

The Institute for Agricultural Economics
of the Christian-Albrechts-Universität Kiel

**Price Formation in the Presence of International Private Food Quality Standard: The
case of Kenyan French beans**

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Dedication

To my sons Kariúki and Ngatia, and my wife Wamúyú

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Zusammenfassung

Private Qualitätsstandards für Nahrungsmittel, insbesondere GlobalGAP, dominieren mittlerweile den westlichen Lebensmitteleinzelhandel. Die Anforderungen von GlobalGAP an die Produzenten beinhalten Investitionen in die landwirtschaftlichen Betriebe, Rückverfolgbarkeit und eine Zertifizierung. Trotz des Nutzens hinsichtlich Qualität, Sicherheit, Gesundheit, Wohlfahrt und Umwelt ist die Erfüllung der Anforderungen kostspielig für Kleinbetriebe und ein Preisaufschlag ist nicht beobachtbar. Auf alternativen Absatzmärkten werden Qualitäts- und Sicherheitsrisiken mittels Verträgen reduziert, wobei aber Nutzung und Häufigkeit der Vertragsverlängerungen bis jetzt unerklärt sind. Die drei Arbeiten, die auf Daten von Produzenten für grüne Bohnen basieren, untersuchen neben der Umsetzung von GlobalGAP den Effekt von GlobalGAP auf die Erzeugerpreise, sowie die Nutzung und Häufigkeit von Vertragsverlängerungen. Die Ergebnisse der ersten Arbeit zeigen, dass die Wahrscheinlichkeit der Umsetzung von GlobalGAP mit steigenden Erzeugerpreisen, der Zunahme der Anzahl der Produzenten in einem Dorf und einer kurzen, überwachten Versorgungsketten sinkt. Sie steigt aber, wenn Schutzvorrichtungen, genossenschaftliche Organisationen und Beratungsstellen vorhanden sind. Das bedeutet, dass Preisanreize, eine unabhängige und überwachte Produktion die Umsetzung behindert, jedoch landwirtschaftliche Produktionsmittel, Kompetenzentwicklung der Landwirte und nicht-monetäre Anreize die Umsetzung unterstützen. Das in der zweiten Arbeit geschätzte ökonometrische Modell zeigt, dass die GlobalGAP Zertifizierung, der Gebrauch von Lieferverträgen, Direktbeschaffung durch Exporteure und die Größe des Marktes eines Dorfes einen positiven Effekt auf die Erzeugerpreise haben. Organisierte Erzeuger erzielen signifikant niedrigere Preise. Der GlobalGAP Preisaufschlag ist nicht sehr groß oder konstant über eine Saison. Auch ist er weniger wichtig in Lieferverträgen und bei der Direktbeschaffung. Es wird festgestellt, dass mehr Käufer in einem gegebenen Dorf, der nicht-wechselnde Verkauf an nur einen Käufer und bessere Straßenverhältnisse die Erzeugerpreise steigern. Die Ergebnisse der dritten Arbeit sind, dass mündliche Verträge mit höheren Erzeugerpreisen und vielen Erzeuger in einem Dorf assoziiert sind, während Beratung, Gruppengröße, postprimäre Bildung und Vertragslaufzeit schriftliche Verträge differenzieren. Die Ergebnisse zeigen außerdem, dass Vertragsverlängerungen mit den Preisen, wenn diese zum Zeitpunkt der Pflanzung bekannt sind, den Spotmarktpreisen, der Entfernung zur Quelle für Bewässerungswasser, der Produzenten-Exporteur Marktverbindung, sowie der Möglichkeit des Erhalts von Bestätigungen und der Nachverfolgbarkeit von Verkäufen zunehmen. Andererseits nehmen sie ab, wenn die Anzahl der Käufer in einem Dorf steigt. Diese Ergebnisse deuten an, dass alternative Absatzmärkte stark von mündlichen Verträgen abhängen, wohingegen die Vertragsverlängerungen mehr auf Zufriedenstellung, Vertrauen, Wechselkosten und Wettbewerb basiert. Alles in allem betrachtet, können Erzeugergruppen und nicht-monetäre Anreize effektiver sein, um Kleinbetriebe in private Qualitäts- und Sicherheitsstandards zu kooptieren. Neben anderen Vorteilen gibt es einen GlobalGAP Preisaufschlag, auch wenn dieser nicht sehr groß ist. Letztlich existieren alternative Absatzmärkte für Kleinbetriebe ohne GlobalGAP Zertifizierung durch Lieferverträge.

Summary

Private food quality assurance standards especially GlobalGAP now dominate Western food retailers' markets. GlobalGAP defines market access condition for producers requiring farm investments, traceability and certification. Despite quality, safety, health, welfare and environmental benefits, compliance is costly for smallholders yet a price premium is unobservable. Alternative markets mitigate quality and safety risks through contracts whose use and frequency of renewal is unexplained. Using data from French bean producers, three essays are presented: analysis of GlobalGAP adoption, its effect on producer prices, use and frequency of contracts renewal. In the first essay, results show that producer price, many producers in a village and short monitored supply chains reduce the likelihood but protective gear, collective organizations and extension services increase the likelihood of adoption. This means that price incentive, independent and monitored production constrains adoption but farm assets, farmer capacity and non-monetary incentives enhance adoption. In the second essay, the econometric model shows that GlobalGAP certification, use of supply contracts, direct procurement by exporters, and the size of markets in a village, have a positive effect on producer prices. Organized producers receive significantly lower prices. The GlobalGAP premium is not very large or constant over one season and is less important than in supply contracts and direct procurement. More buyers in a given village, non-switching selling to one buyer and better roads are found to increase prices paid to producers. The third essay finds that higher producer prices and many producers in a village are associated with oral contracts while extension, group size, post primary education and contract seasons with a buyer differentiate written contracts. Further, the results show that contract renewals increase with price if it is known at planting, spot cash payments, distance to irrigation water source, producer-exporter market linkage, sales receipting and traceability but reduce with the number of buyers in a village. The results indicate that alternative markets depend strongly on oral contracts while contract renewal is based more on satisfaction, trust, switching costs and competition. Overall, producer groups and non-monetary incentives may be a more effective way to co-opt smallholders in private quality and safety standards. Beside other benefits, there is a GlobalGAP certification premium though not very large. Finally, alternative markets exist for smallholders without GlobalGAP certification through supply contracts.

CHAPTER ONE

Introduction

Agricultural sectors in developing countries are characterized by small farm households with low agricultural productivity, incomes and levels of technology use. Engaging in export crops is one opportunity to increase farm household incomes and, thus, bear a growth potential for the agricultural sector. Agriculture is of great importance in terms of livelihoods of the rural population because it accounts for 61% of employment and 14% of Gross Domestic Product (GDP) in developing countries (World Bank, 1999). Though not dominant in world markets, major agricultural exports from developing countries include fresh fruit and vegetables (FFV), oilseeds, coffee and cocoa. These markets are now threatened by Western European consumers' concerns about health, environmental and working conditions which impose high challenges to value chains. FFV are particularly monitored and inspected at import entry points because they have high chances of microbiological contaminations from poor hygiene and pesticide residues from intensive use of agrochemicals (Jaffee, 2005). To solve food quality and safety coordination problem, Western governments use mandatory regulations while retailers and exporters introduce a range of private quality assurance standards (QAS). QAS are important for developing countries farms and firms because they determine access to specific segments of the market, to specific countries and the terms of participation in global value chains (Vorley and Fox, 2004). On the one hand, standards set barriers for new entrants in the value chain, and throw new challenges to existing developing country suppliers (Jaffee, 2003). On the other hand, the challenge of rising standards provides the opportunity for selected suppliers to add value, assimilate new functions, improve their products, and even spur new or enhanced forms of cooperation among actors in a specific industry or country (Jaffee, 2003). The basis for the development of specifically farm based QAS to document and certify the production practices for farm-level systems cannot be overlooked. For instance, food scares e.g., poultry salmonella outbreak and Bovine Spongiform Encephalopathy (BSE) in the United Kingdom (UK) and lately Enterohemorrhagic Escherichia Coli (EHEC) and Schmallenberg virus in parts of the European Union (EU) continue to plague livestock and FFV sectors. This has regulatory implications because developing countries have comparative advantage over developed countries in the production of especially vegetables, cut flowers and fish (Jaffee, 2003). Further, Western governments regulations are in earnest to control food safety risks e.g., UK Food Safety Act (1990) on due diligence in the quality and safety of consumer products, the EU directive on pesticides residue limits (42/2000/EC), Maximum Residue Limits (MRL) monitoring program on

removal and approval of agro-chemical active substances for use in farming and traceability (178/2002/EC) requirement for food handlers (Commission of European Communities, 2004, 2006). Developing countries depend heavily on use of fertilizers and chemicals to increase productivity and control pests and diseases which means that foreign regulations have an impact on production, and post-harvest quality. Private QAS are dominant among retailers with codes of practices, farm audits and testing of residues on exported products being used to differentiate product and production systems (Jaffee and Masakure, 2005). Additionally, retailers demand environmental care, worker-welfare and the origin of food products, showing that the participation of smallholders in international markets will depend on their ability to meet current and emerging demands especially QAS.

Because many QAS contain detailed requirements concerning the production and marketing process of agricultural products, poor smallholders in developing countries, especially, might face potential market access barriers. These market changes increase pressure on farm production costs because approved pesticides are expensive, and there are administratively demanding farm audits and certification programs beside competition for supplies from big farms (Jaffee and Henson, 2004). The main debate however, is that QAS are excluding resource-poor producers in developing countries by setting higher standards for existing suppliers and raising entry requirements for new entrants. An epic case is the establishment of EUREPGAP¹ (currently GlobalGAP (GGAP)) by Euro Retailers Produce Working Group as a farm based QAS to try to control farm level produce quality and safety (Van der Port, 2007). GGAP started as a voluntary QAS but has grown into a mandatory QAS for those wishing to export to most Western food retailers (Codron et al., 2005). It is currently the most widely used Business to Business (B2B) farm QAS in 108 countries covering crops (e.g., FFV, coffee), livestock (e.g., poultry, pigs) and aquaculture (e.g., finfish, molluscs). Most food retailers in the EU demand GGAP certification (Jaffee and Henson, 2004). The standard demands upfront farm investments and traceability for certification which constrain resource-poor smallholders because of lack of financial and expertise capabilities. Kenya exports its FFV in the larger EU exposing over 70% of smallholders to GGAP certification. Certification requires producers to invest in a grading shed, washing points, protective garments, pesticide store and calibrated sprayer and implement a traceability system. Yet the extra cost burden on farm production is not followed by an observable price premium for compliance. Some producers for not being able to meet extra costs have switched into the alternative markets

¹ GlobalGAP is used for EUREPGAP to refer to studies that have been published or papers presented with the name EUREPGAP before the name switch. However, the materials are referenced in their originality.

that do not demand certification (Graffham et al., 2007). For instance, by 2010, only 318 Kenyan producers had GGAP certification compared to 34 individual farms and 352 producer groups in 2006 (GGAP, 2010b). The strategy for alternative markets is to engage smallholders in closely monitored contract production or to buy in the open market. A contract has significant benefits to producers such as an assured buyer, reduced price risk, favourable credit terms where available and lower marketing costs. GGAP is therefore determining market entry and segmenting markets in favour of the most innovative at the farm level. Few empirical studies on GGAP adoption exist (e.g., Okello and Swinton, 2007, Asfaw et al., 2010, Muriithi et al., 2010). This study provides more insight into the role of farm-level determinants in the successful adoption of GGAP. The study also investigates the presence of a price premium after compliance by empirically estimating a price function in the presence of GGAP using one-season cross-sectional price data. The study further analyzes choice of contractual forms: written or oral, and the frequency of renewal in the alternative fresh produce markets. The study uses French beans as a representative crop because it is widely farmed by smallholders with more than half of it being exported into the EU. A description of French beans marketing, studies on GGAP in Kenya and elsewhere, objectives of the study, source of data used to answer the three questions and the layout of the dissertation, follows.

1.1 Kenya's French beans: Domestic and international trade and challenges

French bean is the most important export vegetable in Kenya. They are grown on small farm sizes (0.35-1.2ha) using family and limited hired labor in many regions² that have fertile soils to support high value crops either through rain fed or irrigated farming. French beans are produced for processing purposes or for the fresh market. The beans have a higher income generation compared to traditional crops such as maize and require low level of fixed capital investments. There are about 2.57 million smallholders in agriculture with an estimated 60,000 producing French beans on slightly above 10% of the 82,000 ha of land under vegetables (Ebony Consulting International, 2001). Smallholders contribute between 47-60% of the total export volumes of fresh fruit and vegetables (Jaffee, 2003; Horticultural Crops Development Authority (HCDA), 2004). The participation of smallholders in export markets is supported by linkage to the export exit point in Nairobi by tarmac or rural graveled roads, numerous private export firms, intermediaries and producer groups, established pre-cooling facilities and ready export market destinations (Minot and Ngigi, 2004). Exports are also promoted by preferential rate under Generalized System of Preferences (Jaffee and Masakure,

² The Horticultural Crops Development Authority identifies specific production areas in every province i.e., Central, Western, Eastern, North Eastern, Rift Valley, Nyanza, Coast and Nairobi.

2005).

There is increased demand for fresh produce by Western food retailers from larger suppliers that can document production practices, ensure consistency and reliability (Barret et al., 1999; Dolan and Humphrey, 2004). However, independent producers, outgrower³ schemes and group producers are still preferred by exporters for outsourced contracted supplies because they can observe agronomic practices more carefully for field crops (Humphrey, 2005). Contracting specifies the inputs to be used and the rotation program for the contracted crops (Jaffee, 2003). Additionally, because beans can be exported to wholesale or supermarkets by small and medium or large exporters, smallholder outputs are used to serve short time orders or complement supplies. Small and medium firms export small consignments during the peak season in October-April while large firms export year-round using supplies from their own farms and monitored ‘satellite farms’ (Jaffee, 1995). Small and medium exporters control about 30% and large exporters 70% of the total volume of fresh fruit and vegetables exports from Kenya (Dolan and Humphrey, 2004). Figure 1.1 shows that most of the fresh French beans are exported. The main markets include the UK, France, Netherlands, Germany and Belgium.

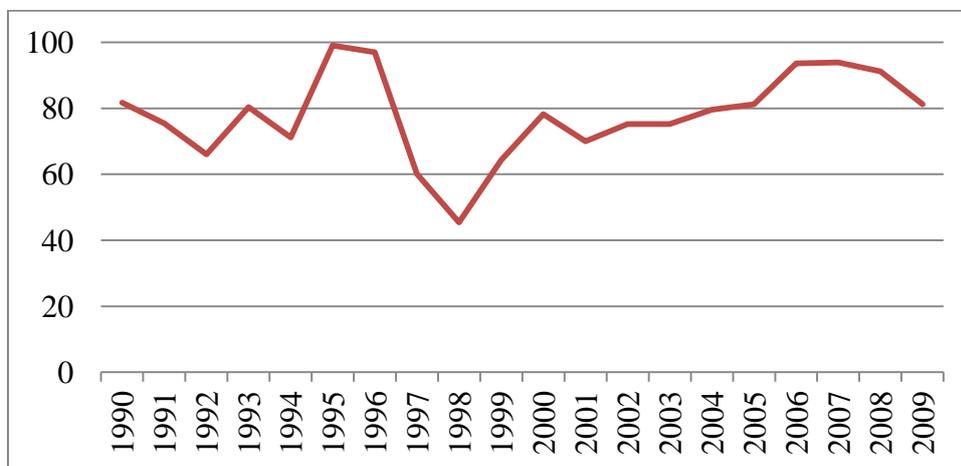


Figure 1.1: % share of Kenya's French beans exports to total production by volume
Source: Adapted from FAOSTAT, 2010 and EUROSTAT, 2010

The share declines between 1995 and 1998 but increases steadily from 1999. This decline occurs during the 1998 El Nino rains. The decline during 2007/2009 is partly due to

³ An outgrower is a farmer or group of farmers sponsored by an export firm to produce a certain crop on own farms, provided with high yielding variety seeds, pesticides and credit etc and monitored by field officers. Exchange relationships are governed by an enforceable supply contract on paper.

disruption by post-election violence and volcanic eruptions in Europe (Central Bureau of Statistics, 2009).

Common to most export crops, French beans producers face numerous challenges. First, domestic consumption is low estimated at 6.6% of the total weight of the food items in the upper income consumers and 11.9% for the middle income consumers while the local market is not well developed among upcoming supermarkets and traditional markets like municipal markets (Central Bureau of Statistics, 2000; Weatherspoon and Reardon, 2003). Second, post-harvest crop losses because of poor transport, lack of proper refrigeration facilities and emergence of pests marginalizes the majority of smallholders (Kimenye, 1995; Natural Resources Institute, 2003). Third, high competition in terms of price and quality, high airfreight and shipment costs, seasonality of exports, intensive production and surveillance for safety in international markets reduces exporters margins (Jaffee, 2003). Nevertheless, Kenya remains the EU retailers choice supply source for beans in sub-Saharan Africa and therefore faces the challenge of meeting quality and safety requirements. For instance in the first six months of 2002, five consignments of French beans were rejected at UK and Dutch borders in relation to the emergence of caterpillar (Jaffee, 2003). The principal challenge however, is how smallholders can comply with GGAP standard which is subscribed to by many food retailers in the EU where over 60% of Kenya's exports of fruit and vegetables are marketed. Further, questions of a price premium to cover GGAP compliance costs remain unanswered. Additionally, both buyers of GGAP and non-GGAP certified produce continue to procure smallholders' supplies using informal or closely monitored production contracts.

1.2 GlobalGAP standard: certification and empirical studies

GGAP standard was established in 1997 as a private initiative of Euro Retailers⁴ Produce Working Group to address traceability, hygienic production and handling of products farmed by suppliers to assure consumers of their safety (GGAP, 2010a). The standard has rapidly spread into many countries and many food retailers in Western Europe require their suppliers to be GGAP certified (Jaffee, 2005; Codron et al., 2005). The process of certification⁵ involves 1) pre-assessment and documentation review of a producer's facilities and production operations, 2) field audits, 3) verification of conformity and 4) certification. Smallholders are required to invest in a grading shed, watering points, sorting tables, toilets, calibrated sprayers, pesticides store, and a waste disposal pit for pesticide effluents (Okello

⁴ E.g., REWE Group (Germany), Ahold (Netherlands), ASDA Group Plc. (UK), Delhaize (Belgium) etc. A complete list is available at <http://www2.globalgap.org/members.html?mentype=retail>

⁵ Process control points can be found at www.globalgap.org/cms/front_content.php?idart=1440

and Swinton, 2007). The standard requires use for farming only approved pesticides which are often times costly and establishment of a traceability system (Grijp et al., 2005; Moll and Igual, 2005). Costs of soil and water testing, certifier's fee, farm audit and certificate fees are paid by producers (Chia-Hui Lee, 2006; Graffham et al., 2007). This has the potential to exclude smallholders in developing countries because they have low managerial, financial and innovative capabilities and export market access is limited to few linkages through few export firms or large cooperatives. Kenyan smallholders are co-opted in the quality and safety value chains by exporters through contracted production. Currently, only 318 producers are certified compared with 34 individual farmers and 352 groups, in 2006. Worldwide the number of certified individual and producer marketing organizations has grown from 18,000 in 2004 to 102,267 as of April 2010 (Moeller, 2006; GGAP, 2010b). If adopted GGAP has the potential to spread benefits of food quality and safety to local markets, improve the health and welfare of producers, protect the environment from hazardous materials and enhance smallholders' market access opportunities (Boselie and Van de Kop, 2004; Humphrey, 2005; Graffham et al., 2007). Empirical studies on compliance with GGAP for Kenyan smallholders are scarce. However, there are funded reports (Graffham et al., 2007; Thiagarajan et al., 2005; Waweru, 2006), commentaries and assessments of GGAP as a quality standard (e.g., Jaffee, 2003; Nyambo and Nyaga, 2006; Moeller, 2006; Liaison Committee on Europe Africa Caribbean and Pacific (COLEACP), 2006) and lately empirical studies by Asfaw et al., (2010) and Muriithi et al., (2010). Elsewhere empirical studies on GGAP include Kleinwechter and Grethe, (2006), Chemnitz, (2007) and Souza Monteiro and Caswell, (2009). The empirical studies address adoption or compliance on the basis of producer, buyer and market factors but do not consider the role of competition, type of the supply chain and the length of producer-buyer relationship in the adoption of GGAP. Further, the studies do not estimate the effect of GGAP on farm gate producer prices, which might determine the sustainability of the standard. Finally, Okello and Swinton (2007) have estimated participation in contract production.

1.2. Objectives of the study

The objectives of this study are:

- a) To determine the farm-level determinants of successful GlobalGAP adoption among smallholders.
- b) To determine the effect of GlobalGAP certification on farm gate producer prices.
- c) To analyze choice of contracts and the frequency of renewal among smallholders.

1.3. Study area and data sources

1.3.1 Study area

This study was done in Mwea Tebere in Kirinyaga South District of Central Province Kenya.

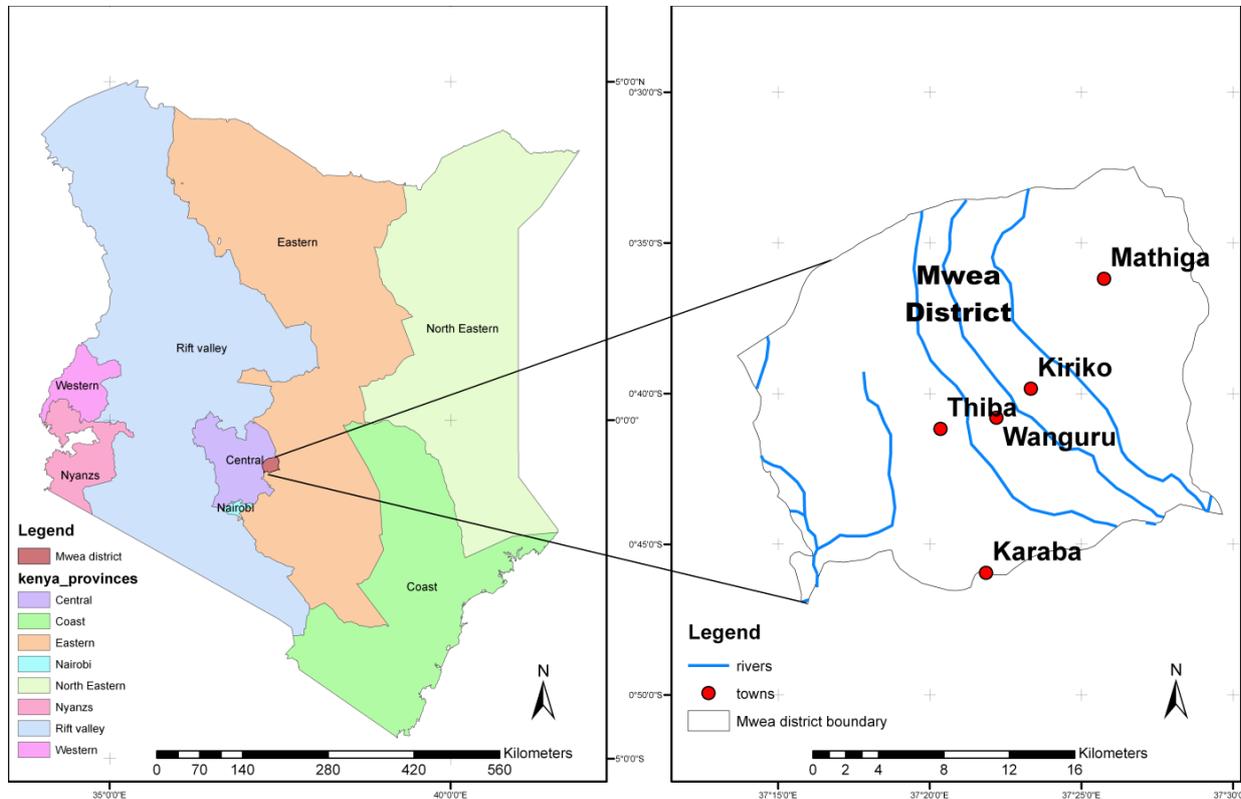


Figure 1.2: Mwea Tebere showing some of the French beans growing areas

It is situated 120 km North West of Nairobi with a population of 153, 095 and an estimated 5400 rice producers' farm families settled over 36 villages⁶ (Government of Kenya, 2009). French beans have a long history in the region. It is grown under irrigation from streams, rivers and National Irrigation Board (NIB) water canals by use of a water pump or free flow (Obare and Kariuki, 2003). Agricultural soils are either red alluvial or dark black cotton (Nguyo et al., 2002). French beans farms are limited in size due to tenancy agreement⁷ between Mwea Irrigation Settlement Scheme (MISS) and NIB (Swynnerton, 1957). Farming depends on family and hired labor. The study site has horticultural pre-cooling facilities at

⁶ A village is a collection of several farm families usually under a village 'headman'-administrator, in government parlance. Several villages within a common boundary and proximity to key towns make up a location.

⁷ A tenant under NIB contract is entitled to 0.41 ha of land for the cultivation of maize or traditional beans and a further 1.62 ha earmarked for rice cultivation. The government of Kenya is currently in the process of issuing title deeds to rice tenants.

Kimbimbi and is the hub of horticultural farming in central Kenya (Fresh Produce Exporters Association of Kenya, 2006).

1.3.2 Survey administration and data collection

The survey data was collected between April-June 2006, with identification and selection of respondents through the services of village headmen done in April 2006. The sampling unit was an individual smallholder at the village level. Because of unequal distribution of villages, the region was divided into major horticulture growing sub-locations: Murinduko, Tebere, Nyangati, Thiba, Mwea and Mutithi, based on the demarcation of those regions along Rivers Nyamindi, Thiba, Murubara, Project Murubara and Mwea Canal. For each region, a random sample of four villages has been selected. In each village, smallholders have been selected based on whether one would be harvesting a French bean crop during the month of June 2006. A total of 249 smallholders in 24 villages were surveyed and monitored until harvesting. Price data⁸ involved on-farm visits during the harvesting and collection of beans at the grading and sorting sheds. This procedure allowed enumerators to observe crop handling activities e.g. sorting, washing, grading and packaging etc and transactions related to change of crop title e.g. issue of receipts and trace-back identities etc. This was done on Mondays and Wednesdays for a period of 3 full weeks in June, yielding six price waves. Data on smallholders' socio-economic factors, infrastructure and marketing aspects, was collected on other days of the week. This included GGAP certification status, prices for each grade, access to bank account, extension, type of supply contract with buyer, number of contract seasons with buyer, training on pesticides, crop and personal hygiene, post-harvest crop handling care, and record keeping. Other data involved farm assets, production structure, number of collective institutions in the village, number of French beans farmers in the village, number of French beans farmers sharing a buyer, and number of buyers in the village.

1.4 Structure of the thesis

The dissertation is organized in three essays. The first essay (Chapter two) estimates the factors that are likely to influence the successful adoption of GGAP by smallholders. As a farm gate standard there are implications for smallholders' production and market access opportunities. Due to emphasis on producer group certification, individual smallholders may have no chance for certification unless they have large farm sizes, which is not realistic. This

⁸ Mwea has had running research projects which makes it easier to get trained research data collectors. However, it makes it difficult to obtain information from farmers who complain of too many questionnaires from the numerous projects. Thus, in order to elicit price information during harvesting and subsequent follow up for unclarified non-price related data, each respondent was given a mobile top-up card worth 2.5€ (1€=KE94).

essay argues that smallholders can still produce beans that match up to GGAP standards for the alternative markets if they have non-land assets, invest in farmer capacity and have access to non-financial incentives. A probit model is utilized with adoption of GGAP as the dependent variable to derive economic estimates.

The second essay (Chapter three) investigates whether GGAP certified producers really get a price premium. There has been a lot of debate on lack of an observable price premium for those complying with food retailers' sponsored certification standards. Whether this is a business strategy to block competition in B2B chains, the question is what smallholders would gain to remain in production. A price premium is therefore argued to be a rational consequence for a standard that imposes compliance costs to producers. The observed producer prices during the market day exhibit some form of auction behavior where, apart from quality other factors such as the transaction costs facing a buyer come into play. This generates auction prices for a buyer per producer per region per day. Therefore, using a hedonic price function estimates for GGAP certification and other variables are obtained.

The third essay (Chapter four) looks at how smallholders choose between written and oral contracts in the production and marketing of export beans. Contracts are used as a strategy to mitigate farm level quality and safety risks in smallholdings. Because of the nature of fresh markets, the type of horticulture exporters and quality motivations, farm level contracts exhibit different formats. Faced with a choice rational producers will choose an option that leaves them no worse off or that which yields the highest benefit compared with all the other alternatives. The choice has risk-sharing and transaction costs reduction considerations for producers and buyers. This notion is used to model choice of contracts using a probit to estimate inferential coefficients. The essay also estimates the factors determining the frequency of contract renewals. Producers and buyers will renew contracts based on some satisfaction, trust, level of switching costs and competition in the market. The frequency of contract renewals is modeled and analyzed using negative binomial regression to capture the lower bound zero renewals and inequality of the conditional means and variances.

In Chapter five the conclusions for the three essays, policy implications and recommendations for further research are presented.

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CHAPTER TWO

The role of non-land assets, farmer capacity and incentives in successful adoption of GlobalGAP certification: Lessons from Kenya's smallholders perspective

ABSTRACT

Private food quality and safety standards are gaining importance in international trade as checks on food safety risks. But there are possibilities of excluding smallholders in developing countries because of the requirement for investment in infrastructure and traceability to obtain certification. We empirically explain smallholders' successful adoption of GlobalGAP standard in Kenya's French beans marketing. The results show that successful adoption is highly probable with more contract renewals with a buyer and the number of producers sharing a buyer. Other success factors include a larger area under beans, higher number of producer groups in neighborhood, larger producer groups, ownership of protective garments, more extension visits and experience. Conversely, an already closely monitored short supply chain, more producers in a village and a higher producer price potentially reduce successful certification. The results suggest that market partnerships, investment in farmer capacity and farm assets, and targeted non-monetary incentives are important success determinants in the adoption of supply chain standards for premium markets. On the other hand, closely monitored short supply chains, independent production and higher producer prices do not favor adoption of private farm level quality and safety standards.

Keywords: Non-land assets; Capacity; Incentive; GlobalGAP certification; Smallholders, Developing countries; Kenya

1 INTRODUCTION

The export of fresh fruits and vegetables is currently the second highest foreign exchange earner contributing 23% of the total agricultural Gross Domestic Product in Kenya. Estimates show that up to 80% of horticultural production in Kenya is undertaken by smallholders (Horticultural Crops Development Authority, 2007). However, public regulations from Western countries, notably use of pesticides in farming and traceability of farm produce favor a reorganization of production and marketing of horticultural products from developing and least developed countries (Unnevehr, 2000). Further, a shift of food quality and safety responsibility to suppliers in the chain through third party monitored voluntary codes of conduct in form of pre-farm gate certifications by importing supermarkets and retailers is putting pressure on smallholders (Jaffee and Masakure, 2005). Use of these quality assurance standards (QAS) as markets access and product differentiation tools compounds horticultural markets more. One of the private food quality standards that producers of fresh fruits and vegetables have to comply with to remain in export crops production is Global Good Agricultural Practices (GGAP, formally EUREPGAP). Smallholders can obtain GGAP certification either individually or as a producer group. Primarily, GGAP certification involves taking full account of pesticides use and disposal because of health, occupational and environmental concerns, investments in supporting farm assets, and a certification fee. Additionally, they must show compliance with traceability of produce, establish sorting and grading facilities and a record keeping procedure.

Case studies show that GGAP technical requirements, investment and certification costs are enormous (Belletti et al., 2005; Graffham et al., 2007). Smallholders are disadvantaged by GGAP because they have limited access to financial, technical and infrastructural resources. Further, many supply chain members in the European Union (EU) where 60% of Kenya's fruits and vegetables are marketed are GGAP compliant. Therefore, failure to comply might mean mass disenfranchising of smallholders, loss of international markets and foreign exchange earnings. With increased emphasis on compliance even from local horticultural associations and donor funded programs, there is need to understand the repositioning of smallholders in the market chain. Currently, there is not enough evidence of what affects smallholders' successful adoption of GGAP in fruits and vegetables production in Kenya. This study empirically estimates the factors that influence smallholders' success to adopt GGAP. The underlying data stem from a survey of French beans producers in Kenya.

The remainder of the paper is organized as follows. Section 1.1, has an overview of incentive and motivation for adopting QAS followed by the theoretical model and research hypotheses in Section 2. The empirical specification, methodology and data description are presented in Section 3. The results of the empirical estimation are reported and discussed in Section 4 and summary and conclusions in Section 5.

1.1. Overview of incentives and adoption of Quality assurance standards

Firm based Quality Assurance Standards

Firm based quality assurance standards document and certify quality management systems for a company's internal operations. Quality assurance standards will influence costs, prices and profits of firms but this depends on a firm's characteristics and activities (Holleran et al., 1999; Henson and Holt, 2000). Further, specific impacts differ from one firm to another. There are expectations that after adoption of a QAS firms will get tangible or intangible benefits. Fouayzi et al., (2006) identify product traceability, product quality, and ability to maintain current customers and attract new ones. Some empirical studies find that confidence with certification agents motivates satisfaction, (Schulze et al., 2007), others recognize perceived benefits such as improved reputation, product safety, business processes and transparency (Gawron and Theuvsen, 2006). Other benefits of a QAS include satisfaction with sales, and access to the domestic market, and with market share (Fouayzi et al., 2006).

There is consensus in most studies that adoption of QAS is related to a firm's characteristics mainly because size determines access to resources. Zuhair et al., (2006) found that firm size, country of control and firm's level of innovation were more influential than industry, major market served and the level of inspection on the adoption intensity of food safety and quality practice. Jayasinghe-Mudalige and Henson (2006) also find large firm size, use of other's brand name, sales and reputation as key motivators of responsiveness to food safety. Adoption is also more likely with firms with a higher number of employees, country of ownership and control, level of innovativeness, level of export orientation and the subsector the firm operates in (Herath et al., 2007). In addition, trading with firms that participate in a given QAS, a firm's own ability to undertake a successful implementation, customers' pressure and need to maintain competitiveness in the marketplace are key incentives for small firms to adopt QAS (Karipidis et al., 2009). Jin and Zhou (2011) find that cooperative size, destination market, reputation, perception and attitude about standards and expected costs and benefits affect the decision to adopt standards.

Barriers to the adoption of firm based QAS are numerous. Lack of a professional quality manager and qualified managers to implement QAS, resistance from executives and workers and lack of understanding of QAS documentation are key disincentives to adoption (Karipidis et al., 2009). Government regulations, walk-in customers and operations in the international market also reduce responsiveness to food safety (Jayasinghe-Mudalige and Henson, 2006). Gawron and Theuvsen (2006) find incomprehensible International Food Standard (IFS) requirements and low managerial practicability as prime disadvantages and Lo and Humphreys, (2000) and Poksinska et al., (2006) find adoption among small firms problematic due to limited resources, and lack of suitable training or educational programs. Schulze et al., (2007) argue that perception of the usefulness of certification reduces with a farmer's experience.

Farmer based Quality Assurance Standards

Farm based quality assurance standards document and certify the production practices for farm-level systems. The motivation for farmer based QAS varies but price expectations and market access are primary concerns for producers (Hobbs, 2003). Firms introduce farm gate standards to control food quality and safety, control supply of produce in the chain and for competitiveness (Dolan and Humphrey, 2000). The adoption of QAS among producers is influenced by public extension, membership to a producer group, a supply contract, large farm size holding and wealth (Okello, 2005). Access to QAS information and vertical integration via exporters, membership to a producer organization, media access, revenue, producer's age, contract farming and farm size positively influence adoption (Kleinwechter and Grethe, 2006). Graffham et al., (2007) find that membership to a producer group and linkage to an exporter or donor influence adoption of QAS. Asfaw et al., (2010) find adoption positively correlated to households with a higher number of female members, intra-household literacy levels, producer group membership, access to information and the level of agricultural training prior to adoption. The level of organization of farmers is more critical to participation in QAS than farm size (Chemnitz, 2007). Membership in larger producer organizations, higher farm productivity, production under a protected designation of origin (PDO), and full time farmers motivate growers to adopt QAS (Souza Monteiro and Caswell, 2009). Muriithi et al., (2010) found extension services, farm size, and household size to have significant positive influence on compliance. Graffham et al., (2007), conclude that adoption of QAS is also limited by financial viability and lack of a price incentive. Muriithi et al., (2010) also find expectation of a premium price positive but with insignificant effect. The costs of compliance are critical impediments to adoption (Kleinwechter and Grethe, 2006).

Generally, firms and farmers are motivated by internal and external incentives in their decisions to adopt QAS. There is motivation arising from the perceived or expected benefits such as profits, premium prices, reputation, reduced costs of operations and market positioning. The motivation to adopt may be due to pressure from downstream trade partners, customers and regulation from governments. Firm size, markets served, inter-linkage with firms that have adopted a QAS, financial capability and human resource capacity motivate adoption of QAS. The main disincentives to adoption are costs of compliance, lack of a definite premium, complex QAS documentation and lack of professional workers. Producers will adopt QAS based on expected producer price, schooling, standard's information, extension services and membership to a producer group, farm size, farm productivity and wealth, access to market linkages, experience, and age. The principal hindrance to adoption is lack of financial viability of the QAS in question. Most of the studies are qualitative targeting firm based QAS such as International Organization for Standardization (ISO) standards series e.g., 9000, Hazard Analysis of Critical Control Points (HACCP), and Good Manufacturing Practices (GMP). There is a paucity of empirical studies on farmer based QAS especially in developing countries.

2 A THEORETICAL MODEL OF TECHNOLOGY ADOPTION

2.1 A model of willingness to adopt GGAP

In this study, GGAP adoption is considered an organizational innovation because it is more than the adoption of high value yielding seeds or irrigation technology etc. Theoretically, a producer is faced with alternative innovations that either satisfies or satisfies not his maximization problem, which could be higher profits, personal health, reputation or higher stability of sales. For simplicity, let a producer be assumed to maximize expected profits, when choosing to adopt an organizational innovation like GGAP. Each innovation has a vector of attributes. However, the producer faces adoption constraints such as investment capital. The choice made is probabilistic because there are risks associated with each production innovation, which renders a producer to a finite set of alternatives from the choice set. A producer evaluates each innovation on the basis of attributes and constraints, assigns a level of profit to each and finally chooses a preferred method. A producer cannot choose two innovations at the same time, hence the choice is also binary (Greene, 2000). Assuming rationality in the decision making process, an innovation is adopted if the expected profits from that innovation are greater than all the other alternatives. For a producer to prefer one

innovation for the other, it is assumed that choice decisions are made under full information. Further, the profits derived are only known to the producer.

Because profits from other production innovations are not easily known, a researcher depends on the observable portions of the maximization problem to determine choice. In our case, what is observed is the choice made by the decision maker at the time of the survey i.e., GGAP certified or not, and the socio-economic factors (e.g., farm structure), which generate heterogeneity of adoption across a given population of producers. The decision to choose an innovation can be represented in a behavioral model as follows:

$$P(i | C_n) = P(\pi_{ni} > \pi_{nj}) \forall j \in C_n = 1, \dots, j; i \neq j$$

where, i is the chosen innovation, j , is the vector of all the other alternative choices, C_n is the choice set of innovations available to producer n , and π is the expected profit of each alternative. This means that a decision maker n chooses an alternative i from a finite set of alternatives in choice set C_n with probability $P(i)$ if the profit associated with π_i is greater than the probabilities associated with all other alternatives in the choice set.

Studies of the adoption of agricultural technologies have focused on the dichotomous decision to participate by estimating limited dependent variable models (Feder and Umali, 1993). In firm and farmer based QAS, empirical studies have used dichotomous models to estimate one-time adoption. Okello, (2005), Wollni and Zeller, (2007), Asfaw et al., (2010) and Muriithi et al., (2010) use the probit model, for instance. Others have used the logistic model (Zuhair et al., 2006; Herath et al., 2007; Souza Monteiro and Caswell, 2009; Jin and Zhou, 2011). Other models such as the hazard model used in Carletto et al., (2010), capture data that have structural and time varying characteristics. Others, e.g., the Tobit model, aim to capture the simultaneity of decisions such as choice and intensity of use (Brush et al., 1992). The success to adopt GGAP certification might be taken as a dichotomous adoption decision because a producer or producer group goes through an audit and verification process to confirm conformity with control points and compliance levels before a certificate is issued. This is a one-time decision and is fully adopted. We have classified producers into those certified or not certified. This is plausible, because there is no envisaged analysis of the intensity of utilizing GGAP after adoption which overrules simultaneity of adoption and use decisions. The adoption variable is expressed in binary form, 1 if the producer has adopted, 0, otherwise.

Factors affecting successful adoption of GlobalGAP

Farmer characteristics

Studies on adoption of QAS reveal that there exists a relationship between observed adoption and a decision maker's socio-economic characteristics. Education, experience, and farm sizes have been shown to positively influence the uptake of EUREPGAP and IFS by smallholders (Okello, 2005; Asfaw et al., 2010). Further evidence on socio-economic factors in the adoption of new farming methods is found in Brush et al., (1992). Farmers who have more school years have the ability to perceive and conceptualize an innovation like GGAP and critically evaluate whether to adopt or not based on costs and expected benefits. The flow and interpretation of technical information, which in turn reduces costs of training is easier with schooled producers. Additionally, educated smallholders may want to trade in export horticulture by adopting GGAP certification as a farm gate differentiation strategy from mainstream producers. Lack of education translates into poor understanding of tough quality and safety standards and low engagement of small farmers in supermarket supply contracts in developing countries (Weatherspoon and Reardon, 2003).

Experience in horticulture farming is a competitive attribute imparting a producer with production and market skills due to the learning process and exposure to agronomic and marketing changes within the sector. As stock of knowledge gained over the production and marketing cycles, experienced producers can form informed choices. If age is considered a proxy for risk taking behaviour e.g., Carletto et al., (2010), then young vibrant producers may be willing to take on GGAP standard with its demands for training and observation of quality and safety than older producers. They are most likely to use credit to run farming as a business than older producers who may be pre-occupied with stable incomes. However, because the ability to take financial and managerial risks demanded by certification may decrease beyond a certain threshold age, quadratic age is used to capture decline in risk taking behavior and hypothesized to be negative.

Apart from the above socio-economic factors, we introduce the number of seasons a producer was involved with a buyer in the export of French beans to represent specialization and specific knowledge on beans production, markets and future changes. Contrary to experience, which endows a producer with general knowledge, interaction with an exporter for more seasons will more likely influence a producer to accept market changes with a view to remaining in business.

Hypothesis 1: A producer's age, schooling, horticulture farming experience and the number of contract seasons with an exporter will be positively correlated with GGAP certification.

Farm characteristics

It has also been shown that where adoption of food safety schemes is costly, farm or firm size reduces the difficulty due to scale economies (Graffham et al., 2007; Herath et al., 2007). Producers with large farms are able to implement productivity practices such as traceability, investment in farm equipment at low per unit costs and assemble crops more efficiently. If farm size were to proxy wealth (see Asfaw et al., 2010), large farm sizes would mean more wealth base and vice versa. It is therefore more likely for producers with large farm sizes to adopt certification than producers farming small farm sizes.

The initial investments before a certificate is offered for a QAS are in most cases enormous and may hinder adoption by a producer. In global trade, there is pressure for extreme care on food handling at the farm level and at all points of the food chain aimed at reducing health risks from pesticide residues and microbial contaminants (World Health Organization, 1998; Zepp et al., 1998; Kilmer et al., 2001; Hobbs, 2003). To be GGAP certified, a pre-assessment and documentation of a producer's facilities and production operations must show compliance. Essential upfront investments include a pesticides store, calibrated sprayer, protective clothing, waste disposal site, toilet and a grading shed (GGAP, 2010; Graffham et al., 2007). A grading shed may be an individual on-farm or common structure. A common shed serves proximately located producers during sorting, washing and packing of beans. A grading shed presents considerable likelihood of reducing post farm produce contaminations. For crop and personal hygiene, producers or their farm workers require protective garments when applying pesticides. Pesticides are applied using a regularly calibrated knapsack sprayer to reduce instances of overdosing crops and spillages that can contaminate the soil and the environment. Protective garments deter chemicals from affecting an applicator's skin and inhalation of toxic fumes during application. Okello and Swinton (2010) find use of protective gear to reduce ailments and exposure to pesticide hazards.

Farm investments are primary in re-auditing for re-certification purposes. Assets are expected to promote adoption because they are essential part of the certification process. Besides, assets reduce a producer's degree of pesticides residue levels and microbiological contaminations in the final product. In the analysis, we include protective garments to represent farm assets since a grade shed and sprayer show perfect prediction of GGAP standard. Meeting maximum residue limits (MRLs) on farm produce meant for export to Western European markets is

important meaning that farm gate producers have to make proper use and application of crop protection products, observe pre-harvest spraying interval and document spraying regimes. Apart from MRLs, producers' welfare and environmental care are key components of GGAP. Therefore, ownership of protective garments is expected to positively affect successful adoption of GGAP certification.

Hypothesis 2: Smallholders that have a large farm size, an on-farm grading shed, a calibrated sprayer and protective garments have a higher probability of being certified.

Market and marketing characteristics

Kleinwechter and Grethe (2006) and Karipidis et al., (2009) found market participants such as buyers of produce to be motivators of food quality practices. The target export markets for fruits and vegetables from Kenya are mainly UK and the larger EU region and are dominated by wholesalers and retailers (Dolan and Humphrey, 2000). Compared to retailers, wholesalers are not as strict on GGAP certification requirements because they target less differentiated consumer markets (Jaffee, 2003). Because downstream chain members define the observed production and procurement relationship with upstream chain members there may be selection of producers (Henson et al., 2005). Exporters that serve markets that demand certification will require and probably support certification of their smallholder suppliers in a cost-sharing arrangement similar to ones identified in Graffham et al., (2007) and Ashraf et al., (2009). In these arrangements registration, farm audits and certification fees are paid by either the exporter, donor/sponsor or jointly with smallholders to guarantee commitment of producers. Intermediaries are mainly considered an impediment to certification (Waweru, 2006). Our dataset contains export firms and intermediaries but no demarcation of the export destinations. However, export firms can buy directly or through trusted intermediaries. For instance, one certified group sells through an intermediary and two non certified groups sell directly to an export firm. We have classified marketers as direct or indirect buyers and christened them short and long supply chain respectively. A short supply chain allows immediate contact between buyers and suppliers so information sharing is more efficient than in a long supply chain. It is hypothesized that successful adoption of certification will be more likely with a short than a long supply chain.

Controlling quality within the supply chain depends on preferred supplier relationships (Dolan and Humphrey, 2000; Boselie et al., 2003; Narrod et al., 2009). Farm gate relationships may have a positive or negative effect on the adoption of GGAP in two ways: if a buyer considers certification necessary or if a buyer is contented with product quality and safety from

contracted smallholders to serve alternative less discerning markets (Jaffee, 2003). However, where the relationship involves closely monitored provision of inputs and direct sourcing from producers, certification will be more likely. A close relationship offers possibility of joint participation in negotiating and sharing costs pertaining to new market changes. The intensity of the relationship is included in the model through interaction variables between supply chain and type of supply contract.

Hypothesis 3: A short supply chain is more likely to be associated with GGAP certification than a long supply chain. A short supply chain with a closely monitored supply contract will have a higher probability of being certified if exporters find it necessary to do so, otherwise not.

Collective organizations

Okello and Swinton, (2007), Souza Monteiro and Caswell, (2009) and Jin and Zhou (2011) have found producer organizations as critical in the adoption of QAS. The unit costs of compliance before certification are enormous for individual smallholders (Graffham et al., 2007). Poor access to credit, information asymmetry, poor infrastructural developments and risk-averse behaviour aggravates smallholders' marginalization (Byerlee and de Polanco, 1986). Smallholders are principally certified as a producer group because of cost considerations (Thiagarajan et al., 2005; Graffham et al., 2007). In an organized group, smallholders can collectively access low cost credit, minimize monitoring and follow up costs through control and self-monitoring mechanism (De Souza Filho et al., 1993; Narrod et al., 2009). GGAP defines a producer group as organized producers with their respective production locations that can allow establishment of a common quality management system and internal annual inspections across the whole group through random sampling of sites. The registered members of a producer group are legally responsible for their respective production locations.

As social networks, producer organizations have the ability to strengthen cooperation through the values and norms that individuals share in common. These values and norms may include trust, reciprocity and sanctions (Meinzen-Dick et al., 2000). Group production facilitates vertical cooperation with downstream marketers on choice of product specifications and quality levels, improved product credibility and timely delivery of orders, and reduced costs of product assembly and segregation. Due to perfect prediction of GGAP certification by group membership variable, we use the number of groups in a given village, group size and number of farmers using a common buyer, and the number of producers farming French beans

in a given village. In fact, group size and the number of groups in a village is critical due to economic viability of GGAP standard because if groups are too small and too dispersed, management and transaction costs increase. Fafchamps and Minten, (2001) find network of business contacts key ingredients in the performance of agricultural traders. It is expected these social networks will influence smallholders' choice behaviour through collective human and financial support, commonality of production and marketing circumstances and set sanctions.

Hypothesis 4: Social networks will increase the probability of smallholders being certified.

Incentives

Lack of training or technical knowhow is identified as a disincentive in the adoption of QAS (Poksinska et al., 2006; Muriithi et al., 2010). Demand for technical and administrative training on the part of producers is directed at minimization of product quality and safety information asymmetries (Henson et al., 2005; Vandergeest, 2007). Under GGAP certification, training is vital because of quality management system technicalities, use and application of crop protection products, understanding residue limits and sources of microbiological contaminations, management of producer groups and record keeping purposes. Training on standards, certification process and MRLs is provided either by government or private extension officers or jointly. The form of training obtained by smallholders will enhance their competencies in on- and off-farm crop handling practices and facilitate GGAP certification.

Credit provision is identified as a strategy to mitigate idiosyncratic market failure in financing agricultural innovations (Rauriyar and Goode, 1996). Credit can be used to finance farm investments and working capital such as paying hired labor and offsetting harvesting costs. It is expected that producers with access to credit will be likely to adopt GGAP. Currently commercial banks in Kenya have smallholder tailored credit facilities for bank account holders. In our analysis we have used ownership of a bank account as a proxy for possibility of accessing credit.

Holleran et al., (1999) and Hobbs (2003) argue that price and profit incentives motivate adopters of quality standards. This is important for smallholders who complain of lack of a price differential for adopting food quality and safety schemes (Graffham et al., 2007). A higher price expectation may spur demand for certification among smallholders if the price covers the costs of complying with the requirements because smallholders would not want to

be left worse off after certification. A higher price for certified produce may however be countered if alternative markets offered competitive prices without certification requirements.

Hypothesis 5: Access to extension services, credit and the expectation of a higher price above competition increases the likelihood of GGAP certification.

3 EMPIRICAL SPECIFICATION OF GLOBALGAP ADOPTION

A binary model permits analysis of adoption by estimating a model relating the observed certification or non certification with factors likely to influence choice. Following the theoretical prepositions above, a producer is willing to adopt GGAP if the expected benefits of certification are strictly greater than the benefit of non-certification:

$$\gamma^* = \begin{cases} \gamma^G & \text{if } \pi^G > \pi^A \\ \gamma^A & \text{if } \pi^G \leq \pi^A \end{cases}$$

Smallholders will adopt GGAP γ^G if its corresponding benefit π^G is strictly larger than the benefit π^A of the alternative method γ^A . The observed choice represents a binary variable which leads to two alternative econometric approaches. The model can be estimated by assuming a logistic or normal distribution density functions. In this case the distribution of choice of GGAP is unknown *a priori* because of the heterogeneity of smallholders' choices. Therefore, we have assumed the idiosyncratic error terms in the estimated model to be independent normal variables and estimate a probit model. The decision is influenced in turn by socio-economic and other factors. These determinants are operationalized by explanatory variables explaining a producer's choice. Consequently, the probability of a given smallholder choosing to adopt GGAP can be represented thus (Greene, 2000)

$$\gamma^* = \begin{cases} P(Y_i = 0) & \text{if } \Pr\left(\sum_{k=1}^k \beta_k X_{ik} + \varepsilon_i \leq w\right) \\ P(Y_i = 1) & \text{if } \Pr\left(\sum_{k=1}^k \beta_k X_{ik} + \varepsilon_i > w\right) \end{cases}$$

where β_k is the regression coefficient for the k^{th} explanatory variable and X_{ik} are the explanatory factors facing smallholder i . An error term ε_i captures omitted variables or researcher's misconceptions. Using the maximum likelihood method, a vector of β' coefficients that maximize the probability of observing a given sample is estimated. The coefficients are interpreted in terms of the relationship between the explanatory variables and the probability of GGAP certification by a smallholder. Positive coefficients show higher

probability of the successful adoption of GGAP standard and negative coefficients indicate lower probability.

3.1 Methodology

To test the hypotheses developed above, we specify the model for the adoption of GGAP among smallholders in the following form:

$$GGAP = \alpha_0 + \beta_1 FF + \beta_2 FA + \beta_3 MM + \beta_4 CO + \beta_5 I + \beta_6 RD + \varepsilon$$

where,

GGAP , is a binary variable: GGAP certified=1, 0, otherwise

FF , are farm-farmer characteristics: age, schooling, horticulture farming experience, contract seasons and area under French beans.

FA , are farm assets: ownership of protective garments

MM , are market/marketing characteristics: type of market linkage, type of supply contract

CO , are collective organizations: producer group membership, number of groups in village, group size, number of beans farmers in village and number of sellers with shared buyer.

I , are monetary/non-monetary incentives: producer price, extension visits, credit access

RD , is the control variable for regional differences: Upper Mwea region=1, 0, otherwise

ε , is the error term capturing measurement errors, proxy variables and unobserved attributes

This dichotomous model is parameterized by including a random error term, which enables an analyst to take account of uncertainty from measurement errors, proxy variables and unobserved attributes. The error term can be assumed to follow a normal distribution, resulting in a probit model, or a logistic cumulative distribution, yielding the logit model (Maddala, 1999). The models arising are considered parsimonious and tractable in structure if it is assumed that a producer maximizes profits, has deterministic choice sets, producer characteristics are measurable and the error term has a simple structure. The estimates obtained from the model represent the probabilities of individuals selecting each alternative.

3.2 Description of data

Table 2.1 reports the descriptive statistics for the data used in the analysis of factors influencing successful adoption of GGAP standard by French beans producers in Kenya. The data comes from a random sample of smallholders collected in April-June 2006. The sample is comprised of 249 smallholder farms producing French beans in Mwea Tebere of Kirinyaga district central Kenya from the following locations: Tebere, Nyangati, Murinduko, and Mwea. Our sample has 72 certified producers in 4 groups, and 177 non certified producers (28 in 2

groups and 149 independent producers). As outlined in the conceptual model, GGAP certification is a one-time adoption innovation with no intermediate adoption.

Table 2.1: Descriptive statistics of explanatory variables by GGAP certification status

Independent Variables	GGAP,N=72		Non-GGAP,N=177		t
	Mean	S.D.	Mean	S.D.	
<i>Farmer characteristics</i>					
Farmer age (yrs)	43.29	7.02	40.86	9.62	-1.94
Schooling (yrs)	10.97	2.14	9.91	2.26	-3.41
Horticulture farming experience (yrs)	13.57	6.96	12.84	7.24	-.73
Seasons with buyer (count)	8.2	3.9	3.19	3.75	-9.42
<i>Farm characteristics</i>					
Area under beans (acres)	1.53	.77	.79	.54	-8.54
Owns grading shed (0,1)	1	0	.26	.44	-2.38
Protective garment (0,1)	.806	.396	.237	.426	-9.71
<i>Market/marketing characteristics</i>					
Written contract (0,1)	.583	.494	.203	.403	-6.53
Producer-exporter link (0,1)	.806	.396	.396	.489	-6.30
<i>Collective organizations</i>					
Group membership (0,1)	1	0	.16	.37	-19.50
Producers sharing buyer (count)	3.64	.99	3.42	1.75	-1.00
Beans farmers in the village (count)	21.13	8.12	18.88	6.55	-2.29
Groups in the village (count)	2.94	1.68	2.51	2.09	-1.55
Group size (count)	22.31	6.65	17.32	2.54	-3.82
<i>Incentives</i>					
Average producer price, 3kg/carton	71.49	17	68.68	24.1	-2.21
Extension access (0,1)	1	0	.37	.48	-10.96
Extension visits (count)	7.76	2.92	3.66	5.16	-6.33
Credit access (0,1)	1	0	.73	.44	-5.08

T-statistics are significant at between 1% and 10% level

Source: Author, computed using STATA 12.1, Mwea Tebere French beans survey, April-June 2006.

(i) Farmer characteristics

GGAP certified producers have an average of 43 years and more schooling years. These characteristics correlate with risk taking behavior because of managerial skills gained over time and education that helps in decision making. GGAP certified producers have 8 contract seasons with a buyer and only 3 seasons for non-GGAP certified ones. More seasons allow acquisition of agronomic skills, develops producer-buyer trust and easy adaptability in farming. The factors may lead to a higher probability of adopting GGAP.

(ii) Farm characteristics

GGAP certified producers have an average of 1.5 acres of land about two times those of non-GGAP producers, which is above the national average of 1.0 acre for Kenyan smallholder horticultural farms. Besides economies of scale a farm is a proxy for wealth, if used as collateral to finance farm assets, for example. All certified producers own an on-farm grading shed but only 26% for non certified producers and three times more certified producers use protective garments than non-certified ones. Use of crop buyer's spray teams, or high cost may be the cause of low use of protective garments by non-certified producers. Farm size, a grading shed and protective garments strengthens farmer capacity and promotes food quality and safety. This would most likely influence successful adoption of GGAP certification.

(iii) Market/marketing characteristics

An average of 58% of GGAP producers use written contracts twice more than the non-GGAP producers indicating that information asymmetry and volatile market conditions might be greater for non-GGAP than GGAP certified producers. Only 40% of non-GGAP producers are linked to the market by an exporter, two times less than GGAP certified producers. A written contract enhances flow and sharing of technical information on produce quality and safety and linkage by financially capable exporters opens external resources to producers and assured market access. Use of written contract and linkage by exporters will influence GGAP adoption.

(iv) Collective organizations

Social interactions increase knowledge transfer through demonstration effect and intra-competition. All certified farmers belong to a producer group and only 16% for non certified ones. A certified farmer knows an average of 21 beans producers in the village while producer groups are larger for GGAP certified producers than for non-certified ones. Large producer groups have critical mass, possible low amortized per unit certification costs, and increased negotiation power to adopt GGAP more easily while knowledge about competition from other producers in the village might motivate producers to adopt GGAP as a differentiation strategy.

(v) Incentives

Certified producers have a higher producer price than non certified producers. A higher producer price expectation can attract interest and willingness to adopt GGAP certification. All certified producers compared to 40% of non-certified producers have access to extension services and 2 times more contact visits with a service provider. Extension imparts technical know-how and strengthens human capital capacity to farm quality and safe produce such as

scouting for pests on farms (Jaffee and Henson, 2004). All certified producers have a bank account signifying a higher possibility of using smallholder-linked credit to finance farm assets. This may suggest a higher likelihood of adopting GGAP adoption for those with more contact visits and possibility of credit access.

4 EMPIRICAL RESULTS

In this section, the factors that affect the successful adoption of GGAP certification are analyzed. The estimated probit coefficients are reported in Table 2.2.

Most variables are significant at between 1% and 10% level. The model correctly predicts GGAP adoption decision for 96% of the sample. The percent of correct forecasts is calculated as the total number of predictions as a percentage of the number of observations. The link test returns an insignificant linear predicted value squared, (p-value= 0.954) at 5% level showing the model is correctly specified. The model has a significant Wald chi-square (17) of 492 at 5% level. An examination of the appropriateness of the model using Bayesian Information Criteria's goodness of fit statistics indicate that the model with the interaction of direct market link and supply contract and age in quadratic form generates a difference of 5.48 in BIC'. This provides very strong support for interaction and the quadratic form for a producer's age. Grading shed, producer group, bank account and access to extension service variables have been dropped from the model because they perfectly predict certification. Access to extension is replaced by the number of extension visits.

The marginal effects indicate that farmer and farm characteristics and collective organizations have the highest marginal influences on smallholders' successful adoption of GGAP. On the other hand, marketing characteristics have the highest marginal influence on unsuccessful adoption of GGAP. Singly, ownership of protective garment has the highest positive marginal effect of 8.7% on the successful adoption of GGAP while the number of farmers in the village has the highest marginal decrease of 1.6% in the success of GGAP adoption. Farming experience has a higher positive marginal effect of 6.8% on the success of GGAP adoption.

Table 2.2: Factors affecting successful adoption of GGAP certification

<i>Independent variables</i>	Without interactions		With interactions		Marginal Effects
	Coef.	p-value	Coef.	p-value	
<i>Farmer characteristics</i>					
Farmer age (yrs)	-.055	0.043	1.042	0.000	.039***
Age squared	-	-	-.013	0.000	-.000***
Schooling (yrs)	-.040	0.687	-.168	0.242	-.006
Farming experience (yrs)	1.195	0.002	1.812	0.002	.068***
Seasons with buyer (count)	.162	0.001	.306	0.001	.011***
<i>Farm characteristics</i>					
Area under beans (acres)	1.318	0.002	2.039	0.000	.076***
Owns protective garment (0,1)	1.683	0.011	2.330	0.009	.087***
<i>Marketing characteristics</i>					
Producer-exporter link (0,1)	-3.625	0.005	4.061	0.049	.151*
Written contract (0,1)	-1.424	0.083	5.771	0.001	.215***
Link*Contract (0,1)	-	-	-10.41	0.000	-.388***
<i>Collective organizations</i>					
Groups in the village (count)	.703	0.017	1.436	0.000	.054***
Group size (count)	.339	0.000	.518	0.000	.019***
Farmers in the village (count)	-.163	0.009	-.426	0.000	-.016***
Farmers sharing buyer (count)	.690	0.009	1.232	0.001	.046***
<i>Incentives</i>					
Average price, 3kg/carton (KE)	-.031	0.391	-.068	0.060	-.003**
Extension visits (count)	.225	0.040	.204	0.048	.008**
<i>Regional dummy</i>					
Upper Mwea region (0,1)	.172	0.730	-.050	0.940	-.002
Constant	-6.26	0.126	-34.42	0.000	
Wald chi2 (<i>df</i>)	78.99	(15)	492	(17)	
Log pseudolikelihood	-25.1		-16.8		
BIC' (<i>diff</i>)	-166.6		-172.0	(5.48)	
Correct classification	96%				
Link test		0.701		0.954	
Number of observations	249		249		

*, **, *** means significant at 90, 95 and 99% levels

On farmer characteristics, age, farming experience and contract seasons with a buyer have positive and significant effect on GGAP adoption. As hypothesized, certification shows a quadratic relationship with age. Age suggests the importance of innovativeness and willingness to take risk in food quality and safety markets. Young producers might adopt GGAP standard to differentiate themselves from mainstream producers. Experienced producers acquire learned farming skills over time, which are crucial in adoption. Although there are training modules providing information on standards, certification and location of third party certifiers (see Ashraf et al., 2009) past experience endows producers with the capacity to make risky farming decisions more reasonably than new entrants. More contract

seasons beget partnerships and trust where a producer can access information and assistance to adopt quality standards as observed in the Kenyan horticultural sector with local supermarkets (Reardon et al., 2003; Narrod et al., 2009). Buyers might also support smallholders with whom they have regular trade seasons to get certified as a source of reliable and consistent supplies. These results suggest that an innovation that increases input and output risks constrains elderly less experienced and lowly connected producers.

An acre under beans increases the likelihood of adopting GGAP standard by 7.6%. Because individual smallholders cannot seek certification, this variable needs careful interpretation. For instance, the 2006 estimates show that only 34 individual large farms and 352 producer groups had certification (Moeller, 2006). However, food quality and safety can be observed efficiently on smallholdings through family labor to GGAP certification requirements because of commitment than with hired labor in large farms (Jaffee, 2003). But as a proxy for wealth, farm size might also signify ability and willingness to innovate. Because of the ability to produce high output volumes at low per unit costs, large farm sizes are preferred as a source of outputs in short supply at certain times of the year by exporters or local supermarkets.

Our result on ownership of protective garments and GGAP's adoption is three pronged: crop hygiene for food safety, personal welfare for producer/worker health and environmental conservation. Use of protective garments reduces health hazards and ailments for instance (Okello and Swinton, 2010). Besides, assuming proper use of a calibrated sprayer, application and disposal of pesticides, environmental protection is observed (GGAP, 2010). Our data showed low levels of ownership of protective garments for non certified producers which means that the producers could be using spray teams (Graffham et al. 2007).

An already monitored short supply chain reduces likelihood of GGAP adoption by about 39%. This confirms our hypothesis that where a buyer finds product quality and safety sufficient to serve alternative less demanding markets, then certifying closely monitored producers is postponed. Quality monitoring and enforcement is common for outsourced supplies by large firms to complement own farm supplies. It is also not uncommon for big companies to use their certificate to market supplies from outside (Ouma, 2010). It has been shown elsewhere that some buyers segregate produce from smallholders for the less strict quality markets (Jaffee, 2003).

An increase in the number of producer groups, group size and the number of producers sharing a buyer by one increases the likelihood of GGAP adoption by between 2% and 5%. The result indicates that organized and commonly shared values can influence adoption of an

innovation collectively either materially and financially. Place et al., (2004) have similar conclusions about farmer groups in horticulture farming. The number of beans producers in a village is negative and significant. With concentration of producers in a village, easy producer group formation and joint search for certification is expected, which is not. The possibility is that many are independent producers serving alternative markets. This result shows how critical mass without an organized framework can hinder adoption of a competitive innovation in a dynamic marketing environment. Lack of organization and networking is considered a hindrance in the exploitation of social capital among small farmers and traders alike (Feder and Umali, 1993; Fafchamps and Minten, 2001; Bandiera and Rasul, 2006).

A higher producer price predicts less likelihood to certification. Higher prices can motivate producers but producers seem to adopt certification for other reasons. It could also mean that non certified producers serve alternative markets because of the price incentive. Extension visits are important success factors in adoption. Knowledgeable smallholders will be resilient and confident in adopting agronomic practices that emphasize value for money, personal and environmental care. This result confirms the importance of training in facilitating understanding of information on technical issues e.g., MRLs, traceability and farm audits. Training minimizes the severity of information asymmetry between upstream and downstream market participants leading to widespread diffusion of food quality and safety standards.

Generally, the model explains the role of the time period a farmer has produced for the export market on the adoption of certification more realistically compared to Asfaw et al., (2010) who found a negative relationship. A producer with more exposure on export market trends on quality and certification has more possibilities of adjusting with innovations because anticipated changes motivate accumulation of the necessary knowledge and investments.

The model shows that age has significant positive influence on successful adoption of GGAP certification but up to a certain limit. Asfaw et al., (2010) found age to be insignificant. A producer's age has a basis for risk-taking behavior. Younger producers are more likely to take risky investments by acquiring credit and seeking the required expertise by dedicating time for training either in farmer-schools or privately. The motivation is to run farming as a business rather than a part-time occupation and on the need to succeed. Full time farming influences positive adoption of traceability for instance (Souza Monteiro and Caswell, 2009).

On the role of producer groups, our results match those of Okello (2005), Asfaw et al., (2010) and Muriithi et al., (2010) who found a positive relationship with adoption of International

Food Safety and EUREPGAP standards. The model shows that non-land assets such as protective garments form some threshold investment for inclusion in the adoption of quality standards. It is noted that inadequate non-land assets may exclude smallholders from food quality and safety market chains (Reardon et al., 2009).

5 CONCLUSIONS

Global Good Agricultural Practices (GGAP, formerly EUREPGAP) has been a key private standard in Kenya's fruit and vegetables horticultural sub-sector for the last 6 years. However, relatively few studies have looked at the factors that affect its successful adoption at the farm level. This study presents an empirical analysis of successful adoption of GGAP by French beans producers.

A higher probability of successful adoption of GGAP is associated with more farming experience, contract seasons with a buyer, land under beans, ownership of protective garments, higher number of producer groups and farmers sharing a buyer in a village, large producer groups and more extension visits.

For French beans producers, capacity to invest in farm assets and to nurture more contract seasons with buyers is a driving force for successful certification. The requirement to have upfront capital expenditure on farm assets is recognized as an exclusion threat for smallholders trying to access high value chains that emphasize on adoption of quality standards (Reardon et al., 2009). However, traders have promoted adoption of quality standards among producers and firms that trade within their chains by requiring adoption for trade conformity (Karipidis et al., 2009). There is evidence in Graffham et al., (2007) and Ashraf et al., (2009) that a cost-sharing arrangement between exporters and smallholders can ease costs of adopting GGAP standard. Our result indicates that more contract seasons with an upstream market participant can enhance successful adoption of GGAP. Farm assets can be financed through smallholder based credit schemes that are available in most commercial banks⁹.

In terms of policy, reliance on organized producer groups may be a more effective way to co-opt smallholders in farm gate private quality and safety standards. Organized groups are closer to the producers compared to individual farmers, can amass trust, resources and self-monitoring mechanisms in the establishment of a common certification platform. Whether

⁹ For example, Equity Bank has an agricultural loan for the purchase of farm inputs and equipment, Cooperative Bank has *Maziwa* loan for dairy producers, Kenya Commercial Bank has *Mavuno* loan for tea producers and Family Bank has *Majani Plus* for the purchase of farm inputs and equipment. Loans are repaid from final product revenues.

smallholders' have proper leadership and management capabilities to foster cohesion and sustainability of organized producer groups needs further research.

Extension services and farming experience improve a producer's capacity in the adoption process. GGAP protocols are specific on traceability and audit of pesticides used on the farm e.g., how, when, how much of pesticides use and where to dispose. Training modules by public or private staff on product quality and safety requirements can enhance widespread compliance and adoption rates in smallholdings (Jaffee and Henson, 2004). Nationally, there are outreach programs tailored to educate producers through 'barazas'¹⁰ on pesticides use and application, certification and traceability. One would be interested, however to know how costs of buyer sanctioned private extension services are appropriated to final producer price.

On the other hand, use of short closely monitored supply chains, more beans producers in a village and a higher producer price lower the odds of successful adoption of GGAP. The low success among those in short closely monitored supply chains and independent producers means that the reach for quality assurance is significantly lower for most producers. The price incentive seems to operate more efficiently outside certification. These results might imply that alternative markets for non certified produce are very strong. This is emphasized in Jaffee (2003) and Ouma (2010). There is need therefore to investigate how smallholders choose short closely monitored supply chains because the chains seem to hinder adoption of standards and subsequent orientation into alternative markets.

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¹⁰ It is a Kiswahili term for a grass-root meeting by government operatives to pass its policies. A permit must be granted by the police department for private barazas. Pesticides Initiative Program (PIP) and Safe Use Project (SUP) use barazas to sensitize producers on emerging market issues notably pesticides use, traceability and certification.

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CHAPTER THREE

Farmgate private standards and price premium: Evidence from the GlobalGAP scheme in Kenya's French beans marketing

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ABSTRACT

The proliferation of private quality and assurance schemes in international trade is defining market access in high value chains. The prime concern for small-scale producers is whether price premiums are realizable due to compliance. Using French beans marketing, the authors find that GlobalGAP certification, produce traceability, number of suppliers, competition for supplies, direct procurement, a good road network, and supply contracts have positive farmgate price effects for smallholders. Potential policy implications are drawn.

1 INTRODUCTION: GLOBALGAP QUALITY ASSURANCE SCHEME IN KENYA

GlobalGAP (GGAP; global good agricultural practices) has received much attention in the literature on food safety and quality as a standard of choice among retailers in the European Union (EU) since its formation as detailed in Glassheim and Nagel (2006). GGAP is a business-to-business standard, which is not communicated to the consumer by labeling. GGAP, initially EurepGAP, was developed in 1997; it started in Kenya with the certification of five Kenyan farmer groups in 2005. Through the Kenyan umbrella horticultural association, Fresh Produce Exporters Association, the Kenyan good agricultural practices, KenyaGAP was benchmarked to GGAP in 2007. Currently, there are approximately 400 GGAP-certified farms in Kenya: 34 individual farms and 352 farmer groups. It is among the most widely used certification programs in the fruit and vegetables sub-sector in Kenya. Nevertheless, the program can have a negative impact on resource-poor smallholder producers. Certification requires compliance with a catalogue of standards regarding the production process. Annual farm audits aim at checking continuous compliance. In most cases, the farmer pays the costs associated with auditing and GGAP certification. GGAP has two certification options: one for single farmers (Option 1) and one for a group of farmers (Option 2). Most farmers in Kenya are certified under Option 2. The complexity and transparency of the program with its numerous control points and the necessary technical and administrative requirements are challenging in a small-scale farming situation (e.g., Food and Agriculture Organization, 1999, Hobbs, 2003). For instance, compliance requires maintenance of pesticide application protocol records, evidence of training on crop hygiene, testing of soil and irrigation water, and assessment of on-farm and off-farm crop handling facilities (GLOBALGAP, 2007). Quantitative estimates of the cost of initial compliance and certification ranges from US\$6000 to US\$8000 (Jaffee, 2003). Continuous compliance and renewal of certificates is estimated to cost US\$200 per month. Graffham, Karehu, and McGregor (2007) have shown that the costs of certification and audits for organized smallholder producers are about US\$632 and US\$154, respectively. More recently, Muriithi, Mburu, and Ngigi (2010) have indicated that input costs (fertilizers and other agro-chemicals) though not standardized, heavily weigh on initial adoption of GGAP for smallholders. To help small farmers cost sharing systems are in place where organized smallholders, the buyer or exporter, and nongovernmental organizations contribute to an arrangement to establish GGAP certification, and GGAP maintenance is shared between organized producers and exporters. The bulk of maintenance costs (86%; Graffham et al., 2007), are paid by the exporter. Although compliance and certification might result in improved on-farm processes, lower

transaction costs, or higher product quality, monetary benefits are less explicit. Some studies conclude that the most important barrier for smallholder producers is the lack of visible rewards for GGAP certification (e.g., Chia-Hui Lee (2006), Commission of European Communities (2006), Graffham et al., (2007), Minae, Casey, Poisot, Santacoloma & Termine, 2006; Thiagarajan, Busch & Frahm, 2005). Similarly, Glassheim and Nagel (2006) argue that farmers are not able to quantify the impact of being GGAP certified on their farm business. Ouma (2010) from interviews with exporters of fresh fruit and vegetables found that not a single respondent claimed to have received a price premium from retailers for GGAP-certified products.

Therefore, the aim of this study is to quantify the monetary reward for GGAP certification at the farm level. It does so by estimating a hedonic function of French beans producer prices econometrically using a panel of 249 Kenyan farmers. Our analysis contributes to the literature by providing a first quantitative assessment of the implicit price premium attached to GGAP certification. Minot and Ngigi (2004) have cited French beans as a success story in the horticultural export sector. The vegetable has higher financial gains per acre compared to traditional crops like maize. French beans have also been a fresh produce export since the mid-1980s, have wider acceptability among producers, easy agronomic practices, and a short growing period and established European markets. Local consumption has a modest standing at 6.6 % of all food items for the upper income consumers and at 11.9 % for the middle income consumers (Central Bureau of Statistics, 2000). Internationally, computed figures from European Union (EU) trade database show considerable penetration of French beans from Kenya to the EU market between 2002 and 2007 with remarkable 26.88% share by value and 12.64% share by volume, respectively (EUROSTAT, 2009). The major export destination remains the United Kingdom (UK), which receives more than 60 % of its total French beans imports from Kenya. Although Reardon and Farina (2002) argue that the EU market is a challenge for imports from developing economies due to the dominance of European continental supermarkets and supply chain standards that demand quality, certification and traceability, Jaffee (2003) states that French beans face minimal phytosanitary sanctions in the UK and Dutch markets. In addition, FAOSTAT (2009) shows that the export price per kilo of French beans increased over the years from US\$0.81 in 1990 to US\$3.21 in 2007.

In the following section, we develop a conceptual framework of producer price formation and third-party certification. In Section 3, the econometric model is presented. The methodology,

data and descriptive statistics are introduced in Section 4. In Section 5, we present the results of the econometric analysis and discuss our results and some conclusions in Section 6.

2 CONCEPTUAL FRAMEWORK

From the foregoing, compliance with third-party certification schemes might be motivated by monetary, i.e., higher and/or more stable product prices, and non-monetary attributes, e.g., reduced transaction costs, higher stability of business relationships with exporters, and strategic issues like market access. As GGAP has become the standard in EU retailing, we cannot easily assess whether a premium is paid by final consumers or not. As compliance with GGAP is not communicated to consumers but rather among intermediate channel participants, it might well be that the premium at this stage is small. Nonetheless, other advantages in the value chain (e.g., less controlling, etc.) might allow for reimbursing producers for the extra costs of complying with GGAP. In this article, we test whether producers generate a price premium for the compliance with GGAP. We borrow much from the literature on product prices, which reveals that commodity prices vary with quality characteristics (e.g., Bierlen & Grunewald, 1995; Carew, 2000; Espinosa & Goodwin, 1991; Estes, 1986; Estes & Smith, 1996; Goodwin, Fuller, Capps, & Asgill, 1988; Parker & Zilberman, 1993; Tronstad, 1993; Tronstad, Huthoefer, & Monke, 1992; Waugh, 1928). More recently, Wollni and Zeller (2007) have found that nature of production, e.g., organic, state of origin or regional differences, and participation in marketing organizations to be significant factors affecting market prices.

Following Hobbs (2003), Graffham et al. (2007) and Okello and Swinton (2007), certification costs are disincentives to the adoption of GGAP. If we use Humphrey's (2005) argument that small-scale level of production, low level of coordination and cooperation among smallholders may lead to high unit costs of compliance and certification for individual producers, then those not willing or not able to obtain certification have two options. They may opt for the local or export markets for noncertified products (Jaffee, 2003; Ouma, 2010). Alternatively, they can opt out of production (Graffham et al., 2007). Noncertified producers may have lower production costs, but then also lack a price premium compared to their certified counterparts. However, Waweru (2006) contends that the costs of certification may be absorbed more easily by way of amortization through group marketing, where smallholders pool land and financial resources. Economic theory indicates that, assuming high quality induces higher costs and buyers are willing to buy the high-quality product, to reach equilibrium, additional costs must be covered by a higher market price (Unnevehr, 2000). The

benefits that smallholder producers achieve through joint producer marketing constitute incentives. For instance, Belletti, Burgassi, Marescotti, and Scaramuzzi (2005) identify market access and premium prices. Moll and Igual (2005) mention a higher cost efficiency and Giraud-Héraud, Rouached, and Soler (2006) cite reduction of failure in product safety as some of the benefits of product differentiation through labeling. However, in the business-to-business GGAP scheme, costs may not necessarily be covered by a corresponding higher price.

Nevertheless, farm gate buyers might have an incentive to offering higher prices to GGAP certified French bean producers to mitigate quality uncertainty and honor reduced transaction costs. As described by Okello (2005), the observed farm gate producer price is derived from the export market price less transaction costs faced by a farm gate buyer. On each market day, buyers purchase beans from producers in a given shed following some criteria reflecting the market served. We assume the prices offered to be auction prices based on quality and other factors facing the buyer on the market day. Hence, smallholder producers are price takers. Consequently, assuming that small producers pursue the goal of monetary gain, the observed farm gate producer prices can be attributed to the production method used by the farmer, spatial, seasonal, quality variations, and other factors.

Conceptually, assume an exporter i is sourcing fresh produce directly at farm level to ship it to export markets in Western Europe. All exporters face the same export market price of French beans P_{ep} . However, transaction costs might vary across exporters TC_i . Therefore, the observed farm gate prices differ due to the exporter's characteristics: $P_{fi} = P_{ep} - TC_i$. This equation implies that an exporter facing increasing transaction costs will offer a lower price P_{fi} to the farmer. Introducing third-party certification like GGAP might cause two different effects. On the one hand, depending on the demand from export markets, exporters might be forced to look for certified producers. In such a case, the exporter needs to offer higher prices to secure supply. Similarly, exports of certified products might result in savings on transaction costs, which the exporter might channel through to producers. On the other hand, exporter-sponsored training and monitoring of GGAP may lead to the problem of hold-up and subsequently offers exporters the possibility to exercise market power. However, as long as a market for noncertified produce exists, such behavior appears to be less realistic.

Following the conceptual framework, farm gate buyers procuring from certified producers may face lower information, monitoring and enforcement costs compared to procuring from noncertified producers. Further, a buyer is assured to get produce of a certain high and safe

quality. Thus, if lower transaction costs and high product quality generate market efficiencies, then farm gate buyers may offer higher farm gate prices. We hypothesize that certified farmers impose lower information and transaction costs on buyers and presumably supply higher quality produce. Such producers will be offered higher French bean prices than noncertified producers.

Beside transaction costs, a buyers' price offer might vary due to characteristics of the export destination and additional services. For instance, retailers' interest on product variety might result in varying buying behavior and varying prices at the export market level (Jaffee, 2003). Furthermore, buyers seek minimal production and distributional risks, and therefore, may have an incentive to offer producers with a functioning traceability system, higher prices (Brousseau & Codron, 1998; Golan et al., 2004; Reardon & Farina, 2002;).

The role of intermediaries in horticultural procurement in Kenya has received much attention (see Graffham et al., 2007; Jaffee, 2003). Intermediaries are argued to have local expertise with lower produce assembling costs compared to exporting firms. However, intermediaries generally add transaction costs to the farm gate price. Therefore, export firms may prefer direct procurement of French beans from smallholder producers to control quality, produce identification and segregation. Traders that choose intermediaries over direct procurement may be small investment firms seeking to minimize transaction costs. Firms procuring directly from smallholder producers could be large; frequently, large horticultural farms involved directly in exporting source additional quantities from small farmers to fill gaps. If quality and safety benefits motivate a buyer to source directly, such a firm could be in a position to trade-off arising transaction costs for product quality. To sum up, it is hypothesized that shorter supply chains with direct procurement offer higher French bean prices to producers than intermediaries.

On the buyer's side, Graffham et al. (2007) note that organized production reduces logistic, monitoring, and enforcement costs arising from sparse distribution of farms in a rural set up. Additionally, organized producers have some sort of bargaining power. It is thus hypothesized that organized producers will receive higher French bean prices.

The farm gate price for French beans will be influenced by site and time specificities. Martinez and Poole (2004) have identified the perishable nature of fresh vegetables as key to quasi-rents by buyers. For example, French beans are harvested early in the morning, and collected between 10 a.m. and noon every day. This time specificity may expose farmers to post-harvest crop handling opportunism on the part of buyers through delayed French beans

collection during the market day. Assuming smallholder producers are rational suppliers, it is expected that farmers would seek to sell their harvested crop as soon as possible to avoid product deterioration from strong heat. Furthermore, the quality of collected beans will vary with each harvesting day as the season progresses since beans will lose vigor and turgidity as the number of harvestings increase. French bean quality will also be affected by on- and off-farm crop handling activities such as grading and transportation through bruising and breakages. Another potential influence on observed price would be the emerging supply of beans from Southern Europe during the June-October season. Changing market conditions will affect prevailing buyer practices such as whether the purchasing behavior is consistent or intermittent and whether the buyer-producer exchange relationship is strongly or weakly enforceable. Therefore, the arising buyer opportunism, quality and market information asymmetries, adopted marketing practices, and on-season for European suppliers may generate varying prices over the season.

Jaffee (2003) indicates that sparse location of small farms and poor roads require logistic investments such as pre-cooling facilities, packing houses, vehicles, and basic collection stations to reduce on- and off-farm crop losses. Omamo (1998) finds that the presence of road or marketing infrastructure, e.g., producer groups and central collection points, etc., increases the efficiency of both marketing and production through reduction of transaction costs and ensures more competitive pricing conditions in marketing. Thus, good quality roads may decrease trader's transportation costs, and subsequently the cost per unit of commodity traded. Economically, growing regions subject to good quality roads are thus hypothesized to have lower logistic and post-harvest crop handling costs, and hence are characterized by higher French bean producer prices. Previous studies show that producer groups with 15 to 20 homogeneous producers within a radius of 1.5 km are subject to reduced costs of assembling produce (Natural Resources Institute, 2002; Nyaga, 2007). However, whether such cost reduction translates into higher producer prices is an empirical question.

3 SPECIFICATION OF THE ECONOMETRIC MODEL

In order to test the existence of GGAP price premium at producer level, the following model is estimated:

$$P_{fik} = \alpha_0 + \omega C_k + \gamma X_k + \varepsilon \tag{1}$$

where P_{fik} is the farm-level price paid to producer k by exporter i . C is a dummy variable representing GGAP certification, and X is a vector of spatial, seasonal, marketing and quality factors that may influence producer prices. The estimated coefficient ω represents the price

premium of certification. Due to the time-series cross-sectional nature of the dataset, a fixed-effects or a random-effects estimator can be used. However, the time-invariant nature of almost all explanatory variables forces us to stick to the random-effects model. That is, the error term ε is assumed to be randomly distributed over producers and uncorrelated with the explanatory variables. But when time-series cross-sectional data have a short time series and large panel, heteroskedasticity and autocorrelation of the error terms ε related to a specific panel or producer, k arise. Our data have 6 observations for each of the 249 producers. Consequently, a feasible generalized least squares model, which takes account of short time series and allows estimation in the presence of autocorrelation across panels, is preferred. Because we assume the existence of a GGAP price premium independent of the French beans' grade, the dependent variable, P_{fik} , represents the average of extra fine and fine grades. Equation (1) has been estimated using a semi-log linear approach for simplicity purposes. This allows us to interpret estimated coefficients as percentage changes. Further, considering that certification premium may not be constant given changing availability of beans in competing production regions of Southern European, GGAP is interacted with the time variable to capture the variation of certification premiums over the season. Additionally, producers in certain administrative locations may be favored by locality differences such as good road networks. Thus, location and type of road are interacted in the final model to generate a coefficient of quality road networks.

4 DATA AND DESCRIPTIVE STATISTICS

Data on producer prices have been selected from 249 Kenyan French bean producers surveyed from 24 villages of Mwea Tebere, Kirinyaga District in 2006. The identification and selection of respondents started in April 2006 through village administrators (headmen) and six trained enumerators. During this period, farmers had already planted French beans and anticipated harvesting in June 2006. Due to unequal distribution of villages within the administrative location, the study area was divided into four sub-regions: Tebere, Nyangati and Murinduko in upper Mwea, and Mwea in lower Mwea based on their demarcation along Rivers Nyamindi, Murubara, Project Murubara, and the Mwea Canal. Villages were listed and a random sample of six villages selected per region. Producers were then selected conditional on the existence of French bean crop due for harvesting in June. Villages had between 1 and 37 smallholders, 100 organized in producer groups, and 149 independent farmers. In May 2006, all producers were interviewed on socio-economic, production and marketing aspects using a short questionnaire. Specific data included producer identity, farm area under beans,

social networks, GGAP certification, supply contracts, and nature of road networks. Collection of price data¹¹ involved farm visits and interviews during harvesting, sorting, and grading. This procedure allowed for the observation of post-farm crop handling practices such as sorting, washing, grading, and packaging etc., as well as the identification of exchange transactions like receipting, trace-back elements, type of buyers, and connections, etc. French beans yield two grades: extra and fine- differentiable through size. Extra is the smallest. French beans are harvested over a period of 3-4 weeks. Therefore, over a 3-week period prices were collected for each grade on 2 days per week, Monday and Wednesday.

Table 3.1 shows price-related descriptive statistics based on the factors hypothesized to influence farm gate producer prices. The prices are stated in Kenya shillings (KE) per 3 kg, which is the standard farm gate packaging weight. The first two columns show the variables and their definitions. Column 3 presents the number of producers for which the respective variable is equal to one and their share on the total sample.

Twenty-nine percent of all producers are GGAP certified. Forty percent of the smallholders are organized into six producer groups with an average size of 17 producers. All but two groups are GGAP certified. Furthermore, the data shows that the number of producers in a village varies from 1 to 37. Obviously, larger villages might be potential hubs of marketing activities for buyers. Additionally, on average nine buyers compete for French beans supplies in a given village. Our data has one buyer that sources exclusively from 61 of the organized producers. Fifty one percent of the smallholders are directly linked to exporters and 22 % of the smallholders use a full trace-back system carrying farmer's name, plot, and group name and produce collection date. The data show that 69 % of producers sold beans to the same buyer all season.

Verbal and informal arrangements dominate marketing exchanges as only 31 % indicate they have a written, supply contract. Thirty-four percent of the producers farm in upper Mwea, with most located in the lower region with better access to irrigation. Only 13 % of farmers have access to graveled or tarmac roads. Although producers sell both French bean grades, 94 % report to aim for extra fine grade.

¹¹ Mwea has had running research projects which makes it easier to get trained research data collectors. However, it makes it difficult to obtain information from farmers who complain of too many questionnaires from the numerous projects. Thus, in order to elicit price information during harvesting and subsequent follow up for un-clarified non-price related data, each respondent was given a mobile phone card worth 2.5€.

Table 3.1: Descriptive statistics for the model variables with unconditional and conditional distribution of French beans prices (N=249)

Variable	Defined as	Obs.	%	Mean	S. D.	Min	Max
<i>Price</i>	Price/ 3kg carton	249	-	69.50	22.28	20	200
<i>Ln(Price)</i>	Log of price	249	-	4.18	.35	2.99	5.29
<i>Week_1_M</i>	Monday 1st week	249	-	93.24	15.89	30	200
<i>Week_1_W</i>	Wednesday 1st week	249	-	79.59	13.40	30	150
<i>Week_2_M</i>	Monday 2nd week	249	-	71.11	14.32	25	135
<i>Week_2_W</i>	Wednesday 2nd week	249	-	62.38	18.27	20	135
<i>Week_3_M</i>	Monday 3rd week	249	-	57.72	19.49	20	135
<i>Week_3_W</i>	Wednesday 3rd week	249	-	52.93	22.39	20	135
<i>NoGap</i>	Non certified producers	177	71.1	68.68	24.06	20	200
<i>Gap</i>	Certified group producers	72	28.9	71.49	17.00	25	100
<i>Independent</i>	Independent producers	149	59.8	67.62	25.36	20	200
<i>Group</i>	Organized producer groups	100	40.2	72.29	16.29	25	100
<i>Sellers</i>	No. of producers in a village	249	-	9.10	6.08	1	37
<i>Ln(Sellers)</i>	Log of no. of producers	249	-	1.86	0.97	0	3.61
<i>Buyers</i>	No. of buyers in a village	249	-	8.94	2.59	2	12
<i>Ln(Buyers)</i>	Log of no. of buyers	249	-	2.13	.38	.69	2.48
<i>Intermed</i>	Intermediaries in marketing	121	48.6	62.65	23.43	20	200
<i>Export</i>	Exporter used in marketing	128	51.4	75.97	19.00	25	135
<i>PartialTrace</i>	Partial trace-back system	194	77.9	68.79	23.35	20	200
<i>FullTrace</i>	Full trace-back system	55	22.1	71.99	17.81	25	100
<i>SwitchBuyer</i>	Several buyers/ season	76	30.5	61.52	23.85	20	150
<i>OneBuyer</i>	One buyer/season	173	69.5	73	20.61	20	200
<i>NoContract</i>	No supply contract used	171	68.7	66.33	23.77	20	175
<i>Contract</i>	Supply contract used	78	31.3	76.44	16.63	40	200
<i>LowerMwea</i>	Farm located in Lower Mwea	164	65.9	68.44	22.19	20	200
<i>UpperMwea</i>	Farm located in Upper Mwea	85	34.1	71.53	22.33	20	150
<i>EarthRoad</i>	Access road earth surfaced	216	86.7	70.48	21.38	20	135
<i>AllRoad</i>	Access road all weather	33	13.3	63.08	26.64	30	200
<i>Fine</i>	Fine grade target harvested	14	5.6	66.38	22.39	15	200
<i>ExtraFine</i>	Extra fine grade target harvested	235	94.4	72.61	23.28	20	200

Source: Own calculations based on survey data using STATA version 9.0. French beans price survey, Mwea Tebere April-June 2006.

Turning to the dependent variable, our data show wide between-producer price differences with a minimum of KE 20 and a maximum of KE 200 per 3kg. These prices are similar to those reported in earlier studies (Graffham et al., 2007). However, the mean declines continuously over the six times of sampling from a high of KE 93 to a low of KE 53. We found that buyers adopt differing price regimes between producers, within and between

marketing days. GGAP-certified producers receive on average higher prices and face a smaller variation compared to noncertified producers.

5 RESULTS OF THE ECONOMETRIC ANALYSIS

The estimated coefficients are presented in Table 3.2. Multiplying the coefficients by 100 gives the percentage change in the price of a 3 kg carton of French beans as a result of a change in the explanatory variable. Coefficients attached to log number of buyers and producers can be interpreted as elasticities. The signs on most of the variables in the model are as expected a priori. The variables are jointly statistically significant.

Table 3.2: Determinants of French Beans' Price

Variable	Without interaction effects			With interaction effects		
	Coeff	SE	z	Coeff	SE	z
Gap	0.095**	0.025	3.88	-0.042	0.027	-1.55
Week_1_W	-0.167**	0.009	-19.44	-0.211**	0.010	-20.40
Week_2_M	-0.306**	0.011	-29.26	-0.363**	0.012	-29.88
Week_2_W	-0.480**	0.011	-42.73	-0.562**	0.013	-44.21
Week_3_M	-0.596**	0.012	-51.39	-0.664**	0.013	-51.25
Week_3_W	-0.716**	0.012	-59.77	-0.773**	0.013	-57.78
Gap*Week_1_W				0.122**	0.018	6.85
Gap*Week_2_M				0.172**	0.022	7.81
Gap*Week_2_W				0.249**	0.024	10.44
Gap*Week_3_M				0.243**	0.025	9.78
Gap*Week_3_W				0.233**	0.026	9.05
Group	-0.308**	0.043	-7.24	-0.300**	0.041	-7.33
Ln(Sellers)	0.054**	0.008	7.12	0.062**	0.008	7.60
Ln(Buyers)	0.033 ⁺	0.018	1.87	0.033*	0.016	2.05
Export	0.146**	0.021	6.92	0.124**	0.020	6.36
FullTrace	0.060*	0.024	2.46	0.046*	0.022	2.10
OneBuyer	0.076**	0.015	4.97	0.083**	0.015	5.56
Contract	0.283**	0.029	9.94	0.293**	0.027	10.70
UpperMwea	0.039*	0.018	2.16	0.045*	0.019	2.32
AllRoad	-0.047*	0.020	-2.38	-0.069**	0.021	-3.35
UpperMwea*AllRoad				0.122**	0.033	3.70
ExtraFine	-0.001	0.019	-0.07	-0.001	0.018	-0.08
Constant	4.251**	0.047	90.83	4.282**	0.045	94.72
Log-likelihood		881.96			934.71	
Wald χ^2 (df)	4275.5**	(16)		5038.08**	(22)	

+ significant at 10%; * significant at 5%; ** significant at 1%

Results of the first specification in column 1 of Table 3.2 indicate that certified producers receive a 9.4 % higher price than noncertified producers. However, the second specification clearly indicates that this estimate is not robust to the inclusion of interaction effects. Controlling for seasonal effects shows that certified producers experience a lower reduction of prices over the season. The econometric analysis suggests that certified producers receive between 12 % and 25 % more per 3kg carton compared to noncertified producers. That is, the trend of declining prices over the season is less steep for certified producers. In an earlier study Asfaw, Mithöfer, and Waibel (2007) find that GGAP-certified producers have a KE 5,271 higher net income compared to nonadopters. Further, Graffham et al. (2007) find some certified producers to have received an extra KE 5 per kg. These results indicate that farm gate buyers are providing incentives for smallholders to improve quality and safety of produce through compliance with export market's product quality schemes. The result contradicts the finding in previous literature that a price premium for farmers is non-visible in farm gate certification schemes (e.g., Chia-Hui Lee, 2006; Commission of European Communities, 2006; Minae et al., 2006; Thiagarajan et al., 2005).

The time dummy variables (*Week_**) indicate distinct price patterns. Prices decrease continuously from the first to the third week. Thus, prices are time-dependent and variation in time is significant. Martinez and Poole (2004) found temporal specificity to be critical in fresh produce markets. When the new harvest starts, producers receive the highest premium. The variation in prices may be explained by quality differences arising from physical attributes. There is also the possibility that exporters are adopting tactical buying behavior during the season. This could either be by purposely setting producer prices high to attract supplies from smallholders selling to competitors or by exploiting the perishable nature of French beans through delaying acceptance to appropriate lower prices because producers would want to avoid economic losses from wasted beans. Finally, the decline of prices over time may also reflect possible fluctuations in foreign exchange rates because export market prices are quoted in foreign currency.

Surprisingly, organized producers (*Group*) experience lower prices compared to independent producers. Across both specifications the estimated coefficients suggest approximately 30 % lower prices. There might be two explanations. First, organized producers probably receive inputs and technical assistance from buyers.. Second, "low quality" farmers might self-select into collective marketing. Obviously, buyers appropriate the attendant costs (i.e., inputs, technical, assistance, and low quality) to the product price with a consequent reduction in the expected final price. For instance, according to Graffham et al. (2007) producers pay KE 3

per kg to offset group costs and investments. In some cases, a management committee overseeing group production and marketing may also charge each producer a small fee to cover administrative and organizational costs (Narro et al., 2009), which may be subsumed in the groups' costs-although whether buyers cooperate to deduct the costs from output prices is unclear. Combining the two results for certification and organized production suggests that organized producers face a higher incentive to comply with GGAP in order to compensate for a negative price premium of organized production. This finding implies that independent producers, the reference group, might serve different markets or use established long-term personal relations with buyers. Furthermore, since 61 % of all organized producers sold to one buyer, the coefficient could reflect oligopsonistic market power use by the respective buyer..

French beans prices respond positively to the size of the market. Looking at the supply side, prices are predicted to be higher in villages with a larger number of suppliers ($\text{Ln}(\text{Sellers})$). The prices tend to increase by 6.2 % for a percentage change in the number of producers in a village. A higher number of producers in a given area might benefit buyers with lower costs of produce assembling and transportation. Similarly, on the demand side, buyers' competition for French beans is predicted to result in a positive effect on farm gate prices. A percentage increase in the number of buyers ($\text{Ln}(\text{Buyers})$) leads to a 3.3 % higher price. This means that many buyers may yield fair and competitive gains to smallholder producers. Our results underline the relevance of competition on markets (Pirrong, 1993). However, the two estimates should not be compared directly as they might measure two separate issues. Whereas the size of the population of producers here might rather indicate local spots of specialization and scale externalities, the number of buyers relates to competitive behavior on the market.

Selling directly to an exporter (*Exporter*) has a positive effect on prices. Producers that deal directly with exporters gain between 12.4 % and 14.6 % per 3 kg carton of French beans. This result shows that by surpassing intermediaries, producers could reap a considerable premium. It seems economically reasonable for buyers to reward exchange relationships devoid of numerous postfarm crop-handling practices. Quantitatively, direct procurement shows the second largest positive coefficient after use of a supply contract.

A fully implemented trace-back system (*FullTrace*) endows small producers a premium of approximately 5-6 %. Identifiable farm produce (i.e., producer, farm plot, and production system and collection date) is rewarded by buyers. A trace-back system improves the certainty and assurance of buyers on product quality and safety from numerous smallholder

producers and offers an opportunity to enforce sanctions following noncompliance. Producers' willingness to be traced is enough evidence that "due diligence" has been exercised during crop production and postharvest crop handling. Golan et al. (2004) argue that trace-back systems also reduce attendant risks in the market chain such as loss of reputation for low quality deliveries, costs of produce rejection on grounds of detected pesticide residues, possible liability costs, and yield distribution efficiencies. Our finding indicates that reduction in distribution costs has the potential to improve product value and market access for marginalized smallholder producers. This is especially critical in markets for quality and safety.

Furthermore, the results show that producers selling to one buyer over the whole season (*OneBuyer*) receive a higher price compared to producers selling to different buyers. The estimated coefficient suggests 8 % higher prices. Delayed collection or lacking produce collection arrangements might force producers to sell their perishable product at lower prices in order to avoid or limit loss through dehydration. The finding could suffer from the possibility that producers receiving lower prices change buyers within one season. Unfortunately, the underlying reasons remain unknown. .

In addition, use of a supply contract (*Contract*) generates 29 % higher French beans prices. Quantitatively, this estimate is the single largest positive coefficient. . As expected, this result indicates that solidifying exchange relationships through prearranged contracts enhances marketing efficiencies. A supply contract that may entail controlled input use and prearranged produce collection render accrued benefits to the buyer such as guaranteed supply consistency and reliability (Jaffee, 2003). On their part, producers benefit from the knowledge of product quality and safety management and access to inputs at preferential terms. The resulting long term mutual and trustworthy trading relationship increases coordination and exchange efficiencies. Our results suggest that a balance of produce consistency and reliability as well as coordination and exchange efficiencies have a positive price effect for producers. Consequently, close production and marketing arrangements between buyers and suppliers seem essential in minimizing marginalization of smallholder producers in their bid to access strict quality markets.

Surprisingly, the estimated coefficient attached to better roads (*AllRoad*) has a negative sign. However, the interaction effect with location points to a positive impact on prices for producers in Upper Mwea (*UpperMwea*AllRoad*). Producers in Upper Mwea whose farms are accessible through all weather roads (*UpperMwea*AllRoad*) get 12.2 % higher prices,

offsetting the negative effect of the all-weather road dummy. . One possible explanation of the negative effect of better roads could be the attraction of added costs of marketing bureaucracies like horticultural fees which are collected at designated roadblocks. Such transaction costs deter buyers from using such routes and may cause low realization of the benefits of accessibility thus exacerbating marketing inefficiencies.

6 DISCUSSION AND CONCLUSIONS

The proliferation of private quality and assurance schemes in international trade is increasingly determining market access in high value chains. Beside market access, the prime concern for producers is whether price premiums are realized due to compliance. This is more important, especially, for smallholders in developing economies where farm gate private standards might impose relatively higher risks due to financial, investment, and organizational pressure. GlobalGAP is a key standard in Kenyan horticulture farming and its implementation could have potential market access implications for the numerous smallholders involved in export marketing.

Using data from a survey of 249 Kenyan French beans producers we present an econometric model to test the existence of a GlobalGAP price premium in observed farm gate producer prices. We find that GlobalGAP certification, the use of supply contracts, direct procurement by exporters, and the size of markets in a village has a positive effect on producer prices. Organized producers receive significantly lower prices. However, the GlobalGAP premium is not very large and less important than supply contracts and direct procurement. Of particular importance is that GlobalGAP premiums are not constant over one season. The fact that no independent producers in our sample have been certified, might indicate the existence of alternative marketing channels without requiring investments in a demanding certification process. Therefore, further research should center on the question of how a farm governance structure, independent or organized production, affects the willingness to apply for GGAP certification.

More buyers in a given village are found to increase prices paid to producers. The converse, which is a decline in the number of buyers in certain regions, may be of great concern for local regulators because it may expose smallholder producers to opportunistic buying behavior. For instance, buyers could exploit time specificity and the perishable nature of French beans to delay collection, collude, or falsify grading, and later derive quasi-rents by offering low prices. Anecdotal evidence shows that small exporters sporadically offer high prices to attract produce, and subsequently exploit the log-in effect. Opportunistic practices

(i.e., diverting contracted produce to competitors, collusion, delayed collection, and falsifying grades etc.) have received attention in the works of Kariuki (2003) and CARE-Kenya (2003). Thus, local authorities should be trained to develop appropriate capabilities to survey the functioning of markets. Indirectly, antitrust policy on local farmers markets can be a contribution to agricultural development.

Better roads are not found to lead to higher prices in the econometric analysis. One possible conclusion is that bureaucratic practices on roads such as horticultural fees and corrupt charges in police guarded roadblocks prevent the realization of efficiency gains. Whether this is the case cannot be finally answered with the dataset at hand. Therefore, the link between institutional quality and the realization of expected efficiency gains due to infrastructure improvements requires future research.

Finally, marketing practices such as a direct linkage to exporters, use of a supply contract, and non-switching selling to one buyer could increase producer's revenues. Informing producers of these findings is a relevant step to realize an impact of this analysis.

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CHAPTER FOUR

Empirical analysis of factors influencing choice of contractual form and frequency of contract renewal in the horticultural sector of developing economies: Kenya's experience

ABSTRACT

Information asymmetry may intensify food quality and safety risks and increase the costs of producing and marketing products from smallholders in developing countries. One economic strategy is to use contracts to mitigate farm gate risks. This study uses data from Kenyan French beans producers to determine the choice of written contracts and the frequency of renewal. The results show that larger groups, post primary education, a higher number of extension visits and number of contract seasons with a buyer increase the likelihood of using written contracts. On their part, oral contracts are likely with higher producer prices and a higher number of producers in the village. The results indicate that if markets seek premium quality and stability written contracts are preferable but in markets that are very competitive and with high transaction costs oral contracts dominate. The frequency of contract renewal increases with prices if given during planting, spot-cash payments, farm distance from irrigation water source, sales receipting and traceability, market linkage by an export firm and large farm sizes but decreases with a higher number of buyers in the village. The results suggest that price incentives, transaction costs, reputation and image considerations shape farm level contract renewals in fresh produce markets.

Key words: Contract forms; Contract choice; Smallholders; Developing countries; Kenya

1. Introduction: motivation for vertical integration and contracting

The demand for food quality and safety by food retailers in the European Union (EU) and United States (US) export markets for fruit and vegetables have potential negative implications for smallholders in developing countries. Because of financial and expertise constraints, smallholders cannot invest in the required food quality and safety infrastructure, or comply with Maximum Residue Limits (MRLs), traceability and certification (Eom, 1992; World Health Organization, 1998; Food and Agriculture Organization, 1999; Lee and Hathaway, 1999; González and Nigh, 2005). Besides increasing potential health risk in the supply chain this inability reduces smallholders' competitiveness in international trade. Strategies to mitigate food quality and safety failure include complete vertical coordination where food retailers shift responsibility to suppliers in relational contracts (Kilmer et al. 2001; Dolan and Humphrey, 2004; Jaffee and Masakure, 2005). At the farm level, buyers use contracts in form of modified extension with strict control and monitoring of critical inputs or more loosely defined oral agreements. The choice of either contract may have implications for smallholders. In a closely monitored contract, smallholders get inputs, technical advice on pesticides use, pest scouting and timely produce collection (Henson and Jaffee, 2008). This minimizes producers' input constraints and product quality and safety risks, and improves market certainty. However, producers have limited production decisions which are vested in the firm. Oral contracts shift most production risks to the producer with a promise for output purchases during the harvest. This exposes producers to input and market uncertainties but with the freedom of making production and marketing decisions. The sustainability of export marketing largely depends on farm level relationships between producers and exporters. The frequency of contract renewals defines whether logical production planning and the management of farms as business units can be guaranteed. Frequent contract renewals allow producers to plan future production plans by acquiring inputs, investing in farm assets and putting more land into production. This can potentially reduce input costs if producers purchase in bulk for current and future production cycles, increase market access and stabilise farm incomes. The frequency might however subject producers to prices below competition. Conversely less frequent contract renewals force producers to switch enterprises or drop out of production due to the inherent market uncertainty. This implies production and marketing decisions are unstable. Nevertheless, less frequent contract renewals could suit short run profit seekers with tactical entry and exit in the market. With the entry of quality and safety concerns in the food chain, closely monitored and frequent contract renewals present an

opportunity for smallholders to comply while oral contracts and less frequent contract renewals in business might hinder such a move.

Horticultural contracts have been used since the late 1990s and continue to play a key role in production and export marketing in Kenya (Jaffee and Little, 1994; Okello and Swinton, 2007). International bilateral contracts between importers and exporters in UK fresh markets and their impact in developing countries suppliers have received a bigger share of studies (Barret et al., 1999; Dolan and Humphrey, 2004; Henson and Jaffee, 2008). An attempt on farm level contracts has been made in Obare and Kariuki, (2003), Neven and Reardon, (2004), Okello, (2005) and Masakure and Henson, (2005). Yet, there still exist not enough comprehensive empirical studies to explain determinants of horticultural contracts and their persistence in Kenya's smallholder horticulture. This paper focuses on the option of contracting, more specifically, the analysis of a farmer's choice to use contracts and which form between written or oral. Further, it analyzes the frequency of contract renewal. The econometric analysis uses extensive survey data from Kenyan French beans producers. We show that written contracts are more likely with large group size, more extension services and contract seasons with a buyer. Oral contracts are more likely with more number of producers in a village and higher producer prices. Contract renewal increases with price knowledge at planting and spot cash payments, farm distance to irrigation water source, sales receipting and traceability, market linkage by an export firm and large farm size but decrease with the number of competing buyers in a village. We find that written contracts are preferable for quality and stability goals and oral contracts for very competitive market regions and with high transaction costs. Further, price incentives, transaction costs, reputation and image considerations determine renewal of contracts in farm level fresh produce markets. It is concluded that contracts are transitional strategies to access high value chains and alternative markets.

The rest of the paper is restructured as follows. Background information on horticultural contracting in developing countries with a special case for Kenya is presented under subsection 1.1. Section 2 discusses the conceptual framework on choice of written contracts and frequency of contract renewal in French beans marketing. The empirical specification and the methodology are discussed in Section 3 and in Section 4 the data set is presented. Empirical results are reported in Section 5 followed by Conclusions in Section 6.

1.1.Horticultural contracting in developing countries: Kenya's experience

Kenya's horticulture is driven by smallholders, large scale and company farms (Jaffee and Little, 1994). Company farms are the exporters, have farms of different sizes, export to different countries and to different importers in the wider EU. Despite production on own farms, company farms source open field crops from smallholders and large scale producers to fill up gaps, or to serve less discerning quality markets and to maintain product shelves in Western food retailers (Jaffee, 2003; Dolan and Humphrey, 2004). Directly, relationships between exporters and smallholders are governed by closely controlled and monitored contracts with independent producers, an outgrower scheme or producer marketing organization (Horticultural Crops Development Authority, 1995). The contracts specify crop variety, provide farm inputs e.g., pesticides and fund post-harvest assets like charcoal cooled refrigerators (McCulloch and Ota, 2002). Within the controlled model, buyers or donor programs support certification of producers (Graffham et al., 2007; Ashraf et al., 2009). Exporters may also use intermediaries to initiate informal contracts with smallholders through a local broker. As in most developing countries, contracts with intermediaries are oral, dependent on social networks e.g., friendship, neighbourhood etc., and are more spot-market oriented (Fuentes, 1998; Gabre-Madhin, 2001; Kariuki et al., 2006). The problems associated with dual-contractual arrangements are evident. Crop homogeneity creates marketing frictions between closely monitored producers and firms because of smallholders' breach of contracts through side-selling contracted produce to competitors (Ouma, 2010). Additionally, smallholders' contracts have high monitoring and oversight costs due to the numbers and expanse distribution in growing regions (McCulloch and Ota, 2002).

The role of contracts in agriculture cannot be overemphasized. They are used for procuring agricultural supplies, cushioning partners against price and market risks, correcting input market failure, income generation, (Roy, 1972; Glover, 1984), supply chain governance and strategy for product quality and safety (Brousseau and Codron, 1998; Hueth et al., 1999; Singh, 2002). The use of contracts is determined by farmer characteristics (e.g., age, schooling, experience etc), agribusiness firms' resources, access to and size of land, investment capacity, price uncertainty, the length of the period of contract, the number of potential contract producers in a region, nearness to road infrastructure, and membership in organized marketing groups (Glover, 1984; Jaffe and Little, 1994; Bercovitz, 1999; Eaton and Shepherd, 2001; Sykuta and Parcell, 2002; Martinez and Poole, 2004; Neven and Reardon, 2004; Fraser, 2005; Okello, 2005). This suggests that contracts can be used to minimize production risks and maximize buyers' quality expectations. Further, it means that there are

transaction costs and risk-sharing incentives subsumed in the producer and the buyer that can explain the observed contract choices. In the marketing of fresh fruit and vegetables in the EU retailing sector, producers may choose contracts in response to pressure to supply quality and safe produce. For buyers, they would offer contracts as a form of risk management in the flow of reliable, consistent, quality and safe supplies with incentive tags to motivate performance.

2. CONCEPTUAL FRAMEWORK

The conceptual framework looks at the choice to use contracts and the frequency of renewal. Information asymmetry on quality and safety yields uncertainty and opportunism in the supply chain necessitating design of contracts that minimize risk-aversion and transaction costs. What determines use of contracts in French beans marketing? What determines the frequency of contract renewals?

2.1 A model of contract choice in French beans farming

Resource-poor smallholders are constrained by market changes that affect their incomes by erecting market barriers, for instance traceability. Exporters face product supply, consistency, reliability and quality risks from outputs outsourced from smallholders, which would lead to loss of business profits, markets and reputation. To simultaneously overcome market access barriers and outsourcing risks producers and buyers might use contracts. The basis for a mutual contract is information asymmetry on product quality and safety, which subjects quality assessment to prohibitive costs (Akerlof, 1970). For instance, exporters have more technical knowledge about French beans quality and safety standards in the export market than smallholders. They could source from spot markets but these may not convey exporters' quality preferences very efficiently because of the varied dimensions of quality e.g., size, color, texture, smell, timing etc. (Caswell and Mojdzuszka, 1996). In such a case, a contract would be favorable. Williamson (1979) argues that if the speed of information transfer is slow between trading partners e.g., conception in the export market and implementation at the farm level, it exposes them to uncertainty and opportunism. Unpredictable changes in producer prices and strategic behavior by exporters regarding distortions of market information e.g., grade preference etc, expose French beans producers to opportunism if buyers seek rents. However, long term relationships based on reputation can reduce opportunism and lead to efficient resource allocation (Williamson, 1979). Contracts will be preferred due to management of relation specific investments, which lose productive value when redeployed (Masten, 1996). Smallholders and exporters invest in relationships that force the establishment of infrastructure such as vehicles, packing houses and spray teams, water

pumps, grading sheds, toilets, pesticide stores and calibrated knapsacks. Under a contract, the relationship creates bilateral dependence where each party can safeguard its investments by mutually agreeing to honor future contracts (Williamson, 2000). Contracts are also viewed as some form of market inter-linkage overcoming capital market failure where the contracted crop acts as collateral (Masakure and Henson, 2005). Due to thin markets for credit provision, a contract can be used to supply crop-linked credit finance at the same time linking producers to the market, for instance.

Information asymmetry on quality and safe produce, the need to safeguard specific assets and correct market idiosyncrasies in horticulture farming might therefore generate interest in contracts. The aim would be to minimize adverse selection and moral hazard problems in the supply of quality and safe produce in export markets in a compatible risk-sharing arrangement and at low transaction costs for the trading partners. Adverse selection means that an exporter cannot ascertain if a producer can accurately supply quality and safe beans which results to search for producers with ability to supply specified requirements. Moral hazard arises if an exporter cannot be sure if a producer has put forth maximal effort to deliver the desired requirements. To mitigate adverse selection and moral hazard problems e.g., cheating on quality and market disinformation, supervision or auditing of activities, control of critical inputs involved in production, provision of explicit or quality measurement based incentives and provision of residual claims might be employed (Fama and Jensen, 1983; Hueth et al., 1999; Giraud et al., 2006) .

Roy (1972) argues that contracts can be written or oral, explicit or implicit and because of unequal bargaining power between partners, contracts may be efficient or exploitative. Contracts have been analyzed using principal-agent and transaction cost frameworks assuming that contracts exist as a risk-sharing option but more to minimize transaction costs (Allen and Lueck, 1993, 1999). In product quality and safety markets, buyers have more knowledge about the market. A buyer, referred to as the principal is assumed to be risk-neutral. He offers contracts that match his preferred criterion e.g., ability to understand quality issues etc. Producers choose contracts on a take-it-or-leave- it basis. The producer, referred to as the agent, is assumed to be risk-averse. We assume that the contracts offered maximize the combined principal's and agent's welfare which eliminates pre-contractual costs e.g., bargaining (Stiglitz, 1974). Because of an alternative less quality discerning market for French beans, a producer can choose either an oral contract for that market or a written contract for the high quality markets. Monitoring for oral contracts is self-driven while written

contracts are closely monitored (Jaffee, 2003). Because oral contracts are not subject to a hold-up situation, smallholders have the leeway to sell to competitors and subject the relationship to shorter trading contracts (Cheung, 1969). Written contracts receive a minimum price for produce deliveries to hold them and to reward high quality. This relationship can persist longer due to the incentives inherent in the arrangement (Crocker and Masten, 1988). We argue that no production for export or alternative market can occur without an oral or written contract.

Assume a risk-averse farmer wishing to produce export beans faces an offer of two contracts; written and oral from a risk-neutral buyer. Under each contract a producer's output can be represented as $q = (e + \theta)$ where e is the unobservable effort of the farmer, and θ is a random variable with mean 0 and variance σ^2 . Written contracts yield high quality, q^H and oral contracts low quality, q^L differentiable due to the monitoring aspect which allows a buyer to enforce quality and safety standards beyond the minimum quality standard (MQS) set in the conventional markets, q^* . The producer chooses either of the contracts depending on whether they want to be closely monitored or not or whether they desire to produce for high end or the alternative market. Mathematically, a written contract is chosen if $q^H > q^*$ and an oral contract if $q^L \leq q^*$. The farmer's problem is to maximize his expected utility, by choosing his optimal effort level given the terms of the contract (Allen and Lueck, 1999). This form of contracting incorporates risk-averse preferences in the farmer's maximizing model so as to assert more effort in meeting product quality and safety (Eswaran and Kotwal, 1985). Due to uncertainty and unobservable effort, there is moral hazard in every contract for which the farmer's quality level falls below MQS, q^* because minimum expected quality is not fulfilled. This is important because of the heterogeneous nature of producers' risk-aversion, productivity, cost of effort and reservation utility (Huffman and Just, 2004). Further, the risk-neutral buyer might offer incentives such as a fixed price, fixed quantity requirements or both or provide inputs in which case a farmer's revenue uncertainty and costs are minimized. As a profit maximizing agent, whenever the expected profit of one of the two contracts is higher than the expected profit without contracting, a rational farmer is expected to agree with the contract offered.

Expected effect of explanatory variables on contract choice

Allen and Lueck, (1999), Prendergast (2002), Huffman and Just (2004) and Fukunaga and Huffman (2009) have used theoretical postulations that a contract will be less of a risk-sharing and more of a transaction cost minimizing option. They argue that in developed countries, choice of crop share or cash-rental contract is influenced by the characteristics of the tenant and the landlord and surrounding factors related to the land which is the contractual consideration. For a developing country, we argue that in the marketing of quality and safe beans, farmer and buyer characteristics and the market environment in which they operate will affect the type of contract chosen. In the principal-agent relationship if the farmer is more risk-averse chances of being monitored increase otherwise they choose to be independent producing the minimum quality for alternative markets. As the farm size under French beans increases which is likely to signal increased wealth and less risk aversion, the contract is more likely to be oral. Producers with large farm sizes would want the freedom of making decisions about their production plans. Large farms will depend more on hired labor than small farms which increases the problem of observing quality and safety compared to use of family labor in small farms (Jaffee, 2003). Large farms would therefore produce for the MQS market.

H1: As the farm sizes increase, the chance of choosing a written contract decreases.

Education increases a producer's knowledge and decision making skills that could be relevant in agronomic practices and market knowledge. Education reduces a producer's risk-averseness meaning that more educated producers will not need to be monitored in their farming activities choosing to sell in the alternative markets.

H2: With more education, the likelihood of choosing a written contract decreases

Lack of product quality and safety information e.g., poor understanding of proper use and application of pesticides might require that risk-averse producers be empowered through training. Producers lacking in this knowledge would most likely choose written contracts that offer the opportunity to be monitored. These are most likely new entrants in the market and would prefer increased farm visits.

H3: An increase in on-farm visits increases the likelihood of choosing a written contract.

Distribution costs increase with the location of farms from the central collection point. The buyer is also aware that monitoring costs increase with increased distances from basic infrastructure. A buyer will choose to operate more closely with farmers that are near good roads or near the collection point to minimize transport and crop assembly costs. But this exposes a buyer to intense competition from other buyers. A rational buyer might choose monitored contracts in villages with more collective organizations to reduce crop assembly

costs. Organized groups can meet quality and safety requirements more easily and minimize monitoring costs because of self-group monitoring system.

H4: Increased number of collective organizations in a village increases the likelihood of using written contracts.

Producer prices are used as incentives in the procurement of farm supplies. High quality produce is more likely to fetch higher prices above the minimum quality that unmonitored low quality producers aim for. Therefore, higher producer prices are more likely with written contracts than oral contracts that depend on open market transactions.

H5: An increase in producer prices is likely to influence choice of written contracts

The characteristics of the buyer-producer relationship have an influence on the type of contract offered. Goodhue et al., (2004) and Fraser, (2005) have found duration of contract with a buyer to have significant influence on the choice of written contracts. Producers that have had a long trading relationship with a buyer are more likely to be involved in written contracts to preserve the value of assets that may have been accumulated. There is also the need to avoid switching costs e.g., lost market linkage and reputation, which may be prohibitive.

H6: A long producer-buyer relationship increases the likelihood of written contracts.

The market size will influence the type of contracts offered. French beans are perishable which make timely market access critical. In villages with many independent producers chances of a loosely developed market hub where buyers can buy produce with less transaction costs exist. This reduces the risk-averseness of producers and hence the likelihood of oral contracts. Buyers would not be able to monitor and control flow of quality produce from many producers in such markets and would most likely offer oral contracts.

H7: An increased number of sellers in the village and number sharing the same buyer reduce the likelihood of written contracts.

2.2 A model of contract renewals in French beans marketing

Contract duration analysis in agriculture is scarce. Cheung (1969) postulates that contract duration is critical in contract design by arguing that contract length results from the cost of transferring land-assets from tenant to landowner. If the cost is too high, longer contracts are preferred otherwise, shorter. Allen and Lueck (1992) argue that contract length depends on mutual information about the reputation of the contractees, existence of contract specific assets and the cost of contract renewal and complex contingent contracts to address changing market conditions. The length of contract variable is used as an independent predictor in the choice of contract in some agricultural studies e.g., Goodhue et al., (2004), and Fraser, (2005)

where the duration of contract with a buyer has significant influence on the choice of written and oral contracts. Contract duration has received much attention in coal (Joskow, 1987), natural gas (Crocker and Masten, 1988) and franchise (Vásquez, 2007) contracts. Contract duration is longer the larger the expected quasi rents and profits and shorter with more uncertainty and a larger distortion of incentive provisions (Crocker and Masten, 1988). Vásquez (2007) finds that the experience of a franchisee and quasi rents generated by investments attracts more contract duration while potential free-riding problem reduces the length of contract. Joskow (1987) finds that the length of coal contracts increases the more relation-specific the assets are. These studies use OLS, 2SLS and Logistic estimations due to the straight forward interpretation of the results. We use a count model to estimate the frequency of contract renewals in fresh produce markets to capture the lower bound zero renewals which violates linearity assumptions.

Bogetoft and Olesen (2003) identify coordination of business relationship, behaviour and performance motivation and minimization of transaction costs as the key objectives of a contract. In the case of French beans production, coordination is the primary purpose of adopting a contract because beans are highly perishable and requires synchronized harvesting and immediate collection. The number of seasons a producer and a buyer have traded will signal stability of a contractual relationship in the marketing of beans. That is, did the contract coordinate flow of quality and safe supplies between producers and buyers? Did it motivate performance and reduce transactions costs? The stability of contracts may be influenced by internal and external factors to the relationship. The main internal considerations are the satisfaction gained over the seasons e.g., product quality, risk reduction, price etc, and trust, while external factors include switching costs and competition. For instance, a buyer who has consistently been supplied with high quality beans is more likely to renew a trading relationship than one who has had poor quality. On the other hand, a producer will be satisfied with a contract if the price received over the seasons were above competition. Trust between trading partners increases the chance of trading for another season and enhances communication and performance of tasks. A business relationship with more trust between partners will be more stable and longer.

Fresh market trade relationships will also be renewable for longer if the switching costs from one partner to another are prohibitive in the short run to affect farming. The frequency of contract renewals might increase to minimize switching costs (Monteverde and Teece, 1982). For instance, if it would involve repaying input credit at short notice then producers would be

bound until repayment maturity. Buyers would also want to avoid loss of supplies that have been committed to certain supply chains to protect future business. Competition for supplies is an important reason for a trading relationship to be renewed many times. Because of changing market environments, partners might wish to trade closely and longer to weather farm and firm competition for supplies. This can be pursued to maintain market position for the buyer and trading status for the producer. Changing buyers or producers every season can potentially erode the reputation of partners and lead to loss of contracts due to imputed unreliability. A farmer will accept to remain in one contract for another season to secure income, market access and safeguard the trade exchange for future market dealings. On their hand, traders will renew relations if quality and safety requirements have been met and if they keep competition checked. Factors that can potentially hold smallholder-buyer relationships for more than one season will generally be carried over from a contract's objectives (Masakure and Henson, 2005).

Factors likely to affect the frequency of contract renewals

Satisfaction with a trading relationship may be in terms of producer prices and market access for the producer, and reduction of trading risks and supplies of quality and safe beans for the buyer. These factors reinforce each other. For instance, if the producer price cushions a producer through the trading period, it motivates production of quality and safe beans that satisfies a trader through reduction of trading risks such as low quality and safe supplies which allows producers to gain market access. However, the predictability and the timing of the producer price define whether producers put maximal effort in achieving quality and safe produce. The more predictable and timely the produce price, the more the satisfaction for producers and buyers and more the frequency of contract renewal.

H1: A producer price that is both predictable and timely will enhance more contract renewals.

More seasons in a contractual relationship will be guided by the ability of producers to consistently supply quality and safe produce. One way is to invest in horticultural equipment and the other is to be near the source of irrigation water. The number of trading seasons may change a producer's wealth of investments but not the distance to the source of water. The uniqueness of horticulture is how timely farms can be irrigated to achieve the desired quality. Farms further from sources of irrigation water can have occasional lack leading to crop failure through water stress. Compared to producers farming further from water sources, nearness to irrigation water would more likely attract more frequent contract seasons with a buyer.

H2: An increased distance from the source of irrigation water is negatively related with more frequent contract renewals.

Switching costs are another reason why a contract might last for more seasons. If changing buyers/producers results in loss of market share, market access and reputation, then partners will stay in the relationship. This yields contracts of longer seasons. The switch may also involve sunk costs in equipment and structures. In fresh produce markets, loss of a supplier might cause hold-up of capital investments for an exporter and loss of markets in the upstream end of the supply chain (Dolan and Humphrey, 2004). Therefore partners are forced to adjust within the arrangement and to fit. Switching costs will vary with the type of buyer and the size of the farmer. Exporters have more switching costs and the larger the farm size, the more the switching costs.

H3: An exporter and a large farm size will be positively related with more contract renewals.

The behavior of buyers and producers and marketing practices will have a negative or positive effect on the frequency of contract renewals. As a basic foundation in the learning process, experience determines understanding of fresh produce market cycles and how to handle buyers' demand on product specifications. Experienced producers search for stable market relations that promise continuity in their market exploits while buyers tend to trust experienced producers because of familiarity in trading. New entrants are liable to making trial and error kind of business decisions because of limited knowledge of the market and market practices. Marketing practices that enhance repeated sales and purchases will define how frequent contracts are renewed. Use of sales receipting is one practice that can be used to record past market relationships, signifying that trade has been concluded with the mutual agreement of both partners.

H4: Experience and sales receipting are positively related with more contract renewals.

A more competitive market requires buyers to guard their market shares and their competitive domain. A market with numerous buyers in a given area will most likely generate unfair competitive practices such as poaching suppliers or cheating on grades, for instance. Buyers can relate less frequently with producers in those regions because of unpredictable market movements. On the other hand, in regions with more sellers, a buyer can move to consolidate his position by locking out competition in terms of consistently renewing contracts with producers. Producers seek established market access to guarantee future incomes. If producers are assured of market access they can stick to a relationship for more seasons to minimize opportunism. It is common for buyers to delay collection of beans to pay lower prices, or to reject crops without explained reasons.

H5: Villages with more buyers are related with fewer contract renewals while villages with many sellers are related with more renewals.

The frequency of contract renewals might also be subject to trust between the two partners. Trust has the potential to reduce transaction costs by avoiding costly negotiations and contracting (Dyer, 1996). Trust can be simplified as acting without undue pressure to fulfill some role that may not be observed immediately by a partner. Coordination of on- and off-farm produce handling is critical in maintaining quality and safety in the supply chain. A relationship that is built on transparency and accountability in food chains is termed due diligent in its responsibility for food quality and safety. Traceability allows producers and buyers to converge in terms of tracking the source of quality and safety failure and to correct the situation before it runs out of hand. A good traceability system coordinates flow of produce, information sharing and reduces distribution inefficiencies. A traceability system that can trace the origin of a product is termed effective and efficient. We use a proxy variable where beans can be traced using the name of the producer, the farm, the produce collection date and whether it originates from an individual farm or organized producer and term it complete and full at the farm level. It is expected that as coordination becomes more explicit, i.e., fully traceable, the more likely that the frequency of contract renewals will increase as a sign of openness.

H6: A full traceability system will be positively related with more frequent contract renewals.

3 EMPIRICAL SPECIFICATION

3.1. Choice of farm gate contracts

A farmer's choice problem can be analyzed using discrete choice model for contract decisions (Masten and Saussier, 2000). Contract choice is an unobservable variable Y_{ij}^* for contract type, hypothesized to have the following economic relationship:

$$Y_{ij}^* = \alpha'x_i + \beta'y_j + \rho'z_{ij}$$

where x_i denotes a vector of farmer i 's attributes; y_j denotes a vector of buyer j 's attributes; and z_{ij} denotes the vector of market conditions plus approximation error, which is assumed to follow a normal distribution with a zero mean and a variance of 1. The observed dependent variable is,

$$Y_{ij} = \begin{cases} 1, & \text{if } y_{ij}^* > 0 \\ 0, & \text{if } y_{ij}^* \leq 0 \end{cases},$$

and the likelihood for choice takes 1 for a written contract and 0 for oral thus:

$$\prod_{ij} F(\alpha'x_i + \beta'y_j + \rho'z_{ij})^{Y_{ij}} \times \{1 - F(\alpha'x_i + \beta'y_j + \rho'z_{ij})\}^{1-Y_{ij}}$$

where $F()$ follows a cumulative normal distribution function giving the probability of a written contract being chosen, conditional on covariates. The coefficients α' , β' , and ρ' can be estimated using the probit model (Greene, 2000). An increase of an explanatory variable with a positive sign raises the probability that a written contract is chosen.

(i) **Methodology: Choice of farm gate contracts**

Here we use a probit model to explain the choice of a written contract. The estimated model is:

$$Y^w = \beta_0 + \alpha_1 X + \alpha_2 N + \alpha_3 F + \alpha_4 G + \alpha_5 T + \alpha_6 A$$

where Y^w represents a written contract=1 and 0, otherwise, X , farm-farmer factors (e.g., farm size, education), N , market attributes (e.g., number of sellers), F , buyer characteristic (e.g., extension service), G , collective organizations (e.g., number of producer groups), T , producer-buyer length of relationship and A , financial incentives (e.g., price). To improve the focus of the key variables discussed we have included a few other variables such as age, on-farm equipment, type of buyer and location of farms.

3.2. Number of contract renewals

Assume that producers and buyers have been in the observed contract before the survey date. Following Masten and Saussier (2000), the decision to renew a contract for another season with a buyer can be modelled as duration of contract. Mathematically, this is represented as follows

$$Z^* = \alpha_0 + \alpha_1 X + \varepsilon$$

where, Z^* is the duration which lies strictly between 0 and T number of seasons in a contract, and X is a vector of attributes that are likely to affect the efficiency of contracting and the longer predicted duration; ε is the stochastic term. The natural lower bound of zero in contract durations affects the distribution of the error term and its parameterization making OLS inappropriate compared to maximum likelihood and count models in solving the problem (Cameron and Trivedi, 1998). We assume the dependent variable Z^* is a log-normally distributed random variable with probability distribution function

$$f(Z^*; \mu; \sigma) = \frac{1}{\sqrt{2\pi} \cdot \sigma \cdot Z^*} \cdot \exp\left[-\frac{(\log(Z^*) - \mu)^2}{2\sigma^2}\right]$$

$$Y \geq 0, \sigma > 0$$

so that $X = \log(Z^*)$ is s-normally distributed: $X \sim N(\mu, \sigma)$.

(ii) Methodology: Determinants of the frequency of contract renewals

As in Goodhue et al., (2004), a behavioral model relating contractual renewals is specified. The dependent variable has 78 producers with zero seasons indicating lack of past renewals with the buyer at the time of the survey. A consistent estimation should take the lower bound of zero into account. Zero observations violate linearity assumptions resulting into biased and inconsistent estimates. It should also account for over-dispersion since the conditional mean is less than the conditional variance. We estimate a negative binomial model as follows

$$\log(D) = \alpha_0 + \beta_1 X$$

where D denotes the number of seasons with a buyer before the survey date, β_s are the regression coefficients to be estimated; X is a vector of explanatory variables that proxy for satisfaction, trust, switching costs and competition. These are identified in the hypotheses. As in the choice model, we have added some variables to sharpen our focus variables in the hypothesis.

4 DATA AND DESCRIPTIVE STATISTICS

The data come from a survey of French beans producers in Mwea Tebere of Kirinyaga district. The sample consists of 249 producers, selected from a random sample of 24 villages conditional on an expected beans harvest in June 2006 and interviewed between April-June 2006. Interviews involved a wide range of marketing practices using a short questionnaire. Table 4.1 shows descriptive statistics for the variables used in the choice of contractual form and renewal frequency models. The P-values show significant differences at 5% level for most variables. Oral contracts seem much more popular, with more than twice the number that uses written contracts. This has the potential to promote personalized open market systems.

Table 4.1: Descriptive statistics by type of contractual form

Variable	Oral (N=171)		Written (N=78)		t-test	P-value
	Mean	S.D.	Mean	S.D.		
<i>Farmer characteristics</i>						
Age (yrs)	40.95	8.63	42.89	9.65	-1.58	.115
Farming experience (yrs)	13.52	7.25	12.04	6.86	1.52	.130
Seasons with buyer (3/yr count)	2.82	2.84	8.56	4.69	-11.89	.000
Rice grower (0,1)	.65	.48	.75	.44	-1.57	.118
<i>Farm characteristics</i>						
Farm size (acres)	.88	.57	1.28	.85	-4.35	.000
Pump ownership (0,1)	.86	.34	.96	.19	-2.35	.019
Protective gear ownership (1,0)	.28	.45	.67	.47	-6.35	.000
Farm-village distance (m)	958.24	1171.33	1132.28	1045.98	-1.12	.262
Farm-water distance (m)	264.24	192.06	323.80	233.14	-2.12	.035
<i>Market-buyer characteristics</i>						
Exporter-linked-market (0,1)	.39	.49	.78	.41	-6.25	.000
Exchange buyer driven (0,1)	.26	.44	.34	.47	-1.35	.188
Price given by buyer (0,1)	.21	.40	.44	.50	-3.98	.000
Sales receipted (0,1)	.33	.47	.99	.11	-12.23	.000
No. sellers in village	21.18	7.20	16	5.44	5.66	.000
No. buyers in village	8.82	2.73	9.19	2.25	-1.04	.301
<i>Collective organizations</i>						
Group membership (0,1)	.17	.38	.90	.30	-15.04	.000
Group size (count)	5.12	11.29	15.46	5.75	-7.66	.000
No. groups in village	2.63	2.02	2.66	1.92	-.11	.916
No. sellers to same buyer	3.41	1.69	3.65	1.27	-1.12	.265
<i>Traceability of farm produce</i>						
Traceability (stages/count)	1.89	1.38	3.11	.76	-7.32	.000
<i>Financial(non)incentives</i>						
Price, 3kg carton (KE)	66.16	23.74	76.68	16.66	-8.71	.000
Price known at planting (0,1)	.14	.34	.72	.45	-11.31	.000
Price fixed/week (0,1)	.13	.34	.11	.32	.34	.732
Spot cash payments (0,1)	.48	.50	.03	.16	7.82	.000
Credit access (0,1)	.74	.44	.97	.16	-4.67	.000
Farm visit extension (0,1)	.36	.48	.97	.16	-11.09	.000
<i>Regional differences</i>						
Upper Mwea region (0,1)	.36	.48	.29	.45	1.14	.256

Source: Author, computed using STATA 12.1, Mwea Tebere French beans survey, April-June 2006.

Farmer characteristics

Producers using written contracts have about 9 seasons in a trading exchange, which is approximately 3 times more than those using verbal contracts. Compared with oral contracts, written contracts seem to be a more stable market arrangement.

Farm characteristics

Producers with written contracts have large farm sizes under French beans, are further from residential villages and source of irrigation water than their counterparts in oral contracts. The farm sizes are within national averages of 1.0 acre though land rents are popular because of National Irrigation Board's (NIB) tenancy agreements that limit non-rice related farm sizes (Kabutha and Mutero, 2000). Small farms are easily manageable using family and limited hired labour especially in observing crop hygiene and handling practices. The ownership of an irrigation water pump is widely spread in both contracts but higher among those with written contracts. Though restricted in NIB's water canals farmers do pump water at an unofficial fee (Kabutha and Mutero, 2000). Hiring equipment at a fee or in exchange for labour is also common. In lower Mwea, water pumps may not be very vital because producers near water canals simply use flooding to irrigate farms. Ownership of protective garments essential for pesticides application, certification, personal and crop hygiene is more pronounced among those with written contracts. It is a requirement for producers to have a regularly calibrated sprayer to minimize overdosing crops and to observe pre-harvest spraying interval because of pesticide residue limits regulations. The majority without protective garments are in oral contracts. This group perhaps uses the services of spray teams from a contracting firm or for finding protective garments expensive, use own clothes. This may predispose them to skin and respiratory ailments (Okello and Swinton, 2010). These investments may be regarded as strong specific assets in horticulture (Williamson, 1979; Wang, 1999).

Market-buyer characteristics

The data shows that sales receipting, and price communication by the buyer dominates market-buyer characteristics for those in written contracts. These market practices promote good business relations and have the potential to enhance trust. Producers with oral contracts dominate in villages, which literary shows how personalized interactions shape contractual arrangements.

Collective organizations

Ninety percent of organized producers have written contracts while producer groups with written contracts are 3 times larger than those with oral contracts. Organized production is effective when implementing on-farm quality systems, minimizes oversight, and monitoring costs, and is a reliable and consistent source of supplies.

Traceability of farm produce

On full produce traceability producers in written contracts have at least 3 identification tags on their produce packaging materials compared to about two for those in oral contracts. It is therefore possible to identify a producer's crop in the immediate market chain by at least a combination of the identification elements e.g., own name and farm plot etc., In written contracts, smallholders' traceability schemes are designed more on breadth (the amount of information the traceability records) than depth (how far back e.g., farm) and precision (tracking unit e.g., delivery date) (Golan et al., 2004). The varied trace-back units could point to a case of low trust between buyers and sellers, which result to different traceability practices (Charlier and Valceschini, 2008).

Incentives

Knowledge of expected prices at the onset of planting, extension services and credit access are used more in written contracts than in oral contracts. Extension has a role in the diffusion of technical and agronomic skills. These incentives, related more with financially capable exporters than intermediaries, reduce production uncertainty, quality and safety risks and support basic farm investments. The finding indicates a substantive shift toward forward pricing. Not surprising, spot cash payments are more of a dominant characteristic in oral contracts because of prevalent open market relations. Lagged payments for produce deliveries will tend to hold-up producers and could perhaps act as a residual claimancy strategy by buyers (Hueth et al., 1999). Producers in written contracts have a higher average price per 3 kg carton of French beans than those in oral contracts suggesting that price is a key incentive in written contracts.

5 EMPIRICAL RESULTS

5.1. Choice of contract

The results of the choice of contracts by smallholder French beans producers are reported in Table 4.2. The model predicts 93% of the classifications. The linktest indicates that the model is correctly specified. The Wald chi-square shows the overall model is significant.

Table 4.2: Factors determining use of contracts by smallholders, 2006

<i>Independent variables</i>	Coefficient	SE	Marginal Effects	p-value
Log farm size under French beans	-.420	.277	-.049	0.103
Post primary school level (0, 1)	.696*	.409	.082	0.108
Post secondary school level (0, 2)	-.249	.333	-.029	0.445
Number of farm visits in the season	.093*	.055	.011	0.064
Number of producer groups in the village	.127	.095	.015	0.166
Number of farmers in a group	.053***	.020	.006	0.003
Log average price, 3kg/carton	-2.136**	1.012	-.251	0.013
Number of contract seasons with buyer	.284***	.074	.033	0.000
Number of sellers in the village	-.142***	.025	-.017	0.000
Number of farmers sharing same buyer	-.109	.113	-.013	0.342
Control variables				
Age	-.201**	.086	-.024	0.026
Age2	.002**	.001	.000	0.017
Experience in horticulture farming	.007	.025	.001	0.773
Ownership of water pump (0, 1)	1.526***	.538	.180	0.001
Ownership of protective gear (0, 1)	.661	.439	.078	0.144
Linkage to market by exporter (0,1)	.211	.532	.025	0.697
Farm region of upper Mwea (0,1)	-.893***	.311	-.105	0.004
Constant	11.5***	4.38		
Wald chi2 (<i>df</i>)	101.3	(17)		
Log pseudolikelihood	-51.75			
Correct classifications	93%			
Linktest	.088	.066		.179
Number of observations	249			

*, ** and *** denote 90%, 95% and 99% confidence levels respectively

Education level

The hypothesis on education and use of written contracts shows support for post-primary educated producers at 10% level. This group relies on agriculture for livelihood and might be very risk-averse to markets that threaten the stability of their incomes. Perhaps due to low skills and few off-farm employment opportunities, these producers find limited decision making environment embedded in written contracts appropriate in their farming and marketing exploits.

On-farm visits

There is a positive likelihood of written contracts with increased number of on-farm extension visits signifying a closely monitored relationship. Extension reduces information asymmetry

on product quality and safety in the market chain by passing on technical advice. Extension has the potential to minimize risks of pesticide contaminants in water sources, post harvest produce and affecting the applicator for instance. This is relevant in environmental, maximum residue limits and personal welfare concerns. Due to arising monitoring costs, a more efficient contract would be more written than oral.

Collective organizations

The results show that a producer group's size positively influences use of written contracts. The marginal effects are less than 1%. There is cooperative strength in organized numbers because of social cohesion and networking, which translate into marketing order and chances for low per unit production costs, and negotiation power for marketed produce (see Fafchamps and Minten, 2001). Because of accumulated marketing and market access capabilities, there would be a tendency to seek a more assuring and reliable market relationship that can cushion their administrative and investment costs.

Producer price

Contrary to expectation, higher French beans prices have negative significant marginal effects of 25% in the choice of a written contract. This seems to be a competitive tool in a market environment dominated by numerous independent producers and competing buyers. Though export markets compete on quality and safety, farm gate buyers use price incentives to induce side-selling and to secure supplies from non-contracted smallholders. The results suggest that the benefits of assured market access in written contracts override price incentives.

Producer-buyer length of relationship

Producers with more number of contract seasons with a buyer are likely to use written contracts. An extra season increases the likelihood of a written contract by 3.3%. This indicates that producers who commit to consistent yearly production seek for reliable market arrangements that might cover risks of adverse market fluctuations. A longer relationship could also be an unnecessary hold-up because producers tend to rely on buyers for soft loans or cash advances.

Number of sellers in a village and sharing of buyer

An increased number of producers in a given village reduces the likelihood of using a written for oral contracts by 1.7%. This is expected in a commonly shared environment. Because producers will tend to informally share true and false information about the functioning of a market, producers are likely collude to renege on strict terms and conditions of a written contract. Additionally, because of the homogeneity of French beans buyers are aware of

shared opportunism and desire to collude to market non-contracted output through contract producers. This result is an indication that holding parties in a tightly controlled production structure is likely to be beset with contractual failure in highly concentrated production regions. In a rural monetised and semi-commercial agricultural economy, buyers face high transactions costs because of marketing malpractices such as side-selling of contracted produce, monitoring and oversight costs (McCulloch and Ota, 2002). Thus oral contracts could more likely be a solution to such marketing failure.

5.2 Determinants of contractual renewals

The likelihood ratio chi-square test ($\chi^2(01) = 79.37$) rejects the null hypothesis that the dispersion parameter alpha is equal to zero at 5% level. This suggests that the frequency of contract renewals is over-dispersed and is not sufficiently described by the simpler Poisson distribution. Table 4.3 shows the negative binomial coefficients. Most of the variables have significant relationship with the frequency of contract renewals at between 1% and 10% level.

Table 4.3: Determinants of contract renewals

<i>Independent variables</i>	Negative Binomial Estimates			
	Coefficient	SE	IRR	SE
Log average price, 3kg/carton	-.255	.561	.775	.435
Price known at planting (0,1)	.216*	.118	1.241*	.147
Spot cash payments (0,1)	.781**	.367	2.184**	.801
Log farm-irrigation water distance (m)	.156*	.092	1.169*	.108
Log farm under beans (acre)	.320***	.096	1.377***	.133
Producer-export firm link (0,1)	.529***	.159	1.697***	.270
Log farming experience (years)	.085	.103	1.089	.112
Sales receipted (0,1)	.782**	.391	2.186**	.855
Log sellers in the village	.061	.070	1.063	.075
Log buyers in the village	-.364*	.217	.695*	.151
Traceability level (count)	.171**	.085	1.186**	.101
Control variables				
Supply contract written (0,1)	.419*	.228	1.520*	.347
Farm region upper Mwea (0,1)	-.299**	.148	.742**	.110
Constant	.623	2.622	1.865	4.890
1/lnalpha	-1.042	.296		
alpha	.353	.105		
Wald $\chi^2(df)$	202.9	(13)		
Log pseudolikelihood	579.17			
LR test $\chi^2(01)$	79.37***			
Number of observations	249			

*, **, *** denote the 90%, 95% and 99% confidence levels respectively

The coefficients for numeric predictors are interpreted as follows: for a one unit increase/decrease, the expected log count of the frequency of contract renewal increase/decrease by the regression coefficient. The dummy variables are interpreted as the expected difference in log count from the reference category. The results can also be interpreted as incidence rate ratios. Numeric estimates are interpreted thus: increasing/decreasing the independent variable by one unit leads to an increase/decrease in the incidence rate of the frequency of contract renewals by a factor equivalent to the variable's coefficient less than 1. For example, increasing the level of traceability by one trace-back unit increases the rate for the frequency of contract renewals by a factor of 0.19. For dummy variables, the independent variable will have a rate equivalent to its regression coefficient times the incidence rate for the reference category. For instance, exporters have an incidence rate of 0.38 times the incidence rate of frequency of contract renewal for intermediaries.

Producer price: predictability and timing

If price expectations are known at planting compared to harvesting, producers have 0.22 times higher expected log counts of contract renewals. Supply and demand imbalances, plus cut throat competition for supplies aggravate side-selling, low prices and loss of postharvest through ad hoc grading standards and quality demands during harvesting time. Producers in such arrangements would not sustain repeated renewals with the buyer for longer. On the other hand, future prices enable producers to plan production e.g., acreage, inputs acquisition etc., and can hold-up producers in a trading relationship for subsequent seasons. Sometimes, upfront pricing could be a buyer's strategy to mitigate adverse on-season price competition. There are possibilities to latter deliberately under-price postharvest produce during harvesting. The difference in the expected log count of contract renewals is 0.78 times higher for spot cash payments compared with lagged payments. Spot cash payments motivate sellers to consistently deliver beans in subsequent market days because they can immediately compare with competitors and also allow producers to offset rather than postpone their financial obligations. This result indicates that recurring trade relationships for French beans producers are enhanced by the ability of the buyer to make immediate payments. The use of price-related incentives to hold smallholders into more production and trading seasons point to a shift from dependence on traditional incentives of credit and extension services. The role of incentives has received attention in Stiglitz (1974) and Bogetoft and Olesen (2003).

Farm-irrigation water distance

The result on farm-irrigation water distance is surprising because it has a positive effect on the frequency of contract renewals. An increase of distance by a meter increases the frequency by 0.16 counts. The possibility is that farms located further from the source of irrigation water have low chances to pollute waterways and assuming that producers use environmental friendly production practices e.g., proper pesticides disposal etc, repeated contract renewals are expected. Firms exporting to UK and EU retail markets are forced to observe environmental conservation and care through KenyaGAP/GlobalGAP standards (GlobalGAP, 2010). Environmental conservation as a quality attribute enhances buyer's image and reputation.

Type of buyer and farm size

An export firm has an expected log count of the frequency of contract renewals 0.53 times higher than intermediaries. This means that they maintain their relationships with smallholders for longer. Besides financial and logistic capabilities over intermediaries in maintaining contracts for consistent and reliable supplies, export firms have experience with smallholders' contracting since the late 1990s (Jaffee and Little, 1994). The farm under French beans is a positive and significant factor in determining the renewal of contracts. An increase in the farm under French beans by 1 acre yields an estimated 0.32 expected log count of the frequency of contract renewals. Land has a significant contribution in fresh produce markets because a buyer is guaranteed of a source of supplies at low assembling costs. A large farm size can support farm investments like a grading shed, traceability and quality management systems, and can be used as collateral against agricultural credit.

Experience and sales receipting

The issuing a sales receipt to conclude exchange results to frequency of contract renewals of 0.52 times units compared to non-receipting. Producers build trust in a trading relationship if exchanges are recorded for future reference. This has the effect of solidifying trade exchanges, motivates repeated sales and purchases and is a fall back strategy in case of disagreements.

Number of sellers and buyers in the village

In villages with many buyers the frequency of contract renewals is statistically lower by a value of 0.36. Engaging producers for longer can wade off stiff competition. But in the presence of many buyers, homogeneity and perishable nature of French beans there abound unfair business practices as each firm tries to buy supplies from competitors. In this case,

buyers might prefer supply and demand dynamics to guide trade relationships which results into less frequent contract renewals.

Traceability of farm produce

On traceability, there are 0.17 higher expected log counts of the frequency of contract renewals for every traceable point added in the system. By consistently subscribing to a strict trace-back system, incidences of low quality produce deliveries and incentive to switch buyers during the season reduce. This minimizes distribution inefficiencies in the flow of marketed beans between a buyer and a producer. More contract renewals might be guaranteed because full traceability is evidence of a producers' willingness for transparent audit of own product quality and safety along the supply chain. The built trust between partners enhances more frequent contract renewals.

The control variables show that compared with oral contracts, those with written contracts have expected log counts of 0.42 times higher. It is plausible to hold producers into a longer exchange relationship for written contracts to benefit from the established monitoring and administrative structures.

6. CONCLUSIONS

The push for farm consolidations, private standards certification, traceability and supply reliability by Western European supermarkets and retailers might exclude developing countries' smallholders from high value chains for lack of scale economies. However, horticultural contracts, written or otherwise have been used to facilitate their co-optation despite contractual enforcement problems. We have particularly examined the factors influencing the choice to use written contracts by French beans producers and the frequency of contract renewal with buyers.

The study reveals that due to low skills and lack of off-farm employment opportunities, post-primary educated producers prefer written contracts. This group relies mainly on agricultural incomes and thus avoids extreme risk in oral contracts for stable markets. The provision of extension services is positively related with written contracts. This result implies that markets for export horticulture are susceptible to food quality and safety checks that demand knowledgeable producers. By providing extension advice, producers can farm in line with environmental and personal welfare requirements. This indicates that search for quality and safe products has a monitoring cost element that buyers might have to incorporate in their plans when sourcing from smallholders.

Collective organizations are deemed crucial in market or production arrangements that demand cost reductions or adoption of new innovations (Bandiera and Rasul, 2006). Our results indicate that large producer groups, which mean negotiation power, market organization and reduced costs of monitoring product quality and safety in a wide production area, positively predict written contracts. This result lends credence to the role of organized groups in bringing order in underdeveloped markets (Place et al., 2004). The policy debate however is whether producer groups should work under an umbrella producer marketing organization or they should operate as single entities in a market for a homogenous product like French beans.

The study demonstrates that the length of relationship between buyers and smallholders has a positive effect on the choice of written contracts. This implies that relationships that span for more seasons are well grounded in closely monitored arrangements perhaps to cushion producers from adverse effects of price and market changes.

Higher producer prices motivate choice of oral contracts. The result might indicate that when price incentive is strong enough, producers choose marketing arrangements that do not hold-up their investments. Anecdotal evidence shows that exporters will rarely offer prices above competition even to those in written contracts. Therefore, the policy issue would be whether prices are realistic incentives in contracting or a strategy to motivate production for future supplies. Further, it would be a researchable question to understand whether producers in written contracts are really getting lower producer prices than their counter parts in oral contracts. The study shows that increased number of sellers in the village predicts oral contracts. The result indicates that concentration of village markets generates localized scale economies, some sort of bargaining power and possibly very competitive prices. Despite higher outputs and low costs of assembling farm produce, possibilities of manipulating quality, higher monitoring and oversight costs favour flexible relationships. This means that oral contracts might dominate alternative market chains e.g., non-certified and local supermarkets that are not strict on quality. The result reveals that where markets are very competitive and transaction costs are high, oral contracts perform better than written contracts.

Overall our results indicate that higher prices and high concentration of producers in a village found oral arrangements while low education, extension, membership in a large producer organization, and a long trading relationship differentiate written contracts. This shows that

strategic farm-based contracts might persist in providing smallholders with access to both the strict food quality and safety markets and the less strict alternatives markets.

The results of the negative binomial model reveal that if the price offered to producers is predictable and payments properly timed at planting, contract renewals between producers and buyers are more frequent. This shows that the role of future prices and a payment arrangement that enhances stability of working capital for producers can stabilize trading in fresh produce markets. Farms that are further from the source of irrigation water have higher frequency of contract renewals with buyers than those that are located closer. Farmers use pesticides and fertilizers in their production, which could easily find their way into waterways through spraying or washouts. The result indicates that if producers and buyers have strong environmental concerns more frequent contract renewals for reputation and image building could be realized. The result on farm size indicates that a guaranteed source of supplies, ability to support farm investments and quality related infrastructure e.g., a quality management system, will generally interpret into more frequent contract renewals with fresh produce buyers.

The study reveals that exporters compared to intermediaries have more frequent contract renewals with smallholders. This suggests that financial and logistic capabilities are critical in managing relationships with smallholders. It could be that exporters remain a more efficient market-linkage for smallholders. Policy wise, it would be economically sensible to initiate buyer-supplier market linkages with the involvement of producers in the decision making process if the failures of past initiatives are to be avoided (see Ashraf et al., 2009). Further, it is logical to ask whether the linkages are sustainable in the long run because some exporters are known to exploit high season windfalls and then to exit leaving a whole lot of disenfranchised producers (Jaffee, 2003). Concluding sales transactions with documented evidence of receipts increases the number of contract renewals with a buyer. This shows that when trade conclusion is mutually agreed with referenced information, trust increases and yields more frequent contract renewals.

The study demonstrates that some form of traceability system is essential in increasing the frequency of contract renewals. Besides distribution efficiencies, traceability enhances trust between buyers and smallholders. The issue with policy would be what could fit smallholder producer units and how far back and forward to go. Nevertheless, there are manual systems developed by donor-private firms' partnerships in place, which could be the beginning point for trace-back systems (Liaison Committee on Europe Africa Caribbean and Pacific, 2006).

The results indicate that competition is negatively related with the frequency of contract renewals. Because of the higher number of buyers in villages it is costly to monitor smallholders because of market malpractices like side-selling of contracted produce. The result means that open market practices in highly competitive regions can only support less frequent contract renewals.

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CHAPTER FIVE

Summary and Conclusions

The European Union (EU) is the main market for Kenya's French beans. Over 60% of the total exports of Kenya's fruit and vegetables are marketed in the United Kingdom (UK), Netherlands, Germany, France and Belgium. The markets are heavily regulated either through public or private standards on the sale of foodstuffs from the farm to the table. There is increased demand by Western food retailers for fresh produce from larger suppliers that can document production practices, ensure consistency and reliability. The principal challenge however, is how smallholders can comply with GlobalGAP (GGAP) standard because it is costly in terms of investment infrastructure, recurrent expenditure on farm audits and certification fees. Many food retailers in the EU are members of GGAP and in fact demand GGAP certification from their suppliers. This poses potential danger of excluding many smallholders from the export market. If adopted, however, GGAP has the potential to spread benefits of food quality and safety to local markets, improve the health and welfare of producers, protect the environment from hazardous materials and enhance smallholders' market access opportunities.

Against this background, this thesis analyses three objectives: 1) What are the determinants of a successful GGAP certification? 2) Does GGAP certification have an effect on farm gate producer prices? 3) Which factors affect the choice of contractual form and the frequency of contract renewal? The thesis answers these three questions by using survey data from 249 smallholder French beans producers from Kenya.

In the first essay, the success by smallholder French beans producers to adopt GGAP a key private standard in Kenya's fruit and vegetables markets for the last 6 years is analyzed. Smallholders will choose a farm innovation if it has more benefits than what they are using or other innovations, otherwise not. This is a binary choice problem that can be analyzed using a logit or probit model. A probit model is preferred in deriving likelihood estimates since choices made by producers are unknown a priori which allows assumption of normality. The results suggest a higher probability of GGAP adoption with more contract seasons with a buyer, a larger area under beans, ownership of protective garments, a higher number of producer groups and farmers sharing a buyer in a village, a larger producer group and more extension visits.

The results on more contract seasons with a buyer and sharing a buyer indicate some sort of network between producers and buyers. Because the initial certification costs are high, they

can be amortized at low per unit cost per producer with a large number of producers and it is also less costly for a buyer who chooses to assist producers in a cost-sharing arrangement. More contract seasons build trust, confidence, consistent supplies base and mutual hold-up, which are an efficient framework to support shared investments and certification. Producers who break trading relations often may not benefit from collective approach to certification if buyers are willing to cost-share. The perishable nature of beans requires consistent buyer-supplier relations and coordination but more important is costs spread if GGAP is to be sustainable among smallholders. The conclusion is that a trusted relationship and critical mass can successfully overcome certification barriers for smallholders.

The results reveal that use of short closely monitored supply chains and more producers in a village lower success of GGAP adoption. As hypothesized, if buyers find quality and safety of produce from closely monitored supply chains sufficient to serve alternative markets, they are not motivated to have them certified. Producers under monitored production contracts have access to private extension services from a buyer's agronomist so quality and safety is strictly observed. This result might mean that either those using short closely monitored supply chains serve alternative markets or though willing to get certification did not succeed. The latter might happen when producers do not fulfill some compliance control points as stipulated in the certification process. On the number of producers in a village, it would be expected that given the opportunity to enter certified markets, smallholders could easily form producer groups to necessitate certification. However, this is not surprising because independent producers might lack a common platform to assess the benefits and costs of certification. In a disjointed decision making environment, it is unlikely to seek certification. Further, if producers do not engage in production throughout the year then amassing group strength becomes difficult. Villages are also likely to be local market centers for buyers targeting alternative markets that do not emphasize on certification. These results might imply two things: one, unsuccessful adoption of GGAP by producers in villages and in short closely monitored supply chains marginalizes many smallholders from accessing premium quality markets and two, alternative markets for non certified produce are well established among smallholders. There is need to investigate how smallholders choose whether to be engaged in short closely monitored supply chains because these chains seem to promote unsuccessful adoption and subsequently deny smallholders access to premium markets.

Further results show that the number of producer groups and their sizes, and number of producers sharing a buyer in a village matter in successful adoption of GGAP. Producer

groups are closer to many farmers compared with individual producers, can amass trust, resources and self-monitoring mechanisms in the establishment of a common certification platform at low cost. In terms of policy, reliance on producer groups may be a more effective way to co-opt smallholders in farm gate private quality and safety standards. Whether smallholders' have proper leadership and management capabilities to foster cohesion and sustainability of producer groups needs further research.

In addition, if a producer owns protective clothing, has access to extension and experience in horticulture farming they are likely to succeed in certification. Lack of farm assets constrains consistent supply of produce while lack of knowledge on product quality and safety increases information costs along the chain which might lead to exclusion from high value chains. It is concluded that successful certification is enhanced by producers' human capacity and access to farm assets. Investing in farm assets might require producers to seek financing through smallholder based credit schemes that are available in most commercial banks¹². On extension, there are private and public service providers and donor-funded outreach programs tailored to educate producers through 'barazas'¹³ on pesticides use and application, certification and traceability. One would be interested, however to know how costs of buyer sanctioned private extension services are appropriated to the final producer price.

In the second essay the effect of GGAP certification on farm gate producer prices is analyzed. Beside market access, the prime concern for producers is whether price premiums are realized due to compliance. The econometric model considers producer prices as hedonic, offered every market day, to reward the desired quality (e.g., color, size, freshness etc) and other factors. A producer who has successfully adopted GGAP gets a price that is assumed to reward certification as an assurance of farm level compliance with product quality and safety. Therefore, certification is treated as a quality attribute in the analysis. The econometric model shows that GGAP certification, the use of supply contracts, direct procurement by exporters, and the size of markets in a village, have a positive effect on producer prices. Organized producers receive significantly lower prices. The GGAP premium is not very large and is less important than supply contracts and direct procurement premiums. Of particular importance is

¹² For example, Equity Bank has an agricultural loan for the purchase of farm inputs and equipment, Cooperative Bank has *Maziwa* loan for dairy producers, Kenya Commercial Bank has *Mavuno* loan for tea producers and Family Bank has *Majani Plus* for the purchase of farm inputs and equipment. Loans are repaid from final product revenues.

¹³ It is a Kiswahili term for a grass-root meeting by government operatives to pass its policies. A permit must be granted by the police department for private barazas. Pesticides Initiative Program (PIP) and Safe Use Project (SUP) use barazas to sensitize producers on emerging market issues notably pesticides use, traceability and certification.

that GGAP premiums are not constant over one season. The premium increases towards the end of the season which could indicate either graduated increase in the premium or an initial low premium to cover certification costs. The interpretation is that unsuccessful certification of producers because of high initial costs is a hindrance to produce quality and assurance as well as a higher price not necessarily on a market day but spread over the season. This result shows that contrary to some literature, it is possible that producers in farm gate QAS are getting a premium not too large as perhaps expected by producers. The fact that no independent producers have been certified, might indicate the existence of alternative marketing channels without requiring investments in a demanding certification process. Therefore, further research should center on the question of how a farm governance structure, independent or organized production, affects the willingness to apply for GGAP certification.

More buyers in a given village are found to increase prices paid to producers. The converse, which is a decline in the number of buyers in certain regions, may be of great concern for local regulators because it may expose smallholders to opportunistic buying behavior. For instance, buyers could exploit time specificity and the perishable nature of French beans to delay collection, collude, or falsify grading, and later derive quasi-rents by offering low prices. Anecdotal evidence shows that small exporters sporadically offer high prices to attract produce, and subsequently exploit the log-in effect. Opportunistic practices (i.e., diverting contracted produce to competitors, collusion, delayed collection, and falsifying grades etc.) have received attention in the literature. Thus, local authorities should be trained to develop appropriate capabilities to survey the functioning of markets. Indirectly, antitrust policy on local farmers markets can be a contribution to agricultural development.

Better roads are not found to lead to higher prices in the econometric analysis. One possible conclusion is that bureaucratic practices on roads such as horticultural fees and corrupt charges in police guarded roadblocks prevent the realization of efficiency gains. Whether this is the case cannot be finally answered with the dataset at hand. Therefore, the link between institutional quality and the realization of expected efficiency gains due to infrastructure improvements requires future research. Finally, marketing practices such as a direct linkage to exporters, use of a supply contract, and non-switching selling to one buyer could increase producer's revenues. Informing producers of these findings is a relevant step to realize an impact of this analysis.

The third essay investigates the factors that affect choice of contractual form and the frequency of contract renewals. Horticultural contracts can facilitate production and consistent

supply of high quality produce, reduction of search costs and co-optation of smallholders into high value chains despite contractual enforcement problems. Contracts are a strategy for risk management and transaction costs reduction in quality and safety conscious consumer markets. An optimal contract without pre-contractual costs is assumed in this analysis. The buyer is risk-neutral and can offer either a written contract with a monitoring rider or non monitored oral contracts. Risk-averse producers choose the contract that suits their personal and market environments under full information. On this basis, it is assumed that the observed contracts have a risk-sharing and transaction cost reducing element and analyzed using the probit model. The frequency of contract renewal is assumed to be based on a relay production method of three-months-three-seasons contract with a buyer every year. To make it tractable, the observed number of seasons with a buyer is assumed to be the number of contract renewals before the survey date. Because of the lower bound zeros that violate linearity assumptions, a negative binomial model is estimated to capture the possibility of over-dispersion. It is hypothesized that satisfaction with the buyer-producer relationship, trust, switching costs and competition determine the frequency of renewals.

The results indicate that producers with post primary education, more extension visits, and contract seasons with a buyer and a higher number of producers in a group differentiate written contracts. Due to lack of skills and off-farm employment opportunities, post primary educated producers use written contracts in the production of beans. This reveals that a group that relies mainly on agricultural incomes is risk-averse preferring stable market relationships. Markets for export horticulture are subject to food quality and safety checks that demand knowledgeable producers. Extension advice empowers producers with that knowledge. The result indicates that search for quality and safe products has a monitoring cost element that buyers might have to incorporate in their sourcing plans from smallholders. The number of contract seasons suggests that when contacts spun for longer, the need to perhaps cushion partners from adverse effects of price, output and market changes motivates a well grounded and closely monitored relationship.

The size of groups gives producers negotiation power, enhance market organization and minimize monitoring costs in a wide production area. Buyers would prefer transaction-cost reducing organizations in markets that compete on quality. Organized groups might also seek contractual forms that help them to cover administrative costs and stabilize markets for their high product volumes. This result lends credence to the role of organized groups in bringing order in underdeveloped markets. The conclusion is that where markets seek quality and

stability written contracts are preferable. The policy debate however is whether producer groups are efficient under an umbrella producer marketing organization or as single entities in a market for a homogenous product like French beans.

A higher number of producers in the village and a higher producer price predict choice of oral contracts. Critical mass in the number of sellers generates a shared market that is very competitive in prices. When producers in a village produce a homogeneous fresh product, price fluctuations are very high and unlikely to signal quality beside high monitoring and oversight costs. Such a market becomes very risky to transact in with written contracts. Price incentive induces performance to farm quality and safe produce. It measures a producer's expected income from farming at the end of the season. Buyers might use price as a "captive" clause to deter side-selling of produce to competitors and to establish a common base for future supplies. However, sustaining higher prices in markets with numerous independent producers is costly. This result implies that when price incentive is strong enough, it may motivate producers to prefer open flexible market arrangements. Our results reveal that where markets are very competitive and transaction costs are high, oral contracts perform better than written contracts.

On the frequency of contract renewal, the econometric results show an increase if producer prices are known at planting time and payments made on the spot, with farm distance to irrigation water source, sales receipting and traceability, area under beans and market linkage by an export firm but a decrease with the number of competing buyers in a village. Predictable prices and timely payments enhance producers' planning, stability of incomes and can stabilize trading in fresh produce markets. The result shows that by enhancing producer satisfaction, buyers are able to secure more contract renewals. This result further indicates that price incentives play a major role in reducing contractual failure on the part of risk-averse partners in fresh produce markets. Farmers located further from irrigation water source have more contractual renewals compared to those located nearer. Farms near water sources have a higher possibility of contaminating waterways through farm wastes. Environmental conservation is a key component of GGAP standard and local environmental regulations by National Environment Management Authority (NEMA). As key stakeholders, buyers are keen to avoid antagonizing government regulations which would most likely be interpreted as the cause of observed preference for farms located further from water sources for frequent contract renewals. The result shows that if producers and buyers have strong environmental concerns frequent contract renewals for reputation and image building, balance arising

transaction costs. The results suggest that concerns for transaction costs reductions especially switching and searching for suppliers, and price competition motivate more frequent contract renewals. The case of reputation and image building is in strong favour for more frequent contract renewals for farmers unlikely to compromise the environment.

Sales conclusions with a receipt increase the frequency of contract renewals with a buyer. A receipt documents evidence of past trading relations for future reference. It means that any party aggrieved in the course of relating can refer to the receipted information to solve differences. Prices and output records are important planning items for successful farm business. This result shows that when trade conclusion is mutually agreed with referenced information, there is trust, friction in the relationship decreases yielding more contract renewals. Full traceability increases the frequency of contract renewals too. Perhaps because of distribution efficiencies and trust in the products handled, contract renewals become highly possible and easy between partners. Traceability signals acceptance of transparency and responsibility over product quality and safety. This strengthens a buyer's trust with producers. The result on receipting and traceability indicate that trust between partners in fresh produce markets has the possibility of reducing contractual failure and unnecessary renegotiations. Policy wise, consideration should be given to what could fit smallholder units, how far back and forward to go though the existing manual systems from donor-private firms' partnerships could form the basis for development.

The result on farm size indicates that a guaranteed source of supplies, ability to support farm investments and quality infrastructure e.g., a quality management system, will generally interpret into more contract renewals with fresh produce buyers. Compared to intermediaries, export firms engage in more frequent contract renewals, which suggest that financial and logistic capabilities are critical in managing contracts. This indicates that exporters remain a more efficient market-linkage for smallholders. The result on the number of buyers in a village shows that stiff competition makes it difficult to renew contracts more frequently because of the inability to depend on an uncertain open market system. Policy wise, initiating market linkages with the involvement of producers in the decision making process reduces chances of failed initiatives. The sustainability of linkages when some exporters exploit high season windfalls and then exit leaving disenfranchised producers needs further probe.

The study contributes to the growing discourse on QAS in international markets severally. There are arguments that business to business standards are segmenting markets at the farm level. The study has shown that market partnership, farmer and farm asset capacity and

targeted incentives aid smallholders to successfully adopt GGAP certification to access premium markets. Conversely, short closely monitored supply chains and independent producers reduce successful adoption of GGAP opting to serve alternative less demanding markets. Therefore, the debate on market segmentation is clearly not baseless. This finding has implications in developing and least developed countries because export crops are promoted by a few export firms showing that smallholders markets might be highly segmented with increased QAS.

On the argument that QAS exert extra farm production costs with no observable gains in producer prices, this study has shown that although not very large, GGAP certified producers have a price premium. GGAP is not visible at the consumer end so producers have no stake on the consumer price. However, market participants are passing on price benefits to producers in a small way. Finally, this study has shown that farm level contractual forms evolve as risk-reduction and transaction cost minimizing options for buyers and producers. Contracts are an efficient strategy to order quality and safe supplies from smallholding farms. Hence, the study lends support to the use of contracting as a transitional strategy for smallholders in developing countries to produce quality commodities for consumer based markets.

Further, the study points to several windows for further research. There is an opportunity to extend empirical analysis to other smallholding sub-sectors e.g., cut flowers and fruit production. Secondly, the study utilizes a one season cross-sectional data with a very short time period to model successful adoption of GGAP certification, its effect on producer prices, and choice of contracts and frequency of renewals. This is done under strict assumptions: no dis-adoption or renewal of certification, no change of contracts or buyers was considered for example. Future research should consider studying long term effects of certification with respect to producer group growth and implications for structural change, price volatility, stability of market exchange and rejection rates, using a longer panel. Such a study would capture certification and contracting as on-going processes, where producers enter or exit. The results have also shown that producer prices are influenced by seasonality and buyers. A study of price transmission to assess the relationship between producer and exporter prices at various times of the season could expose market (in)efficiencies and possible market power tendencies in the supply chain. Finally, a value chain analysis for beans might locate participants of the supply chain and possibly explain the duality of markets at the farm level.

Methodological Appendix

This section includes methodological issues that are not fully included in Chapter Two and Chapter Four.

Successful GlobalGAP certification and Choice of contractual form

We are interested 1) in the successful adoption of GlobalGAP (GGAP) certification by smallholder French beans producers and 2) in the choice of written contracts in marketing. The choice made by a producer manifests some maximized underlying utility. This utility is latent meaning it cannot be directly observed. Therefore, the observed choice is utility maximizing for that producer. The motives for adopting GGAP are varied: costs reduction, quality, profits and reputation. Some producers may, others may not be successful in adopting GGAP because of financial and technical constraints. On the other hand, the benefits of using a written contract are diverse: an assured buyer, price risk reduction, quality and access to incentives where available e.g., credit. In both strategies, buyers are assured high quality and safe supplies, minimized transaction costs of searching for sellers, and reliability. Under increased farm production costs from certification, we assume that resource constrained French beans producers would pursue price/profit/revenue motive more succinctly (Hobbs, 2003). This applies to contracts too. As profit maximizing agents, producers will evaluate each choice given its probability level $P(\bullet)$ from a finite set of alternatives in a certain choice set, C_n . In our case, producers have a binary choice problem: either successfully adopt, GGAP or not, OR choose a written or oral contract. If the latent profit associated with GGAP (or written contract), π_i is greater than the probabilities associated with profits from non-certification (oral contracts), then a producer adopts GGAP (or uses a written contract) thus:

$$\pi_i = \beta X_i + \varepsilon_i, \quad y_i = 1(\pi_i > 0) \\ y_i = 0(\pi_i \leq 0) \quad 1$$

where π_i is the latent profit, X_i is a vector of explanatory variables, y_i is the successful adoption of GGAP (or use of written contract) and ε_i is a random error capturing unobserved attributes. This choice will be heterogeneous across a given population of smallholder producers because of socio-economic characteristics. Some producers will have successfully adopted GGAP (or used written contracts) because of better placement in terms of resources and access to incentives. Since the utility is latent, we can only use observable factors e.g., producer experience, to explain the observed adoption or use. The latent profit π_i is assumed

to be a linear function of the explanatory variables X_i and the unobservable error variable ε_i in the form

$$\pi_i = \alpha + \beta X_i - \varepsilon_i \quad 2$$

Because the latent profit is not directly observable the use of Ordinary Least Squares regression of π on X is unreliable and produces biased estimates. The probability of the latent profit being observed is represented as follows

$$\pi_i = \Pr(y_i = 1) = \Pr(\pi_i > 0) = \Pr(\alpha + \beta X_i - \varepsilon_i > 0) = \Pr(\varepsilon_i < \alpha + \beta X_i)$$

As in Maddala (1999) and Greene (2000) we assume the error term ε_i to be independently and identically distributed with mean zero and unit variance, $\varepsilon_i \sim N(0, \sigma^2)$, and utility to be random, so that the observed GGAP (or written contract) equals 1 if the profit gained is more than from the alternative, $y_i = 1(\pi_i > \pi_0)$, otherwise 0, $y_i = 0(\pi_i \leq \pi_0)$. This yields the probit model:

$$\pi_i = \Pr[\varepsilon_i < \alpha + \beta'X] = \Phi(\alpha + \beta'X) \quad 3$$

where $\Phi(\bullet)$ is the standard normal density, $\Phi(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^z e^{-1/2Z^2} dZ$.

The reduced regression form of the probit model is mathematically specified:

$$P(Y = 1) = 1 - F(-\beta'X) + \varepsilon$$

where, Y is the choice made, β' is a vector of parameter estimates and X is a vector of explanatory variables included in the function. This model is considered parsimonious and tractable in structure assuming that utility is maximized, choice sets deterministic and the characteristics of the decision maker measurable and that the error term ε has a simple structure (Greene, 2000). We have assumed the normal probability density function because the choice to adopt GGAP (or use written contracts) is unknown a priori and estimated probit coefficients by maximizing the likelihood function,

$$L = \prod_{y_i=1} [1 - F(-\beta'X_i)] \cdot \prod_{y_i=0} F(-\beta'X_i)$$

where $F(\bullet)$ is the distribution function of ε . The outputs of the models represent the probabilities of individuals selecting each alternative.

The frequency of contract renewals

The purpose of this section is to estimate the frequency of contract renewals. Generally smallholders produce French beans on a three-three month production cycle per year. The 3-3 tier system is based on relay production where a crop is planted in planned sequence on different plots so that a producer has three crop harvests during the year. Each three month period is a season. A buyer who contracts a producer is assured of consistent supplies during this season but not guaranteed in the second or third phases of the 3-3 tier season. The renewal of a contract for the second phase is assumed given at the end of the first 3 month season if the partners are satisfied with the dealings of that forgone season. Otherwise, the renewal is terminated. This means that a producer could search for a different buyer during the course of the first phase if not interested with renewal with a buyer for the second phase of crop harvests. A buyer also has the same option of changing a producer for the coming season. We assume that during the actual season there are no withdrawals of business dealings.

We only have data on the number of seasons a producer had sold to a buyer at the time of the survey. We assume that there have been renewals and terminations of contracts for a certain period of time. This helps us to capture the likelihood that producers and buyers could have parted ways at one point and then reconciled in subsequent seasons. This is not uncommon in fresh produce markets in the study area. The period is computed as follows:

$$T = \frac{UL - LL}{3}$$

where T is the time period interval; UL is the maximum number of seasons in the sample; LL is the minimum number of seasons in the sample and 3 is the three-three month contract period per year. This equation returns a value of 6.6 or about 7 years. The observed number of seasons is taken as counts or frequency of contract renewals in a 7 year period. Table A.4 presents descriptive statistics on the reported number of seasons. The minimum number of seasons is 0 which means that these producers did not have any contract renewals with the buyer in the last 7 years. Producers could change buyers, exit or change into a non-export crop etc or buyers could change producers, move to another region, or exit for some seasons etc. The relationship between the frequency of contract renewal and covariates could be estimated using the canonical regression specification for count variables: the Poisson. The Poisson model is a regression of the form,

$$\text{Prob}[Y = y_i | x_i] = \frac{\exp(-\lambda_i)\lambda_i^{y_i}}{\Gamma(1 + y_i)},$$

$$\lambda_i = \exp(\alpha + x_i'\beta), y_i = 0, 1, \dots, i = 1, \dots, N \quad 1$$

where x_i is a vector of covariates, λ_i is the mean of the Poisson distribution, Γ is the gamma function and $i = 1, \dots, N$, indexes the N observations in a random sample. The model has a loglinear conditional mean function that is equal to its conditional variance

$$E[y_i | x_i] = \text{Var}[y_i | x_i] = \lambda_i \quad 2$$

where, $E[y_i | x_i] = \lambda_i$ is the conditional mean and $\text{Var}[y_i | x_i] = \lambda_i$ is the conditional variance. However, this assumption is restricted in our data. The mean frequency of contract renewals in table A.4, $\lambda_i = 4.54$ is lower than the variance $\lambda_i = 18.21$ indicating non equality of the mean and the variance. For example, table A.5 shows that the variances of the frequency of contract renewals for price knowledge and payment mode are higher than the means. The mean value of the dependent variable appears to vary with when price is known and the type of payment mode. These differences further suggest that a Poisson model, in which these values are assumed to be equal, could be inappropriate in our analysis. Where observed data displays overdispersion i.e., the conditional variance is larger than the conditional mean, a more general model, the negative binomial performs better than the Poisson model (Cameron and Trivedi, 1990; Greene, 2008).

The negative binomial regression relaxes equidispersion assumption in the Poisson model (equation 2) through introduction of latent heterogeneity ε in the conditional mean to induce overdispersion (Greene, 2008),

$$E[y_i | x_i, \varepsilon_i] = \exp(\alpha + x_i'\beta + \varepsilon_i) = \exp(\alpha + x_i'\beta)\exp(\varepsilon_i) = \lambda_i h_i \quad 3$$

where, error term, $h_i = \exp(\varepsilon_i)$ is assumed to have a one parameter gamma distribution, $G(\theta, \theta)$

with mean 1 and a variance $\frac{1}{\theta} = \psi$ and a probability density function,

$$f(h_i) = \frac{\theta^\theta \exp(-\theta h_i) h_i^{\theta-1}}{\Gamma(\theta)}, h_i \geq 0, \theta > 0. \quad 4$$

The latent heterogeneity preserves the conditional mean, $E[y_i | x_i] = \lambda_i$ but induces over dispersion in the variance, $\text{Var}[y_i | x_i] = \lambda_i [1 + \left(\frac{1}{\theta}\right)\lambda_i] = \lambda_i [1 + \psi\lambda_i]$.

By integrating out the error term in (4) and transforming the Gamma distribution as a function of the Poisson mean, the marginal negative binomial distribution is obtained

$$\text{Prob}(Y=y_i|x_i)=\frac{\Gamma(\theta+y_i)r_i^\theta(1-r_i)^{y_i}}{\Gamma(1+y_i)\Gamma(\theta)}, y_i=0,1,\dots, \theta>0, r_i=\frac{\theta}{(\theta+\lambda_i)} \quad 5$$

θ is the dispersion parameter. Our interest is to estimate, α , β and θ parameters. Statistically, the estimated coefficients from (3) have an additive effect in the $\log(y)$ scale,

$$\log(\lambda_i)=\alpha_0+\sum_{j=1}^k x'_j\beta+\varepsilon_i \quad 6$$

and are interpreted as expected log counts of the frequency of contract renewals. If equation 6 is expressed in multiplicative form, the results are interpreted as incidence rate ratios,

$$\lambda_i = \exp(\alpha_0) * (\sum_{j=1}^k x'_j\beta) * (\varepsilon_i) \quad 7$$

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Table A.1: Compliance with GlobalGAP requirements by farm structure (N=249)

	% Producer groups (N=100)	% Independent producers (N=149)	t-test	Sample N=249
<i>Upfront Requirements</i>				
<i>Training modules</i>				
Pesticide use, application and control	100	77.2	-5.42	86.4
Crop and personal hygiene	100	79.2	-5.10	87.6
Record keeping	100	32.9	-14.23	59.8
Post harvest crop care	100	16.8	-22.18	50.2
<i>Farm investments</i>				
Calibrated sprayer	100	93.3	-2.67	96.0
Own-farm grading shed	98	13.4	-23.42	47.4
Water pump	97	84.6	-3.20	89.6
Protective clothing	76	16.1	-11.75	40.2
<i>Traceability of farm produce</i>				
Producer's name	98	73.2	-5.41	83.1
Farm's code	61	22.8	-6.56	38.2
Produce collection date	84	55.0	-4.96	66.7
Produce grade	100	100	-	100
Producer group name	100	0	-	40.2
<i>Certification status</i>				
Certified	72	0	-19.5	28.9

Source: Author, computed using STATA 12.1 Mwea Tebere French beans survey, April-June 2006

Table A.2: Descriptive statistics for GlobalGAP requirements conditional on producer group certification status (N=100)

Upfront Requirements	Not certified group (N=28)		Certified group (N=72)		t-test
	Mean	S. D.	Mean	S. D.	
<i>Training</i>					
Pesticides use, application and control	1	0	1	0	-
Crop and personal hygiene	1	0	1	0	-
Book keeping	1	0	1	0	-
Post harvest crop care	1	0	1	0	-
<i>Farm investments</i>					
Calibrated sprayer	1	0	1	0	-
On-farm grading shed	.93	.26	1	0	-2.33
Water pump	.89	.31	1	0	-2.91
Protective garment	.64	.49	.81	.40	-1.72
<i>Traceability of produce</i>					
Producer group name	1	0	1	0	-
Produce grade	1	0	1	0	-
Producer's name	.93	.26	1	0	-2.33
Farm's code	.89	.31	.5	.50	3.84
Produce collection date	.79	.42	.86	.35	-.92
<i>Certification</i>					
Certified	0	0	1	0	-

Source: Author, computed using STATA 12.1, Mwea Tebere French beans survey, April-June 2006

Table A.3: Descriptive statistics based on certification status and farm structure (N=249)

Independent Variables	NCG, n=28		IND, n=149		C-G, n=72		NCG/IND	NCG/CG
	Mean	S.D.	Mean	S.D.	Mean	S.D.	t-test	t-test
Age (yrs)	44.46	10.83	40.18	9.22	43.29	7.02	-2.180	0.632
Schooling(yrs)	10	2.26	9.89	2.26	10.97	2.14	-0.230	-1.993
Experience(yrs)	12.25	8.45	12.95	6.98	13.57	6.96	0.465	-0.794
Contract seasons	6.46	4.57	2.58	3.22	8.2	3.9	-5.413	-1.891
Farm size (acres)	.79	.71	.79	.50	1.53	.77	0.071	-4.397
Grading shed (0,1)	.93	.26	.13	.34	1	0	-11.651	-2.330
Protective gear (0,1)	.64	.48	.16	.37	.81	.40	-6.004	-1.719
Written contract (0,1)	1	0	.05	.23	.58	.49	-22.089	4.302
Export firm link (0,1)	.93	.26	.30	.46	.81	.40	-7.095	1.509
Group member (0,1)	1	0	0	0	1	0	-	-
Farmers sharing buyer (count)	3.5	1.57	3.4	1.78	3.64	.99	-0.268	-0.523
Farmers in village (count)	15.43	5.38	19.53	6.55	21.13	8.12	3.106	-3.408
Groups in village (count)	1.93	1.14	2.62	2.21	2.94	1.68	1.620	-2.929
Group size (count)	17.32	2.5	0	0	22.31	6.65	-84.310	-3.825
Mean Price, 3kg carton	74.33	14.15	67.62	25.36	71.49	17	-3.330	1.919
Extension visits (0,1)	1	0	.26	.44	1	0	-8.990	-
Extension (count)	10.04	2.83	2.46	4.59	7.76	2.92	-8.410	3.497
Credit access (0,1)	1	0	.68	.46	1	0	-3.570	-

NB: NCG-Not certified groups, IND-Independent Producers, CG-Certified groups

Source: Author, computed using STATA 12.1, Mwea Tebere French beans survey, April-June 2006

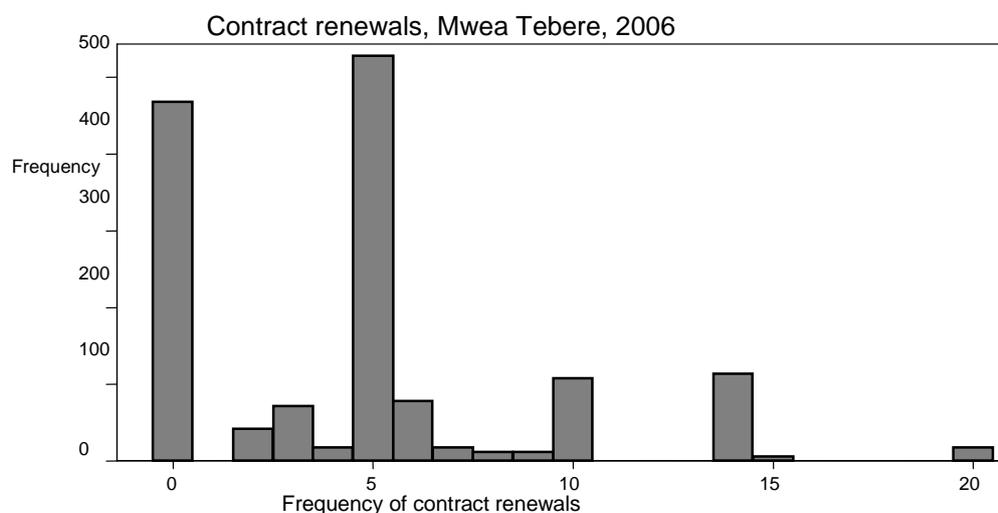


Figure A.1: Distribution of contract renewals among French beans producers

Table A.4: Descriptive statistics for the frequency of contract renewals

Distribution of producers	N	Mean	SD	Var.	Min	Max	P50
All sampled producers	249	4.54	4.27	18.21	0	20	5
Excluding producers with 0 seasons	171	6.61	3.58	12.80	2	20	5
Excluding producers with 20 seasons	248	4.48	4.16	17.31	0	16	5
Excluding producers with 0 and 20 seasons	170	6.53	3.44	11.81	2	16	5

Source: Author, computed using STATA 12.1, Mwea Tebere French beans survey, April-June 2006

Table A.5: Contract renewals conditional on price knowledge and payment mode

Variable	N	Mean	Var
Price known at planting time	80	8	18.18
Price known at harvesting time	169	2.90	9.92
Spot cash payment after delivery	83	2.34	13.06
Lagged payment after delivery	166	5.64	17.23

Source: Author, computed using STATA 12.1, Mwea Tebere French beans survey, April-June 2006

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Research Interests

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