DETERMINANTS OF SUSTAINABLE COFFEE MARKETING CHANNEL CHOICE AND SUPPLY RESPONSE AMONG ORGANIC AND UTZ CERTIFIED SMALLHOLDER FARMERS: EVIDENCE FROM UGANDA

By

Martin Ndinomupya Angula

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ABSTRACT

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Sustainable coffee certification initiatives have created a fast growing niche market that promises to ameliorate smallholder coffee producers' hardships brought about by low coffee commodity prices in recent years. The current debate has focused on whether these initiatives are accessible, especially by smallholder farmers and whether they indeed deliver on this promise, with certification costs believed to constitute an entry barrier. However, evidence has emerged that even when free certification has been given to smallholder coffee farmers, some farmers continue to sell certified coffee in the conventional coffee markets. This study uses a double hurdle model to identify those factors that shape coffee growers choice of marketing channel and sales volume decisions once a marketing channel has been selected. The study concludes that labor availability (own and hired) and the size of farm holding are the main constraints to both participation in the sustainable coffee marketing channel and the sales volume to this channel. Revenue from crop sales other than coffee is also an important determinant of participation and sales volume. Age was the only demographic factor that was found to be statistically significantly related to participation and sales volume.

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LIST OF ACRONYMS

FOB – Free On Board

CMB – Coffee Marketing Board

EU – European Union

EUREP-GAP – Good Agricultural Practice Standard developed by Eurep group of firms

ICA – International Coffee Agreement

ICO – International Coffee Agreement

UCB – Ugandan Coffee Board

UCDA – Ugandan Coffee Development Authority

US – United States

CHAPTER I: INTRODUCTION

1.1 General Background

Coffee is the world's most traded commodity, only second to oil, with an estimated sales value of 9 billion dollars between 1999 and 2000. Coffee as a commodity employs about 25 million people, fills about 400 billion cups every year with about 40 percent of the world's population believed to consume coffee regularly (Fitter and Kaplinsky, 2001). Between 17 and 20 million families derive livelihood from coffee production and most of these people live in developing countries (Lewin et. al., 2004; Giovannucci and Potts, 2008). Although coffee production and trade play such a vital role in the lives of many poor families, coffee prices plummeted following the collapse of the International Coffee Agreement (ICA) in 1989 resulting in what is referred to as the biggest coffee crisis ever. Prior to this, coffee prices were managed by the International Coffee Organization (ICO) through the ICA thereby ensuring price stability for coffee farmers. The ensued coffee crisis culminated into financial and social hardship among coffee farmers (Wollni and Zeller, 2006).

As an attempt to ameliorate problems associated with low coffee commodity prices, a number of coffee labeling schemes have emerged. These schemes are aimed at correcting market failures for value attributes (consumer health, environmental protection, social justice) associated with coffee production (Calo and Wise, 2005; Giovannucci et. al., 2008). These schemes rely on third-party certification and verifications to ensure integrity throughout the supply chain. The first schemes were Fair Trade, Organic and Shade Grown Coffee. Subsequent schemes include Rainforest Alliance, Bird Friendly and Utz Certified (formerly known as Utz Kapeh). Coffee grown under these schemes are collectively referred to as "sustainable coffee"(Lewin et. al., 2004).

According to Giovannucci (2008), certified coffee amounted to about 4 percent of global green coffee export or more than 22,000 metric tons in 2006 representing an export value (FOB) of approximately US$ 330 million. However, there are some inconsistencies in the estimates of the growth rate of the certified organic coffee. AC Nielson suggests that organic and sustainable coffee sales in the US has increased by approximately 54 percent during November 2004 – November 2005 while total coffee sales grew by only 8.5 percent in the same year. The Organic Trade Association shows a slower growth rate for organic coffee sales, about 40 percent for the period December 2004 to December 2005 (Giovannucci et. al., 2008). Certified coffee represents a fast growing niche market; it remains small, estimated to represent just about 2 percent of coffee consumption in industrialized countries' markets. In spite of its small market share, it offers attractive benefits not only to farmers but also the entire industry in terms of increased sales and greater profits all along the supply chain (Giovannucci and Koekoek, 2003). The perceived attraction of farmers to produce sustainable coffee is increased income versus all other environmental, social and other benefits (Giovannucci et. al., 2008; Lazaro et. al., 2008).

While these schemes are believed to provide an escape route for coffee farmers out of poverty, it is widely debated whether these certified markets are accessible to farmers with certification costs believed to constitute a barrier to entry. Rice and McLean (1999) argued that it is a fallacy on the part of the farmers to claim that certification costs for organic standards are prohibitive and a barrier to entry. They argued that farmers as individuals may not be able to afford certification costs but group certification is reasonably affordable, at least considering price premiums prevailing at that time. On the other hand, Calo and Wise (2005) found that premiums were only a reasonable incentive for producers to convert to organic production under unusually high coffee prices. Organic coffee price premiums are market-driven in two ways: 1) it is a

premium above the prevailing conventional coffee market price; and, 2) the size of the premium is determined by supply and demand forces in the organic coffee market. No research has been completed on the sustainability certified coffee which in lies the uniqueness of this paper.

1.2 Problem Statement

While free certification (Organic and Utz Certified) was given to smallholder coffee farmers in a coffee contract scheme in Uganda, it has emerged that 20 percent of those farmers opted to sell certified coffee in the conventional market as conventional coffee. The actions of these farmers seems to suggest that there are more reasons why smallholder farmers are not participating in certified supply chains besides conversion and certification costs as cited in the literature. Hence, the aim of this paper is to identify constraints and preferences shaping farmers' marketing channel choice. Previous studies (Wollni and Zeller, 2006; Wollni, 2007; Wollni et. al., 2008; Calo and Wise, 2005; Giovannucci and Potts, 2008; Bacon et. al., 2008; Bolwig et. al., 2009) have looked at household or community level effects of participation in sustainable coffee markets by smallholder farmers. However, all these authors only compared certified and non-certified farmers. No study has looked at smallholders' ex-post certification constraints/preferences associated with sustainable coffee niche market participation. This is the gap in literature that this paper seeks to address. This paper will identify ex-post certification constraints and preferences shaping smallholder farmers' choice of marketing channel.

1.3 Research Questions

The research questions are:

- What factors influence the choice of marketing channel among certified smallholder coffee growers?
- What are the marginal effects of those factors on the probability of participation in the sustainable coffee marketing channel?
- What factors shape certified smallholder coffee farmers' sales volume decisions once the certified sustainable marketing channel has been selected?

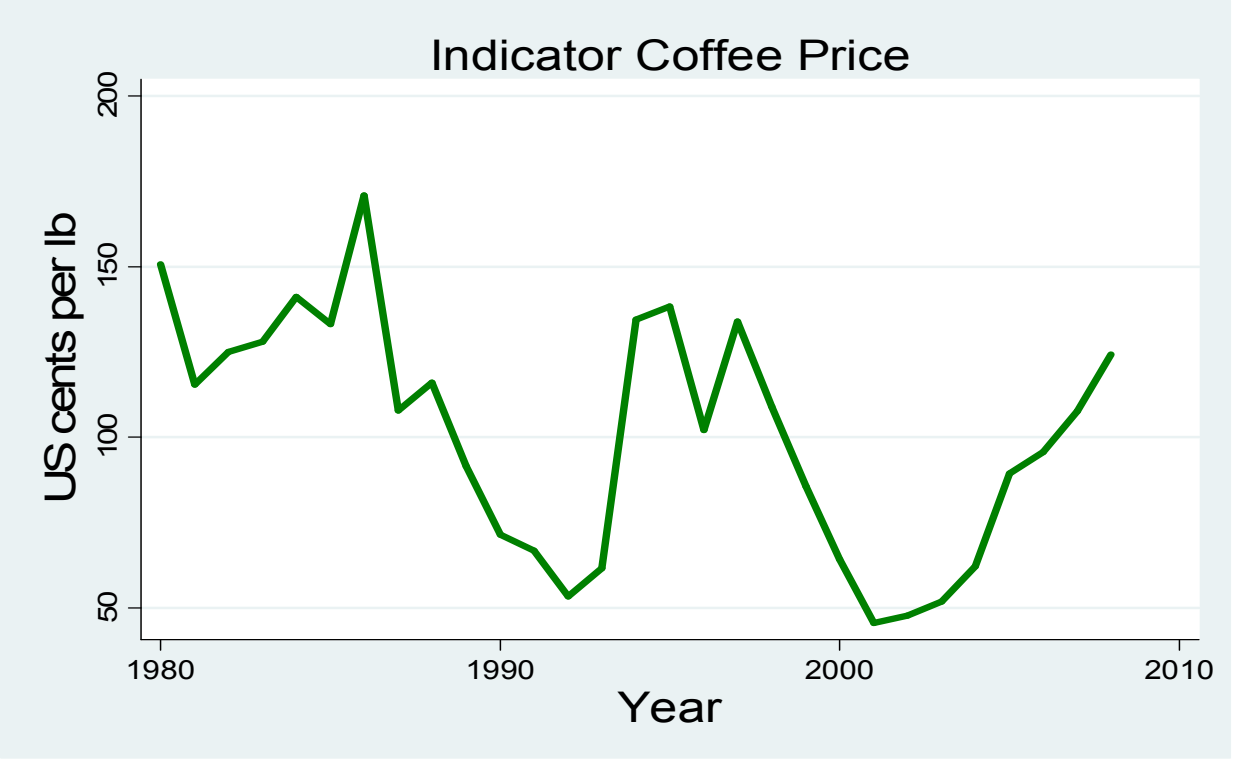
This thesis is divided into four chapters. Chapter 2 gives an overview of literature on conventional coffee, the sustainable coffee market, Ugandan coffee market and the analytical models used to study the coffee and related markets. Chapter 3 is concerned with the methods used in the study; particularly it looks at the basic model used in the study, and the data and variables used in the analysis. Chapter 4 gives the results and Chapter 5 gives conclusions and policy implications from the study.

CHAPTER II: LITERATURE REVIEW

2.1 Background on Coffee Market (Coffee Crisis)

According to Ponte (2002a), Oxfam (2002), and Calo and Wise (2005) the coffee market was managed through an International Coffee Agreement (ICA) from 1962 – 1989. Coffee prices were managed through export quotas allocated to coffee exporting countries and excess coffee stock was held and kept out of the market. Coffee consuming countries helped by financing coffee stock holding. However, coffee prices plummeted in 1989 following the collapse of the ICA and the subsequent overproduction by major producers like Brazil as well as the emergence of major coffee producers like Vietnam (See figure 1 below for the trend in coffee prices since 1976). The figure shows indicator coffee prices which include both Robusta and Arabica.

Figure1. Indicator Coffee Prices, 1980 – 2008



Source: International Coffee Organization (ICO).

The problem of low coffee prices were further compounded by the coffee market restructuring that took place in many coffee producing countries as well as increased consolidation in the coffee supply chain. As can be seen in figure 1, coffee prices picked up in 1995 and 1997 following a frost and draught that ruined the Brazilian crop, but tumbled even below producers' cost of production thereafter.

Following coffee market restructuring in many coffee producing countries, the coffee supply chain became more consolidated which saw an ever diminishing proportion of coffee income accruing to coffee farmers. In fact, Talbot (1997) noted that the proportion of income accruing to producers fell from 20 percent to 13 percent between 1989-90 and 1994-95. Producers of cheap unprocessed coffee received less than 6.5 percent of the final retail value (Oxfam 2002). All of these developments in the coffee market culminated in growing impoverishment of coffee dependent families, decline in human welfare and development (Calo and Wise 2005).

2.2 Emergence of Sustainable Coffee Market

The coffee crisis resulted in coffee growers having a lower standard of living and wide spread environmental degradation, as farmers abandoned their coffee farms in pursuit of more lucrative opportunities. As an effort to reverse these adverse effects, a number of coffee labeling schemes have emerged. The main labeling schemes are organic, fair trade and shade grown coffee but other initiatives such as Utz Certified, Rainforest Alliance, and Bird Friendly are also gaining substantial market shares. Coffees produced as part of these schemes are collectively referred to as "sustainable coffee" to differentiate it from coffees from conventional production systems. The main idea behind these schemes is to create market based incentives for those coffee farmers who produce their coffee in a socially and environmentally responsible way. Social and

environmental responsibility is defined in terms of the adoption of practices that protect the environment and social fairness in coffee production. According to Calo and Wise (2005), sustainable coffee schemes represent a market-based efforts to communicate information about coffee production to consumers thereby correcting market failures to value their associated attributes (health, environmental protection, and social justice). The communication of product information in the market place has the potential to alter demand, thereby providing new and promising opportunities for coffee farmers. Price premiums and rising demand create incentives for farmers with the capacity to respond by changing their production structures and take advantage of the new market opportunity.

Marketing coffee as sustainable is a relatively new idea for the coffee industry and until recently, this coffee has had limited supply. Sustainable coffees are now at a crossroads with many opportunities in new, high volume distribution channels (Giovannucci and Koekoek, 2003). The market for this coffee has grown robustly at all levels of the supply chain. The sustainable coffees supply chain involves 32 producer countries, hundreds of producer organizations, dozens of specialized traders, more than 20 consuming countries, hundreds of roasters, hundreds of brand-owners, and thousands of retailers. Higher quality is the recipe for sustainability. Adequate quality is certainly an important component of a farmer's ability to be competitive and minimum quality is a baseline necessity (Giovannucci and Koekoek, 2003; Donnet et. al., 2007).

2.2.1 Organic Coffee

Organic agriculture is a production management system promoting and enhancing biodiversity and soil activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony (Ponte, 2004; Daviron and Ponte, 2005).

Giovannucci (2006) states that there are no universally agreed upon definition of organic agriculture and identified three salient facets of an organic definition as having regulatory, agronomic or holistic aspects. The growth of organic production systems date back to the beginning of the 20^{th} century with systemic guidelines and formulations for "sustainable" production already published in Europe, the U.S., and South Asia by that time (Giovannucci, 2006). The first trade of a third-party certified organic product was coffee from Mexico in 1967 (Giovannucci and Koekoek, 2003). Organic coffee did not achieve real growth until the late 1990s when the combination of growing consumers' health and environmental concerns led to rapid growth of the sector (Giovannucci et. al., 2008). In contrast to conventional coffee, organic coffee is much more expensive to produce and can require as much as 3 times the labor of a moderately tended conventional coffee. This is by far the biggest cost associated with the switch from conventional to organic production (Calo and Wise, 2005). This may not be true for most African countries including Uganda where the use of inorganic inputs is low. Organic products are sold at a premium at the retail level, higher margins have been generated for all those involved in the marketing chain although the distribution of these margins may be skewed against producers (Ponte, 2004).

2.2.2 Utz Certified (Utz Kapeh)

Utz Certified was founded in 1997 by Guatemala coffee producers and the Dutch coffee roaster Ahold coffee company (Utz Certified, 2009). Utz has now become an independent third-party certified coffee labeling scheme. This scheme was founded with the idea to create recognition for responsible coffee producers and tools for roasters and brands to respond to a growing demand for assurance of responsibly produced coffee. It has developed a code of conduct for growing

sustainable coffee on the basis of "good agricultural practices" of the European Retail Group (EUREP-GAP) now (GLOBALGAP). This code contains certain criteria for soil management, fertilizer use, integrated pest management, waste pollution management, worker health, safety and welfare and other socio-economic and cultural aspects (Utz Website 2009; Daviron and Ponte, 2005).

As of March 2004, Utz kapeh had certified 42 farms and groups of cooperatives in 12 countries (Ponte, 2004) but by July 2009, this number has exploded to 314 farms and cooperatives in 21 countries (Utz Certified, 2009) as shown in table 1. The majority of the farms are located in central and south America (Brazil, Guantemala, Honduras, and Colombia). Kenya has the highest number of Utz certified farms in Africa. This increase in the number of Utz certified farms and cooperatives is expected to increase although no quantitative estimates have been made.

Table 1 The Number of Utz Certified Farms and Groups of Cooperatives in 2004 and 2009

Country	**Farms & Groups of Cooperatives**	
	2004	**2009**
Burundi	0	1
Ethiopia	0	3
Kenya	0	28
Tanzania	0	1
Uganda	3	7
Zambia	1	2
India	1	5
Indonesia	1	7
Papua New Guinea	0	2
Viet Nam	6	15
Costa Rica	2	6
El Salvador	0	1
Guatemala	8	28
Honduras	1	21
Mexico	0	16

Table 1 (Contin'd)

Nicaragua	0	9
Dominic Republic	0	1
Bolivia	1	4
Brazil	8	124
Colombia	2	19
Peru	6	14

2.3 Overview of the Ugandan Coffee Industry

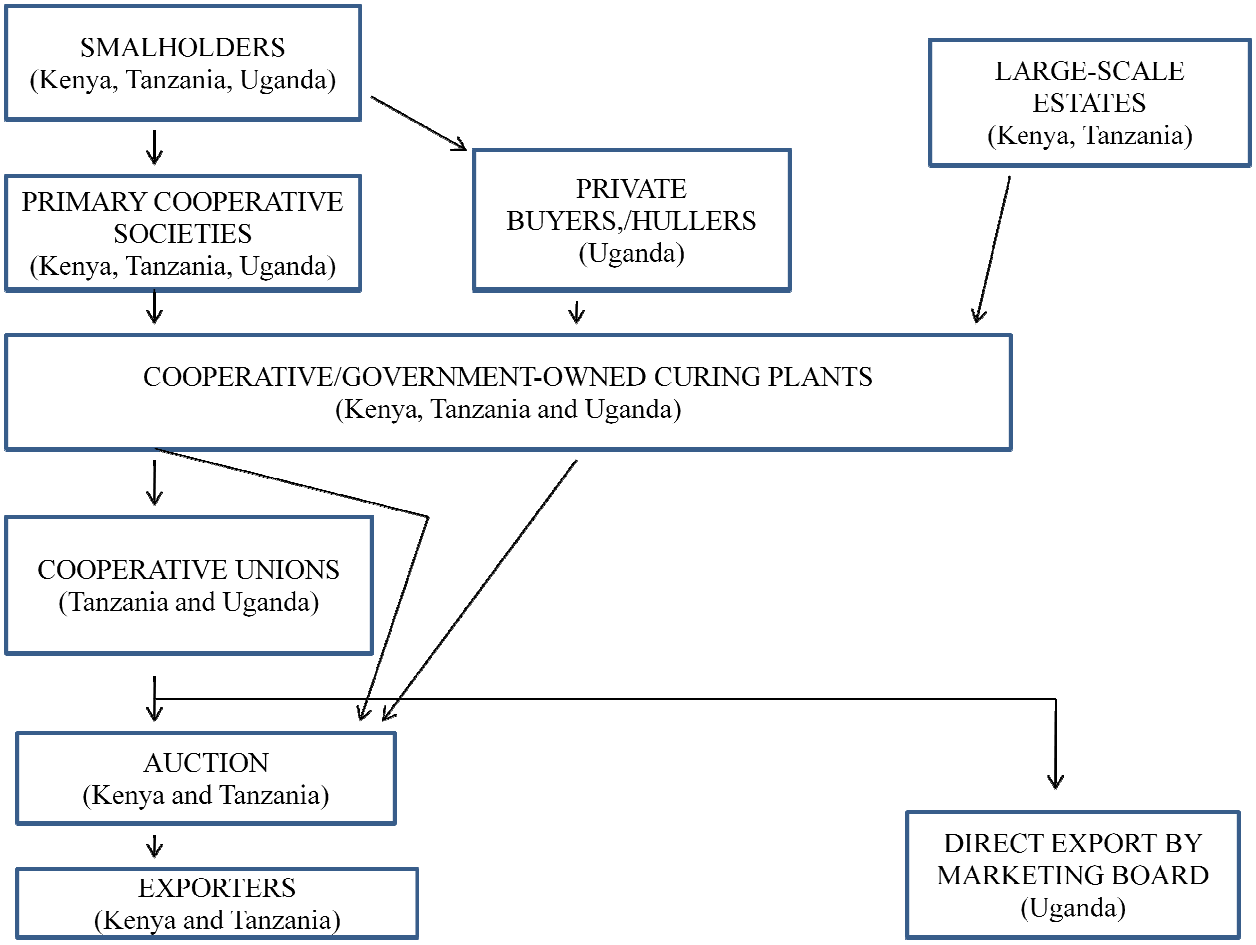
According to Baffes (2006) and Akiyama (2001), coffee was introduced to Uganda in 1900 as an estate crop and the crop is thought to have been imported from Malawi. The Ugandan Coffee Board (UCB) was founded in 1930 to control quality related aspects. In 1969, the UCB was given full mandate over the coffee industry including export monopoly. However, the board was split into two entities in 1991; the Coffee Marketing Board Ltd. (CMB) and the Ugandan Coffee Development Authority (UCDA). The CMB was charged with the function of coffee trading and processing while the UCDA was responsible for monitoring and regulating the coffee industry and advising government on policy issues.

2.3.1 Coffee Marketing Chain before Liberalization

As shown in figure 2, coffee in Uganda was produced predominantly by smallholder farmers with coffee farm size ranging between 0.1 and 0.5 hectares. Cooperative societies and private buyers competed for coffee from smallholder farmers. The ownership of coffee handled by the cooperative societies remained in the hands of the farmers until it was sold at the auction exposing farmers to price fluctuation risk. However, the farmers received the same price (from the cooperative societies) irrespective of when their coffee was delivered or sold. The coffee

marketing board was the sole exporter of Ugandan coffee and cooperatives and domestic coffee buyers were obliged to sell their coffee to the board.

Figure 2 Coffee Marketing Chain before Liberalization



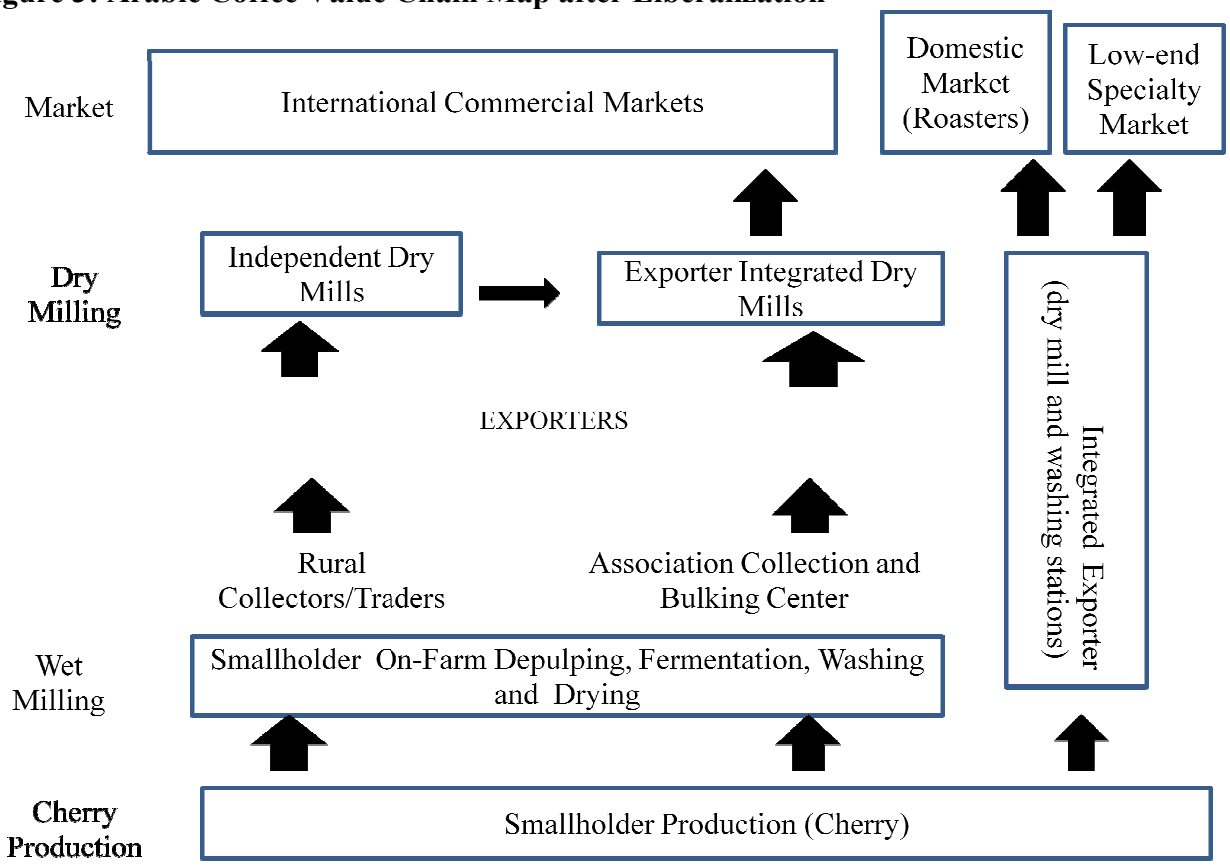
Source: Ponte, 2002

2.3.2 Coffee Marketing Chain after Liberalization

The collapse of ICA was followed by market liberalization and the Ugandan coffee sector was not an exception. The Ugandan CMB was liquidated in 1992 which marked the end of government's involvement in coffee marketing (ponte, 2002a). Figure 3 shows the four stages (cherry production, wet milling, dry milling and market) of the Arabic coffee supply chain in Uganda. Coffee cherry production is done exclusively by smallholder farmers with the coffee

farm size typically ranging from 0.5 to 2.0 hectares. The wet milling of coffee is done on-farm by farmers themselves using low cost tools such as manual depulpers. Wet milling involves activities such as depulping, fermentation, washing and drying. The coffee leaves the farm gate at a parchment stage. Dried coffee beans are then sold to rural collectors/traders and association collection and bulking centers who in turn sell to exporters. Coffee exporters dry mill the coffee and export the green coffee either to international commercial markets or domestic roasters. Some small quantities of higher quality coffee is wet processed and dry milled by vertically integrated companies (exporters) working under contract with low-end specialty buyers (Clay et. al., 2008). These companies (exporters) in turn contract coffee farmers to grow high quality certified coffee for them and pay price premiums to the farmers.

Figure 3: Arabic Coffee Value Chain Map after Liberalization



Source: Modified from Clay et. al., 2008, unpublished

2.4 Overview of the Kawacom (U) Ltd's Sipi Organic Coffee Contract Farming Scheme

The Sipi contract farming scheme is operated by Kawacom (U) Ltd, one of the coffee exporters in Uganda. Kawacom is a subsidiary of the international commodity trading house Ecom Agroindustrial Corporation. The scheme is situated on the northern slopes of Mount Elgon in the Kapchorwa District in eastern Uganda. There were a total of 3,870 contracted farmers in the scheme in 2005. All farmers in the project area were invited to join the scheme but some farmers declined to join, only about 62 percent of the farmers in the area joined the scheme at its inception (Ondeke and Bolwig, 2007, Unpublished).

All farmers in the scheme are certified to both the EU and the US organic standards and also to Utz Certified sustainability standards. Certification was fully paid for by Kawacom. Contracted farmers agreed to abide by the coffee production contract standards issued by Kawacom and Kawacom promised to buy certified coffee from the farmers and pay them a price premium for certification. Farmer eviction from the scheme is possible due to non-compliance of the organic and Utz certified standards.. Kawacom also encourages farmers to adopt coffee quality enhancing practices such as harvesting only ripe cherries and timely pulping of the coffee cherries after harvest etc. but farmers may not be evicted if they choose not to follow these practices. However, these farmers forfeit the price premium because Kawacom will not purchase their coffee since it does meet the required grades and standards. Kawacom only buys coffee that meet their grades and standards, namely a moisture content of 13% or less and coffee that is clean (absence of foreign matters) (Bolwig et. al., 2009).

Based on the data, the contract did not compel all of the farmers to sell their coffee to Kawacom. Contracted farmers have two marketing channel options: Kawacom provided that they meet the grades and quality standards or to one of the many middlemen in the area who buy coffee of any quality. The middlemen buy coffee and in turn sell it to exporters. Other exporters in the area do not buy directly from farmers; perhaps because of the cost involved in aggregating small quantities from individual farmers, thus they prefer buying substantial quantities from middlemen whom most of them are local coffee farmers themselves (Bolwig et. al., 2009).

2.5 Analytical Models

The literature on smallholder farmers' market participation and decision making in specialty markets has been thin. Most of the literature has concentrated on studying the impact of

transactions costs that is believed to shape the farmers' orientation with markets (Barrett, 2007; Renkow et. al., 2003; Bellemare and Barrett, 2006; Key et. al., 2000; Holloway et. al., 2004; Holloway et. al., 2002; Holloway et. al., 2000; Hobbs, 1997; Goetz, 1992; Alene et. al., 2008; Minot, 1999). Mark et. al., (2009) studied the adoption of direct marketing strategies by U.S. farmers and its impact on gross sales. Wollni et. al.,(2008) and Wollni and Zeller (2006) studied the impact of participation in specialty markets and cooperatives on the adoption of soil conservation practices and coffee price. A major issue in modeling developing countries' rural household marketing behavior is whether farmers make marketing decisions (participation and intensity of participation) sequentially or simultaneously. Empirically, this determines whether the participation and intensity of participation decisions are modeled together or separately (in two parts). Bellemare and Barrett (2006) tested these hypotheses and found evidence in support of sequential marketing behavior (i.e. a farmer first decides whether to participate and then decides how much volume to sell once the participation decision has been made). However, Balsvich et. al. (2006) did not find any difference between sequential and simultaneous decision processes.

Various empirical models have been used to indentify factors shaping farmers' market participation behavior. Hobbs (1997), Holloway et. al., (2000) and Holloway et. al., (2004) used a tobit model to model farmers' market participation behavior. The tobit (Tobin, 1958) modeling approach presumes that the participation and volume decisions are made simultaneously and the same factors that affect the participation decision also affect the sales volume decision in the same way. The zeros on the dependent variable (intensity of participation) represent corner solutions (non-participation due to economic reasons). The shortcoming with this modeling approach is its inability to separate the participation and intensity of participation decisions.

Another weakness is that the zeros on the dependent variable (intensity of participation) may be due to discreet choices not to participate as opposed to corner solutions.

Alene et. al., (2008) and Goetz (1992) used a sample selection modeling approach similar to the Heckman's (1979) sample selection model. In this approach, the participation and volume decision are estimated sequentially (i.e., same independent variables may have different influence on participation and sales volume decision). The zero observations on the dependent variable are assumed to be due to non-economic reasons (discrete choice not to participate). Positive quantities of output are expected once a farmer decides to participate and thus does not allow for corner solutions in the sales volume decision. This modeling approach requires the use of exclusion restriction in order to correctly identify the parameters. The assumption about the generating mechanism that generates the zeros on the dependent variable (intensity of participation) precludes the presence of corner solutions.

The Cragg (Double Hurdle) model was used by Holloway et. al., (2004) and Mark et. al., (2009). It is called a double hurdle model because it allows for censoring at both decision stages (Brouhle and Khama, 2005). Positive output can only be supplied if a farmer is a potential participant in the market (participation hurdle) and the farmer is not at a corner solution in the sales volume decision (supply hurdle). As in the sample selection approach, this model allows for the possibility of a discrete choice not to participate (non-participation due to non-economic reasons) but a farmer can be at a corner solution in the second decision stage. This model allows flexibility to use the same independent variables in both decision analyses. However, it has been cautioned that using the same explanatory variables in both decision stages may complicate the identification of parameters in the model (Yen et. al., 1996; Jones 1992; Neumann et. al., 2001). The exclusion restrictions requirement in the double hurdle model can be ameliorated by

assuming independence between the error terms (error terms between the two hurdles). In addition, Smith (2003) suggested that there is no efficiency gain by estimating dependent double hurdle models.

The double hurdle model with independent error terms is used for this study mainly because we do not have exclusion restriction variables (i.e. attitudinal and ethical variables) which are essential for estimating dependent models such as the Heckman selection model. The double hurdle model is also preferable because it allows for farmers to be at corner solutions in the second stage which is consistent with our data. The selected model amply serves our purpose because it enables us to estimate the participation and intensity of participation separately in order to identify factors that influence either decision.

2.6 Factor for Inclusion in the Analysis

In this study, market participation is conceived as an adoption decision as in Holloway et. al., (2001) and Mark et. al., (2009). This assumption is appropriate considering the fact that participating in sustainable coffee marketing channels entails signing a contract and adopting quality enhancing practices. Thus, we utilize the rich adoption literature to help determine which variables to include in our model. In this exercise, we shall confine ourselves to the adoption of agricultural innovations and technologies, not necessarily for coffee only. According to Tsourgiannis et. al., (2008), in contrast to firms in other industries, the strategic management process of farmers is not well known. This includes factors and farm/firm characteristics that shape their decision to choose a specific marketing alternative. The reasons for this are that most agricultural products are undifferentiated at farm level and most smallholder farmers cannot exploit economies of scale due to the size of their holdings. However, the emergence of specialty

coffee markets present an opportunity for farmers to produce high quality coffee and strategically position themselves in the market by pursuing a focus value creation strategy.

Ryan and Gross (1943) first showed that adoption of agricultural innovations is typically uneven among farmers, since then, researchers have attempted to identify factors and farm/farmers' characteristics associated with adoption (Knowler and Bradshaw, 2007). Although different innovations require different management and resources, the following factors have been found to explain adoption of agricultural innovations.

Isin et. al., (2007), Marenya and Barret (2006), D'Souza et. al. (1983) have found education level attained by the household head to positively influence adoption. However, the effect of education on adoption decisions largely depends on the knowledge and skill requirements of the technology to be adopted. According to Marenya and Barret (2006), formal schooling consolidates or can be indicative of unobserved managerial competencies and greater cognitive ability.

The age of household head has been found to be negatively correlated with the adoption decision (Mugwe et. al., 2008; Kasie et. al., 2008; Bourton et. al., 1999). This could be because younger farmers tend to have a longer planning horizon and appear to be more likely to invest. There may also be implicit costs associated with learning new skills and other adjustment aspects. Younger farmers are believed to be adventurous and less risk averse (Marenya and Barret, 2006; Knowler and Bradshaw, 2006).

Male households tend to be more likely to adopt innovations than female households (Adesina et. al., 2000). African women are marginalized and have lower access to critical resources such as land, labor and are also deprived of educational opportunities. The inherent inequalities in resource ownership between men and women diminish female farmers' ability to adopt

innovations. These inequalities are caused by cultural conditions in many African cultures which traditionally deprived women of entitlements to critical resources (Quinsumbing, 1996; Kavane, 2004).

According to Kassie et. al., (2008), Marenya and Barret (2006), and Bourton et. al., (1999), household size is used as a proxy for household labor availability and has been found to positively influence adoption. Resource poor households may be constrained by financial resource liquidity which precludes the possibility of hiring wage labor; this makes household labor more important for the adoption of innovations. In addition, the real cost of wage labor may be higher than the observed wage rate because wage labor tends to suffer from agency problems which necessitate increased supervision (Marenya and Barret, 2006; Kydd 2001). However, Adensina et. al., (2000) caution that a large family may also choose to allocate resources to food production and forgo the pursuit of cash income especially considering the volatile food prices and imperfect food markets.

A positive relationship has been found between the size of farm and the adoption decision (Kassie et. al., 2008; Sidibe, 2005). According to Feder et. al., (1985), the influence of farm size on adoption decisions can vary depending on the nature of technology to be adopted. It largely depends upon factors such as fixed adoption costs, risk preferences of farmers, human capital requirements, credit constraints, labor requirements, tenure arrangements and etc.

The influence of income on adoption has been found to be inconsistent. Increased income provides the farmer with purchasing power necessary for the purchase of inputs and hiring of labor (Marenya et. al., 2003, Kydd, 2001). Income also enables farmers to avoid selling or harvesting their crops before they are fully ripe for the purpose of meeting urgent household cash needs. Alternatively, income sources may mean a high opportunity cost of household labor. For

example, Calo and Wise (2005) found a high opportunity cost of labor employed in coffee production in Mexico. Thus, farmers may see more incentives in pursuing other income generating opportunities.

Kassie et. al., (2008), Bayard et. al., (2006) and Sidibe (2005) found that farmers who are members of farmer's organization or are in contact with extension services are more likely to adopt than non-members. Membership in organizations or access to radio broadcast is considered a proxy to farmers' access to information. According to Adesina et. al., (2000), farmers' organizations have an advantage in disseminating information because they allow increasing returns to scale in information dissemination. Furthermore, it has economies of scope for extension agencies because they can reach a large number of farmers. Farmers that join organizations are more receptive to new ideas.

Belscivich et. al., (2006) found that a higher dependency ratio positively influenced cattle farmers' decision to sell to processors other than to the traditional channel. Dependency ratio represents labor structure availability in the household.

Wollni and Zeller (2006) found a positive relationship between altitude and coffee farmers' participation in specialty coffee markets. Altitude is commonly used as a proxy for coffee cupping quality (Vaast et. al., 2005 and Wintigens, 2004, Donnet et. al., 2007).

Summary

This section introduced a brief background on coffee price trends after the collapse of the international coffee agreement. Sustainability initiatives in the coffee sector came to the fore to ameliorate economic hardships experienced by coffee growers as coffee prices plummeted in the 1990s. The section also gave a brief overview of the Ugandan coffee sector before and after liberalization, including some background information on the Kawacom contract scheme. The

section concluded with analytical models considered for the study, outlining their strengths and weakness and reasons why the double hurdle model is used in this study. The next section develops the double hurdle model which is applied to this data.

CHAPTER III: METHODS

3.1 The Basic Model

Following Cragg's (1971) framework, the i[th] farmer participation decision can be expressed as:

$$p_i^* = X_i + \varepsilon_i \qquad (1)$$

With x_i representing a 1 x K vector of factors influencing the participation decision, β is a 1 x K vector of parameters estimates, ε_i represent a random error term that is assumed to be normally distributed as N(0, 1), p_i^* representing a latent participation variable and we can observe a binary value of p_i if:

$$p_i = \begin{cases} 1 \, if \; p_i^* > 0 \\ 0 \, if \; p_i^* \leq 0 \end{cases} \qquad (2)$$

The sales volume is expressed as:

$$y_i^* = Z_i \alpha + \mu_i \qquad (3)$$

Where z_i is a 1 x K vector of factors affecting the supply volume decision, α represents a 1 × K vector of parameters to be estimated, μ_i is a normally distributed random error as $N(0, \sigma^2)$, both ε_i and μ_i are assumed to be independent, i.e. $\begin{pmatrix} e_i \\ \mu_i \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & \sigma^2 \end{pmatrix}\right]$ y_i^* represents a latent supply variable and we observe y_i if:

$$y_i = \begin{cases} y_i^* \text{ if } y_i^* > 0 \text{ and } p_i \\ 0 \text{ otherwise} \end{cases} = 1 \qquad (4)$$

Thus, this model consists of two decision stages; 1) the marketing channel participation decision p_i^* and 2) the sales volume decision y_i^*. The probabilities of participation and supply intensity are determined by parameters $\beta \, and \, \alpha$ respectively. The model does not restrict the use of exogenous variables $x_i \, and \, z_i$, i.e. $x_i = z_i$ is not restricted as these factors can have different impacts on the two decision processes, however, for proper identification of parameters $\beta \, and \, \alpha$, some exclusion restrictions may be needed (i.e. attitudinal or ethical variables).

The participation model (equation 1) will be estimated using a probit model with the left hand variable p_i equal to 1 if a farmer sold some quantity of coffee to Kawacom and 0 if no coffee is sold to Kawacom. The supply intensity decision (equation 2) will be estimated by a truncated regression model with the left hand variable y_i representing the value of sales to Kawacom in Ugandan shillings. According to Pudney (1989), Newman et. al., (2001), and Newman et. al., (2003), the double hurdle model is not based on any formal choice theory, and thus it is difficult to choose which explanatory variables to include in each decision stage. However, the underlying assumption is that the first stage decision (participation decision) is often a result of social, psychological, or ethical distinction and it is not determined by economic variables. Therefore for the purposes of this study, variables non-coffee income and non-crop income will be excluded in the probit model.

The log-likelihood function for the double hurdle model with independent error terms is given as (Moffatt, 2005):

$$LL = \sum_{0} \ln\left[1 - \theta\left(X'_{1i}\beta_1\right)\theta\left(\frac{X'_{2i}\beta_2}{\sigma}\right)\right] + \sum_{+} \ln\left[\theta\left(X'_{1i}\beta_1\right)\frac{1}{\sigma}\varphi\left(\frac{p_i - X'_{2i}\beta_2}{\sigma}\right)\right] \qquad (5)$$

The first term in equation (4) accounts for the probability of passing the participation hurdle and the second term indicate the density of observing non-zero sales. According to McDowell (2003) and Aristei et. al., (2007), the log-likelihood of the double hurdle model under the assumption of independent error terms is equivalent to the sum of the log-likelihoods of a probit model and a truncated regression model. Thus the double hurdle model can be estimated by maximizing the two components separately.

a) Market Participation Decision

The farmer participation adoption decision is modeled following Holloway et. al., (2001), Rahm and Huffman (1984), and Adesina and Chianu (2002), and the farmer's market participation decision can be modeled within the utility maximization framework. The farmer participates in the coffee marketing channel if the utility derived from participation is greater than can be derived from participating in the conventional marketing channel. Let j denote the marketing channel choice set faced by the i^{th} coffee farmer, j = 1 for sustainable coffee marketing channel and j = 0 for the conventional coffee marketing channel. The unobservable utility function that rank the i^{th} farmer's preference can be expressed as a function of the farmer's demographic and economic characteristics as well as the characteristics of the marketing channel, for example, price and quality standards. This can be expressed as $U(S_{ji}, E_{ji}, M_{ji})$ where S_{ji} represent a vector

of farmer's demographic characteristics, E_{ji} represent a vector of the farm characteristics (e.g. number of productive trees), and M_{ji} represent a vector of the marketing channel specific characteristics (e.g. price). The farmer will choose the sustainable coffee marketing channel if and only if the latent random variable $y^* = U_{1i} - U_{0i} > 0$.

The probability of choosing the specialty marketing channel can be expressed as follows:

$$\begin{aligned} P_i &= P_r(Y=1) = P_r(U_{1i} > U_{0i}) \\ &P_r\{(\alpha_1)F_i(S_{1i}, E_{1i}, M_{1i}) + \varepsilon_{1i} > (\alpha_0)F_i(S_{0i}, E_{0i}, M_{0i}) + \varepsilon_{0i}\} \\ &P_r(\varepsilon_{1i} - \varepsilon_{0i}) > F_i(S_i, E_i, M_i)(\alpha_0 - \alpha_1) \\ &P_r(\mu_i) > -F_i(S_i, E_i, M_i, \beta) \\ &F_i(X_i\beta) or\, Y_i(X_i\beta) \end{aligned} \qquad (6)$$

Where Pr(.) is a probability function, $\mu_i = \varepsilon_{1i} - \varepsilon_{0i}$ is a random disturbance term, $\beta = \alpha_0 - \alpha_1$ is the coefficient vector, and $F_i(X_i\beta)$ is the cumulative distribution function for μ_i evaluated at $X_i\beta$ (Rahm and Huffman, 1984).The exact distribution for F depends on the assumed distribution of μ_i, we assume a standard normal distribution function for this study and thus use a probit model for empirical analysis. The linear version of the participation equation has the form:

$$P_i = \forall S_{ji} + \exists E_{ji} + \Omega M_{ji} + \varepsilon_{ji} \qquad (7)$$

where $\forall, \exists, \Omega$ are parameters to be estimated and ε_{ji} is a random error.

b) Supply Intensity Decision

Following Holloway (2001), the i^{th} farmer derives utility from supplying a certain quantity of coffee for sale to the sustainable coffee market channel. The objective function of the farmer is

to maximize utility by supplying a given quantity subject to production constraints. This can be represented as:

$$\begin{aligned}
&Maximize\, U\left(Y_i \mid S_{ji}, E_{ji}, M_{ji}, I_{ji}\right) subject\ to\ y_i \geq 0 \\
&First\ Order\ Condition\ \phi\left(Y_i \mid S_{ji}, E_{ji}, M_{ji}, I_{ji}\right) \leq 0 \\
&Non-negativitiy\ restriction\ Y_i \geq 0 \\
&Complementary-slackness\ condition\ \phi\left(Y_i \mid S_{ji}, E_{ji}, M_{ji}, I_{ji}\right) Y_i
\end{aligned} \qquad (8)$$

Where Y_i represent sales value, I_{ji} represent a vector of the farmer's economic characteristics (e.g. income source number), the rest of the variables are as defined in the participation decision. The linear version of the sales equation can be written as:

$$Y_i = \beta S_{ji} + \theta E_{ji} + \vartheta M_{ji} + \gamma I_{ji} + \mu_{ji} \qquad (9)$$

where $\beta, \theta, \vartheta, \gamma$ are parameters to be estimated and μ_{ji} is a random error.

3.2 Data

This study is based on the secondary data collected from smallholder coffee farmers in Kawacom (U) Ltd's Sipi organic coffee contract farming scheme in the eastern part of Uganda. The household data survey took place in 2005 and involved a sample of 114 contracted Arabic coffee farmers. This data was collected by a team from the Danish Institute for International Studies[1]. A two-stage random sampling method was used for the farmers from a population of all registered and certified organic farmers in the project; there were a total of 3,870 farmers in the project. Project participants were randomly sampled in a number of parishes chosen purposively to reflect the range of agro-ecological conditions in the area, using a list of registered farmers provided by Kawacom. All farmers in this project were certified and compliant with the EU

[1] We thank Dr. Simon Bolwig (Principal Investigator) for providing us with the data.

organic regulation in 2000-01as well as to the Utz Kapeh sustainability standard in 2003. Out of the 114 farmers in the scheme, 23 farmers produced coffee but did not sell any coffee to Kawacom.

A highly trained team of survey enumerators were hired by the research project to undertake the data collection exercise. All survey data were obtained through a one to one interview with the farmers except for field related data which was obtained by physical measurements and observations (Odeke and Bolwig, 2008; Gibbon and Bolwig, 2007; Bolwig et. al., 2009).

3.2.1 Variables

Table 2 gives the variables used in this paper, their description, summary statistics and expected signs with respect to their expected relationship with the two dependent variables: selection of a marketing channel and total sales value (in Ugandan Shillings).

The dependent variables used in the analysis are participation (participation decision) and coffeesales (sales volume decision). Other dependent variables were considered including quantity of coffee sold to Kawacom (in Kg) but were not found to be suitable to either address the research question or had measurement problems within the dataset.

The dependent variable for the participation decision (probit) is defined as 1 if a farmer sold some positive quantity of coffee to Kawacom and 0 if no coffee was sold to Kawacom. Out of the 114 contracted farmers in the sample, 23 farmers did not sell any coffee to Kawacom. This gives us the farmer's propensity to participate in the sustainable coffee marketing channel.

The dependent variable for the sales volume decision is defined in terms of the value of sales in Ugandan shillings. One US dollar exchanged for nearly 1,780.7 Ugandan shillings (CIA, 2009)

in 2005. This gives us the factors that are important in determining sales value for those farmers that sold coffee to Kawacom.

The independent variables are: Sex of household head, Age of household head, Altitude, Productive trees, Non-coffee income, Non-crop income, Farm organization membership, Whether farming is a primary activity, Ability to hire labor, Whether the farmer is a member of a credit project, Whether the farmer has been visited by an extension agent in the past two years, Education level of household head, Household size, Dependency ratio, Size of the farm holding, Average coffee price and will be discussed in order of expected significance to the dependent variables.

Non-coffee income represents income accruing to the household from the sale of other crops other than coffee. Income from other sources other than coffee may enable the farmer to purchase necessary inputs to meet quality requirements of the sustainable coffee marketing channel (Marenya et. al., 2006; Kydd, 2001). However, non-coffee income may also divert resources such as labor from coffee production (Marenya et. al., 2006; Kydd, 2001). Thus, the expected sign for this variable is indeterminate apriori. Non-coffee income for an average household is UGX 203,409, ranging from 0 to 1,699,000 UGX. Some common sources of income are reported to be: sales from other crops, livestock sales, farm labor export, brewing alcohol and etc.

Non-crop income represents income accruing to the household from the sales of other farm products other than crops. This income may come from sales of livestock or non-farm wage labor. Income from non-crop sources may be positively associated with participation and sales volume decisions as it enables the farm household to purchase the necessary inputs and invest in coffee quality improvement (Marenya et. al., 2006; Kydd, 2001). However, the pursuit of non-

crop income may divert away labor that could otherwise be used in coffee production (Marenya et. al., 2006; Kydd, 2001). The impact of this variable on the sales value to the sustainable coffee channel is also indeterminate apriori. The sample's average for non-crop income is UGX 661,488, ranging from 0 to 5,660,000 UGX.

Wage Labor is a dummy variable equal to 1 if a farmer hired any wage labor in the previous season and 0 if no wage labor was hired. Ability to hire labor indicates that the household is able to augment its own labor supply especially during the peak demand for labor. This enhances the household's ability to meet quality requirements of the sustainable coffee marketing channel (Wollni and Zeller, 2006). We expect this variable to positively influence the participation and supply intensity decisions. On average, about 66 percent of the interviewed households were able to hire some labor which included salaried workers, work groups organized among neighbors and friends in exchange for reciprocated labor. The household organizing a work group prepares a mean and a traditional brew.

Household size represents the total number of persons in a household. Quality requirements of the sustainable coffee marketing channel necessitate the adoption of labor intensive production, harvesting and processing practices (Wollni and Zeller, 2006). For example, it is important to selectively pick only ripe coffee cherries which place a heavy demand on labor. We expect the household size variable to be positively associated with the participation and supply intensity decisions. An average household in the sample has about 7 members, ranging from 2 to 15 members.

Farm size represents the total farmland holding owned by a coffee farmer measured in hectares. Farmland size is a surrogate for wealth (Feder et. al., 1985), thus we hypothesize that this variable is positively associated with the participation and supply intensity decisions. The sample

average size of the farm holding is about 1 hectare, with the whole farm size ranging from 0.93 to 4.25 hectares.

Education represents the level of educational attainment of the household head in years. Education enhances managerial competencies and successful implementation of improved production, processing and marketing practices (Marenya and Barret, 2006) thereby making it possible for farmers to meet quality standards of the sustainable coffee marketing channel. We expect education to increase the propensity to participate in the sustainable coffee marketing channel and increase sales value to the sustainable marketing channel. The sample average of the number of years each respondent spent in formal school is 7 years with the maximum number of years spent in formal school at 16 years. This refers to formal schooling from grade 1 up to post-graduate studies.

Price represents the price offered by the sustainable coffee marketing channel including the premium for certification in Ugandan shillings. A price premium provides an incentive to farmers to improve the quality of the coffee. It is expected that price increases incentivize participation in the sustainable coffee marketing channel. On average each farmer received 2163 Ugandan shillings per Kg of parchment coffee, the lowest price was 1389 and highest 2557 Ugandan shillings.

Extension[2] is a dummy variable equal to 1 if a farmer has had contact with an extension agent in two years prior to the survey and 0 if no contact. Farmers that are in contact with extension agents are expected to be more exposed to information that may not be accessible to other farmers (Kassie et. al., 2008; Bayard et. al., 2006). Thus we hypothesize that the extension

[2] This variable represents extension services not related the regular training given by Kawacom.

variable is positively associated with participation and supply intensity. About 71 percent of the farmers received training from an extension agent in the last two years of the interview.

Membership in Farmers Organization is a dummy variable equal to 1 if a farmer is a member of a farmer organization[3] and 0 otherwise. Membership in an organization is considered a proxy for information access, it is expected that members are more likely to participate in the sustainable coffees marketing channel and have increased supply intensity (Kassie et. al., 2008; Bayard et. al., 2006; Sidibe, 2005). Only 28 percent of the respondents reported to have membership in a farmers' organization in 2005.

Age represents the age of the household head in years. Younger farmers are expected to be more adventurous and less risk averse than older farmers as shown in other studies (Knowler and Bradshaw, 2006). Thus age is expected to be negatively associated with sustainable coffees marketing channel participation and supply intensity. The sample average age is about 46 years ranging from 24 to 86 years old.

Gender is a dummy variable equal to 1 if the head of household is male and 0 if female. Male households tend to have better access to productive resources necessary to meet quality requirements of the sustainable coffees marketing channel than female households (Adesina et. al., 2000). We expect this variable to be positively associated with the participation and supply intensity decisions. About 93 percent of the households in the sample were headed by male farmers.

Farming primary activity is a dummy variable equal to 1 if farming is the household head's primary occupation and 0 otherwise. This variable measures the proportion of the

[3] This represents farmer organizations not related to the scheme.

farmer's time dedicated to farming. If farming is the primary economic activity then those farmers are more likely to participate and may produce greater output. On average, about 83 percent of households regarded farming as their primary activity.

In order to allow for simple non-linear effects, we included quadratic terms of continuous variables farm size, age, education and household size (Boughton et. al., 2007).

Table 2. Farm household Variables Summary Statistics and their Expected Signs for Participation and Sales Intensity Decisions.

Explanatory Variable	Description	Obs.	Mean	Std. Dev.	Min	Max	Expected Sign Participation decision	Expected Sign Sales Intensity decision
Non-coffee Income	Income from sales of other crops other than coffee (continuous variable)	114	203,409	308,847.1	0	1,699,000	Indeterminate	Indeterminate
Non-crop Income	Income from sales of other farm products other than crops (continuous variable)	114	661,488	1,100,122	0	5,660,000	Indeterminate	Indeterminate
HiredLabor	Farmer hired labor in the previous season (1 = yes, 0 = no)	114	0.66	0.48	0	1	+	+
PriceAveCoffee	Average coffee price in Ugandan Shillings per kg parchment equivalent (continuous variable)	112	2,163	1,389.4	1,389.4	2,556.6	+	+
HouseholdSize	Total number of persons in a household (continuous variable)	114	7.36	2.5	2	15	+	+
SizeWholeFarm	Size of the farm holding in hectares (continuous variable)	112	1.04	0.79	0.93	4.25	+	+

T**able 2 (Contin'd)**

EducationHH	Number of years a farmer spent in school	114	6.98	3.68	0	16	+	+
Altitude	Coffee plot mean altitude in meters above sea level (continuous variable)	114	1,880	94.47	1,656	2,101	+	+
Prodtrees	Total number of productive coffee trees per coffee plot (continuous variable)	107	585	516.65	30	2,700	+	+
MemberCreditProj.	Farmer is a member of a credit project (1 = yes, 0 = no)	114	0.53	0.5	0	1	+	+
FarmOrganisation	Membership in a farmer organization (1 = yes, 0 = no)	114	0.28	0.45	0	1	+	+
FarmingPrimaryAct.	Farming is the primary activity (1 = yes, 0 = no)	114	0.83	0.38	0	1	+	+

Table 2 (Contin'd)

TrainingExtension	Farmer has been in contact with an extension agent in the previous season (1 = yes, 0 = no)	114	0.71	0.46	0	1	+	+
SexHH	Sex of the household head	114	0.93	0.26	0	1	-	-
AgeHH	Age of the household head in years (continuous variable)	114	46	13.99	24	86	-	-
DependencyRatio	Proportion of members of the household under the age of 16 years (continuous variable)	108	0.73	0.44	0.11	2.5	+	+

The summary statistics for the farmers who sold some coffee to Kawacom and those that did not sell any coffee are given in table 1A (Appendix). The average age for the farmers who sold some coffee to Kawacom is 47 years while for those that did not sell any coffee to Kawacom is 43 years with a maximum age of 86 and 66 respectively. As expected, farmers who sold some coffee to Kawacom received a relatively higher price on average 2, 212.69 Ugandan shillings compared to 1, 960.53 Ugandan shillings for the farmers who did not sell any coffee to Kawacom. Project farmers who sold some coffee to Kawacom are only slightly more educated with an average number of years spent in school of 7 years compared to 6.5 years for those who did not sell any coffee to Kawacom.

Interestingly, the non-coffee income is higher on average for the farmers who did not sell any coffee to Kawacom compared to those who sold some coffee to Kawacom, 272,440.9 and 182,543.3 Ugandan shillings respectively. However, non-crop revenue is higher for the farmers who sold some coffee to Kawacom compared to those that did not sell any coffee. Farmers who sold some coffee to Kawacom have large farm holdings, on average, compared to the farmers who did not sell any coffee to Kawacom.

Summary

This section introduced the basic model, followed by the model operationalization. The basic model is operationalized within the utility maximization framework. Next, we explained the data source and concluded the section with the definition of the variables used in the study and their expected signs. The next section discusses the results of the study and draw conclusions.

CHAPTER IV: RESULTS

This chapter presents the result of the econometric analysis as outlined in chapter 3. The econometric models were estimated using Stata software. The validity of the estimates heavily depends on the assumptions made about the distribution of the error terms in both the participation and sales intensity equations. The double hurdle model assumes that both error terms are normally distributed but if the data is not normally distributed, the estimates will be inconsistent (Moffatt, 2003). A conditional moment test for the null hypothesis that the disturbances have a normal distribution was performed using a tobcm command in stata. The test result rejected the normality of distribution at 1percent significance level and maintained that the disturbances are non-normal. To correct for this, a box-cox test was performed to test for the model specification that best fits the data and the test results favored a log specification. Thus, the dependent variable (coffeesales) in the second hurdle was transformed to natural logs using the (1+coffeesales) procedure in order to accommodate the zero observations which would otherwise become missing as done in several other studies (STATA, 2009). The main findings of the study are presented in table 3.

Table 3 presents the regression results for both the probit and truncated regression models. The regression results are discussed in 4.1 for the probit model and 4.2 for the truncated regression model. The truncated regression model was significant at 1 percent and the probit model has pseudo R^2 of 0.4950.

Table 3 Determinants of participation and coffee sales

Explanatory variables	Marginal Effects			
	1st Stage: Participation		2nd Stage: Sales Value	
	Coeff	P > |z| LS	Coeff	P > |z| LS
Altitude (000)	9.625	0.000 ***	-11.962	0.000 ***
	(0.650)		(2.019)	
Hired Labor	0.080	0.081*	0.774	0.025**
	(0.063)		(0.389)	
Household size	0.024	0.029**	0.229	0.010**
	(0.016)		(0.088)	
HouseholdSize2	0.012	0.185	0.005	0.840
	(0.022)		(0.022)	
SizeWhole Farm	0.023	0.033**	0.469	0.077*
	(0.024)		(0.265)	
SizeWholeFarm2	0.003	0.019**	0.986	0.025**
	(0.006)		(0.440)	
AgeHH	0.004	0.026**	0.026	0.054*
	(0.002)		(0.014)	
Age2HH(000)	0.036	0.051*	0.577	0.555
	(0.066)		(0.978)	
PriceAveCoffee(000)	0.115	0.055*		
	(0.107)			
RevenueNonCoffee(000)	-1.039	0.077*		
	(0.587)			
MemberCreditProje.	0.064	0.125	0.412	0.058*
	(0.054)		(0.376)	
EducationHH	0.005	0.334	0.015	0.785
	(0.005)		(0.055)	
Education2HH	0.001	0.238	0.104	0.061*
	(0.003)		(0.055)	
FarmingPrimaryAct.	-0.015	0.695	-0.527	0.281
	(0.035)		(0.489)	
FarmerOrganisation	0.324	0.318	0.459	0.316
	(0.033)		(0.457)	
TrainingExtension	0.015	0.677	0.392	0.318
	(0.042)		(0.392)	
CostSellingCoffee	-0.005	0.691		
	(0.011)			

Table 3 (Contin'd)

Prodtrees(000)	-0.524	0.141	0.267	0.473
	(0.042)		(0.372)	
SexHH	-0.273	0.608	-0.075	0.912
	(0.033)		(0.676)	
DependencyRatio	0.096	0.315	0.017	0.133
	(0.072)		(0.502)	
RevenueNonCrop(000)	0.74	0.369		
	(0.139)			

Level of significance, * 10%, ** 5%, *** 1%.
Probit model pseudo $R^2 = 0.4950$

Note: Marginal effects are evaluated at the mean of the explanatory variables, dummy variables measures discrete change from 0 to 1. Standards errors are reported in parentheses.

4.1 Participation model results (Probit model)

The model performed well with a pseudo R-Squared of 0.495. Most of the statistically significant variables in the probit model have expected signs with an exception of altitude and age. We will first discuss the significant variables with the expected signs and then those with the unexpected signs.

Ability to hire labor has a positive and statistically significant effect on the probability of participating in the sustainable coffee marketing channel. Enabling a non-labor hiring household to hire labor increases the probability of participation by 8 percent. Hired labor may be important for households facing own labor supply constraints, particularly during coffee harvesting and subsequent processing as these activities need to be performed on a timely basis and any delay may result in dramatic loss of quality. Own labor may be constrained because children may be in school during the peak labor demand hours or own labor may be taken away from coffee production to attend to other activities/enterprises on the farm particularly food producing enterprises. It is plausible to assume that agency problems that normally render hired labor

unattractive is low in coffee production because unripe or semi-ripe berries can easily be detected visually, which minimizes the amount of supervision for hired labor.

Household size, a proxy for own labor supply has a positive and statistically significant effect on the probability of participation in the sustainable coffee marketing channel. On average, an additional member to the household increases the propensity to participate in the sustainable coffee marketing channel by about 2.4 percent. This shows that household size is an important determinant of farmers' participation in sustainable coffee markets. Household labor availability may be a critical constraint especially during time sensitive activities such as the harvesting of coffee cherries whereby untimely harvesting of ripe cherries may result in a substantial loss of quality. In addition, this activity may coincide with other activities on the farm (tending banana crops, weeding and so on) which induces competition for resources between various enterprises on the farm. Wollni et. al., (2008) found a similar result in their study on farmers' participation in organic markets. This result is plausible because the participation decision determines the kind of quality enhancing practices the farmer may adopt in the production and processing of coffee and these practices may be labor intensive.

Farm size increases the farmers' propensity to participate in sustainable coffees marketing channel. All other things held constant, an additional hectare to the farm size increases the probability of participation by about 2.44 percent. Farm size may be a surrogate variable for wealth and the larger the farm size the lower the risk may be with market participation. Wollni et. al., (2008), Wollni (2007) and Alene et. al., (2007) all have found similar results. There is an increasing marginal effect on sustainable coffee marketing channel participation as farm size increases over the whole range of the data since the quadratic term (farm size squared) is positive and statistically significant at the 5 percent significance level. This result makes sense because

larger farmers may be better able to mobilize and garner necessary resources to meet quality requirements of the sustainable marketing channel and supply substantial quantities of coffee to make their investment in coffee quality worthwhile.

The probit results show that older household heads have a greater propensity to sell their coffee to the main exporter (Kawakom) rather than to middlemen. On average, an additional year to the farmer's age increases the propensity to sell to the sustainable coffee marketing channel by 0.35 percent. This result is unexpected based on the literature because younger farmers are expected to be more receptive to new ideas and are less risk averse (Marenya and Barret 2006, Knowler and Bradshaw). However, Wollni et al., (2008) also found that older farmers are more likely to participate in organic markets during their study of Honduran farmers. The age variable may be confounded with experience but we could not control for experience in this study. Older household heads are expected to be more experienced in coffee production and better able to meet quality standards of the sustainable coffee marketing channel. Older household heads also may not have as many off-farm activities and hence have more time to work on their coffee farms thereby ensuring the quality of their coffee. The quadratic age term (age squared) is positive and significant only at the 10% significance level indicating increasing returns to age over the whole range of the data.

Coffee price is a significant determinant of sustainable coffee marketing channel participation but its marginal contribution to the probability of participation is low. On average, an additional Ugandan shilling increases the propensity to participate in the sustainable coffee marketing channel by 0.012percent. This result is not surprising because it has been reported that middlemen tend to compete strongly with the exporter (Kawacom) for organic coffee, sometimes

pushing up prices to match the Kawacom price (Bolwig, 2007a, unpublished). In fact, some farmers cited reasons for selling organic coffee to middlemen to be due to a lack of appreciable price difference between the two marketing channels. This result reinforces the argument that price premium provide an important incentive for farmers' participation in the sustainable coffee markets but the magnitude of this incentive largely depends on the size of the premiums received by farmers. Moreover, it is plausible to assume that this variable signifies farmers' cost-benefit assessment (i.e., whether the price premium is high enough to offset the cost of investment in the quality of coffee). It appears that the mere presence of the scheme in the area may have positive spillover effects for all farmers (whether selling coffee to Kawacom or not) due to price competition between Kawacom and the middlemen that tend to raise coffee price.

It is surprising that altitude (proxy for coffee quality) is negatively associated with participation in the sustainable coffees marketing channel participation. On average, increasing altitude where coffee is grown by 1 meter above sea level leads to a 0.09 percent decrease in the probability of participation in sustainable coffee marketing channel. This result is counter intuitive considering that studies (Wintgens, 2004; Vaast et. al., 2005, Donnet et. al., 2007) have found a positive relationship between altitude and coffee quality (cupping quality). This finding may reflect the fact that quality aspects such as taste, aroma, and flavor are not considered in the determination of coffee price received by farmers. Thus, there seems to be no relationship between altitude, cupping quality and the coffee price farmers receive (see appendix 1). In this project, farmers are rewarded only for the visual (moisture content, cleanliness) quality attributes of the coffee they sell. It is likely that this variable is confounded with other unobservable factors (productivity and presence of coffee berry disease). More information is needed to definitively understand this result.

4.2 Sales Intensity Model Results (Truncated Regression Results)

The truncated regression model performed well and it was significant at the 1% significance level. Table 3 presents the findings of the truncated regression model and shows that income, labor availability and farm size are the most important determinants of sales intensity to the sustainable coffee marketing channel. Only labor related variables are statistically significant at the 5% level but all significant variables conform to our apriori expectations except for age and altitude. Due to the possibility of endogeneity problems as is mostly the case in cross-section analysis and the absence of instrumental variables, we shall confine our interpretation of results to correlation and no causality implication will be made. As in the previous section, we first discuss the significant variables with the expected signs and then those with the unexpected signs.

Ability to hire labor is an important constraint associated with coffee sales to the sustainable marketing channel. This means that households that are unable to augment their own labor supply may find it difficult to sell large quantities of coffee to the sustainable coffee marketing channel. Peak requirements for labor may coincide with other activities on the farm (weeding, tending banana crops and etc.) which places a heavy demand on farmers' own labor supply. It is also plausible to assume that farmers may opt to dedicate more time to food crops given unreliability of food markets in many rural communities. Thus, the ability to augment own labor during the critical periods of coffee harvesting and processing would enable the farmer to meet quality standards of the sustainable coffee marketing channel and hence avail more coffee quantities for sale.

The household size (a proxy for own labor) is positive and significantly associated with the value of sales to the sustainable coffee channel. This result underlines the importance of labor in the

ability of farm households to increase the amount of coffee sales to the exporter. Large households are able to produce more coffee that meet the quality standards of the exporter (Kawakom). This result is plausible because the coffee quality enhancing practices necessary to produce the quality of coffee required in the sustainable coffee marketing channel are labor intensive (e.g., selectively picking only ripe cherries; timely pulping (removal of the soft flesh of the ripe cherries from the coffee bean); and subsequent fermentation (removal of the mucilage before drying); sun drying on a dry and clean surface to a moisture content of 11-12% , and storage under dry and clean conditions) (Bolwig 2007, unpublished).

Membership in the credit project is an important determinant of coffee sales intensity. Membership in a credit organization affords farmers to make necessary investments in order to upgrade the quality of their coffee to meet the standards of the sustainable coffees marketing channel. This result shows that the lack of access to credit significantly affects the amount of sales the farmers are able to make available to the sustainable coffee markets.

Once the decision to sell to the sustainable coffee marketing channel is made, the size of farm holding is positively and significantly associated with sales values (at 10% significance level) to the sustainable coffee marketing channel. Farm size may signify unobserved constraints and shadow prices facing the household (Marenya and Barret, 2007). This variable may be a surrogate variable for wealth indicating access to resources such as labor, capital, credit and information. There seems to be increasing returns to farm size as farm size increases within the range of the data. This finding is surprising considering that labor supply seems to be an important input for coffee production which may be limited in larger holdings, but it is expected that farmers with large farmland may be able to offer an attractive wage to relax the labor constraint.

Non-coffee income is significant and negatively associated with sales value to the sustainable coffee marketing channel. This result shows the opportunity cost of allocating resources to coffee production. Thus, if the sale of other crops other than coffee provides a lucrative opportunity, farmers may allocate production resources away from coffee in pursuit of this profitable opportunity. This result confirms that there is competition for production resources among enterprises on the farm, at least for marketable crops and this may exert pressure on other resources such as labor.

Older household heads sell more coffee to the sustainable coffee marketing channel than younger household heads. This result may imply that older household heads may be more resourceful and more experienced in coffee production than younger household heads. This may especially be true considering that meeting quality standards of sustainable coffees marketing channel does not require new skills in coffee production. The younger households may also face time allocation constraints as they may be pursuing non-farming opportunities and tending to young children. The quadratic term age squared is not statistically significant showing a constant return to age over the entire range of the data.

Altitude, although important in determining the sales volume to the sustainable coffee marketing channel, has a sign contrary to expectations. This result is surprising because studies have found a positive association between altitude and coffee quality (cupping quality). But since the cupping quality of coffee is not rewarded for during coffee parchment sale, it is plausible to assume that this variable may be confounded with other unobservable variables such as productivity and coffee diseases since coffee diseases tend to be more prevalent at higher altitude levels (Clay et.al., 2008, unpublished). More information is required in order to understand the actual impact of altitude on coffee sales value to the sustainable coffee marketing channel.

Our findings largely agree with the anecdotal evidence from focus group interviews on the immediate reasons why farmers sell certified coffee to middlemen (Bolwig, 2009, personal communication). The major reasons cited by four farmers who sold certified coffee to middlemen include: 1) inability to meet the moisture requirements demanded by Kawacom; 2) Kawacom pays a fixed price irrespective of coffee quality (as long as it meets the basic minimum) and volume of coffee sold by farmers; 3) need for credit for paying school fees and Kawacom does not provide credit; 4) Middlemen buy coffee of any quality; and 5) Kawacom does not buy coffee from farmers as regularly as farmers would have wanted.

According to Bolwig (2009, unpublished), selling coffee to middlemen may be an economic strategy to reduce the cost of coffee harvesting, and speed up the sale of the coffee and access to cash. That strategy may include one or all of the following practices the farmer may: choose to sell coffee on the tree leaving the buyer to perform the picking and processing; harvest unripe berries together with ripe berries by clean stripping of branches; dry coffee on the ground and refrain from cleaning the coffee; sell fresh berries; or, sell undried or partly dried parchment. Selling coffee to middlemen may also be related to labor saving strategies, access to credit, poor access to income from other sources and lack of savings. More research is needed in this area.

Table 4 summarizes the key findings for both participation and the sales volume models. Although the methods used can allow variables to have opposing impact on the participation and volume of sales decision, no variable has opposing signs in the two models but the level of impact differs between models. For example, Non-coffee revenue is significantly associated with the participation decision and plays no role in the sales volume decision. Similarly, age of the household head is strongly associated with the participation decision but plays a less significant

role in the sales volume decision. For variables with quadratic terms, none show diminishing returns, and household size squared is insignificant in both models.

Increasing altitude by 1 meter reduces the probability of participation by 0.09 percent and sales volume by 1.2 percent. Enabling a non-labor hiring household to hire labor increases probability of participation by 8 percent and sales volume by 77 percent. An additional member to a coffee growing household increases the probability of participation by 2.4 percent and sales volume by 22.9 percent. An additional hectare to the size of the farm holding increases the probability of participation by 2.3 percent and sales volume by 46.9 percent. An addition year to the age of the head of the household increases the likelihood of participation by 0.4 percent and sales volume by 2.6 percent. Enrolling a non-participant household into the credit project increases sales volume by 41 percent. An increase in non-coffee revenue by one shilling increases the propensity to participate in sustainable coffee marketing channel by 7.7 percent. These results are the same as in table 3 but here we focus only on marginal effects for the significant variables. However these results need to be interpreted with caution due to possible endogeneity and thus causative implication should not be over-emphasized, especially since only cross section data was used.

Table 4 Summary of the Main Findings of the Study

Explanatory Variable	**Marginal Change (Explanatory variable)**	**marginal Change in Probability of Participation**	**Marginal Change in Sales**
Altitude	Increase by 1 meter	-0.09%	-1.2%

Table 4 (contin'd)

HiredLabor	Enabling a non-labor hiring household to hire labor	+8%	+77%
HouseholdSize	Increasing by 1 member	+2.4%	+22.9%
SizeWholeFarm	Increasing farm size by 1ha	+2.3%	+46.9%
AgeHH	Increase by 1 year	+0.4%	+2.6%
MemberCreditProj.	Enabling a non-member household to participate		+41%
RevenueNonCoffee	Increasing revenue by 1 shilling	+7.7%	

CHAPTER V: CONCLUSIONS AND POLICY IMPLICATIONS

Certified coffee niche market are believed said to offer an opportunity for coffee growers to get out of poverty due to the low coffee prices offered in the conventional coffee market. However, it has been observed that even where certification has been given to smallholder coffee growers free of charge, some smallholder coffee growers continued to sell certified coffee in the conventional market as conventional coffee. This study used a double hurdle model to identify factors that influence smallholder coffee growers' choice of marketing channel and sales intensity once a marketing channel was chosen.

The regression analysis shows that labor availability is a major constraint limiting both farmers participation in the sustainable coffee marketing channel and the level of sales to this channel. This finding is in contrasts with the findings of the study by Wollni and Zeller (2007) who found that labor availability was not a limiting factor for Costa Rican coffee farmers due to the presence of migrant workers from Nicaragua. The implication is that those household with limited access to labor (own or hired) may be excluded from these lucrative market opportunities. Labor constraints could be mitigated through the adoption of capital intensive production and processing technology. However, meeting quality standards of the sustainable coffee marketing channel prescribes that farmers follow certain production and processing practices that are necessarily labor intensive.

The size of farm holding (proxy for wealth) was also found to be an important determinant of both the market channel participation and the level of sales to this channel. This implies that resource poor farmers may find it difficult to access high value coffee marketing channels. This also points to the fact that improving coffee quality entails non-trivial investment by farmers and this may create entry barriers for the poor farmers. Although contract farming avail opportunities

for farmers to participate in high value coffee marketing channel, wealth and asset endowment of farmers appear to be critical to the success of participants in these schemes. This is reflected in the importance of asset related variables such as the size of the land holding, labor and income. Thus, policies and programs that are aimed at empowering farmers and improve their wealth position may go a long way in enabling coffee farmers to take full advantage of these lucrative opportunities. Policies and programs aimed at land reforms and redistribution that will enable resource poor farmers access to farming land may help relax some of these constraints in the long run. Further, although these schemes may be accessible to farmers through subsidized certification, successful participation hinges upon coffee farmers' ability to meet quality requirements of the high value coffee marketing channels.

The study found that coffee growers may be attracted by price premiums offered by the sustainable coffee marketing channel, although its overall impact appears to be limited. This may reflect a cost-benefit assessment on the part of the farmers in deciding whether the premium offered is worth investing in quality. This has important implications in that the distribution of the price premium within the supply chain is important if farmers' participation is to be ensured.

Access to credit was found to be a constraint for the amount of coffee offered for sale to the sustainable coffee marketing channel. Access to credit enables farmers to make necessary investments in the quality of their coffee and meet quality requirements of this channel. Rural smallholder farmers are generally perceived as risky customers and financial institutions are often reluctant to extend credit to such farmers. Policies promoting investment by both private and public sector in making credit available to farmers will go a long way to relax this constraint.

Other factors such as farmers' demographics do not seem to play any significant role in shaping coffee farmers' participation and sales intensity to the high value certified coffee marketing

channel with an exception of age. Thus, this paper concludes that wealth endowment is critical to farmers' participation and intensity of participation. Another important conclusion is that the mere presence of the scheme seems to have a positive externality because it enhances the overall coffee prices in the project area as both Kawacom and middlemen compete for certified coffee as average price received by farmers tend to fall as soon as Kawacom stops buying coffee. However, this study was limited by the absence of exclusion restriction variables in the dataset as secondary data was used. Thus, selection models such as Heckman selection model were deemed appropriate but could not be used. Another limitation is that other variables such as distance to the selling point and other wealth variables as used in the contract farming literature were not available in the dataset, and thus could not be used in this study. Therefore, further research is needed to understand the impact of those variables that could not be obtained for this analysis to further understand the factors shaping sustainable coffee channel participation among smallholder coffee farmers and their level of participation once the channel is selected. Further, the use of cross-section data has limited interpretation of the findings of this study; particularly, the causal implication on the basis of the marginal effect could not be emphasized due to possible endogeneity problems. Thus, there is need to collect time series data to be used in future research.

APPENDICES

APPENDICES:

Table A1: Summary Statistics.

Sold no coffee to Kawacom

Variable	Obs	Mean	Std. Dev.	Min	Max
ageheadhh	23	42.95455	12.33067	25	66
sexheadhh	23	.9545455	.2132007	0	1
altitudeco~n	23	1963.364	53.33947	1862	2059
prodtrees	22	510	639.6562	50	2700
priceaveco~q	23	1960.527	322.5457	1389.4	2468.5
costsellin~e	23	.4090909	1.532477	0	7
farmerorga~r	23	.2727273	.4558423	0	1
farmingpri~y	23	.8636364	.3512501	0	1
hiredlabor	23	.5454545	.5096472	0	1
membercred~t	23	.4090909	.5032363	0	1
trainingex~n	23	.6363636	.492366	0	1
education	23	6.454545	3.035148	0	11
households~e	23	6.5	2.110067	3	11
dependency~o	23	.7095455	.4646707	.14	2.2
sizewholef~a	23	.8517091	.6929672	.2591	3.2384
RevenueNon~e	23	272440.9	413433.5	0	1350000
revenuenon~p	23	466500	795420.2	0	3390000
coffeesale~m	23	0	0	0	0

Sold some coffee to Kawacom

Variable	Obs	Mean	Std. Dev.	Min	Max
ageheadhh	91	47.04444	14.42447	24	86
sexheadhh	91	.9222222	.269322	0	1
ageheadhhs~e	91	2418.933	1498.512	576	7396
altitudeco~n	91	1858.67	90.03433	1656.3	2100.5
prodtrees	86	603.1977	484.6422	30	2550
priceaveco~q	91	2212.691	229.7102	1443.5	2556.6

T**able A1 (Contin'd)**

costsellin~e	91	.7611111	1.428498	0	7.5
farmerorga~r	91	.2777778	.4504125	0	1
farmingpri~y	91	.8111111	.3936132	0	1
hiredlabor	91	.6888889	.4655417	0	1
membercred~t	91	.5555556	.4996878	0	1
trainingex~n	91	.7333333	.4446941	0	1
education	91	7.044444	3.806886	0	16
households~e	91	7.511111	2.513981	2	15
dependency~o	84	.7385714	.434015	.11	2.5
sizewholef~a	91	1.091927	.8040189	.0931	4.2504
RevenueNon~e	91	182543.3	279931.3	0	1699000
revenuenon~p	91	666740.5	1071281	0	5660000
coffeesale~m	91	504851.9	500420.9	27980	2350000

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