it can be formulated as follows:

$$Y_i^{berry} = \delta + \alpha \mathrm{P}_i + \beta \mathrm{X}_i + \varepsilon_i \quad (1)$$

where Y_i^{Berry} denotes blackberry income in household i. P_i is the treatment effect which equals 1 if a household participated in modern supply chains and 0 otherwise. X_i is a set of explanatory variables representing household, farm and geographic characteristics assumed to influence blackberry incomes. Among our sample of blackberry farmers participating in modern supply chain, we find substantial presence of farmers that sell only a specific share of their blackberries to this chain. Blackberry incomes of farmers classified as modern chain participants in model (1) are therefore to some extent influenced by the production processes for, and marketing particularities of traditional channels. We take this into account and redefine the treatment variable to include the sales proportion of blackberries that farmers sold to modern markets defined as the participation intensity (PI).

Model (2) can be specified as:

$$Y_i^{berry} = \delta + \alpha \mathrm{PI}_i + \beta \mathrm{X}_i + \varepsilon_i \quad (2)$$

In addition to OLS regressions, we use propensity score matching (PSM) to estimate the impact of participation in modern supply chains on blackberry income. PSM is a non-parametric technique pioneered by Rosenbaum and Rubin (1983). This procedure allows controlling for selection bias on observables and thus supports our conditional independence assumption. In other words, PSM is concerned with finding a comparison group that comes statistically as close as possible to the treatment group in terms of observed characteristics (Ravallion, 2001). However, finding observations in the treatment and control groups that are precisely identical is barely possible. For that reason, PSM estimates a probit model in the first place to calculate the farmers' *propensity* to participate in the treatment group as a score, the propensity score (PS). Subsequently, observations in our two groups are matched based on the closeness of the predicted propensity scores. We can then isolate the average treatment effect on the treated (ATT) which amounts to the mean difference in outcomes across these two groups conditional on matching of observations that area highly similar in term of observed characteristics (Khandker, Koolwal, & Samad, 2010):

$$ATT = E[Y^{Berry}(1)|T = 1, P(X)] - E[Y^{Berry}(0)|T = 0, P(X)] \quad (3)$$

where Y^{Berry} (1) and Y^{Berry} (0) are the potential outcomes (blackberry income) for farmers that receive the treatment (T=1), participation in modern supply chains, versus control group farmers that do not receive the treatment (T=0).

Several matching procedures are available for PSM. We chose nearest neighbor matching (NNM), kernel-based matching (KM) and radius matching. NNM matches each observation of the treatment group with an observation of the control group that is as close as possible in terms of PS. The aim is to minimize the distance of propensity scores between the treated farmer and his or her match in the untreated group. We match the treated farmer with the four nearest neighbors. KM employs the propensity scores of the whole set of control group observations to determine a suitable match for each observation of the treatment group. The PS of the control group farmers are weighted inversely proportional to the distance of PS between treated and control observation, i.e. the closer PS between these groups, the higher the weight assigned. We define a default bandwidth of 0.06 for KM. Radius matching involves matching of untreated observations that fall within a predetermined radius - the so-called caliper - of the PS of treated observations. We restrict this caliper to 0.008 following Fischer and Qaim (2012). We perform matching with replacement for all matching algorithms which ensures that each control unit can be matched several times with treatment units if it represents the closest distance in term of PS, i.e. if he or she is the best match.

One question of concern is the choice of variables which can influence farmers' participation in modern supply chains which can be used to calculate the propensity scores. As opposed to

Maertens and Swinnen (2009) and Wang, Moustier and Nguyen (2014), who solely include few conventional controls, we follow Fischer and Qaim (2012), and Chiputwa, Spielman, and Qaim (2015), who suggest incorporating a much broader set of covariates to enhance precision and reliability of the computed propensity scores. It is important to note that, ideally, only the variables should be included which were measured before joining a modern supply chain and which are likely to be unaffected by farmers' inclusion in this chain (Ravallion, 2001) in order to circumvent problems of reverse causality. Thus, we include variables with a time lag in our probit model when appropriate. One of the key assumptions of PSM is extensive overlap of propensity scores across treatment and control group farmers to assure an area of common support (Khandker, Koolwal, & Samad, 2010). In other words, the PS of one group should not systematically exceed the maximum or fall below the minimum of the PS of the other group. This is important to ensure the selection of statistically very close matches and to avoid bias that would emerge if too many observations had to be dropped due to lack of common support.

So far, we have presented impact evaluation techniques to estimate the effect of participation in modern supply chains on net blackberry income. As already explained, an analysis of household income helps us to attain a better understanding of the overall welfare effects of marketing channel choice for a blackberry producing household. Therefore, we repeat the previous procedures, but define household income as our outcome variable of interest. We specify models (4), (5), (6), as follows:

$$Y_i^{House} = \delta + \alpha \mathrm{P}_i + \beta \mathrm{X}_i + \varepsilon_i \quad (4)$$

where $Y_{\mathrm{i}}^{\mathrm{House}}$ denotes household income *i,* P_i is our treatment variable which equals 1 if a household participated in modern supply chains and 0 otherwise. X_i is a set of explanatory variables related to household, farm and geographic characteristics assumed to influence household income. The selection of covariates is broadly informed by previous studies which in similar ways have explored impacts on household income (c.f. Hansen & Trifkovic, 2013; Maertens & Swinnen, 2009; Wang, Moustier, & Nguyen, 2014; Schipmann & Qaim, 2010).

We encountered a substantial presence of farmers that sell only a specific share of their blackberries to modern supply chains. We recognize this to potentially influence our outcome variable of interest and redefine the treatment variable to include the sales proportion of blackberries that farmers sold to modern markets as participation intensity (PI):

$$Y_i^{House} = \delta + \alpha PI_i + \beta \mathrm{X}_i + \varepsilon_i \quad (5)$$

Finally, we estimate the average treatment effect on the treatment of participation in modern supply chains on household income using PSM. We include the identical covariates for the probit model of receiving the treatment which predicts our propensity score. NNM, KM, and radius matching are chosen with the same specifications as matching algorithms:

$$ATT = E[Y^{House}(1)|T = 1, P(X)] - E[Y^{House}(0)|T = 0, P(X)] \quad (6)$$

where Y^{House} (1) and Y^{House} (0) are the potential outcomes (household income) for farmers that receive the treatment (T=1), i.e. participation in modern supply chains, versus control group farmers that do not receive the treatment (T=0).

4.6 Results

4.6.1 Descriptive results

We begin our descriptive analysis with a comparison of household characteristics that are displayed in table 8. Modern supply chain farmers are significantly older and better connected through cell phones than their counterparts in the traditional supply chain group. The latter can be important, because it allows buyers of modern chains to more efficiently and flexibly interact with blackberry farmers in order to place blackberry supply orders or to discuss delivery conditions.

Table 8. Household characteristics by supply chain participant (N = 363)

	Modern Supply Chain (N = 51)	Traditional Supply Chain (N = 312)
Household head male (dummy)	0.902	0.869
	(0.300)	(0.338)
Age of household head (years)	54.059**	49.696
	(13.681)	(13.850)
Cell phone ownership (dummy)	0.745***	0.526
	(0.440)	(0.500)
Household labor capacity [a]	3.173	3.068
	(1.292)	(1.401)
Household lives in central Tungurahua Province (dummy)	0.902*	0.798
	(0.300)	(0.402)
Association with '*cadena provincial de la mora'* (dummy)	0.471***	0.057
	(0.504)	(0.233)
Membership in farmer group (dummy)	0.725***	0.337
	(0.457)	(0.473)
Bono de desarrollo humano (dummy)	0.235***	0.593
	(0.428)	(0.492)

Note: Standard deviation in parentheses; * p<0.1, ** p<0.05, *** p<0.01; [a] Household members were converted to man-equivalent units following Runge-Metzger (1988): household member < 9 years olds = 0; 9 to 15 years or above 49 years = 0.7; 16 to 49 years = 1.

Furthermore, we find that a higher proportion of participant farmers is located in central Tungurahua Province which is endowed with good road infrastructure in spatial proximity to the major urban market center Ambato. Blackberry farmers selling to modern markets interact more intensively with other blackberry farmers, because 47.1% (vs. 5.7%) are associated with *'cadena provincial de la mora'*, a governmental and NGO-driven market linkage program envisaging collective marketing to modern channels, and even 72.5% (vs. 33.7%) are members in a farmer group. We

also observe that farmers included in traditional supply chains are poorer. This is measured by the *bono de desarrollo humano* (BDH) which is a conditional-cash-transfer program of the Ecuadorian government. This does not necessarily imply, however, that being poor is a *cause* of exclusion from modern supply chains.

We now turn to structural differences in farm characteristics and blackberry cultivation indicators that are shown in table 9. A number of salient findings emerge. First, the blackberry farm sector in the central Ecuadorian Andes is homogenously composed of a large amount of small farmers that own approximately 1 ha land of which around 0.3 ha is under blackberry cultivation. We cannot find any systematic difference between modern and traditional supply chain participants in either of these two land size categories. This is surprising given the widespread belief that mainly large-scale farmers can be included in modern channels (cf. Barrett et al., 2012; Reardon, Timmer, Barrett, Berdegué, 2003; Neven, Odera, Reardon, & Wang, 2009) as they would predestined to produce the quantities required. Second, modern supply chain participants use technologically more sophisticated cultivation practices, as underscored by a larger proportion of farmers equipped with irrigation systems and a higher score in the agricultural asset index. Traditional supply chain farmers grow more plants per solar[3] and are more productive as measured by higher yields per plant as their counterparts in the modern supply chain group.

Table 9. Farm characteristics and blackberry cultivation indicators by supply chain participant (N = 363)

	Modern Supply Chain (N = 51)	Traditional Supply Chain (N = 312)
Farm size owned (ha)	1.095	0.968
	(0.933)	(2.916)
Blackberry area under cultivation (ha)	0.312	0.325
	(0.237)	(0.421)
Number of productive plants/solar [a]	248.384***	269.372
	(56.611)	(676.120)
Plant yield (kg)	5.365	7.426
	(4.680)	(10.423)
Ownership of irrigation system (dummy)	0.902***	0.702
	(0.300)	(0.458)
Experience with blackberry cultivation (years)	12.137	14.250
	(9.937)	(10.188)
Agricultural asset index	3.059***	2.369
	(0.988)	(0.842)

Note: Standard deviation in parentheses; * p<0.1, ** p<0.05, *** p<0.01; *solar* is a commonly used farm unit of measurement in Ecuador; 1 = 0.1750 ha.

[3] Solar is a commonly used farm unit of measurement in Ecuador; 1 solar = 0.1750 ha.

4.6.2 Profitability

Next, we examine profitability of blackberry farming per solar in 2012, comparing farmers participating in modern and traditional supply chains (table 10). Our measure of profitability is net blackberry income that we calculated by subtracting production costs from gross revenues from blackberry sales per acre. We consider solely variable costs for calculating total blackberry production costs, because these are directly related to the production level of blackberries and therefore likely to be associated with the product quality and quantity requirements typical of a particular supply chain[4]. There are a number of unexpected findings inconsistent with earlier studies and common theoretical understanding which deserve closer consideration.

Table 10. Blackberry profitability per *solar*[a] by supply chain participant (N = 363)

	Modern Supply Chain (N = 51)	SD	Traditional Supply Chain (N = 312)	SD
Plant costs (US$)	43.492	(88.190)	28.079	(133.239)
Chemical fertilizer costs (US$)	84.212	(108.151)	80.001	(153.176)
Manure (US$)	89.479	(188.832)	77.539	(187.902)
Phytosanitary control (US$)	223.292*	(239.120)	377.464	(615.194)
Herbicide cost (US$)	5.107	(10.823)	8.094	(25.836)
Input costs (US$)	445.581	(460.370)	571.177	(773.382)
Hired labor costs (US$)	851.634**	(1563.478)	438.488	(1314.929)
Production costs (US$)	1297.215	(1690.980)	1009.665	(1617.882)
Blackberry sales (kg)	1,440.829	(1706.993)	1900.728	(2331.827)
Blackberry price (US$/kg)	1.387**	(0.398)	1.260	(0.426)
Gross revenues (US$)	1,593.011*	(1234.368)	2259.331	(2385.187)
Net blackberry income (US$)	295.796***	(1384.683)	1249.666	(2344.956)
Net blackberry income (incl. family labor opportunity costs US$)	-4700.036	(5513.291)	-6888.329	(10605.450)

Note: Standard deviation in parentheses; * p<0.1, ** p<0.05, *** p<0.01; [a] *solar* is a commonly used farm unit of measurement in Ecuador; 1 solar = 0.1750 ha.

To our surprise, we find that net blackberry income is significantly and sizably *lower* (nearly 1,000 US$ per year) for farmers participating in modern supply chains. The vast majority of studies analyzing profitability of crops sold to different marketing channels, however, observed at least modest positive gains from high value chain participation. The underlying mechanism for this income difference among farmers with access to modern supply chains originates from higher prices (cf.

[4] We do not include fixed – or overhead – costs, such as land rent, land taxes, depreciation of farm capital, because these are not specific to a marketing channel.

Neven, Odera, Reardon, & Wang, 2009; Rao & Qaim, 2010), higher sales volumes (cf. Escobal & Cavero, 2011; Hernández, Berdegué, & Reardon, 2012) or higher productivity levels (cf. Rao & Qaim, 2010) or a combination of all three. For our sample of blackberry growers, we also observe a higher price per kilogram for modern market suppliers. This makes sense as it rewards farmers' compliance with sophisticated delivery requirements occurring in this chain. This price difference, however, is not large enough to offset the sizably higher blackberry production costs, and the lower sales quantities in the modern supply chain. The former is primarily driven by the stronger reliance on hired farm labor which raises hired labor costs to almost twice as much as compared to traditional market farmers. The latter is surprising, as previous research suggested that farmers producing for modern channels are able to deliver higher volumes due to larger areas under cultivation, higher productivity levels or both (Hernández, Reardon, & Berdegué, 2007; Hernández, Berdegué, & Reardon, 2012).

In our study, higher sales quantities among traditional supply chain farmers are associated with a combination of two factors: First, traditional market participants cultivate more blackberry plants per solar and second, are more productive as indicated by higher yields per plant (cf. table 9). The results of the profitability analysis also point to the persistence of traditional markets in developing country food systems (Guarín, 2013) which commonly absorb literally unlimited supply volumes and can guarantee a secure market outlet for farmers. Another possible explanation for higher yield levels among traditional supply chain farmers can be the higher labor intensity of production as illustrated in table 11.

Table 11. Labor intensity of production by supply chain participant (N = 363)

	Modern Supply Chain (N = 51)	Traditional Supply Chain (N = 312)
Share of household members dedicated to blackberry cultivation (%)	0.720 (0.280)	0.740 (0.257)
Labor to land ratio (labor days/solar)	414.335* (392.163)	615.864 (792.999)
Family labor to land ratio (labor days/solar)	356.845** (389.176)	581.285 (783.209)
Hired labor to land ratio (labor days/solar)	57.490 (95.810)	34.579 (112.324)

Note: Standard deviation in parentheses; * p<0.1, ** p<0.05, *** p<0.01

Traditional supply chain farmers have around 200 labor days per solar more than their counterparts which is in line with findings by Hernández, Berdegué, and Reardon (2012). As agronomic practices for blackberry, such as pruning, phytosanitary control, or harvesting are commonly very labor intensive, it is conceivable that greater workload increases harvest quantities under conditions of similar blackberry areas under cultivation. Moreover, control group farmers use more family labor

that might be more loyal and have higher incentives for performing cultivation practices in a productive manner, since they directly depend on the economic outcomes of their work.

Table 11 further demonstrates that blackberry growing is a family farming activity, because more than 70% of the members in each household are dedicated to blackberry cultivation practices. Therefore, we also included the imputed value of family labor as an additional cost component in our calculation (table 10). These costs can be considered as opportunity cost for not contracting hired labor that would carry out the farming activities for the farmer or family member, who in turn may look for alternative income options. The family labor cost component is sizable which results in negative blackberry income for both groups. This differs from previous research (e.g. Hernández, Reardon, & Berdegué, 2007; Neven, Odera, Reardon, & Wang, 2009; Rao & Qaim, 2010) where incomes derived from selling different FFV to modern markets remains positive even after addition of family labor opportunity costs. This underlines the fact that cross-country comparisons of crop profitability that are marketed to different channels can be invalid, as they tend to generalize over the peculiarities of the agronomic practices of the crop under study and the socio-cultural context in which farming is embedded.

4.6.3 Impact assessment

In the previous section, we analyzed profitability of blackberry farming comparing modern and traditional supply chain participants and observed a significant difference. However, we cannot satisfactorily attribute this difference to participation only. There could be other factors, such as number of blackberry plants cultivated or labor-to-land ratio that explain this difference or it could also be that blackberry profitability of the control group was already higher before treatment group farmers joined the modern supply chain. Therefore, we use different econometric and impact evaluation techniques which allow us to more precisely estimate the effect of modern supply chain participation. In addition to the impact on net blackberry income, we also examine the effects on total household income, since it gives us a clearer picture about the overall economic effect on the household.

We start our analysis with some descriptive statistics about the composition of household income distinguishing between modern and traditional supply chain participants. Table 12 illustrates that modern supply chain farmers earn almost twice as much household income than their counterparts. This difference, however, is not driven by more profitable blackberry farming as table 10 clearly demonstrated, but a much higher income proportion that these farmers obtain from off-farm employment. This suggests an intra-household substitution effect where blackberry farmers selling to traditional markets heavily rely on family labor (cf. table 11) for blackberry growing and therefore achieve higher profit rates for blackberry at the expense of participating in the off-farm labor market.

Table 12. Composition of household income by supply chain participant (N = 363)

	Modern Supply Chain (N = 51)		Traditional Supply Chain (N = 312)	
	Amount	Income share [a]	Amount	Income share [a]
Blackberry net income (US$)	760.774*	9.0%	1690.336	34.8%
	(3148.600)	-	(3081.296)	-
Farm net income [b] (US$)	1812.440	21.4%	2216.584	45.6%
	(5036.051)	-	(4189.216)	-
Livestock net income (US$)	484.247	5.7%	204.034	4.2%
	(1435.104)	-	(1068.962)	-
Off-farm income (US$)	6179.216***	72.9%	2444.362	50.2%
	(11095.310)	-	(3986.786)	-
Household income (US$)	8475.903***	100%	4864.980	100%
	(11429.090)	-	(5904.227)	-

Notes: [a] Income share refers to the share of the *sample mean* of income categories in *sample mean* household income for the particular group; [b] Farm net income includes blackberry net income; Standard deviation in parentheses; *p<0.1, ** p<0.05, *** p<0.01

In the next step, we present the results of different model and impact evaluation specifications (cf. 4.5 for detailed explanation) to estimate the effect of participation in modern supply chains on blackberry and total household income respectively. Table 13 depicts the results of OLS regressions estimating the effect of modern supply chain participation on blackberry income. First and foremost, we find that participation (model 1) has a significant negative effect on blackberry income. Participation in modern supply chains is associated with a decline in blackberry income of 756 US$ per year. This is unexpected in light of the vast majority of previous studies that apply OLS techniques and have identified positive relationships (Miyata, Minot, & Hu, 2009; Wang, Moustier, & Nguyen, 2014), but it underpins the results of our profitability analysis displayed in table 10.

The negative effects are a combination of three things: first, higher plant productivity and higher plant densities allow traditional market farmers to sell larger quantities and therefore obtain higher gross revenues. Second, the sizable hired labor to land ratio among modern market farmers raises their production costs which cannot be compensated by higher prices offered in these markets. Third, income diversification strategy towards off-farm employment among these farmers has stimulated a substitution effect towards contracting hired labor in order to set household labor free for participation in off-farm labor markets. Higher household labor capacity is positively related to blackberry income. This is plausible, because the more household labor available, the more can be allocated to growing blackberry performing different agronomic practices which increases productivity. Blackberry area under cultivation has a positive and significant effect on blackberry income. Larger areas will lead to higher blackberry harvest that can be sold which translates into higher blackberry income. Table 13 further shows that better endowment with agricultural assets such as crop sprayers which is likely to increase quantity and quality of blackberries positively affects

blackberry income. Moreover, it is important to note that blackberry income is significantly affected by geographic factors. Farmers living in central Tungurahua Province are associated with an increase in blackberry incomes of 1,582 US$. This is probably related to the better marketing options in the central part of the province and the higher plant productivity levels in this area. In model (2) we include the ratio of blackberry marketing quantities sold to modern supply chains to take into account that some farmers participate in both chains. We can see that the results are overly robust to the first model.

Table 13. OLS regressions on blackberry income

Variable	Coefficient (1)	Standard error	Coefficient (2)	Standard error
Participation in modern supply chain (dummy)	-755.5*	457.8		
Participation intensity in modern supply chain (%)			-1,000.8**	474.6
Household head male (dummy)	557.6	406.6	574.7	410.1
Age of household head (years)	-24.6*	14.38	-24.6	14.4
Education of household head (years)	-28.1	80.85	-31.2	79.8
Cell phone ownership (dummy)	-222.8	305.5	-227.3	305.5
Household labor capacity	210.7*	110.8	208.1*	110.5
Blackberry area under cultivation (ha)	1,936.6*	1,149	1,903.5*	1,146
Ownership of irrigation system (dummy)	31.9	436.7	31.3	435.7
Agricultural asset index	364.0**	175.8	370.8**	175.2
Off-farm employment (dummy)	-963.5**	393.9	-968.9**	396.5
Ownership of livestock (dummy)	510.6	479.2	516.9	477.9
Experience with blackberry cultivation (years)	4.7	13.57	5.1	13.63
Association with *'cadena de la mora'*(dummy)	-657.5	833.0	-735.5	827.3
Access to agricultural extension service (dummy)	-221.6	459.7	-211.5	462.7
Located in central Tungurahua Province	1,581.6***	587.3	1,537.7***	586.7
Constant	-223.6	1,253	-192.3	1,239
Observations	363		363	
Adjusted R-squared	0.098		0.098	

Notes: *p<0.1, ** p<0.05, *** p<0.01

Hereafter, we estimate the average treatment effect on the treated of participation in modern supply chains on blackberry incomes using PSM. In the first step, we run a probit model predicting the factors that influence participation in order to compute the PS. The results of the probit model are depicted in table 17 in the appendix. For a statistically valid PSM, we have to make sure that we compare similar cases and to obtain sufficient overlap in PS. The propensity score distribution is often used to check the region of common support. This distribution is shown in Figure 4 in the appendix. There are only two treatment group observations that have too high propensity scores and fall of the region of common support. These were excluded from the following analysis. An-

other test for matching quality is to address balancing properties. To do this, we compare the means of covariates that we used to predict the propensity scores before and after matching. This can help us to see if both groups are really comparable before matching is performed. The results in table 18 in the appendix illustrates that the matching procedure was able to eliminate the major differences in covariates between treatment and control group farmers.

We now turn to the estimated average treatment on the treated of participation in modern supply chains on blackberry income (model 3) which is depicted in table 14. We can see that the coefficient has the expected negative sign, but turns out to be significant for all three matching estimators. While these results do not confirm our OLS estimates, we can argue that our findings are not robust to the overly optimistic view concerning modern supply chain participation.

Table 14. Average treatment effects for blackberry income

Matching algorithm	ATT (US$)	Standard error
Nearest neighbor matching	-635.197	631.248
Kernel-based matching	-651.793	592.034
Radius matching	-414.725	640.155

We now analyze the effects of participation on household income in models (4) and (5). Participation and participation intensity in modern supply chains have no effects on household income of blackberry farmers as shown in table 15. These results also challenge the enthusiasm about the positive implications of the modernization of agri-food supply chains for the welfare of farm households. It seems that factors other than marketing channels are important for overall household income. Male and older household heads have a positive impact on household income. As expected, better education and higher household labor capacity are positively related to income. We also detect a positive relationship between farm size and household income which is surely plausible. Participation in off-farm labor market has the strongest positive influence on household income. This is conceivable, because off-farm income forms a major share of household income among our sample farmers. Interestingly, vehicle ownership and living in central Tungurahua province is positively associated with household income. Farmers owning vehicles, such as cars or pick-ups, are more mobile and can more easily bridge long distances to urban centers. As a result, they have a better access to information and can more simply find employment that raises their income. Farmers living in central Tungurahua province are located in greater geographic proximity to the major urban center, Ambato, which offers substantial employment in the off-farm sector to farm households which they capitalize on. In model (5), we replace the treatment variable participation with participation intensity. The results of this model specification confirm the results of model (4).

Table 15. OLS regressions on impacts of modern supply chain participation on household income

Variable	Coefficient (4)	Standard error	Coefficient (5)	Standard error
Participation in modern supply chain (dummy)	876.8	1,391.1		
Participation intensity in modern supply chain (%)			78.3	1,596.4
Household head male (dummy)	1,069.2**	531.6	1,037.4*	539.0
Age of household head (years)	59.3*	31.9	62.2*	32.8
Education of household head (years)	415.9**	197.9	435.6**	209.5
Household labor capacity	920.1***	234.2	928.1***	234.3
Membership in farmer group (dummy)	-733.3	1,159.2	-641.5	1,122.8
Farm size (ha)	270.8***	53.8	269.4***	54.0
Off-farm employment (dummy)	3,434.1***	678.3	3,486.0***	686.8
Ownership of livestock (dummy)	214.9	1,115.9	248.3	1,119.4
Ownership of vehicle (dummy)	2,732.6**	1,371.5	2,819.4**	1,361.7
Located in central Tungurahua Province (dummy)	3,127.6***	714.1	3,146.1***	723.5
Constant	-9,029.6***	2,915.5	-9,295.2***	3,049.1
Observations	363		363	
Adjusted R-squared	0.239		0.238	

Notes: *p<0.1, ** p<0.05, *** p<0.01

Next, we estimate the ATT on household income using PSM. The results are displayed in table 16. The sign of the coefficient indicates a positive effect, but it is not significant. Hence, we do not find any evidence that modern supply chain participation has an impact on household income. This confirms our OLS results.

Table 16. Average treatment effects for household income

Matching algorithm	ATT (US$)	Standard error
Nearest neighbor matching	593.711	2182.665
Kernel-based matching	1,380.120	1815.321
Radius matching	1,529.900	1812.611

4.7 Conclusion

In this article, we have analyzed the effects of blackberry farmers' participation in modern supply chains on farmers' income in the central Andes of Ecuador. Using OLS regressions we find a significant negative effect of participation on net blackberry incomes. This finding is not robust to the effect that we estimated using PSM. We do not find any evidence that participation in modern supply chains has an effect on total household income; neither with OLS regressions, nor using PSM.

Our results challenge previous empirical evidence which suggests mainly positive impacts of modern supply chain participation on producers' profitability and/or household income. In our case, we

cannot find that modernization of agrifood supply chains translates into the expected income gains at the farm and household level. We highlight several reasons for this.

First, it appears that the extent of procurement system modernization in the Ecuadorian blackberry sector has not (yet) deeply penetrated into the farm sector and not (yet) led to the sufficient economic incentives. The profitability analysis demonstrates that the modest price difference between both channels cannot compensate for the higher costs among modern market suppliers that are largely driven by stronger reliance on hired labor. Higher production costs are not uncommon (Escobal & Cavero, 2011; Hernández, Reardon, & Berdegué, 2007; Neven, Odera, Reardon, & Wang, 2009), but are offset in other study contexts by higher prices, yields, and sales volumes in modern channels. In our case, traditional market suppliers have higher yields and sales volumes which might indicate more intensive blackberry production practices. The main advantage for farmers of participating in modern supply chains seems to stem from the more stable prices in modern supply chains rather than higher incomes as evidenced in prior studies (Hernández, Reardon, & Berdegué, 2007). It might also be the case that modernization in the Ecuadorian blackberry sector is still in its infancy and needs more time to develop the benefits and changes in production practices that theoretical and empirical evidence has predicted. An indication for this could be that only a small proportion of farmers which sold to modern supply chains in the recall year 2012 have already sold to the same modern chain buyer in our sample in the previous years.

Second, one of the key messages in this article is the high level of resilience of traditional marketing systems which embody crucial market outlets for farmers. They offer literally unlimited access and market assurance absorbing large amounts of FFV supply with heterogeneous quality characteristics. In spite of the price risks associated with these markets, farmers tend to be attracted by these incentives offered. This is line with Guarín (2013) who emphasizes the persistence of traditional and in particular wholesale markets for developing country food systems.

Third, we believe that our findings are specific to the blackberry sector in the Ecuadorian Andes and the regional context in which the sector is embedded. Blackberry cultivation practices have only limited potential for mechanization, such that the various practices as pruning, weed control or harvesting are particularly labor-intensive. The group of farmers who gained access to modern marketing channels is wealthier and is therefore able to substitute high labor demand through contracting farm labors whereas the poorer traditional supply chain farmers allocate more family labor to these activities. This explains the reported higher production costs among modern chain farms. According to economic theory of production, family labor is more motivated and loyal and may therefore in combination with higher input application partly explain higher productivity levels among traditional market suppliers. Moreover, modern channel farmers have broader access to off-farm opportunities that is determined by proximity to urban centers endowed with better transport and communication infrastructure, higher educational attainment, and wealth which is consistent

with empirical evidence on participation in nonfarm income activities (Barrett, Reardon, & Webb, 2001). We argue that farmers participating in modern supply chains appear to be attracted by off-farm employment as it offers higher returns than blackberry farming. Our interpretation is that participation in the off-farm labor market acts as a substitute for dedicating a higher share of family labor to the intensification of blackberry cultivation.

Fourth, it seems that the major shift in production processes that is needed to meet the requirements of modern and traditional markets is the careful handling of the berries from the moment of harvest over post-harvest management up until the delivery to the collection point. We argue that upfront investments in agricultural assets, such as irrigation systems that would increase capital intensity of production are not explicitly demanded or looked for by the modern agrifood industry. Hence, this could be one of the main reasons why only slight price differences emerge between the two marketing channels.

We acknowledge some limitations of our study. The impact assessment techniques are built on the conditional independence assumption (CIA) which states that we can observe all factors that influence farmers' participation in modern supply chains. If there were unobserved factors (e.g. farmers' motivation, confidence) that not only affected participation, but were also correlated with household incomes, CIA would be violated. In other words, self-selection of farmers into modern supply chains based on unobserved characteristics would lead to a bias in the participation coefficient. PSM cannot control for selection bias arising from unobserved heterogeneity. A sensitivity analysis that can test the robustness of the CIA is the calculation of Rosenbaum bounds. These bounds indicate how large unobserved factors between treatment and control observations have to differ to turn a significant treatment effect insignificant. The PSM findings, however, demonstrate insignificant results, such that calculating Rosenbaum bounds is not meaningful. Previous research on the income effects of modern supply chain participation has shown that the results of PSM are robust to potential selection bias on unobservable factors (Chiputwa, Spielman, & Qaim, 2015; Wang, Moustier, & Nguyen, 2014). Likewise, Schipmann and Qaim (2010) and Miyata, Minot, and Hu (2009) demonstrate that OLS regressions lead to unbiased estimates. These studies increase confidence in the results that we present in this article.

The cross-sectional design of our study can only capture a snapshot view. A dynamic perspective could yield a more robust version of our results and take into account variations in seasonal agro-climatic conditions (due to, e.g. droughts, volcano eruptions) and the productive cycles of perennial blackberry plants that could have influenced some of the variables that we collected. This could be particularly interesting, because some of the specialized traders supplying modern buyers only recently have placed supply chains in the study area.

The findings of our study bear a number of policy implications. We cannot conclude *per se* that public policy should support farmers in gaining access to modern supply chains, since our results did not show any sizeable positive effects. Conversely, based on our findings we should not recommend that linking farmers to modern supply chains shall be impeded either. We argue that government agencies should closely monitor the prospective evolvement of modernization tendencies in the Ecuadorian blackberry sector. This would include regular communication in the form of stakeholder meetings with purchasing managers or firm representative to better understand and accompany their procurement decisions and changes in organization of market linkages. It is therefore critical for policy-makers or regional development agencies to be aware of these potential changes in incentive structures which may infer more pronounced impacts at the farm and household level. If incentives for farmers' participation in modern channels rise, they might become more willing to enhance their farming specialization on blackberry or even undertake certain investment in land or farming equipment to intensify blackberry production for this channel. Furthermore, our findings do not share concerns about the strengthening of income disparities and rural equity attributed to the modernization of food sectors which was expressed in prior studies (Andersson, Chege, Rao, & Qaim, 2015; Briones, 2015). The results of our study also lend support to the important role of traditional – in our case especially wholesale – marketing systems which represent crucial market outlets for a vast majority of blackberry farmers. Public policy and researchers alike should pay closer attention to the organizational, institutional, and infrastructural constraints of such agrifood marketing systems.

4.8 References

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4.9 Appendix

Table 17. Determinants of participation in modern supply chain (probit estimates)

Variables	Coefficient	Standard error
Household head male (dummy)	-0.0655	(0.321)
Age of household head (years)	0.0179**	(0.00831)
Education of household head (years)	0.0672**	(0.0272)
Household labor capacity	0.0569	(0.0749)
Cell phone ownership (dummy)	0.281	(0.223)
Blackberry area under cultivation (ha)	-0.00904	(0.308)
Ownership of irrigation system (dummy)	0.165	(0.227)
Agricultural asset index	-0.0489	(0.0998)
Off-farm employment (dummy)	0.240	(0.204)
Ownership of livestock (dummy)	0.172	(0.309)
Experience with blackberry cultivation (years)	-0.0259**	(0.0102)
Participation in farmers' blackberry field day (dummy)	0.770***	(0.273)
Association with *cadena de la mora* [a] (dummy)	0.594*	(0.317)
Access to agricultural extension service (dummy)	0.0814	(0.242)
Located in central Tungurahua province (dummy)	-0.200	(0.304)
Constant	-3.019***	(0.670)
Observations	363	

Figure 4. Propensity score distribution and area of common support

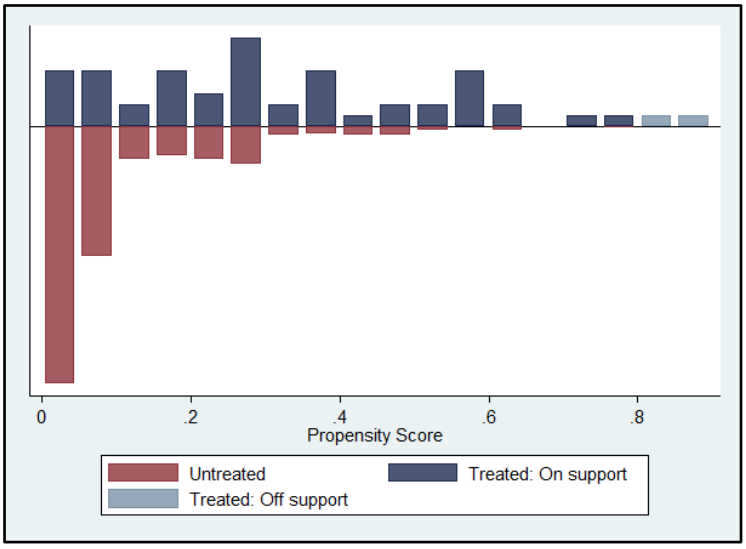

Table 18. Balancing tests of covariates for PSM

	Before matching			After matching		
	Treated	Control	P-Value	Treated	Control	P-Value
Household head male (dummy)	0.90	0.87	0.51	0.90	0.95	0.35
Age of household head (years)	54.06	49.67	0.02	54.14	52.60	0.58
Education of household head (years)	8.92	6.06	0.00	8.55	8.62	0.94
Household labor capacity	3.17	3.07	0.31	3.14	3.25	0.68
Cell phone ownership (dummy)	0.75	0.53	0.00	0.74	0.75	0.86
Blackberry area under cultivation (ha)	0.36	0.33	0.53	0.28	0.31	0.63
Ownership of irrigation system (dummy)	0.37	0.20	0.01	0.37	0.45	0.39
Agricultural asset index	1.92	1.57	0.02	1.92	2.05	0.60
Off-farm employment (dummy)	0.61	0.46	0.05	0.59	0.63	0.72
Ownership of livestock (dummy)	0.90	0.85	0.32	0.90	0.87	0.64
Experience with blackberry cultivation (years)	12.14	14.25	0.17	12.27	12.96	0.73
Participation in blackberry field day (dummy)	0.80	0.33	0.00	0.80	0.77	0.72
Association with *cadena de la mora* [a] (dummy)	0.22	0.04	0.00	0.18	0.23	0.58
Access to agricultural extension service (dummy)	0.71	0.37	0.00	0.69	0.71	0.87
Located in central Tungurahua province (dummy)	0.90	0.80	0.08	0.90	0.90	1.00
Median bias		30.8			8.6	
Pseudo R-Squared		0.232			0.027	

5 GENERAL CONCLUSIONS

5.1 Summary of main findings

Over the last two decades, agrifood markets in developing countries have been undergoing fundamental structural changes. The modernization of agrifood supply chains is both a cause and consequence of this transformation process that has far-reaching implications for the farm sector and the millions of farmers that cultivate and commercialize agricultural produce under these altering and more complex market conditions. This dissertation contributes to this ongoing debate in three major ways.

Chapter 2 has a theoretical and conceptual focus and presents cluster and global value chain (GVC) approaches that can be applied to study supply chain relationships and industry organization against the background of the restructuring processes unfolding in agrifood sectors in developing countries. We call for an integration of the two approaches to overcome their respective individual shortcomings and to more comprehensively assess the developmental implications of the agrifood sector transformation should cluster or GVC research be carried out. Further conceptual and empirical work for linking these approaches is highly warranted.

Chapter 3 provides an original contribution to the discourse about the determinants of farmers' participation in emerging modern supply chains. We collected survey data from blackberry farmers in the Ecuadorian Andes to examine the role that individual social networks might play for participation. We differentiate between two social network specifications. First, we estimate the endogenous social network effect and control for correlated unobservable factors at the level of *cantons*. Our results suggest that the number of suppliers to modern markets in a farmers' network positively influences the probability that he or she also participates in modern chains. Second, we computed a social network index (SNI) which consists of several proxies for the amount of contacts that can link farmers to modern supply chains. We find that SNI has a positive and highly significant effect on participation. Another main finding of our study is that the modernization of blackberry supply chains does not leave any bias against small or asset-poor blackberry producers.

Chapter 4 is concerned with assessing the impacts of modern supply chain participation on blackberry and household income. We use OLS regressions and propensity score matching (PSM) to estimate the effects on these two income measures. We find a significant negative effect on net blackberry incomes when using OLS which is not robust to the PSM results. We do not find any evidence that participation in modern supply chains has an effect on household income; neither with OLS regressions, nor using PSM. These results oppose previous findings that have mainly showed a positive effect of modern supply chain participation on crop profitability or incomes.

This study presents another two key findings. First, we find substantial resilience of traditionally-organized marketing systems which embody crucial market outlets for farmers. In spite of the price risks associated with these markets, farmers seem to be attracted by market assurance and large volumes these markets are able to absorb which enables them to achieve even higher incomes than their counterparts that sell to modern markets. Second, the group of farmers which gained access to modern marketing channels has at the same time broader opportunities to engage in off-farm employment. The perceived higher returns obtained from these activities seem to act as a substitute for dedicating a higher share of family labor to the intensification of blackberry cultivation commonly assumed to be needed to participate in modern supply chains.

5.2 Managerial implications

Retailer and agro-processors active in the Ecuadorian blackberry sector have introduced modern procurement systems to be able to source blackberries with the desired quality attributes, consistency, and volumes at given times. They concluded verbal agreements with specialized traders and farmers to reduce transaction costs by circumventing traditional supply systems. In spite of this reorganization, company officials have expressed difficulties in managing marketing relationships with farmers. The main challenges have to do with the sporadic lack of farmers' compliance with the agreement specifications. Farmers decide to side-sell parts of their blackberry harvest to the wholesale or local markets in times of periodic price spikes. The conventional marketing preferences towards traditional markets often result in traditional cultivation, post-harvest, and harvest practices among farmers which commonly do not match with the requirements in modern supply chains. The severe overuse of pesticides presents the major concern for export-oriented companies.

For managers, it is recommendable to undertake the following actions for enhancing value chain efficiency and diminishing transaction costs: companies should increase the incentives for farmers to minimize side-selling to traditional marketing system. The incentive could be more favorable or fixed prices or the provision of certain inputs, such as high-quality fertilizer or fungicides. It is further advisable to step up efforts to provide advisory services and training to farmers on how to adapt blackberry farming practices in a way that meets the new requirements of the modern food industry. Another strategy could be initiating value chain stakeholder platforms under public support as pioneered with the *'cadena de comercialización de la mora'* which can help to better coordinate blackberry marketing. It would be equally important to take 'soft measures', for example to introduce themselves and the company in public events, such as blackberry field days where a great number of blackberry farmers is present. One of the objectives should be to facilitate communication and improve relationships between farmers and the private sector which so far have been largely based on prejudices and mistrust.

5.3 Policy implications

Policy-driven attempts to support farmers' inclusion in modern supply chains should be embedded in a careful analysis of the market structure and the magnitude of modernized supply chains of the particular agricultural product under analysis. Such an approach allows inference of growth dynamics of the modern market segment and accordingly, the product volumes that will be channeled through these chains. This is important, because such an exercise can provide relevant information on the scope for integrating farmers into modern supply chains that is to a large extent contingent on the strategic decisions of firms which determine the expansion of this modern market segment.

The impact evaluation findings have not revealed the expected positive effects of participation in modern supply chains on farmers' incomes. Hence, it should not *per se* be a key priority of the public sector to step up efforts and funding to link blackberry farmers to modern supermarkets and agro-processors. Governments should closely monitor prospective modernization tendencies in the Ecuadorian blackberry sector. This should involve regular stakeholders meetings with purchasing managers to be aware of potential changes in the organization of procurement and implied adjustment of incentive structures for farmers.

Collective marketing is rarely practiced in the Ecuadorian blackberry sector presumably due to limited institutional support. The formation of *'cadena de comercialización de la mora'* with public and NGO assistance is a first step into this direction as it manages and coordinates target harvest quantities and direct market linkages with agro-processors, retailers, or smaller niche markets such as ice-cream parlors or hotels. This will also raise awareness on alternative marketing options for blackberry farmers to be able to circumvent the wholesale market in Ambato which is traditionally the dominant market outlet. Institutional support should be strengthened to help blackberry farmers organize in such joint marketing relationships. A potential strategy is the organization of participatory market chain approaches (PMCA) in which the various actors of the supply chain develop a joint vision, share market knowledge and identify common interests. This can be crucial to achieve durable and sustainable linkages between farmers and downstream buyers in the blackberry supply chain. Such events may be assigned a high priority.

The findings in these studies lend support to the resilience of traditional - especially wholesale - marketing systems which represent crucial market outlets for a vast majority of blackberry farmers which will likely perpetuate in the future. One of the major issues in this regard is the periodic price fluctuation of blackberries in the traditional market that provides incentives for farmers to breach previously concluded supply agreements with modern buyers. It remains to be seen if fixed prices for agricultural products in wholesale markets set by the ministry of agriculture will be a solution to this. In light of the popularity of wholesale markets, it is indispensable for public policy

to pay closer attention to the organizational, institutional, and infrastructural constraints of such marketing systems

5.4 Limitations

The studies presented in this dissertation entail particular limitations. First, we may encounter endogeneity problems due to the specification of social networks in chapter 3. This bias might arise from simultaneity, when it is not clear if the farmers' decision is influenced by his or her social network, or reverse, if the farmer influences his or her social network. For our study context, we assume that a farmer has started selling to a modern supply chain and based on his or her (positive) experience influences social network farmers to join this chain. Conversely, it could also be that social network members sell to modern supply chains and subsequently influence the behavior of a farmer to join a supply chain. We were not able to find a valid instrument that could replace the social network variable as suggested in other studies and will have to rely on the estimated endogenous social network effect. Another point of concern in this respect is the dynamic perspective. It might be that farmers have met accidently *after* they individually decided to supply a modern chain. In this case, network formation will have occurred after the decision to supply has already been made. With our time-limited data we cannot fully rule out that such events will have occurred before the other.

Second, the impact assessments in chapter 4 are built on the conditional independence assumption (CIA) which implies that all factors that influence farmers' participation in modern supply chains can be observed. CIA would be violated, if there were unobserved factors that not only affected participation, but were also correlated with the outcome variable, incomes. In other words, self-selection of farmers into modern supply chains based on unobserved characteristics would lead to a bias in the participation coefficient. There could be a positive bias when attributes, such as motivation or confidence that we cannot control for are correlated with access to modern supply chain and incomes. A negative bias would occur if farmers endowed with higher entrepreneurial ability decided not to participate in modern supply chains, because they have better access to off-farm employment. In this case, entrepreneurial ability would be negatively correlated with participation.

Instrumental variable techniques might be useful instead of the performed OLS regressions. Finding a truly exogenous instrumental variable that would affect participation, but not income is challenging. Likewise, PSM cannot control for selection bias arising from unobserved heterogeneity. We must assume that all factors affecting participation are observed. A sensitivity analysis that can test the robustness of the CI assumption is the calculation of Rosenbaum bounds. They indicate how large unobserved factors between treatment and control observations have to differ to turn a significant treatment effect insignificant. The findings of the PSM analysis on incomes show insignificant results which renders the meaningfulness of Rosenbaum bounds questionable.

Third, the snapshot view obtained by the cross-sectional study design cannot identify changes over time. This would be important in order to explore changes in farm management and agronomic practices occasioned by participation in modern supply chains – in particular, because some specialized traders supplying modern buyers only recently have placed supply chains in the study area. A dynamic perspective could yield a more robust version of our results and take into account variations in seasonal agro-climatic conditions (due to, e.g., droughts, volcano eruptions) and the productive cycles of perennial blackberry plants that could have influenced some of the variables that we collected. For example, the productive cycle in which plants are situated influences their productivity levels and consequently determines the intensity and costs of input and labor requirements. Another point of concern refers to the production of own manure which is prevalent in the Ecuadorian Andes, since many farm households keep livestock. Production of own manure on the farm requires the allocation of mostly family labor to these activities. The value of these opportunity costs incurring when farmers decide to not purchase manure as an alternative are not in included in our profit calculations.

5.5 Future research

We anticipate four areas of future research: first, the participation of farmers in (modern) supply chains is an inherently geographic question (Barrett et al., 2012). Lead firms in agrifood supply chains first decide about the geographic placement of their supply chains *before* they contact or select farmers as suppliers of agricultural produce. The firms' choice of a geographic region for its procurement practices is strongly influenced by the regional ability to provide agricultural products with the desired quality and sufficient and year-round quantity under low transaction costs. Geographic attributes such as concentration of large farmers, agro-climatic conditions, soil quality, slope, crime rate, road quality or distance are key determinants that researcher can observe by including appropriate questions in the survey or by using secondary data. The integration of geographic attributes in models that explore influencing factors of (modern) supply chain participation can also be informative about potential intensification of regional socio-economic inequalities.

Second, chapter three examines the influence of social networks on farmers' participation in modern supply chains. This article provides an important contribution to this relatively unexplored research direction. However, there is scope for improvement with regard to the identification of the social network effect. To circumvent simultaneity problems, future research should find valid instruments or use time lags in the network formation in order to establish a clearer direction of causality. In addition, a more in-depth analysis of the theoretical pathways of social network effects is warrantable. For example, screening or information cost hypothesis could be investigated in more detail.

Third, a methodological extension to the empirical studies in this dissertation is the application of panel data approaches. Is inclusion in modern supply chains durable? Can income effects be sustained? Can participatory market chain approaches (PMCA) support the resilience of supply chains? These are important questions that cannot be answered with our time limited data. For the case of blackberry in Ecuador, it will be interesting to see if the more recent participation in modern supply chains leads to changes in farm management and agronomic practices over time as some specialized traders that supply modern buyers have only recently placed supply chains in the study region. A dynamic perspective could also smoothen the effects of specific shocks (e.g. droughts, volcano eruption) that have occurred in the recall period of the survey or smoothen differences in the productive cycles of perennial blackberry plants which both could have affected some of our variables.

Fourth, most of existing studies create a picture in which every farmer is keen on supplying modern supply chains as soon as they would emerge. The resilience of traditional markets (Guarín, 2013; Humphrey, 2007) that embody crucial market outlets for farmers draws a different picture. More importantly, interviews with blackberry farmers have revealed preferences for selling to wholesale markets or other more traditional market outlets, even if marketing opportunities with modern markets exist. This seems to be a rational strategy of avoiding the risk of commitment to one sole modern buyer and of keeping marketing flexibility. As a result, we have to learn more about the genuine marketing preferences of farmers as investigated by Blandon, Henson, and Islam (2009). Choice experiments and subjective statement questions in questionnaires might offer the relevant tools.

5.6 References

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ANNEX A - HOUSEHOLD QUESTIONNAIRE

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

GlobalFood
www.uni-goettingen.de/globalfood

ECUADOR ENCUESTA DE HOGAR 2013

Esta entrevista es parte de una investigación para una tesis de doctorado en Economia Agricola de la Universidad de Göttingen en Alemania. El objetivo es recolectar información sobre los canales de comercialización de la mora y los impactos socioeconómicos de la producción y de las ventas de la mora. Los datos proporcionados serán tratados con confidencialidad y solamente serán empleados con fines científicos. Su participación es totalmente voluntaria.

0,01 Cantón

0,02 Parroquia

0,03 Coordenadas casa

°S

°O

Altura

0,04 Nombre del encuestado

0,05 Teléfono del encuestado

0,06 Dirección (si necesario ubicación del hogar)

0,07 Código del hogar

0,08 Fecha

0,09 Hora de inicio del encuesta

:

0,10 Hora de terminación del encuesta

:

0,11 Nombre encuestador

0,12 Código encuestador

0,13 Entrevista completada?

Si

No

0,14 Revisado por Nico

0,15 Fecha de revisión

Índice

Sección 1: Características del hogar

MIEMBROS DEL HOGAR SON TODAS LAS PERSONAS QUE USUALMENTE COMEN DE LA MISMA OLLA Y DUERMEN BAJO EL MISMO TECHO. ESTO INCLUYE TAMBIÉN MIEMBROS QUE ESTUVIERON AUSENTES POR MENOS DE DOS MESES EN EL AñO 2012. PRIMERO PREGUNTE POR TODOS LOS MIEMBROS DEL HOGAR INICIANDO CON EL/LA JEFE/A Y ESCRIBA TODOS LOS NOMBRES EN LA COLUMNA (1,01). LUEGO HAGA LAS PREGUNTAS POR FILA POR CADA MIEMBRO DEL HOGAR.

Código de ID	1,01	1,02		1,03		1,04	1,05	1,06		1,07	
	Cuáles son los nombres de los miembros del hogar?	Cuál es la relación entre [NOMBRE] y el jefe del hogar?		Cuál es el sexo de [NOMBRE]?		Cuántos años tiene [NOMBRE]?	Cuántos años de educación oficial recibió [NOMBRE] ?	Cuál es el nivel más alto de educación que alcanzó [NOMBRE]?		Cuál es la lengua materna de [NOMBRE]?	
		Jefe/jefa	1	Masculino	1			Si es muy joven	0	Español	1
		Esposo/esposa	2	Feminino	2			No educación formal	1	Kichwa	2
		Hijo/hija	3					Primaria	2	Otro (especifique)	3
		Hijastro/-a	4					Secundario	3		
		Nieto/-a	5					Universidad	4		
		Hermano/-a	6					Maestría	5		
		Cuñado/-a	7					Doctorado	6		
		Padre/madre	8								
		Abuelo/-a	9								
		Otro pariente (especifique)	10								
		Otro no pariente	11								
1											
2											
3											

Sección 1: Características del hogar

MIEMBROS DEL HOGAR SON TODAS LAS PERSONAS QUE USUALMENTE COMEN DE LA MISMA OLLA Y DUERMEN BAJO EL MISMO TECHO. ESTO INCLUYE TAMBIÉN MIEMBROS QUE ESTUVIERON AUSENTES POR MENOS DE DOS MESES EN EL AñO 2012. PRIMERO PREGUNTE POR TODOS LOS MIEMBROS DEL HOGAR INICIANDO CON EL/LA JEFE/A Y ESCRIBA TODOS LOS NOMBRES EN LA COLUMNA (1,01). LUEGO HAGA LAS PREGUNTAS POR FILA POR CADA MIEMBRO DEL HOGAR.

1,08		1,09		1,10	1,11		1,12		1,13		1,14		1,15	
Posee [NOMBRE] un celular?		Durante el año 2012 [NOMBRE] recibió el bono de desarrollo humano?		Cuánto recibió [NOMBRE] por año?	Durante el año 2012 [NOMBRE] recibió dinero de personas que no viven dentro del hogar?		En el año 2012, [NOMBRE] trabajó fuera de la finca?		Por favor especifique el trabajo?		Este trabajo estaba relacionado con mora (transporte, cosecha etc. ?)		Cuándo recibió [NOMBRE] su salario?	
Sí	1	Sí	1		Sí	1		Sí	1	Empleado/a público	1	Sí	1	Por día	1
No	2	No	2		No	2		No	2	Empleado/a privado	2	No	2	Por semana	2
										Jornalero/a o peón	3			Por mes	3
										Patrono/a	4			Otro (especifique)	4
										Socio	5				
										Por cuenta propia	6				
										Otro (especifique)	7				
		SI NO PASE A LA PREGUNTA 1,11		DÓLARES		DÓLARES	SI NO, PASE A LA PREGUNTA 1,18								

Sección 1: Características del hogar

MIEMBROS DEL HOGAR SON TODAS LAS PERSONAS QUE USUALMENTE COMEN DE LA MISMA OLLA Y DUERMEN BAJO EL MISMO TECHO. ESTO INCLUYE TAMBIÉN MIEMBROS QUE ESTUVIERON AUSENTES POR MENOS DE DOS MESES EN EL AñO 2012. PRIMERO PREGUNTE POR TODOS LOS MIEMBROS DEL HOGAR INICIANDO CON EL/LA JEFE/A Y ESCRIBA TODOS LOS NOMBRES EN LA COLUMNA (1,01). LUEGO HAGA LAS PREGUNTAS POR FILA POR CADA MIEMBRO DEL HOGAR.

1,16	1,17	1,18		1,19	1,20	1,21		1,22
Cuál fue el salario recibido cada vez en promedio?	Cuántas veces lo recibió en el año 2012?	En el año 2012 [NOMBRE] trabajó en propia producción de la mora?		En una típica semana cuántos días trabaja [NOMBRE] en la producción de la mora?	En un típico día, cuántas horas trabaja [NOMBRE] en la producción de la mora?	En cuáles actividades del manejo de la mora ayuda [NOMBRE] típicamente? [VARIAS RESPUESTAS POSIBLES]		Cuál es la distancia de su casa al mercado mayorista en Ambato [KILÓMETROS]?
		Sí	1			Plantación	1	
		No	2			Fertilización	2	
						Control fitosanitario	3	
						Poda	4	
						Deshierba	5	
						Riego	6	
						Cosecha	7	
						Poscosecha	8	
						Venta	9	
		SI NO, PASE A LA PREGUNTA 1,22				Otra (especifique)	10	

Sección 2: Actividades pecuarias

POR FAVOR COMIENCE CON LA PREGUNTA 2,01. DESPUÉS CONTINUE CON LA PRIMER ESPECIE Y HAGA LAS PREGUNTAS A PARTIR DE 2,02 HASTA 2,04. CONTINUE CON LA PRÓXIMA ESPECIE Y HAGA LAS MÍSMAS PREGUNTAS HASTA QUE TODAS LAS ESPECIES SON CUBIERTAS. SIGUIENTE, POR FAVOR HAGA LAS PREGUNTAS 2,05 Y 2,06 PARA CADA PRODUCTO DE ORIGEN ANIMAL. FINALMENTE, POR FAVOR HAGA LAS PREGUNTAS A PARTIR DE 2,07 HASTA 2,09.

	2,01	2,02	2,03	2,04		2,05	2,06	2,07	2,08	2,09
Especie	Poseyó **algún** animal hace 3 años? Sí 1 No 2	Cuántos [ESPECIE] posee actualmente?	Cuántos [ESPECIE] vendió en el año 2012?	Cuánto ganó en promedio por animal de estas ventas?	Productos de origen animal	En el año 2012 vendió [PRODUCTO DE ORIGEN ANIMAL]? Sí 1 No 2	Cuánto fue el monto de estas ventas del año 2012?	En el año 2012, cuánto gastó en alimentación para los animales?	En el año 2012, cuánto gastó en servicios veterinarios, remedios y vacunas?	En el año 2012, cuánto gastó en personas que cuidaron a sus animales?
Vaca, toro o ternero					Huevos					
Gallina o pollo					Leche					
Cabra					Carne					
Oveja					Queso					
Cerdo o chancho					Pellejo & Piel					
Cuy					Abono					
Conejo					Mantequilla					
Pavo					Yogur					
Mula					Lana					

Sección 3: Características de la finca

Lotes propios

3,01	Cuántos lotes propios tiene actualmente?		
3,02	Cuántos de los lotes propios son directamenta explotados por personas de su		PONGA CÓDIGO DE ID DEL LOTE Y ESTADO DEL LOTE (3,07) EN LA TABLA EN LA SIGUIENTE PÁGINA.
3,03	Cuántos de los lotes propios son dados en arriendo?		PONGA CÓDIGO DE ID DEL LOTE Y ESTADO DEL LOTE (3,07) EN LA TABLA EN LA SIGUIENTE PÁGINA.
3,04	Cuántos de los lotes propios son dados al partir?		PONGA CÓDIGO DE ID DEL LOTE Y ESTADO DEL LOTE (3,07) EN LA TABLA EN LA SIGUIENTE PÁGINA.

Además de lotes propios

3,05	Cuántos lotes de otros hogares son tomados en arriendo por personas de su hogar?		PONGA CÓDIGO DE ID DEL LOTE Y ESTADO DEL LOTE (3,07) EN LA TABLA EN LA SIGUIENTE PÁGINA.
3,06	Cuántos lotes de otros hogares son tomados al partir por personas de su hogar?		PONGA CÓDIGO DE ID DEL LOTE Y ESTADO DEL LOTE (3,07) EN LA TABLA EN LA SIGUIENTE PÁGINA.

Código de ID del lote	3,07 Cuál es el estado del lote?		3,08 Cuál es el área del lote?			3,09 Cuál sistema de riego se utiliza actualmente por		3,10 Tuvo **algún** sistema de riego hace 3		3,11 [SI ES PROPIO]: Tiene título de propiedad?		3,12 [SI ES DADO EN ARRIENDO]: cuánto le pagó a usted en el año	3,13 [SI ES TOMADO EN ARRIENDO]: cuánto le pagó al propietario el año 2012?
	Propio y explotado por el hogar	1		Hectáreas	1	Aspersión	1	Sí	1	Sí	1		
	Dado en arriendo	2		Cuadras	2	Goteo	2	No	2	No	2		
	Dado al partir	3		Metros cuadrados	3	Gravedad	3						
	Tomado en arriendo	4		Otro (especifique)	4	Otro (especifique)	4						
	Tomado al partir	5				Ninguno	99						
				UNIDAD								DÓLARES	

Sección 4: Producción agrícola

LA TABLA ABAJO TRATA SOLAMENTE DE LOS LOTES EXPLOTADOS POR EL HOGAR Y LOTES TOMADOS EN ARRIENDOS. POR FAVOR PREGUNTE SOBRE LOS CULTIVOS QUE SE CULTIVÓ EN EL PRIMER LOTE (4,01) Y UTILICE LAS FILAS DE LA MISMA PREGUNTA. DESPUÉS PARA EL PRIMER CULTIVO HAGA LAS PREGUNTAS A PARTIR DE 4,02 HASTA 4,07 PARA EL PRIMER CULTIVO. CONTINUE CON EL SEGUNDO CULTIVO Y HAGA EL MISMO PROCESO. CUANDO TERMINÓ CON TODOS LOS CULTIVOS DEL LOTE 1, CONTINUE CON EL PRÓXIMO LOTE Y HAGA EL MISMO PROCESO.

Lotes propios explotado por el hogar (estado de lote 1) y lotes tomados en arriendos (estado de lote 4)

Código de ID del lote	4,01				4,02			4,03			4,04			4,05	4,06	4,07
	En el año 2012, cuántos cultivos cultivó en [LOTE]?				Cuál área dedicó al [CULTIVO] en este lote?			Cuánto de [CULTIVO] cosechó en el año 2012?			Cuánto de la cosecha del [CULTIVO] vendió en el año 2012?			En año 2012, cuál precio recibió en promedio [POR UNIDAD] de estas ventas?	En año 2012, cuál fue el precio más bajo [POR UNIDAD] de estas ventas?	En año 2012, cuál fue el precio más alto [POR UNIDAD] de estas ventas?
	Cebolla blanca	1	Maíz	9		Hectáreas	1		Kilogramo	1		Kilogramo	1			
	Cebolla colorada	2	Manzana	10		Cuadras	2		Quintales	2		Quintales	2			
	Claudia	3	Mora	11		Metros cuadrádos	3		Canasto	3		Porcentaje	3			
	Col	4	Papa	12		Otro	4		Otra	4		Todo	4			
	Durazno	5	Pasto	13								Otra	5			
	Frutilla	6	Pera	14												
	Lechuga	7	Taxo	15												
	Limón	8	Tomate de árbol	16		UNIDAD		CANTIDAD	UNIDAD		CANTIDAD	UNIDAD		DÓLARES	DÓLARES	DÓLARES
			Otro (especifica)	17												

LA TABLA ABAJO SE DEDICA SOLAMENTE A LOTES QUE SON DADOS AL PARTIR (ESTADO DEL LOTE 3) Y TOMADOS AL PARTIR (ESTADO DE LOTE 5). POR FAVOR EMPIECE CON EL PRIMER LOTE Y PREGUNTA CUÁLES CULTIVOS SE CULITVARON EN ESTE LOTE. POR CADA CULTIVO HAGA LAS PREGUNTAS 4,09 a 4,15. SI HAY MÁS DE UN LOTE DADO/TOMADO AL PARTIR CONTINUE CON EL SEGUNDO LOTE Y HAGA EL MISMO PROCESO.

Código de ID del lote	4,08				4,09		4,10		4,11		4,12		4,13	4,14	4,15
	En el año 2012, cuántos cultivos se cultivaron en [LOTE]?				Cuál área dedicó a [CULTIVO] en este lote?		En el año 2012, cuánto de [CULTIVO] se cosechó?		Cuánto de esta cosecha recibió?		Cuánto de esta parte vendió?		Cuál precio recibió en promedio [POR UNIDAD] de estas ventas?	En año 2012, cuál fue el precio más bajo [POR UNIDAD] de estas ventas?	En año 2012, cuál fue el precio más alto [POR UNIDAD] de estas ventas?
	Cebolla blanca	1	Maíz	9		Hectáreas	1		Kilo	1		Kilo	1		Kilo	1			
	Cebolla colorada	2	Manzana	10		Cuadras	2		Otro	2		Porciento	2		Porciento	2			
	Claudia	3	Mora	11		Metros cuadr	3					Otro	3		Todo	3			
	Col	4	Papa	12		Otro	4								Nada	4			
	Durazno	5	Pasto	13											Otro	5			
	Frutilla	6	Pera	14															
	Lechuga	7	Taxo	15															
	Limón	8	Tomate de árbol	16		UNIDAD		CANTIDAD		CANTIDAD		UNIDAD		DÓLARES		DÓLARES		DÓLARES	
			Otro (especifica)	17															

Sección 5: Producción de la mora

EMPIECE CON LA PREGUNTA A LA IZQUIERDA (5,01) Y HAGA TODAS LAS PREGUNTAS EN ESTA PÁGINA.

5,01			5,02	5,03	5,04		5,05	5,06	5,07		5,08	
Recuerda la área total que dedicó a la mora hace 3 años?			Actualmente, cuántas plantas de mora tienen en total?	Cuánto del número total de estas plantas tienen de 0 a 1 año?	Cuáles variedades de la mora cultiva en su finca? [VARIAS RESPUESTAS POSIBLES]		Cuál es el porcentaje de la mora de castilla con espinas?	Cuántos años de experiencia tiene en el cultivo de la mora?	En cuál frecuencia cosecha la mora?		El año 2012, en cuáles meses **no** cosechó la mora? [VARIAS RESPUESTAS POSIBLES]	
	Hectáreas	1			Mora de Castilla con espinas	1			Semanalmente	1	Enero	1
	Cuadras	2			Mora de Castilla sin espinas	2			Cada dos semanas	2	Febrero	2
	Metros cuadrados	3			Mora de Brazo	3			Mensualmente	3	Marzo	3
	Otro (especifique)	4			Mora Cherokee	4			Otra (especifica)	4	Abril	4
					Mora roja	5					Mayo	5
					Mora negra	6					Junio	6
					Otra (especifique)	7					Julio	7
											Agosto	8
											Septiembre	9
											Octubre	10
ÁREA	UNIDAD			NÚMERO O PORCENTAJE							Noviembre	11
											Diciembre	12

Sección 5: Producción de la mora

EMPIECE CON LA PREGUNTA A LA IZQUIERDA (5,09) Y HAGA TODAS LAS PREGUNTAS DE ESTA PÁGINA.

5,09			5,10	5,11		5,12		5,13		5,14	
Qué cantidad de mora cosechó en promedio por mes durante todo el año 2012?			[SI ES CANASTO] Cuánto pesa un canasto?	Qué persona en su hogar compra típicamente los insumos para la mora?		Qué persona en su hogar decide sobre el manejo de la mora?		Qué persona en su hogar controla a los jornaleros que trabajan en la producción de la mora?		Qué persona en su hogar está encargada de comercializar la mora?	
	Kilogramo	1		Código de ID miembro 1	1	Código de ID miembro 1	1	Código de ID miembro 1	1	Código de ID miembro 1	1
	Canasto	2		Código de ID miembro 2	2	Código de ID miembro 2	2	Código de ID miembro 2	2	Código de ID miembro 2	2
	Otra (especifique)	3		Código de ID miembro 3	3	Código de ID miembro 3	3	Código de ID miembro 3	3	Código de ID miembro 3	3
				Código de ID miembro 4	4	Código de ID miembro 4	4	Código de ID miembro 4	4	Código de ID miembro 4	4
				Código de ID miembro 5	5	Código de ID miembro 5	5	Código de ID miembro 5	5	Código de ID miembro 5	5
				Código de ID miembro 6	6	Código de ID miembro 6	6	Código de ID miembro 6	6	Código de ID miembro 6	6
				Código de ID miembro 7	7	Código de ID miembro 7	7	Código de ID miembro 7	7	Código de ID miembro 7	7
				Código de ID miembro 8	8	Código de ID miembro 8	8	Código de ID miembro 8	8	Código de ID miembro 8	8
								No tenemos jornaleros	99		
CANTIDAD	UNIDAD			LLENA NOMBRE Y CÓDIGO		LLENA NOMBRE Y CÓDIGO		LLENA NOMBRE Y CÓDIGO		LLENA NOMBRE Y CÓDIGO	

Sección 5: Producción de la mora

EMPIECE CON LA PREGUNTA A LA IZQUIERDA (5,15). LA PRIMER PARTE DE ESTA HOJA TRATA DE LOS JORNALEROS. SI EL ENCUESTADO NO CONTRATÓ A JORNALEROS PARA LA MORA PUEDE PASAR DIRECTAMENTA A LA PREGUNTA 5,21. HAGA LAS PREGUNTA HASTA 5,24 Y SIGUE CON LA SIGUIENTE SECCIÓN.

JORNALEROS

5,15	5,16	5,17	5,18	5,19	5,20	5,21	5,22	5,23	5,24
En el año 2012, contrató a jornaleros/as que les ayudaron con la mora?	Le ayudaron también en la cosecha de la mora?	En el año 2012, cuántos jornaleros/as contrató? [CUÁNTAS PERSONAS]	En el año 2012, cuántos días trabajaró cada una de estas personas?	Cuánto les pagó en promedio por día? (INCLUYENDO LA ALIMENTACIÓN)	Cuántos de sus jornaleros contratados fueron femeninos?	Por qué razón cultiva la mora? [VARIAS RESPUESTAS POSIBLES]	Cuáles son los principales problemas en su producción de mora? [VARIAS RESPUESTAS POSIBLES]	Actualmente cuenta con alguna certificación que es relevante para su producción de la mora?	Desde cuándo cuenta con esta certificación?
Sí 1	Sí 1					Tradición 1	Plagas 1	Agricultura límpia 1	
No 2	No 2					Es un cultivo rentable 2	Enfermedades 2	Otra (especifique) 2	
						Es fácil vender 3	Poca lluvia 3	Ninguna 99	
						Faltan alternativas 4	Suelos infertiles 4		
						Ingreso estable 5	Altos costos 5		
						Otra (especifique) 6	Espinas 6		
						NO LEE RESPUESTAS A AGRICULTOR	Manejo fitosanitario 7		
							Falta crédito 8		
							Disponibilidad de jornaleros 9		
							Otro (especifique) 10		
SI NO CONTRATÓ PASE A LA PREGUNTA 5,21							**NO LEE RESPUESTAS A AGRICULTOR**		

Sección 6: Costos de producción

IMPORTANTE EN ESTA PARTE SON SOLAMENTE LOS CULTIVOS QUE SE CULTIVÓ EN LOS LOTES EXPLOTADOS POR EL HOGAR (ESTADOE LOTE 1), DADO AL PARTIR (ESTADO DE LOTE 3) Y TOMADO EN ARRIENDO (ESTADO DE LOTE 4). POR FAVOR PRIMERO PONGA LOS CÓDIGOS DE ID Y LOS NOMBRES DE LOS CULTIVOS (6,01 Y 6,02). COMENZAMOS CON LA MORA. PREGUNTA SOBRE TODOS LOS COMPONENTES DE COSTOS (6,03 HASTA 6,08). EN EL CASO DE LA MORA YA TENEMOS LA INFORMACIÓN SOBRE COSTOS DE JORNALEROS. HABER FINALIZADO TODAS LAS PREGUNTAS DE UN CULTIVO POR FAVOR SIGUE CON EL PRÓXIMO.

6,01	6,02				6,03	6,04		6,05	
Nombre del cultivo	Código del cultivo				Siembra	Fertilización		Abonos órganicos [SOLAMENTE SI FUERON COMPRADOS AFUERA DE LA FINCA]	
					En el año 2012, cuánto gastó en plantas, estacas o semillas de [CULTIVO]?	En el año 2012, aplicó abono químico en [CULTIVO]?	Cuál fue el costo total de estas aplicaciónes?	En el año 2012, aplicó abono orgánico en [CULTIVO]?	Cuál fue el costo total de estas aplicaciónes?
	Cebolla blanca	1	Manzana	10		Sí 1		Sí 1	
	Cebolla colorada	2	Mora	11		No 2		No 2	
	Claudia	3	Papa	12					
	Col	4	Pasto	13					
	Durazno	5	Pera	14					
	Frutilla	6	Taxo	15					
	Lechuga	7	Tomate de árbol	16					
	Limón	8	Otro (especifica)	17					
	Maíz	9							
Mora			11						

Sección 6: Costos de producción

IMPORTANTE EN ESTA PARTE SON SOLAMENTE LOS CULTIVOS QUE FUERON CULTIVADOS EN LOS LOTES EXPLOTADOS POR EL HOGAR (ESTADOE LOTE 1), DADO AL PARTIR (ESTADO DE LOTE 3) Y TOMADO EN ARRIENDO (ESTADO DE LOTE 4). POR FAVOR PRIMERO PONGA LOS CÓDIGOS DE ID Y LOS NOMBRES DE LOS CULTIVOS QUE FUERON CULTIVADOS EN LOS LOTES. EL PRIMER CULTIVO ES LA MORA. PREGUNTA SOBRE TODOS LOS COMPONENTES DE COSTOS (6,03 HASTA 6,09). EN EL CASO DE LA MORA YA TENEMOS LA INFORMACIÓN SOBRE COSTOS DE JORNALEROS. SI EL ENTREVISTADO APLICÓ MÁS DE UN INSUMO UTILICE LAS FILAS DE ABAJO. HABER FINALIZADO TODAS LAS PREGUNTAS DE UN CULTIVO POR FAVOR SIGUE CON EL PRÓXIMO.

6,06		**6,07**		**6,08**	
Control fitosanitario		Herbicidas		Jornaleros	
En el año 2012, cuántos controles fitosanitarios realizó para [CULTIVO]?	Cuál fue el costo promedio para cada control?	En el año 2012, aplicó herbicidas en [CULTIVO]?	Cuál fue el costo total de estas aplicaciónes?	En el año 2012, contrató a jornaleros/as que les ayudaron a manejar [CULTIVO]?	Cuánto gastó en ellos en el año 2012? [SOLAMENTE ESTE CULTIVO]
		Sí 1 No 2		Sí 1 No 2	

Sección 7: Comercialización de la mora

POR FAVOR COMIENCE CON LA PREGUNTA 7,01 Y ASIGNE DIRECTAMENTE TODOS LOS CÓDIGOS Y NOMBRES DE LOS COMPRADORES. DESPUÉS CONTINUE CON LA PREGUNTA 7,02 QUE VALE PARA TODOS LOS COMPRADORES MENCIONADOS ANTES. A CONTINUACIÓN HAGA LAS PREGUNTAS 7,03 HASTA 7,19 EN LA FILA CON EL PRIMER COMPRADOR. SIGUA CON EL SEGUNDO COMPRADOR Y REALICE EL MISMO PROCESO. CUANDO TODOS LOS COMPRADORES SON COMPLETADOS HAGA LAS PREGUNTAS 7,20 HASTA 7,25.

Código de ID del comprador	7,01		7,02	7,03		7,04		7,05	7,06	
	A cuáles compradores vendió la mora en el año 2012? [VARIAS CONTESTAS POSIBLES]		Cuáles fueron sus más importantes compradores? [1=LO MÁS IMPORTANTE, 2 = MENOS IMPORTANTE ETC.]	Comercializó a [COMPRADOR] individualmente o en grupo?		Típicamente transportó y entregó usted la mora a [COMPRADOR]?		Si usted entregó el producto a [COMPRADOR], cuánto tiempo tarda normalmente desde la cosecha hasta el inicio del transporte?	Si usted entregó el producto a [COMPRADOR] cuál es el más típico modo de transporte?	
	Mercado Mayorista de Ambato	1		Individualmente	1	Sí	1		Camioneta	1
	Mercado local	2		En grupo	2	No	2		Camión	2
	Heladería	3							Automóbil	3
	Intermediario Vicente (El tío)	4							Bicicleta	4
	Distrifrut	5							Motocicleta	5
	Greengarden	6							Autobús	6
	ProAgrip	7							Caminando	7
	Otro intermediario	8							Otro	8
	Planhofa	9								
	Tierra Linda	10								
	Otra agroindustria	11								
	Detallista	12								
	BioNatur	13	PONGA LOS NÚMEROS 1 a 3			SI NO PASE A LA PREGUNTA 7,08		HORAS		
	Otro supermercado	14								

Sección 7: Comercialización de la mora

POR FAVOR COMIENCE A LA IZQUIERDA (7,07) Y HAGA TODAS LAS PREGUNTAS DE ESTA PÁGINA SOBRE [COMPRADOR]. PREGUNTAS 7,09 Y 7,10 NO VALEN PARA EL MERCADO MAYORISTA Y EL MERCADO LOCAL.

7,07		7,08		7,09		7,10		7,11			7,12		
Cuál es la distancia en kilómetros y en minutos a [COMPRADOR] con este modo de transporte ?		En cuáles de estos últimos 5 años comercializó a [COMPRADOR]?		Conoció a [COMPRADOR] antes de venderle la mora?		Cómo entró en contacto con [COMPRADOR] con el fin de venderle la mora?		Cuánto le vendió a [COMPRADOR] en el año 2012?			Cuánto le pagaron en promedio por [UNIDAD]?		
		2008	1	Sí	1	Es miembro de la familia	1		Kilogramo	1		Kilogramop	1
		2009	2	No	2	Es un amigo	2		Canasto	2		Canasto	2
		2010	3			Es un vecino	3		Otro	3		Otro	3
		2011	4			Por otros agricultores de la mora	4						
		2012	5			Por mi asociación	5						
						Casualidad	6						
						Otro (especifica)	7						
						NO LEE RESPUESTAS A AGRICULTOR							
KILÓMETROS	MINUTOS							CANTIDAD	UNIDAD		DÓLARES	UNIDAD	

Sección 7: Comercialización de la mora

LAS PREGUNTAS DE ESTA PÁGINA YA NO SE REFIEREN A LOS COMPRADORES ESPECÍFICOS. TRATAN DE LA COMERCIALIZACIÓN EN GENERAL. DESPUÉS DE LA PREGUNTA 7,25 CONTINUE CON LA PRÓXIMA SECCIÓN.

								SOLAMENTE SI VENDIÓ AL MERCADO MAYORISTA									
7,20		**7,21**		**7,22**		**7,23**		**7,24**		**7,25**	
Cuáles son los principales problemas en cuanto a la comercialización de la mora? [VARIAS CONTESTAS POSIBLES]		Cuáles criterios considera para vender la mora a un comprador? [VARIAS CONTESTAS POSIBLES]		En una escala de 10 - 1, cuán importante es encontrarse con amigos al vender la mora [10=MUY IMPORTANTE, 1=SIN		Porque vende al mercado mayorista en Ambato? [VARIAS RESPUESTAS POSIBLES]		En el año 2012, a cuantos intermediarios vendió en este mercado?		Se encuentra con amigos cuando venden al mercado mayorista?	
Mal precio	1	Alto precio	1			Buen precio	1			Siempre	1
Inestabilidad del precio	2	Confianza	2			Costumbre	2			Con frecuencia	2
Poder de los intermediarios	3	Pago al contado	3			Ya conozco compradores	3			A veces	3
Faltan alternativas al mercado mayorista	4	Precio estable	4			Reducir riesgo	4			Nunca	4
Alta exigencia en la calidad	5	Amistad	5			No exigen un producto con calidad	5				
Demora en pago	6	No tiene grandes exigencias	6			Compran toda la cosecha	6				
Otra (especifica)	7	Otra (especifica)	7			Por necesidad	7				
NO LEE RESPUESTAS A AGRICULTOR		**NO LEE RESPUESTAS A AGRICULTOR**				Puedo vender otros productos	8				
						Otra (especifica)	9				
						NO LEE RESPUESTAS A AGRICULTOR					
				PONGA EL NÚMERO				PONGA EL NÚMERO			

Sección 8: Calidad de la mora

POR FAVOR EMPIECE CON LA PREGUNTA 8,01 A LA IZQUIERDA Y HAGA LAS PREGUNTAS HASTA 8,07. CONTINUE CON LA SIGUIENTE PAGINA.

8,01		8,02		8,03		8,04		8,05		8,06		8,07	
Cómo identifca que la mora está lista para la cosecha? [VARIAS RESPUESTAS POSIBLES]		Quién cosecha la mora tipicamente? [VARIAS RESPUESTAS POSIBLES]		Indicó usted a los jornaleros como se cosecha la mora adecuadamente?		Capacitaron a los jornaleros sobre buenas prácticas de higiene?		Seleccionó usted la mora antes de venderla?		Clasificó la mora antes de venderla?		Cosechó directamente en el empaque?	
Color de la fruta	1	Familia	1	Siempre	1	Siempre	1	Siempre	1	Siempre	1	Siempre	1
Tamaño	2	Jornaleros	2	Con frecuencia	2	Con frecuencia	2	Con frecuencia	2	Con frecuencia	2	Con frecuencia	2
Firmeza	3	Ambos	3	A veces	3	A veces	3	A veces	3	A veces	3	A veces	3
Sabor	4	Otro (especifica)	4	Nunca	4	Nunca	4	Nunca	4	Nunca	4	Nunca	4
Forma	5												
Otra (especifica)	6												
NO LEE RESPUESTAS A AGRICULTOR													
		SI JORNALEROS NO COSECHAN PASE A LA PREGUNTA 8,05											

Sección 8: Calidad de la mora

POR FAVOR EMPIECE CON LA PREGUNTA 8,08 A LA IZQUIERDA. SI UTILIZARON MÁS DE UN TIPO DE EMPAQUE PARA LA VENTA (8,09) PONGA LOS CÓDIGOS EN LAS FILAS QUE CORRESPONDEN A LA MISMA PREGUNTA.

8,08		8,09		8,10	8,11	8,12		8,13		8,14	8,15	
En el año 2012, qué tipo de empaque utilizó para la cosecha de la mora? [VARIAS RESPUESTAS		En el año 2012, qué tipo de empaque utilizó para la venta de la mora? [VARIAS RESPUESTAS		Cuál es la capacidad de los tipos de empaque para la venta? [PREGUNTE POR TODOS LOS TIPOS	De los típos de empaque para la venta, cuáles fueron los más utilizados? [1 = LO MÁS UTILIZADO]	Limpió los empaques para la venta antes de colocar la mora en estos?		Almacenó la mora antes de venderla?		Cuántas horas en promedio almacenó la mora hasta su transporte?	Dónde almacena la mora normalmente? [VARIAS CONTESTAS POSIBLES]	
Canasto	1	Canasto	1			Siempre	1	Siempre	1		Cuarto frío	1
Gaveta plástica	2	Gaveta plástica	2			Con frecuencia	2	Con frecuencia	2		En el huerto	2
Caja de cartón	3	Caja de cartón	3			A veces	3	A veces	3		En la casa	3
Caja de madera	4	Caja de madera	4			Nunca	4	Nunca	4		En el carro	4
Tarrina	5	Tarrina	5								Otro lugar (especifica)	5
Balde	6	Balde	6								**NO LEE RESPUESTAS A AGRICULTOR**	
Bolsa	7	Bolsa	7									
Otro (especificia)	8	Otro (especificia)	8									
				PONGA CAPACITAD	PONGA LOS NÚMEROS			SI "NUNCA" PASE A LA SIGUIENTE SECCIÓN		HORAS		

Sección 9: Crédito y acceso a información

POR FAVOR COMIENCE A LA IZQUIERDA CON LA PREGUNTA 9,01. SI LOS MIEMBROS DEL HOGAR OBTUVIERON MÁS DE UN CRÉDITO (PREGUNTA 9,02) PONGA LOS NÚMEROS EN LAS FILAS DE LA MISMA PREGUNTA. INICIE CON EL PRIMER CRÉDTIO Y HAGA LAS PREGUNTAS 9,03 HASTA 9,08. LUEGO REALICE EL MISMO PROCESO CON EL SEGUNDO CRÉDITO. CUANDO TENEMOS TODA LA INFORMACIÓN SOBRE LOS CRÉDITOS PASE A LA PREGUNTA 9.09.

9,01		9,02	9,03		9,04	9,05	9,06		9,07		9,08	
En el año 2012, obtuvo usted o un miembro de su hogar algun crédito?		Cuántos créditos obtuvieron ?	Quién fue el/la prestamista?		Cuál fue el monto total de este crédito?	Cuál fue la tasa de interés?	Cuál fue la frecuencia de pago?		El crédito fue relacionado con la producción de la mora?		En qué empleó el crédito? [VARIAS RESPUESTAS POSIBLES]	
Sí	1		Banco	1			Quincenal	1	Sí	1	Comprar insumos	1
No	2		ONG	2			Mensual	2	No	2	Arrendar tierra	2
			Gobierno	3			Trimestral	3			Comprar tierra	3
			Comprador	4			Semestral	4			Otra inversión agrícola (especifica)	4
			Asociación	5			Anual	5			Construcción o mejoras de la vivienda	5
			Institución de Microfinanzas	6			Otra (especifica)	6			Pagar deudas	6
			Cooperativa de ahorro y crédito	7							Emergencia	7
			Prestamista informal	8							Estudios de un miembro del hogar	8
			Otro (especifica)	9							Otro (espicifica)	9
			Conocidos/Amigos	10								
SI NO PASE A LA PREGUNTA 9,09						PORCENTAJE						

Sección 9: Crédito y acceso a información

POR FAVOR COMIENCE A LA IZQUIERDA CON LA PREGUNTA 9,09. SI PERTENECEN A MÁS DE UN GRUPO/ASOCIACIÓN PONGA LOS NOMBRES DE ESTOS EN LAS FILAS DE LA PREGUNTA 9,10. LUEGO INICIE CON EL PRIMER GRUPO O ASOCIACIÓN Y HAGA LAS PREGUNTAS 9,11 Y 9,12. DESPUÉS REALICE EL MISMO PROCESO CON EL SEGUNDO, TERCERO ETC. GRUPO O ASOCIACIÓN. CUANDO TENEMOS TODA LA INFORMACIÓN SOBRE LOS GRUPOS Y ASOCIACIONES CONTINUE CON LA PREGUNTA 9,13.

9,09		9,10	9,11	9,12		9,13		9,14		9,15		9,16	
Actualmente, es usted o una persona de su hogar miembro de un grupo o asociación?		Cómo se llama(n) los grupos/ asociaciones a los cuáles pertenecen?	Desde cuándo pertenece a [GRUPO/ ASOCIACIÓN]?	Cuáles son los beneficios de ser miembro de este [GRUPO/ ASOCIACIÓN]? [VARIAS RESPUESTAS POSIBLES]		Ha participado en el curso de capacitación sobre la mora del INIAP/GIZ?		Alguna vez recibió servicios de asesoría agrícola sobre la mora?		Quién lo proporcionó? [VARIAS CONTESTAS POSIBLES]		Cuáles tipos de asesoría proporcionaron? [VARIAS CONTESTAS	
Sí	1			Comercialización colectiva	1	Siempre	1	Sí	1	INIAP	1	Manejo del cultivo	1
No	2			Almacenamiento colectivo	2	Con frecuencia	2	No	2	GIZ	2	Poscosecha	2
				Transporte colectivo	3	A veces	3			MAGAP	3	Precios/mercado	3
				Compra colectiva de insumos	4	No	4			IEDECA	4	Otra (especifique)	4
				Proporciona asistencia técnica	5					HGPT	5		
				Capacitación	6					Personas de la asociación	6		
				Intercambiar información de mercados	7					Sector privado	7		
				Subsidio del estado	8					Universidad	8		
				Facilita acceso a crédito	9					ONG	9		
				Compartir equipo agrícola	10					Otro (especifique)	10		
				Red social	11								
				Otro (especifico)	12								
SI NO PASE A LA PREGUNTA 9,13				**NO LEE RESPUESTAS A AGRICULTOR**				SI NO PASE A LA PREGUNTA 9,17					

Sección 9: Crédito y acceso a información

POR FAVOR EMPIECE A LA IZQUIERDA CON LA PREGUNTA 9,17 Y HAGA TODAS LAS PREGUNTAS HASTA 9,25.

9,17		9,18		9,19	9,20		9,21	9,22		9,23		9,24	9,25	
Alguna vez participó en un día de campo de la mora?		Está asociado/a a la cadena provincial de la mora?		Desde cuándo está asociado a la cadena?	Conoce usted productores de la mora que venden a la agroindustria?		Cuántos productores ?	Habló con ellos sobre la comercialización de la mora?		Conoce usted productores de la mora que venden a supermercados		Cuántos productores ?	Habló con ellos sobre la comercialización de la mora?	
Sí	1	Sí	1		Sí	1		Sí	1	Sí	1		Sí	1
No	2	No	2		No	2		No	2	No	2		No	2
		SI NO PASE A LA PREGUNTA 9,20			SI NO, PASE A LA PREGUNTA 9,23					SI NO PASE A LA PREGUNTA 9,26				

Sección 9: Crédito y acceso a información

POR FAVOR COMIENCE A LA IZQUIERDA CON LA PREGUNTA 9,26. EN LAS SIGUIENTES PREGUNTAS ANOTE LOS NOMBRES PREGUNTE POR CADA PERSONA DESDE CUANDO LA CONOCE.

9,26		9,27	9,28	9,29		9,30	9,31
Conoce usted técnicos que trabajan en el MAGAP de la Provincia de Tungurahua?		Sabe cómo se llaman estas personas?	Desde cuándo las conoce?	Conoce usted personas que trabajan en el INIAP de la Provincia de Tungurahua?		Cómo se llaman estas personas?	Desde cuándo las conoce?
Sí	1			Sí	1		
No	2			No	2		
SI NO PASE A LA PREGUNTA 9,29		PONGA LOS NOMBRES	AñO	SI NO PASE A LA SIGUIENTE SECCIÓN		PONGA LOS NOMBRES	AñO

Sección 10: Bienes del hogar

POR FAVOR EMPIECE CON EL PRIMER BIEN DE LA COLUMNA (BICICLETA) Y PREGUNTE CUÁNTOS POSEE ESTE HOGAR. DESPUÉS HAGA LAS PREGUNTAS 10,02 HASTA 10,04 EN LA MISMA FILA. SI EL/LA ENTREVISTADO/A NO TIENE IDEA SOBRE LOS MONTOS EN LAS PREGUNTAS 10,03 Y 10,04 PREGUNTE POR ESTIMADOS. SIGUA CON EL PRÓXIMO BIEN.

	Bienes	10,01	10,02	10,03	10,04
		Cuántos del [BIEN] posee su hogar?	En qué año lo compró?	Cual era el valor de compra de [BIEN]?	Cuanto valdría en el mercado si lo vendiera hoy?
		SI NINGUNO, TACHA CELDA Y PASE AL SIGUIENTE BIEN		DÓLARES	DÓLARES
Vehículos	Bicicleta				
	Motocicleta				
	Automóbil				
	Camioneta				
	Camion				
	Tractor				
Equipo agrícola	Tijera de podar				
	Arado				
	Motoguadaña				
	Picador				
	Bomba de fumigar con motor				
	Bomba de fumigar manual				
	Bomba de agua				
	Reservorio de agua para riego				
	Silo o Sistema de almacenamiento de productos				

ANNEX B - DECLARATION ON PROPORTION OF OWN WORK

I hereby, declare the proportion of own work performed in the scientific papers that are included in this dissertation.

The first paper titled *'Cluster and global value chains: conceptual approaches and case-study evidence of the agri-food sector'* is co-authored by my colleague Anna Müller. I have performed the following parts: literature review and writing mainly on sections related to cluster theory, wine cluster case study, and linking cluster and GVC research; joint work was performed on conceptualization of the paper, introduction and conclusion.

The second paper titled '*Understanding participation in modern supply chains under a social network perspective – evidence from blackberry farmers in the Ecuadorian Andes',* is co-authored by Prof. Ludwig Theuvsen, Dr. Wilson Vásquez, and Jun.-Prof. Meike Wollni. I have carried out the following parts: development and conceptualization of research question, choice of study design, questionnaire design in cooperation with Dr. Wilson Vásquez and colleagues, implementation of the survey in cooperation with Dr. Wilson Vásquez and colleagues, analysis and interpretation of the research results.

The third paper titled *'Income effects of modern supply chain participation – the case of blackberry farmers in the Ecuadorian Andes',* is co-authored by Prof. Ludwig Theuvsen, Dr. Wilson Vásquez, and Jun.-Prof. Meike Wollni. I have carried out the following parts: development and conceptualization of research question, choice of study design, questionnaire design in cooperation with Dr. Wilson Vásquez and colleagues, implementation of the survey in cooperation with Dr. Wilson Vásquez and colleagues, analysis and interpretation of the research results.