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Organic Certification, Sustainable Farming and Return on Investment: Empirical Evidence from Ghana

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Diplom-Volkswirtin Linda Kleemann
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Zusammenfassung auf Deutsch

Diese Dissertation analysiert die Wirtschaftlichkeit und Umweltverträglichkeit von kontrolliert biologischer kleinbäuerlicher Landwirtschaft in Afrika vor dem Hintergrund der stark wachsenden Nachfrage nach biologischen Lebensmitteln in Europa.

Zertifizierte Biolandwirtschaft in Afrika erscheint angesichts von unzureichender Ernährungssicherheit auf den ersten Blick wie ein Luxus. Allerdings führen Umweltbelastungen und degradierte Böden durch die Landwirtschaft und der Klimawandel bei internationalen Organisationen, Gebern und lokalen Regierungen zu einem erhöhten Bewusstsein für die Bedeutung von Nachhaltigkeit in Landwirtschaft und Ernährung. Aktuelle landwirtschaftliche Entwicklungsstrategien versuchen sowohl das Einkommen der ländlichen Bevölkerung zu steigern als auch die Umwelt zu schützen. Am Beispiel von exportorientiertem Ananasanbau in Ghana analysieren wir, ob zertifizierte Biolandwirtschaft diese beiden Ansprüche erfüllen kann. Aus einer Preistransmissionsanalyse können wir mit Hilfe der hedonischen Nachfragetheorie schließen, dass die Kernnachfrage nach Bioprodukten schneller steigt als das Angebot und damit Potential zur Erweiterung der Produktion bei gegebenen Preisrelationen vorhanden ist. Allerdings erfordert die Biozertifizierung erhebliche Investitionen von Seiten der Bauern. Die Analyse des Return on Investment zeigt, dass diese Investitionen wirtschaftlich sinnvoll sind. Wir benutzen hierfür ein neues Verfahren, mit dem wir den Effekt der Zertifizierung von verwandten Effekten wie Vertragsanbau und Export separieren können.

Außerdem dient die Zertifizierung als Katalysator für die stärkere Nutzung von agrar-ökologischen Anbaumethoden. Der Gebrauch dieser Methoden ist zwar in der Regel profitabel, aber immer noch sehr geringen Ausmaßes. Das gefährdet die Nachhaltigkeit des kleinbäuerlichen biologischen Anbaus in Afrika. Daher sollte deren verstärkter Einsatz, vor allem hinsichtlich der Überwindung von Barrieren durch hohe Transportkosten, und die Ausnutzung von Skaleneffekten aktiver unterstützt werden.

Wenn diese Aspekte bedacht werden, kann biologisch-zertifizierte Landwirtschaft nach unseren Analysen ein alternativer Entwicklungspfad für Teile der ländlichen Bevölkerung sein, da es eine schnell wachsende internationale Nachfrage mit nachhaltigen Produktionsmethoden verbindet, die vor allem für die ärmeren Kleinbauern attraktiv sind.

Summary in English

This thesis analyzes the economic and environmental performance of certified organic small-scale agriculture in Africa in light of the rapidly growing demand for organic foods in Europe. In the face of the food insecure situation in Africa, certified organic agriculture appears as a luxury at first glance. However, climate change, pollution, and soil erosion caused by agriculture, lead to an increased awareness of the importance of sustainability in agriculture and nutrition among international organizations, donors and local governments. Therefore current agricultural development strategies try to increase both the income of the rural population and protect the environment. Using the example of export-oriented pineapple cultivation in Ghana, we analyze whether certified organic farming meets these two aims.

Working from large to small, we first analyze the international market integration for premium-priced organic certified products. We find that the conventional market acts as a price leader for the organic one, but demand shocks are transmitted to the organic market through the conventional market with a time lag and lower intensity. In addition, there is neither increasing market integration, nor a declining price premium on organic pineapples. Employing hedonic demand theory, we can show that this happens when the core demand for organic products is growing faster than supply. Thus potential exists for scaling up at given price ratios.

Even though, small-scale farmers tend to have difficulties in meeting international market standards and large farms have advantages due to economies of scale, we find that production for the export market is possible and profitable for smallholders. Employing value chain analysis, organic production seems more profitable than conventional production due to the retail level price premium on organic products that is passed on to farmers and that overcompensates lower yields on organic farms. Even more, from a theoretical perspective, organic farmers should also be more likely to get into contractual relations with exporters.

However, a premium is paid for certified products only and the certification with internationally approved labels requires a substantial investment on the side of the farmers. Using novel primary data that allows us to separate the effect of certification of related effects such as contract farming and exporting; and controlling for selection bias, we estimate the return on investment and find a positive effect of switching from conventional to organic production when competing on the global market for pineapple. The data also shows that relatively poorer, less educated households are more likely to adopt organic production. While we cannot determine whether this happens because they are more attracted by this form of production or because of targeting by exporters and NGOs, it nevertheless implies that organic certification is pro-poor.

In addition, organic certification serves as a catalyst for the increased use of agro-ecological farming methods and our results suggest that there is not necessarily a trade-off between economic efficiency and environmental friendly farming practices. However, even though cost-effective, their overall use is still very low. This endangers the sustainability of small-scale organic farming in Africa. Therefore, their increased usage should be supported more actively, especially by overcoming transport cost barriers and by exploiting economies of scale. To sum up, our analysis shows that, given the sufficient use of agro-ecological practices, certified organic agriculture can be an alternative path of development for parts of the rural population. It combines a rapidly growing international demand with sustainable production methods that are attractive to the poorer farmers.

Chapter 1

Introduction

This dissertation connects three distinct features of agriculture in Africa: First is the unsustainable situation of farming in Africa. Second are the difficulties that small-scale farmers face when trying to increase their income by accessing world markets. And third is the increasing demand in developed countries for food products from certified organic agriculture. The overarching question is if the first two problematic features can be alleviated by making use of the third feature. This would then be one step towards the distant aim of a sustainable, resilient African farming situation with a prospering small-scale sector that is well integrated into international value chains.

Certifications with sustainability standards or ecolabels for the dominantly small farmers in Africa promise to provide two types of economic benefits. They hope to reduce rural poverty by providing market access and higher profits through a combination of premium prices and better or more resilient yields, and offer long-term environmental benefits for the local economy. In this dissertation we examine if and under what circumstances small-scale farmer organic certification provides these benefits. Certified organic farming in this case refers to production which satisfies at minimum the EU organic standard (EC) 834/2007 and (EC) 889/2008, which largely prohibits the use of synthetic inputs. By contrast the term sustainable agriculture usually refers to a combination of methods including reduced use of synthetic inputs and soil fertility enhancing production practices, but does not satisfy externally specified and verified criteria.

Such a certification approach should be supported by development aid and local governments, only to the degree that it delivers on its social and ecological objectives. Hence, the central policy question is, to what extent innovative agriculture strategies for small-scale farmers can provide an alternative development model for specific parts of the rural population, while at the same time delivering environmental benefits.

Starting with the first feature, the unsustainable farming situation in Africa, it is without doubt that the situation of African agriculture is unsustainable in all three pillars of sustainability: economy, society and ecology. At the same time, recurrent hunger crises highlight the need for improvement in agriculture, in particular improving yields. This is not only a humanitarian dilemma but also a question of social and political stability. Numerous scientific studies (e.g. Arezki and Brückner, 2011; Bellemare, 2011; Bush, 2010) find a direct correlation between food security crises and political unrest, which constitutes a social problem of insufficient availability of food. This social problem is internationalized by an increasing global demand for grains for food, feedstock, energy, and biomass and aggravated by the effects of climate change. The IAASTD (2009) estimates that the global demand for grain will increase by 75% between 2000 and 2050.

To this pressure add ecologically unsustainable production patterns. Agriculture is responsible for environmental damage such as underground water depletion, soil erosion, pollution, loss of biodiversity, and deforestation. In parts of Africa, land is already strongly degraded (IAASTD, 2009). It is thus necessary to reduce the environmental impacts of agriculture so as to not further destroy its own ecological foundations. Sustainable production models that intend to increase yields, while protecting the environment and increasing resilience to climatic changes, have been promoted by donors and governments (Kassam et al., 2012; Branca et al., 2011; FAO, 2011; Knowler and Bradshaw, 2007; Erenstein, 2002). This initial situation and proposed solutions are studied in more detail in the overview article in chapter 2.

The second feature, the restructuring of global food value chains with stricter requirements for food safety, traceability, and the increasing importance of private voluntary standards (PVS), has in many cases led to the exclusion of developing country small-scale producers from international value chains, while at the same time, a horticulture industry in Sub-Saharan Africa (SSA) has emerged, facilitated by diversification policies and the international demand for tropical vegetables and fruit all year round. Horticulture potentially favors small-scale farmers because of its labor intensity and high production value per unit, which translates into better acceptance of small production units by buyers and a labor monitoring cost advantage for family farms. One approach to help re-include smallholders in agricultural export activities in this sector is the certification of producers with internationally approved food labels. A well-known example is GlobalGAP certification, which is a private standard in primary production of plant and animal products and a quasi-precondition to enter the European and North American export markets with conventional horticultural produce. Organic certification is another example that meets the rising demand for natural foods and achieves premium prices internationally. Both systems offer group certification options for small farmers.

Regarding the third feature, the increasing demand for environmental friendly food products, the organic food and drinks sector has been growing with an average growth rate of over 10% in the last 15 years, considerably higher than that of the conventional market and similar to Fairtrade and comparable labels. In addition, organic food is moving from the niche market into large specialized stores and supermarkets with consumer demand concentrated in North America and Europe. Certification with internationally recognized standards gives access to this fast growing high-end market and the price premia paid for it (UNEP, 2007).

This situation creates niche market opportunities for producers in developing countries. The compelling idea is that smallholders could simultaneously increase their income and produce more sustainably by responding to the global demand for high priced organic food. This would potentially alleviate two problems at once: increase ecological sustainability and improve incomes in rural areas in developing countries. If viable, this would be an interesting approach, the implementation of which donors and local governments would want to support if they would know where the key frictions lie.

The success of this potential win-win solution depends on many factors ranging from adjustments of production techniques and costs of certification, to ecological superiority, and to external factors to the individual farmer such as future market developments and information deficits. This dissertation assesses the overall outcome taking into account the influence of these factors. The example of pineapple from Ghana is used. The author collected primary data from small-scale pineapple producers in Ghana, and assembled primary and secondary data on international prices and costs.

Pineapple is one of Ghana's most important non-traditional export crops and it is the most developed horticultural export sector. At the same time Ghana is a typical African country in that it is characterized by an agricultural sector with low levels of technology and productivity. Additionally, Ghana has highly degraded soils on which population pressure and climate change exert further pressure (Diao and Sarpong, 2007). Therefore, the Ghanaian government emphasizes the necessity to modernize the agricultural sector, increase and diversify exports and address the problem of declining yields through environmental protection (Government of Ghana, 2010). International institutions also place more importance on sustainability in agriculture (FAO, 2011; Knowler and Bradshaw, 2007) and both nationally and internationally organic agriculture is explicitly mentioned as a promising solution in this context.

Working from general level to detail, we begin our study on world markets in chapter 3, more specifically with the price transmission between conventional and organic products. The readiness to substitute conventional by higher priced organic food products, i.e. the willingness to pay (WTP) a higher price for organic food based on perceived desirable characteristics is well-documented, but the integration of the organic and conventional sub-markets is underexplored, to some extent due to severe data constraints. We therefore take an unusual approach and deduct the dynamic characteristics of the demand functions from the international price behavior over time. In so doing we are able to provide more general results than by using survey based methods that use cross-section data based on choice experiments rather than on actual buying behavior over time. Analyzing spatial price transmission between conventional and organic pineapple on the European market, we can demonstrate the existence of a non-declining price premium for organic products. Moreover, the conventional market acts as a price leader for the organic market, which is the expected result, given that the conventional market is much larger than the organic market. We also find reaction lags and thresholds below which organic prices are unaffected by conventional price changes. This price adjustment behavior does not change over time, even while the organic niche market expands. Hedonic demand theory explains this observation with a situation in which the demand for organic products expands faster than supply. This implies large potential for scaling up organic sales.

In the next chapter, we leave the international price sphere and conduct a value chain analysis for Ghanaian conventional and organic pineapple. In order to be beneficial for farmers, price premia on consumer markets have to be transferred along the value chain to the producers. To what extent this happens and where costs differ between conventional and organic pineapple along the value chain is the focus of chapter 4. As it is a common concern also in other high value commodities such as coffee that this transmission channel does not function well, this question is very relevant.

The analysis provides the missing link between the literature that finds a high willingness to pay a premium for organic products in developed countries (e.g. Teisl et al., 2002; Nimon and Beghin, 1999; Bjorner et al., 2004) and the literature that finds that certified organic agriculture is more profitable than conventional agriculture in developing countries (e.g. Bolwig et al., 2009; Maertens and Swinnen, 2009), by showing how the costs and prices for organic produce are formed at the farm level and how they develop along the value chain. Ghana provides a particularly interesting case for this analysis because it experienced a drastic market-induced change in the pineapple industry. Between 1983 and 2005, the export pineapple sector was beneficial for many smallholders that delivered fruit for the export market, but a change in the variety demanded on world markets led to massive drop in exports and subsequent exclusion of smallholders from the export pineapple value chain due to perceived high smallholder production costs and frequent contract breaching. Around the same time, certified organic production of pineapples started to increase. With regard to donor efforts to bring back smallholders into export production, it is central to know whether this happened by chance or whether the organic niche market has properties that make it better suited for smallholders and whether the organic sector is sufficiently different from the conventional one such that diversification into this niche market can serve as a risk spreading strategy for the sector.

To be able to evaluate the profitability of organic production for smallholders, we calculate the costs and revenues of production for these farmers and compare them with those for conventional smallholders and large farms using secondary data from several farm surveys. Our results demonstrate that, contrary to a widely held opinion in Ghana, production for the export market is a realistic option for both organic and conventional smallholders. Assuming that smallholders export an empirical average share of their production, the benefits outweigh costs of production even though smallholders tend to have quality problems with their fruit and large farms benefit from economies of scale. In addition, our findings suggest that, in percentage terms, a fair share of the organic price premium is passed from retail level to Ghanaian farmers. From a theoretical perspective organic farmers should also be more likely to get into contractual relations with exporters, because surpluses for both groups of actors (smallholders and exporters) exist and side-selling is less attractive for organic smallholders. This is the case, because alternative outlets offer a much lower price for organic produce and local markets for certified organic products are virtually non-existent.

In chapter 5, we go further into detail and analyze smallholder participation and return on investment (ROI) in organic certification. We build on the recent literature that analyses impacts of private voluntary standard certifications for small-scale farmers in developing countries and improve it in several ways. In particular, we give a more representative picture of the sector and separate the effect of certification from the effects of exporting and contract farming by restricting ourselves to the post-export decision between conventional and organic strategies. From a policy perspective this analysis answers the question whether organic certified export-oriented farming offers new possibilities to farmers in contrast to conventional export-oriented farming.

We use the ROI as opposed to other income indicators because we focus on certification as an investment strategy from the perspective of the farmer. Because randomization of treatment was neither feasible nor sensible in our case, we rely on regression techniques using an endogenous switching regression model (ESR) to control for selection bias based on observables and unobservables. We find that organic farmers tend to be poorer, less educated and more traditional in terms of farming attitudes and that farming strategies are determined to a large extent by current and past social networks and current networks within the pineapple sector. Controlling for these characteristics certified organic farming is the more profitable option. The reason lies in higher prices achieved on export and local markets, which overcompensate for lower yields.

In the next chapter (chapter 6) we make the environmental aspect in organic production explicit. We first estimate the effect that organic certification has on the actual use of agro-ecological production methods, such as the planting of cover crops or the use of organic fertilizer (as opposed to using no fertilizer at all). We then determine the impact that the intensity of use of these practices has on the ROI of small-scale pineapple farming in Ghana.

Our hypothesis is that organic certification acts as catalyst for increased adoption of such practices. Since they are not required by the certification standard, the effect has to run through different channels. That such channels exists at all is subject to debate and hence there is a dilemma of (perceived) insufficient adoption, in which organic farmers in developing countries remain in a state of "organic-by-default" production with little or no use of inputs or other soil enhancing methods and consequent low yields and unsustainable production. Because these practices are widely known in the target population and can be applied independently by each farmer, their adoption cannot be considered as a classical treatment which we would be able to randomize over the target population. Therefore, we rely on a modification of the generalized propensity score approach developed by Hirano and Imbens (2004) to control for selection bias. Since the previously done endogenous switching regression for the binary choice results in no significant influence of unobservables we can safely assume that regression based on selection on observables is sufficient. Our results show that organic certification indeed seems to act as a catalyst for adoption.

In the second step, we determine the impact that the intensity of use of agro-ecological practices has on the ROI for small-scale pineapple farmers in Ghana. This second step connects the ecological needs to protect the environment and replenish soil fertility with economic rationality by measuring the ROI of increasing their use, keeping in mind that one of the main barriers to implementing improved agricultural technologies in developing countries that is continuously cited are short-term economic constraints. Above all, significant yield changes, which have been measured in response to adoption of agro-ecological practices in previous studies, may only materialize in the longer term.

We find a nonlinear relationship between the ROI and the intensity of agro-ecological practice use, where most farmers are caught in a low impact dip. After studying the agro-ecological method use patterns at different levels, we suppose that transport costs for organic material may act as a barrier to more intensive adoption. Since the use of agro-ecological methods is generally very low and governments and international organizations see a strong necessity to increase their use in the face of climate change and food security, it would make sense to combine the catalytic effect of certification with active support to reduce these barriers.

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Chapter 2

Sustainable Agriculture and Food Security in Africa: An Overview

Linda Kleemann

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Contact: Kiel Institute for the World Economy, Hindenburgufer 66, 24105 Kiel, Email: linda.kleemann@ifw-kiel.de.

Sustainable Agriculture and Food Security in Africa: An Overview

Abstract

The development of the agricultural sector and the improvement of the food security situation are seen as essential components to sustainable development in Africa. However, continuing population growth, impacts of climate change and environmental degradation add to an unprecedented combination of pressures that threaten existing efforts and solutions. This article discusses the challenges of meeting the food security needs in a sustainable way. Due to its involvement of all three dimensions of sustainable development, economic, social and ecological, we argue that organic farming could be one possible approach to create a more sustainable agricultural system.

Keywords: sustainability, organic agriculture, food security

JEL codes: O13, Q01, Q56

1 Introduction

It is widely accepted that hunger and malnutrition are not just a problem of food availability, but also a problem of access to food. As argued by Sen (1999), people suffer from hunger when they cannot establish their entitlement over an adequate amount of food. Thus, to eliminate hunger and malnutrition in the long-run, it is crucial to understand how policies can increase the production of food and ensure an equitable distribution of the food produced, as well as of the resources needed for production. Both policy makers and analysts acknowledge the need for improving agricultural productivity and in boosting food security in Africa. However, the problem of long-term food security appears to be compounded by the effects of climate change, large-scale investments in agricultural land, and highly volatile world market prices, especially for staple foods. Successively evolving causes and context factors, as well as multiple reciprocal cause-effect relationships complicate the ability to make a clear-cut statement of causality. The expansion of the world population, changing consumer habits, which lead to an increase in the demand for meat products, along with EU agricultural subsidies and the use of land for cultivation of biofuels, are just some of the many complex influential factors (von Braun et al., 2008).

The development of the agricultural sector and the improvement of the food security situation strongly influence other sectors of the economy and are seen as essential components to sustainable development in Africa. Progress in achieving food security is also a prerequisite to achieving the Millennium Development Goals (MDGs).[1] From the African perspective, the fight against hunger is the most pressing social challenge. On the production side, it is of dire importance to increase the productivity of smallholder farming and the more effective use of large farms to meet the dietary needs of the rural poor. At the same time, it is also necessary to reduce the environmental impacts of the agricultural sector so as to not destroy its own ecological foundations. In many parts of Africa, the land is already strongly degraded. The agricultural successes of the recent decades, with their methods of increasing productivity by use of mineral fertilizers and pesticides, have damaged the foundations of the long-term productivity of the land (IAASTD, 2009).

Globalization has also posed a second challenge to the African farming landscape. According to the IAASTD, the global demand for grain will increase by 75% from 2000 to 2050 (IAASTD, 2009). Hence, a dwindling amount of water and soil must feed more people, and, at the same time, feed animals for meat production as well as produce energy crops and biomass for the chemical industry. This raises the pressure on an already precarious food supply in Africa.

Due to the complexity of the influencing factors, the approaches to be pursued in order to achieve sustainable agriculture and food security in Africa need to be differentiated and tailored to the specific circumstances. Drawing on available literature, this article presents an overview of the challenges facing sustainable food production in sub-Saharan Africa. Given the potential conflict between increased food production that may lead to both higher emissions and better food security, information on the sustainability of food production in sub-Saharan Africa could be of interest to both analysts and policy makers.

The paper is structured as follows. The next section discusses the concept of sustainability, as well as the three dimensions of sustainability. This is followed by an outline of the food security challenges in sub-Saharan Africa and the reasons for the low agricultural productivity. The fourth section discusses the strategies employed to promote sustainable food production in the region. The final section presents concluding remarks and implications.

2 Sustainable Agriculture and Food Security

2.1 Sustainability in Agriculture

Development is defined as sustainable according to the so-called Brundtland report when it ‘meets the needs of the present without compromising the ability of future generations to meet their own needs’ (UN WCED, 1987). Sustainable agriculture and food security therefore stands for maximizing the productivity of the land and improving the well-being of people under the constraint of minimal damage to natural resources (land, water, air, and biodiversity) (Pretty, 1999). Agriculture is seen as a multifunctional system. Through the incorporation of the whole value chain for food products, nutrition becomes part of this system.

Sustainable agriculture has often been discussed in a controversial manner, with various authors suggesting different competing strategies to accomplish this goal. Pretty (1999) uses a capital-based model of agriculture, in which capital consists of natural, social, human, financial and physical capital, and provides services that underpin the agricultural system. Capital in this model is affected by politics, production processes and institutions. If this influence is successfully used, feedback processes will strengthen the capital base. If it is not successfully used, then it results for instance in environmental pollution or social tensions, which reduce the total capital stock. According to Pretty, a sustainable system increases the capital stock over time. Other authors assume that an absence of capital stock reduction is sufficient. Availability of and access to the five different types of capital depends on contextual factors. These are divided, according to Pretty, into (short term) fixed factors (e.g. climate, agricultural ecology, soil and culture) and dynamic factors that can be externally influenced (e.g. legislation) (Pretty, 1999). The problem with models of this kind is the absence of a comparable measure for evaluating the different parts of the capital stock. Dimensions used to approximate such a measure are energy or monetary values.

In the three pillars of sustainability, economic sustainability ensures that farmers do not make any financial losses. This means, first, that his physical and financial capital, expressed in monetary units, does not decrease, which in turn is influenced by factors, such as prices, conditions of trade and yield that are considered in the following paragraphs in more detail.

The first factor, prices, often opens up the question of whether high food prices help to promote African farmers. This cannot be easily answered. The price fluctuations of the past four years and the resulting scientific studies do not show a clear picture. High prices can make farming in Africa more profitable and encourage investment in the sector. At the individual level, this is especially true for farmers who have enough land and access to adequate infrastructure, and are able to meet stringent international quality standards. Those who should benefit under the social aspect of sustainability, namely small and poor farmers lose from increasing prices, because they are mostly net food buyers (see for example Swinnen, 2011, World Bank, 2008). In the long term, they could also benefit if high prices lead to increased investment in food production and thereby to a higher production volume that is shared equitably. However that part of the price increases and price volatility that can be traced back to speculation (Gilbert, 2010), affects all farmers negatively through increased uncertainty.

Second are conditions of trade. Small farmers in Africa have so far hardly benefited from the benefits of international agricultural trade because barriers are high between African countries and regulations for processed food in both developed countries hamper processing industries (IAASTD, 2009). Against the backdrop of growing markets for high quality and organic products in industrialized countries, new marketing channels are opening up. These can create new income opportunities under the condition that there is support for farmers to meet the required environmental regulations and quality standards.

Third, for economic sustainability with particular consideration to small farmers, framework conditions are particularly important. This concerns the physical infrastructure- especially transport routes, markets and storage facilities, the information infrastructure, and the institutional framework. Numerous studies emphasize the significance of contract security (for the reduction of transaction costs), and social safety nets (e.g. agricultural insurance) (Barrett et al., 2012). Also, land ownership or secure long-term leases are starting points to enable small farmers to escape out of poverty and malnutrition, since access to credit and investments in innovations and long-term measures, such as the preservation of soil fertility, are highly correlated to the security of land tenure (Abdulai, et al., 2011).

The social dimension of sustainability in agriculture and nutrition is reflected in the justice, health, distribution, gender, and cultural aspects of society and is summarized in Pretty's model under social and human capital. Without long-term food security social sustainability is inconceivable. Increases in global food production will only lead to the alleviation of hunger, when the availability of food for the poor, through lower prices, higher incomes or better infrastructure, is improved. Measures to increase production volumes can even deteriorate access when vulnerable parts of the society are deprived of the opportunity for subsistence agriculture without simultaneously creating new income opportunities for them.

Against the backdrop of a growing global demand for resource-intensive food and renewable raw materials, a further intensification of agricultural production in Africa risks that its benefits are not used primarily to improve food security. 1 to 2% of global arable land is already used for energy crops and this number shows an upward trend. On social grounds, among the major causes of rural poverty and malnutrition are the unequal distribution of land and insecure and unclear land tenure rights. With the aim of counteracting unequal distribution of land, land reforms have been implemented in several African countries. However, not all have been successful. The ongoing relocation of peasants to make way for large-scale agricultural investment projects counteracts these efforts to distribute land more equally. In addition, from a social standpoint, access to water should be fairly distributed and the use of limited water resources should primarily benefit food security.

The improvement of educational opportunities for the poor is an effective way to create social sustainability while combating hunger. Numerous studies show a positive correlation between education level, income opportunities and nutritional status. A virtuous cycle is set in motion because well-fed and, thus healthier people are better able to feed themselves adequately and have improved employment opportunities. To this adds the advantage of better education for agricultural production itself, since sustainable agriculture is highly knowledge intensive.

The final pillar of sustainability concerns natural capital, which is termed ecological sustainability. It is based strongly on the original ideas of sustainability, not to overexploit nature. An ecologically sustainable way of life would use the environment and natural resources only to an extent that these regenerate. In particular, the industrial high-yielding agriculture is often viewed as environmentally unsustainable as it is very input-intensive and dominated by large-scale monocultures.

2.2 Is Africa's food security situation sustainable?

The food security and nutrition situation in sub-Saharan Africa is clearly not sustainable. Even though a recent report from the United Nations on the Millennium Development Goals discloses that the number of people living in absolute poverty in developing countries has declined from 1.8 billion in 1990 to 1.4 billion in 2005, the regional and intra-African distribution of poverty is highly heterogeneous: in Sub Saharan Africa- the world region with the highest poverty rate- 51% of the population lived in absolute poverty in 2005; in South Asia that number was at 39% of the population; in the Latin American-Caribbean region, 8%, and in Northern Africa it is at 3% of the population (UN, 2010).

Poverty can hinder the acquisition of sufficient quantities of food and affects both the urban and rural population. In the latter, poverty can prevent improvements in productivity when inputs cannot be purchased. Labor productivity is also low due to little educational opportunities and inadequate access to health care and/or malnutrition leading a vicious cycle of poverty and hunger.

While the proportion of hungry people in the world has declined recently, the absolute number has increased (according to data from FAOSTAT). According to statistics from the UNSCN, the southern Africa region with 239 million hungry people comes second after the Asia Pacific region with 578 million. However, the number of hungry people in Asia has decreased over the past 20 years while it has increased by 40% in Africa. In percentage terms Sub-Saharan Africa leads the way with 25% malnourishment. Accordingly, the World Hunger Index (WHI)[2] prepared by IFPRI, Concern Worldwide, and Welthungerhilfe (2011), also shows the worst picture for Southern Africa and the worst country case examples are also in Africa: Congo, Burundi, Eritrea and Chad, where continuing conflict and political instability worsen the situation.

Beyond the mere lack of calories, the problem of food insecurity also includes the so-called hidden hunger; that is malnutrition due to nutrient deficiencies, such as vitamin and mineral deficiencies. These are mostly associated with other health problems (von Braun, 2001)[3]. Again Africa is the largest region in the world with a high nutrient deficiency. On a global scale, deficiencies in iodine affect an estimated two billion people worldwide, zinc (1.2 to 2 billion), iron (0.8 to 1.2 billion), and Vitamin A, that can cause blindness (200 million), are the most common. Many people suffer from multiple micronutrient deficiencies.

The problem of food security in Africa is as much a problem of quantity as a question of access. Taking the current world harvest as basis, there is theoretically more than sufficient energy available globally, namely the equivalent of about 800 grams of grain per day (Flachowski, 2011)[4]. Nonetheless, this amount is distributed extremely unequally. Africa imports far more food than it exports (Figure 2.1) and the quantity of imports has increased significantly over the last five decades, as per-capita food production has continuously declined (Mc Arthur, 2011). Inaccessible rural areas and areas of conflict are particularly underserved. The presence of adequate amount of food and nutrients is therefore a necessary but not a satisfactory condition for food security.

There are two types of access to food: self-sufficiency and markets. As a result of poverty, subsistence farmers are unable to feed themselves because they have insufficient factors of production at their disposal. Under these circumstances, they are just as dependent as the urban population on the purchase of food products. These parts of the population at risk of hunger or already food insecure are particularly vulnerable to changes in food markets. The most obvious example is rising prices. The average African spends 50-80% of his income on food, compared to 12% for the average German. Under these circumstances, rising food prices lead to reduced intake of calories and/or a reduction in the quality and diversity of food. Often animal products, fruits and vegetables are replaced by cheaper grains (UNSCN, 2010). Table A.2.1 shows the enormous differences in caloric intake and consumption of food of animal origin. It is noteworthy to mention that the minimum in all the above mentioned categories is in Africa.

Some African countries suffer from the so-called ‘double burden of hunger and obesity’, i.e. the simultaneous problem of malnutrition and obesity and the resulting health issues. The background behind this problem lies with the adaption to the dietary habits and eating styles of the industrialized countries - the so-called 'nutrition transition' (Mendez and and Popkin, 2004).

3 Reasons for the Current Agriculture and Food Security Situation in Africa

The relationship between the three pillars of sustainability is particularly obvious in agriculture. If the soil is degraded, farming will not be economically productive. That is, it produces too little food. As a result, people suffer from hunger or malnutrition, which in turn leads to a destruction of natural resources. This implies that ecological sustainability is influenced not only by geographic and climatic factors and changes in agricultural technologies, but rather depends more on political, social and economic terms. These factors are discussed in this section.

Starting with geographical conditions, a large part of Africa's climate is considered not well suited for agriculture, a reason often given for its long history of famines. This is expressed as a limited availability of natural resources, especially water, even though Africa is rich in many other natural resources.

For instance land is not generally considered a limiting factor for the African agricultural landscape. Large stretches of land have so far hardly been put into agricultural use. However, only 10% of the land is truly fertile (UNEP, 2008a) and 13- 16% of the arable land has been damaged from erosion or been degraded as a result of other chemical and physical changes, such as infrastructure, cities, and pollutants (Bai et al., 2008). A recent study by von Braun et al. (2011) shows that about 17% of the agricultural production in Sub-Saharan Africa is lost due to land degradation, in some regions up to 40%, and on average 8% throughout the continent. This consequently leads to an increasing use of moderately arable soils. Forests, which cover about 20% of the African landscape, are strongly deforested. The deforestation rate is more than four million hectares per year, twice the world average (Kelatwang and Garzuglia, 2006).

Rapid population growth raises the pressure on the forests and already heavily farmed areas. Almost the entire global population growth in the next couple of years will, according to calculations done by the United Nations, take place in developing countries. This will increase the populations in many African countries by more than 50%. Through this population surge, the amount of theoretically available arable land per person is predicted to decline from 4.7 hectares per person in 1970 to 1.5 in 2050. In reality, this may occur faster than predicted in the model, since competition from renewable resources and settlements must be considered in the equation. Due to the fact that settlements are often located in fertile river valleys and coastal plains, some of the best agricultural land is converted almost irreversibly into cities and roads.

Africa is the warmest and second-driest continent, making water a limiting factor in the expansion of the agricultural landscape. Water is as much a staple food as a basis for food production. With an average share of 70%, in some African countries even above 90% agriculture uses the most amount of water. This water use is not sustainable if the rate of use exceeds ground water recharge or if it leads to a contamination of ground- or surface water. According to the Intergovernmental Panel on Climate Change (IPCC) irregular and reduced precipitation will quadruple the number of people affected by water shortages in Africa by the year 2050 to more than 250 million (IPCC, 2007). Low levels of irrigation in agriculture and efficiency in water use limit agricultural production growth.

The effects of global warming are already appear to be destroying harvests and threatening food security in Africa. There are five major effects of climate change on agriculture: First, the increases in the concentration of CO_2 in the atmosphere, which can in turn lead to a fertilization effect; second, higher average temperatures and third, changes in the availability of water, which are expected to have strong yet different regional effects. Fourth is the increased weather extremes and fifth, higher soil degradation that can lead to significant harvest losses (Dusseldorp and Sauter, 2011). The expected rise in droughts for already dry regions and the higher risk of flooding wetlands will present Africa with higher risks for famine. Globally, the entire agricultural yield potential is not expected to change significantly by 2080 due to the effects of climate change, yet predictions for Africa are negative. By 2020, crop yields from rain-fed agriculture, which accounts for 90% of farming, in some African countries are projected to decline by up to 50% (IPCC, 2007). The United Nations Environment Program reports that the total of climate-related decline in agricultural production will be as much as 10% in southern Africa (UNEP, 2008a).

Further reducing local availability of food post-harvest losses amount to about one-third of the total harvest volume.[5] In southern and eastern Africa, the post-harvest losses in cereals alone are 10-30%. In Tanzania, about 60 million liters of milk (16% of the total production in the dry season and 25% in the rainy season) are lost (UNSCN, 2010). Large post-harvest losses are caused by lack of investment in harvesting technology and storage facilities, improper handling and transport, and poor infrastructure. Even in densely populated areas in parts of Southern Africa it may take more than five hours to reach the nearest market (Nellemann et al, 2009). Much of the post-harvest losses could be prevented with existing technology if invested locally, but weak institutions and political instability in some countries discourage investments.

Another key factor that contributes to a decline in agricultural productivity is low spending on research and development (R&D) in agriculture. While other developing countries recorded an increasing trend, the real expenditure on agricultural R&D in southern Africa has been decreasing. In 1981, the expenditures were at US$1.15 billion; in 2000 they decreased to US$0.87 billion (UNEP, 2008b). In addition, protected agricultural markets reduce profits in the sector and thereby limit investments. Rosegrant et al. (2001) calculate that global trade liberalization in the agricultural sector would allow for an estimated US$4.4 billion in additional income in sub-Saharan Africa (US$22 billion for all developing countries). However, depending on comparative advantages, a strategy of export growth within a weak national regulatory framework can negatively affect ecological sustainability.

On the demand side the weak purchasing power of the African populations slows down progress. Poverty not only causes low demand, it also increases environmental degradation. Bai et al. (2008) find a positive correlation between the degradation of land and poverty. This relationship is explained by the attempt of the resource poor to be self-sufficient, without concerns for the environment. At the same time environmental degradation is taking away the most important resource from the poor and thereby reinforces their poverty, producing a vicious circle.

The climatic and economic factors mentioned combined with the low prices for land in Africa, make farmland attractive to investors. Financially strong state and private investors have recently been either long-term leasing or purchasing large areas of productive farmland. The economic, ecological and social consequences of such investments are controversial. On the one hand, the agricultural policy in Africa has been neglected so that there is a strong need for investment. On the other hand, there is not only an unstable food security situation, but also unclear property rights and weak government control and regulation in many African countries. Contracts for land can thereby place both the local population and the environment at a disadvantage. Unregulated land use can either lead to degradation and erosion, high greenhouse gas emissions, and overuse of the water supply or take advantage of unexploited harvest potentials, and an increase productivity and food security. The local population may lose their land without adequate compensation or they may profit from better infrastructure and new employment possibilities in rural areas.

Against the background of climate change, agriculture also plays an important role in ecological sustainability. About one-third of all global greenhouse gas emissions come from farming (UNEP, 2008a), where the emissions from the livestock industry are in the most critical position since it claims 70% of agricultural land in the world (IAASTD, 2009). A meat-based diet affects the ecological sustainability negatively, because the direct emissions (through the livestock themselves) and the indirect emissions (through fodder production) are on average higher than for the production of plant-based foods, though, the emission level depends, among other things, on the technology used and the location of production. Figure 2.2 shows the nitrogen oxide emissions for different world regions. Africa has the lowest amount of emissions. However, agriculture has a far bigger share in this region than in richer regions of the world[6].

Environmental degradation is a major limiting factor of agricultural productivity growth. When soils are subject to unsustainable exploitation in the course of food production, these processes limit their suitability for or impede further use (through erosion, salinization, acidification, compaction, contamination with toxic substances and the loss of soil organic matter). A sustainable agriculture must at least maintain, and best promote soil fertility. Since agricultural use generally leads to a net discharge of nutrients from the soil, they have to be replaced through organic or mineral fertilizers. The protection of soil fertility requires a long-term investment. Unclear and weak property rights in land reduce incentives to invest in the resource land, and to take measures to improve the soil and prevent erosion (e.g. Abdulai et. al., 2010). Investments in land in turn affect farming yields, which are higher for users with secure land rights than for users with insecure land rights.

Climate change and agriculture share a reciprocal relationship: on the one hand, agriculture influences climate change in several ways; on the other hand, climate change affects agricultural production. Changes in rainfall, temperature and other climatic factors are expected to negatively affect food production in Africa (see section 2).

This overview shows that there are many, partly competing aspects of sustainability. Proposed solutions aim to cover one or more aspects more or less completely.

4 Solution Proposals and the Example of Organic Farming

4.1 Solution Proposals

There are a number of partly competing proposals that prioritize different aspects of sustainability differently. The question of the best priorities and solutions is highly controversial.

As traditionally most poor work in farming, many researchers believe that growth in the agricultural sector is the most effective way to reduce poverty and thereby increase food security (e.g. Dewbre et al., 2011, Byerlee et al., 2009, Thirtle et al., 2003). But whether this is done best by the establishment of large farms or supporting existing smallholders is a critical point of disagreement between scientists.

The Alliance for a Green Revolution for Africa promotes a package of new high-yielding varieties, increased use of inputs and better access to markets and financial services. Whether or not genetic engineering of crops should be part of such a strategy is subject to intense debate. Amid the potential benefits are high-yielding crops that grow under adverse environmental conditions and on so far unsuitable lands. Opponents point towards the risks of reducing genetic diversity and contamination of the natural environment.

Adaptation to climate change is also needed, using better technology or expanding cultivated land or compensate through increasing food imports. This solution would target the use of plants that can adapt to new climate conditions and the adjustment of agricultural methods, such as the timing of sowing and the use of water. Additionally, agroforestry has the potential to mitigate the effects of climate change (IAASTD, 2009).

Among the less contested proposals for ways forward is a strong increase in agricultural research, education and extension services. The CAADP (Comprehensive Africa Agriculture Development Program) under the supervision of the African Union agreed on a target mark of 1% of the income in agriculture to be spent for agricultural research as well as 10% of the total government budget that should be put into agriculture in general. Most of the participating countries do not achieve these targets yet, but there is a positive development (Omilola et al., 2010). Industrialized countries could also invest more in research, in particular to reduce the latent conflict between environmental protection, resource conservation and food security. Estimates by IFPRI suggest that 20-30% of global development assistance should be channeled into agriculture to ensure food security (vpn Braun et al., 2008). Furthermore, a reduction of trade restrictions by developed countries and a decrease in subsidies for the domestic agricultural industry would be beneficial for the agricultural sector in Africa in general.

Now, one solution proposal, organic agriculture, will be discussed in more detail and with special attention to local circumstances and alternatives in Africa. As the name suggests, it is aimed at principally ecological sustainability. The central theme of organic farming is conducting economic activity in accordance with the principles of ecosystems. This allegedly leads to improved (social, ecological and economic) sustainability (Lampkin and Padel, 1994). Besides the production of food, raw materials or energy, agriculture is responsible for environmental and resource protection. Instead of relying on the principle of output maximization, as used in conventional agriculture, inputs are optimized. Nutrients should be efficiently used in quasi-closed cycles. These principles lead to a focus on the use of local resources and the avoidance of external inputs where possible. Organic farming also seeks to increase productivity but only as long as intensification of production is compatible with sustainability.

In Africa, organic farming is often promoted as a promising sustainability and food security strategy. Due to its similarity to the traditional local agriculture, the transition to organic farming is supposed to be particularly easy to achieve for poor farmers that live in remote areas. Additionally, converting to organic farming supposedly eliminates the dependence on expensive fertilizers and pesticides. Whereas uncertified produce usually serves the local market, certified organic produce in Africa is almost exclusively allocated to the export market. Europe and North America account for 97% of the world market (Willer and Kilcher, 2009), and the market is growing rapidly in these regions. Many studies have demonstrated the willingness of consumers to pay a higher price for organic products (e.g. Bjorner et al., 2004; Loureiro and Hine, 2002; Nimon and Beghin, 1999). Hence, certified organic produce also offers an attractive market in the North. This is why in Africa most organic produce is certified according EU or US organic regulations. So far, there has been little research into the demand for organic - certified or uncertified - produce within Africa.

When limited resources such as phosphate and the rising costs of energy-intensive production of mineral fertilizers to lead to increases in production costs and farmers in marginal areas of Africa face already high costs due to poor infrastructure, the substitution of artificial fertilizers with organic compost can be not only an ecological, but also an economic advantage. Therefore conversion to organic agriculture in Africa is promoted by a range of non-governmental organizations, development cooperation projects and entrepreneurial initiatives.

4.2 Economic Impacts of Organic Agriculture

The yield potential of organic farming in locations with medium and low soil productivity, especially in the tropics and subtropics, is perceived to be equal or superior to that of conventional production at the present state of knowledge. This is due to the fact that inputs used in conventional farming are often used in low quantities or not at all by farmers in these regions that the effectiveness of mineral fertilizers on soils with low nutrient retention capacity is reduced, and that high-yielding varieties are often unsuitable for cultivation in sub-optimal locations. According to Dusseldorp and Sauter (2011), the great variance in results in empirical studies comparing yields from conventional and organic production indicates that the potential for intensifying ecological production is underutilized in comparison to conventional production and that widespread view that organic farming could only feed a small proportion of the world's population is a preliminary judgment based on limited data.

A number of scientific studies have employed case studies to examine the economic consequences of a conversion to organic farming and organic certification for small farmers in developing countries. Even if, due to the methodology employed in the studies, it is not always clear whether the results stem from the actual conversion, or from other aspects, e.g. unobservable characteristics of the farmers, generally a cautious positive image emerges from the results. A study by Pretty and Hine (2001) that observes a group of 208 sustainable agriculture projects in Africa, Asia and Latin America, shows that sustainable agriculture can increase yields and visibly improves the overall nutritional condition of small farmers. In the 45 projects examined in 17 African countries, the production volume of the farms increased in all cases. Also, according to Pretty (1999), natural and human capital, which are the basis for the sustainability of projects, were accumulated. Overall, most studies find that because of higher prices from certified organic products, small farmers profit more from certified organic, than from conventional farming, while production costs are similar to those of conventional production[7] (e.g. Bolwig et al., 2009; Maertens and Swinnen, 2009). Hence, those farmers that manage to meet the certification requirements and quality standards of the international market are most likely to benefit.

The question of whether and under what circumstances a significant number of farmers are able to meet these standards, has a mixed answer. The literature gives us both positive and negative examples (e.g. Markelova et.al, 2009; Roy and Thorat, 2008; Wollni and Zellner, 2007). The cost of certification alone is generally not affordable for small farmers or cooperatives in Africa without substantial support by governments, businesses or aid programs.[8]

Furthermore, the high level of management and knowledge intensity of organic farming can be an important entry barrier for poorly educated farmers with limited access to information systems and poor links to other farmers in similar situations and is often a reason for the breakdown of organic agriculture initiatives in Africa. This problem is also reflected in the low yields that are reported in many scientific studies on organic compared to conventional small-scale farms in Africa despite the aforementioned yield potentials.

Organic and sustainable agriculture are often equated colloquially. However, several tests have shown that organic agriculture plus minor use of chemical inputs often reach the best results in terms of yield and environmental compatibility in an African context, and thus could be called sustainable, too. However, in this case the option of certification and thereby to achieve higher prices is no longer applicable.

4.3 Social Impacts of Organic Agriculture

With respect to the improvement of the nutritional situation of the disadvantaged and rural population that are mainly peasant farmers, it seems that organic agriculture can empower them to increase their production with limited productive resources, to decrease their production risk by enhancing the diversity of their cultivation systems and therefore to contribute to adapting to climate change. Furthermore, higher labor intensity and lower capital intensity of organic agriculture can have a positive impact on employment opportunities in rural areas. Studies have shown that by refraining from using chemicals, which were rarely used properly, a positive impact on the health of farmers (fewer symptoms of poisoning, less water-related health issues) could be observed. So far, however, in most cases not all of the named potentials are being exploited.

Cultural proximity to traditional agriculture is often highlighted by supporters. However, this aspect is hard to investigate empirically. Nevertheless, it seems that organic agriculture is more suitable for (traditional) small and medium-scale diversified farms and less for (modern) large-scale specialized plantations. If this tendency is confirmed, the poorer parts of the rural population, respectively small-scale farmers, could benefit disproportionately from investments in the sector. If the yield potential of organic agriculture would be utilized, the availability of food would increase where access to food is the limiting factor for food security. Likewise, the above mentioned support of small-scale farmers with new production technologies, and the distribution of agricultural knowledge and training act in a similar fashion as investments in education of the rural population.

4.4 Ecological Impacts of Organic Agriculture

Obviously, abstaining from the use of chemical additives has a positive impact on the environment through lower pollution. This positive aspect is particularly important in Africa, because improper use of chemicals in agriculture by African small-scale farmers is very common, including the use of excessive amounts, insufficient safety measures during application, careless storage and use of highly toxic outdated substances.

Since agricultural use leads to a net outflow of nutrients from the soil, especially when crop production and livestock are spatially separated, nutrients have to be supplied through organic or mineral fertilizer to preserve soil fertility and thus the yield potential of the soil. Small-scale farmers in developing countries often fail in doing so. There is a tendency that farmers which are getting certified are those who practice so-called ‘organic by default’ agriculture, i.e. traditional shifting cultivation without or with low addition of nutrients. From an ecological point of view, this method will only be sustainable if the fallow period is long enough, which is rarely anymore the case due to an increasing population density and resulting shortage of land. In the present circumstances, this method leads to leaching of soils. So far no scientific studies exist that can affirm or reject this hypothesis on the basis of data on the nutrient content of agricultural soils. However, there are many studies, including those named in the last section that suggest that the principles of organic agriculture are understood and taught as negative laws in Africa. Little importance is given to positive instructions, of what one should do to maintain soil fertility. In this respect, organic farming in Africa has a vast untapped potential. This type of agriculture can have positive effects on the protection of resources, of the soil and the biodiversity if the application of the principle of the closed nutrient cycle is applied. A number of studies (such as Niggli and Kasterine, 2007 and UNCTAD, 2006) have also shown that organic agriculture does better than conventional agriculture in adaptation to and prevention of climate change. Through a better CO2-balance, organic farming can mitigate the effects of climate change. The amount of emissions per hectare is significantly lower; however they are similar or higher per unit of output. In addition, organically managed soils absorb more CO2 (carbon sequestration) (Niggli and Kasterine, 2007). Furthermore, adapting to climate change seems easier using organic farming because the induced diversification spreads risk and more robust varieties are grown (UNCTAD, 2006; Stolze et al., 2000).

Some authors conclude that practicing organic farming in conformity with its holistic principles leads to synergies that only come through the interplay of several factors (e.g., Pretty, 1999; Shiferaw and Holden, 1999). The change of single factors– a ceteris paribus approach –, for example the introduction of water conservation practices through terraces without making improvements at other points of the system at the same time is much more ineffective and possibly unprofitable than if several factors are changed together. In this example this could be the further simultaneous use of improved organic fertilizer to increase productivity and the improvement of access to the credit market to finance the new activities.

4.5 Adoption and Diffusion of Organic Agriculture

The number of certified small-scale farmers is relatively high. In 2009, Uganda was, after India, the country with the second largest number of certified producers in the world, and

Ethiopia, Tanzania and Burkina Faso were also ranked in to the top ten (Willer and Kilcher, 2009). However organic-certified agricultural land in Africa remains limited despite intensive research and mostly positive observed impacts and untapped potentials of organic agriculture (see Figure 2.3).

There is a vast literature on the adoption and diffusion of agricultural technologies in developing countries (see e.g. Feder et al., 1985 and Feder and Savastano, 2006; Foster and Rosenzweig, 1995, 1996, and 2010) trying to explain this phenomenon. Scientific studies have identified several typical barriers to agricultural technology adoption which can be summarized in six groups: biophysical characteristics of farms, complexity of the technology, household features, poverty of the land tenants, property rights, and input and output markets. The width of this list shows that the spread of organic agriculture can stagnate at many points. The complexity of organic agriculture that exists due to its holistic approach is one of the reasons why its realization can be difficult or at least lengthy. A lot of support programs and initiatives just take up single aspects such as the certification. They also often do not accompany the whole process of conversion[9]. If the parts are interdependent, this strategy is not very helpful.

The time-lag of organic agriculture is a disadvantage. Many of the positive effects only become visible in the long-term, amongst others because soil fertility changes slowly. In the certification system this reflects in the three-year transitional period before products can be sold as organic certified.

Furthermore there are other aspects that can have a great impact on the diffusion of organic agriculture in Africa. One of these aspects is the role of collective institutions such as cooperatives which are frequently used to disseminate agricultural technologies and organize the process of certification for small-scale farmers. The meaning of the functioning of these institutions and the incentives for farmers to join them should not be underestimated. The investigation of the question how farmers or farm households decide for or against a new technology such as organic agriculture within a complex entity of new and old technologies, institutional environment, market conditions, available resources, and cultural and social networks, cannot be derived from traditional theoretical models of agricultural household (e.g. de Janvry, et al., 1991) and is subject of current research. For instance, higher prices for final goods can have very diverse impacts. The return of land and labor increase and thereby encourage investments in agriculture. This can be new technologies that improve soil fertility. But higher prices can also cause the opposite and aggravate ecological damage. If these prices are not expected to be non-permanent, or the discount rate in the future is very high, it may make more sense for the farmer to leach the soil in order to make a higher profit quickly rather than investing in more sustainable long-term technologies.

Overall, the problem of slow diffusion is not just a problem of organic agriculture but many technologies in Africa and other developing countries. Therefore, a number of researchers currently try to answer questions about barriers to adoption and diffusion, and the question of individual profitability of new technologies (e.g. Suri, 2011).

5 Concluding Remarks

The increase in the number of both undernourished and malnourished people in sub-Saharan Africa over the last decade has intensified the calls for measures to help boost agricultural productivity and output in order to enhance the food security situation in the region. The challenge for African agriculture is therefore substantial. Alongside this challenge to find ways to increase food and livestock production are concerns about agricultural sustainability, as an unprecedented combination of pressures are emerging to threaten the sustainability of existing social and ecological systems. The continuing population growth, impacts of climate change and environmental degradation that are driving the limited resources towards their thresholds need to be taken into consideration in the development of sustainable production techniques.

This article discusses the challenges of meeting the food security needs in a sustainable way. Given that sustainable development is a concept that includes economic, social and ecological dimensions of conservation, we argue that the dual goals of ensuring food security and promoting sustainable production are achievable in the African context only with the right policy mix. We use organic farming as one example for a sustainable development strategy for African agriculture and nutrition. Its big advantage is its involvement of all three sustainability criteria, but due to its complexity it has weaknesses, especially in implementation.

The study by Pretty and Hine (2001) which analyzed some projects involved in sustainable intensification showed that, provided there is a political and economic domestic recognition that agriculture matters, then food production can be increased without doing harm to the environment and increasing the flow of beneficial environmental services. In principle, organic farming is one possible approach to create a more sustainable agriculture. However, further studies on individual motifs and conditions of transition to organic farming are necessary. Under certain circumstances agricultural productivity can also be improved by organic farming, but more intensive and context-specific research to better utilization of its productive potential is needed.

On the market of ideas organic agriculture has to stand up to other strategies for action that promote their sustainability and come with other advantages and disadvantages. In a given political and institutional situation various strategies appear attractive in different ways. However, there are general principles that we consider important to recognize when selecting between alternatives. First, no strategy should work against food security, that is, the sufficient production of and access to food. Second, natural resources, a clean environment, human health and social justice are basic aspects for a functioning agriculture as well as for social and ecological sustainability. In the past, the development of the agriculture often focused singularly on increasing productivity. Third, future strategies have to acknowledge the multifunctionality of agriculture and take into account the complexity of agricultural systems within different socio-economic and ecological situations. Farmers are not just producers but also managers of ecosystems. The incentive systems for all actors in the agricultural sector and for consumers have to be changed in a way that they address this multifunctionality. In the sense of social sustainability, activities have to be geared more towards previously disadvantaged social strata such as farmers with limited resources.

To choose the right strategy mix, all possible economic, social and ecological consequences should be evaluated and used as basis for decisions. The weighting of individual advantages and disadvantages is necessarily a subjective one and depends on the institutional, political, societal and natural context.

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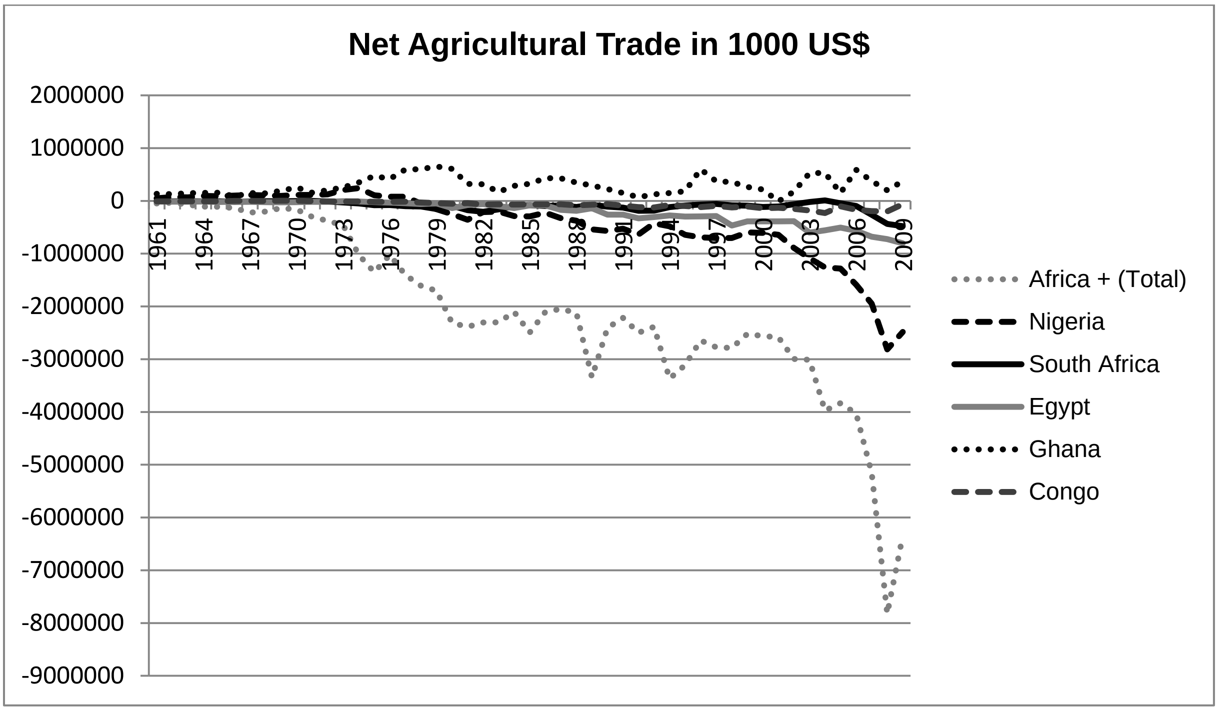
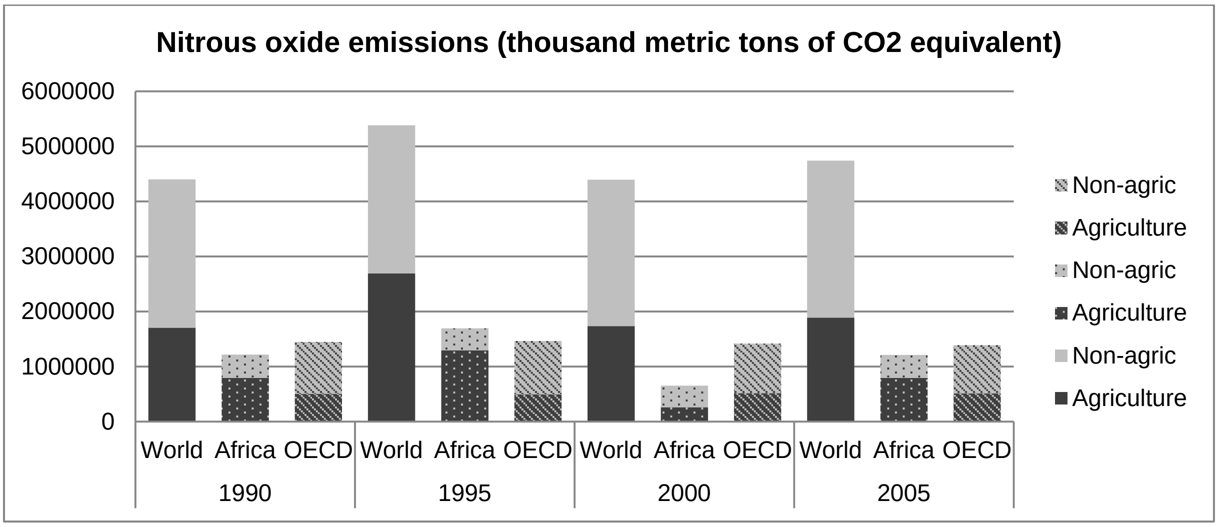
Figures and Tables

Figure 2.1: Difference in Exports and Imports in Trade of Agricultural Goods in Africa 1961- 2009



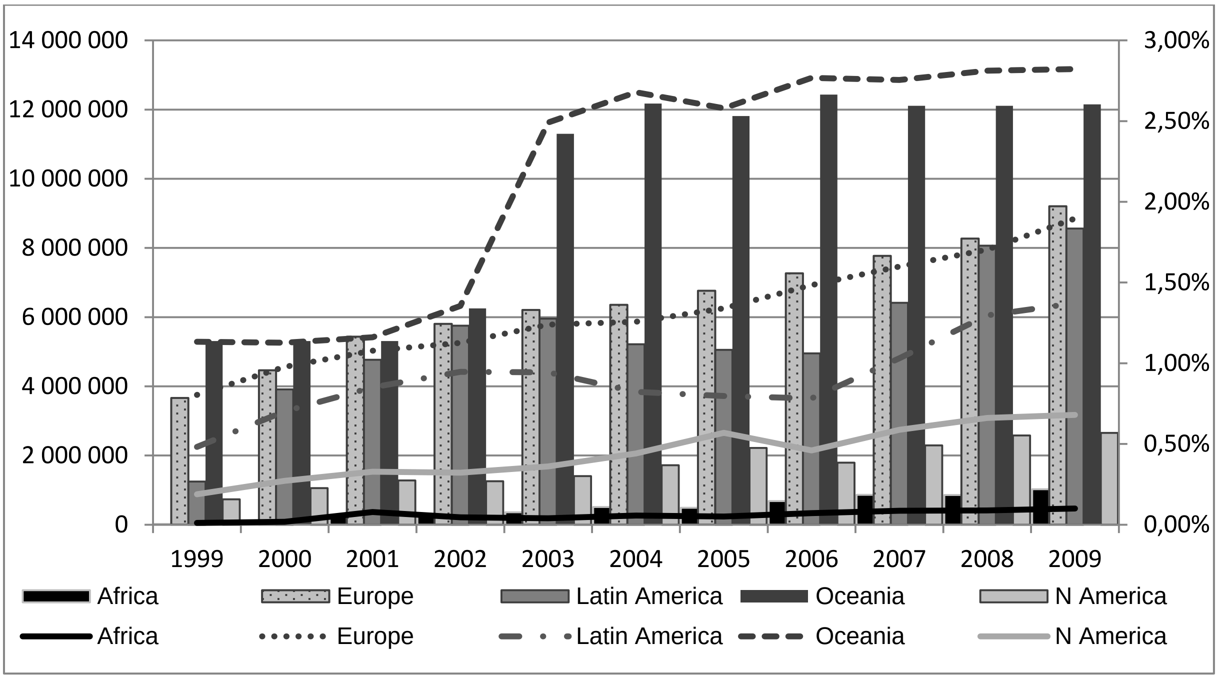
Source: own representation, statistics from FAOSTAT

Figure 2.2: Comparative Nitrogen Oxide Emissions from Agriculture



Source: own representation, data from the World Bank: World Development Indicators.

Figure 2.3: Development of Organic Certified Area Worldwide (In hectares and percentage of the total agricultural land)



Source: own illustration using data from the Research Institute of Organic Agriculture FiBL and International Federation of Organic Agriculture Movements IFOAM (2011).

Appendix

Table A.2.1: Energy and Protein Consumption per Person (Extremes, means, and Germany for reference; data from 2005)

	Min	Average	Max	Germany
Energy (Mcal/person/day)	1.5 (DR Kongo)	3.0	3.9 (USA)	3.5
Part from Animal Origins (% of total)	1.4 (DR Kongo)	12.9	32.6 (Island)	20.0
Protein from Animal Origins (g/ person/day)	1.7 (Burundi)	23.9	69.0 (USA)	52.8
Eggs (kg/ person/day)	0.1 (Burundi, Central. Afr.-Rep.)	9.0	20.2 (China)	11.8
Milk (kg/ person/day)	3.1 (DR Kongo)	82.1	367.7 (Sweden)	248.7

Source: adapted from Flachwoski (2011).

Notes

[1] The MDGs consist of eight goals, each with one or more sub goals that have been established in 2000 by several international organizations to be achieved by 2015. MDG 1 stands for the halving of extreme poverty and hunger, MDG 7 concerns ecological sustainability, MDGs 4, 5 and 6, infant mortality rate, maternal mortality and the combating of major diseases, such as AIDS and malaria.

[2] The WHI is based on three values: the proportion of undernourished in the population, the proportion of underweight children under five years old and the mortality rate among children under five years of age.

[3] **Food security** is defined as a state where an individual has at any time physical, social and economic access to sufficient, affordable, safe and nutritious food. **Undernourishment** is an aspect of food security measured as a state where the human intake of energy from food is below the minimum energy requirement of the body. This requirement is defined by the amount of energy necessary to achieve an acceptable size by weight ratio (‘’weight for attained height’’) and perform light physical activity.

Malnutrition is a broad term that includes all forms of malnutrition. It can have many different causes, including infections, and nutritional, and socio-cultural factors. Malnourishment encompasses both the concepts of undernourishment and of obesity (definition from the UNSCN, 2010).

[4] The quantity of food needed to achieve individual food security, the number of humans and their average dietary energy requirements can be used to determine the total amount of food needed.

[5] The estimates can be found for instance on the website www.phlosses.net

[6] Nitrogen compounds generate the environmentally harmful substances ammoniac, nitrate and laughing gas (nitrous oxide).

[7] Other sustainability standards like fair trade also yield positive results.

[8] This is true for the export market in general due to its strict requirements. In addition, certifications such as GLOBALGAP for conventional produce are almost universally in demand in the export of fresh agricultural produce from Africa. For example, 76% of all fruits and vegetables in the European market are GLOBALGAP certified (PIP, 2009).

[9] Even compensation payments that are regularly used in Latin America for carbon sinks have made little difference. Problems with the correct measurement of environmental services by agriculture add to the difficulties.

Chapter 3

Knowing Where Organic Markets Move Next - An Analysis of Developing Countries in the Pineapple Market

Linda Kleemann

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The Kiel Institute for the World Economy, Hindenburgufer 66, 24105 Kiel, Germany, Email: linda.kleemann@ifw-kiel.de, Tel. +49 431 8814249.
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Knowing Where Organic Markets Move Next -

An Analysis of Developing Countries in the Pineapple Market

Abstract

As consumers' demand for organic products grows, selling organic products potentially opens up profitable market participation options for farmers in developing countries. This paper studies two aspects of profitability for the producers. It uses hedonic demand theory and empirical analysis to examine the relation between conventional and organic markets using the strongly growing pineapple market as an example. Our analysis confirms a nonlinear dependence of the organic market on the conventional one and a non-declining premium. We conclude that there is a larger potential of the organic market and hence the number of farmers in developing countries who can potentially benefit from growing organic products.

Keywords: price transmission, private voluntary standards, organic agriculture, organic markets

JEL classification: F14, L11, L15, O13, Q13, Q17

1 Introduction

Organic market growth rates are around 10%, far higher than those of conventional markets and supermarkets have started offering organic food as part of their usual range of products. Consumer demand for organic products is concentrated in North America and Europe; these two regions comprise 97% of global revenues (Willer and Kilcher, 2009). Organically grown pineapple has also become more popular among consumers. Like other tropical fruit, it is grown almost exclusively in developing countries and like other organic products, organic pineapple earns a premium price on the market compared to conventional varieties. Hence, the shift from conventional to organic production might be an opportunity for small and middle-sized farmers to reap higher returns from their investments. Since this change, however, requires costly adjustments of production techniques as well as considerable costs for certification, several aspects of organic production need to be considered when trying to determine its profitability. Another important aspect of profitability that has been disregarded in the previous literature so far is the relation between the organic market and the conventional one and its likely future development. Besides a price premium for the organic product this includes the co-movement of the two prices. In this paper we restrict our focus to this price dimension of the profitability of organic production.

The willingness to pay (WTP) a higher price for organic food based on perceived desirable characteristics has been well-documented. The academic literature has shown the existence of a, quite variable, price premium for organic food products (e.g. Boland and Schroeder, 2002; Huang, 1996; Loureiro and Hine, 2002; Thompson, 1998). We take a different approach and deduct dynamic characteristics of the demand functions from price behavior over time. Thereby we are able to provide more general results than by using survey based methods that use cross-section data based on choice experiments rather than on actual buying behavior over time (Huang and Lin, 2007 is an exception). Although our method is indirect it has the advantage of measuring what consumers are actually buying and paying in the marketplace when they have a choice between organic and conventional produce. Despite its importance for the further promotion of organic certification in developing countries, this has not been studied before.

Applying state of the art time series methods, we analyze spatial price transmission between conventional and organic pineapple on the European market by looking at prices for pineapple from Africa and Latin America respectively. Our observations not only confirm the existence of a non-declining price premium for organic products, the analysis also shows that the conventional market seems to act as a price leader for the organic market while being unaffected by organic price behavior. However, organic prices do not follow conventional prices one by one. Our results show the existence of lags and thresholds below which organic prices are unaffected by conventional price changes. These thresholds and the corresponding price adjustment behavior do not change over time, even while the organic niche market expands. Theoretically, this observation can be explained when the core demand for organic products expands faster than supply. Hence, one important implication of our analysis is the potential for the scalability of the organic market.

The rest of this paper is organized as follows. First, an introduction to the market for pineapple is given. Then, a theoretical background for the study is presented. Afterwards, the price data for conventional and organic pineapple is described and spatial price transmission between the organic and conventional markets is analyzed using time series techniques such as co-integration and vector error correction models. The paper ends with a conclusion.

2 The Market for Pineapple

Pineapple is well suited for this analysis because it is a relatively homogeneous good, compared to, for instance coffee, where a lot of different varieties and quality grades prevail. This homogeneity is relevant in trade and exists because it is difficult to control for quality of single pineapple at low transaction costs. In the definition of Nelson (1970) pineapple can be seen as an experience good.

The world market for fresh and dried pineapple[1] is dominated by one variety (although this variety may change from time to time) and kilogram prices are relatively uniform across fruit sizes and qualities. In addition, the fresh pineapple market has been recording exceptional growth rates: the European market for fresh and dried pineapple has grown on average by 19% between 2003 and 2007 (FruiTrop, 2008)[2], where world pineapple production totals nearly 16 million metric tons. In 2007, the main consumers of fresh pineapples were the US (2.5 kg per capita per year), followed by the EU (2.1 kg per capita per year) and Japan (1.3 kg per capita per year) (FruiTrop, 2008). Measured by volume and value of net imports, the European Union (EU 27) is the world's largest consumer. Fresh pineapple in Europe comes mainly from Latin America (around 80%) and Africa (10 - 15%, Figure A.3.1). The market in the United States is completely dominated by Latin American pineapple, complemented by some domestic production. In order to study the price developments of pineapple produced in various world regions, we have therefore chosen the European market as a case study.

Africa had been Europe's major supplier of fresh pineapples until it was replaced by Central America. Up to the late 1990s, the EU market was dominated by pineapples from West Africa, especially from Côte d'Ivoire. Costa Rica, which was almost absent from the world market in the late 1980s, is now by far the largest fresh pineapple exporter to Europe and North America. Whereas in 2000, with 24%, Costa Rica held a lower market share in Europe than Côte d'Ivoire with 29%, its share of the European market for fresh pineapple has grown from 44% in 2003 to 73% in 2009 (Figure A.3.1). Exports from Côte d'Ivoire have meanwhile developed the opposite way. Being the European market leader in the 1970s, Côte d'Ivoire's market share has been constantly declining since then and was around 6% in 2009 (Figure A.3.1). Ghana is the second largest African pineapple exporter to Europe after Côte d'Ivoire and is expected to increase its market share.

The rise of Costa Rica as a market leader for fresh pineapple in Europe is strongly linked to a new pineapple variety called MD2 that was introduced by the company Fresh Del Monte Produce in 1996. This variety, grown exclusively in Latin America at that time, rapidly took over the US market. The success of MD2 has been explained by a combination of the characteristics of this variety and commercial strategy (for example Fold and Gough, 2008).

In the early 2000s, the wave swept to Europe. The resulting brisk upward trend in MD2 pineapple supply induced a price fall for the MD2 variety (Faure et al., 2009). By today, the price premium on MD2 which was up to 100% at market entry is almost non-existent. The formerly dominant variety, Smooth Cayenne lost market share from over 90% at the end of the 1980s to almost nonexistence today (Loeillet, 2004). The MD2-variety has become the standard variety consumed in the EU.

The most globally traded conventional fresh tropical fruits (bananas and pineapples) are primarily produce in large-scale plantations owned by transnational companies who also engage in contractual arrangements with local producers. A few large multinational companies mostly control the supply of pineapples to the large retailers within a tightly structured supply chain. This might lead to high entry barriers for small farmer market participation as indicated by many researchers (e.g. Minten et al., 2009). By contrast, organic produce is mostly produced by smallholders and does not yet rely as much on vertically integrated supply chains. For developing countries with a significant share of smallholders in production such as Ghana, the support for diversification of exports towards niche markets (for example organic markets) could therefore increase the profitability of production. In niche markets, which tend to be smaller by definition, farmers can exercise more bargaining power whilst at the same time meeting the latest requirements on quality, traceability, packaging, and standards such as GLOBALGAP[3] or organic might hold the key to good profits (Minot and Ngigi, 2004).

Most organic pineapples for the EU market are produced in Ghana with an increasing amount coming from Costa Rica (CBI Market Survey, 2008). Unfortunately, there are no official trade statistics on organic products and there is no data available that shows the development of volumes and values of the world pineapple market divided according to conventional and organic products. However, it is estimated that up to 40% of total pineapple exports from Ghana are organic and/or fair-trade certified.

Trade in organic food products differs from trade in other food commodities due to the organic certification requirement. Certification according to regulation (EC) 834/2007 and

(EC) 889/2008 is a prerequisite for any producer wishing to export organic produce to the European market. Organic certification requires producers to adopt certain environmental standards, most importantly to refrain from using synthetic inputs. The rapid growth of the organic food sector with an average growth rate of 13% between 2002 and 2006 creates niche market opportunities. The market value was estimated at US$46 billion in 2007 (double the value of 2000), and is expected to increase to US$67 billion by 2012 (UNCTAD, 2008; Willer et al., 2008). In the EU, it is now estimated between 2.5 and 4.5% of total food sales. For organic pineapples market growth has been even larger. It is assumed that the permission to use ethylene for flower induction in organic production in 2005 played an important role in the high growth rates in the organic pineapple market. Taken as a whole, Europe is the largest market for organic products, and although available data is very imprecise and often out-dated, it is assumed that this holds also for the organic pineapple market. According to estimations by the Sustainable Markets Intelligence Centre (CIMS), the European market for organic pineapple was about five times the size of the US market in 2004[4].

However, not only the growing demand makes organic cultivation attractive for producers. Some studies explain the growing interest in organic agriculture in developing countries also by the fact that it requires less financial input and places more reliance on the natural and human resources available (Willer et al., 2008 amongst others). Hence, it is worthwhile to analyse if switching from conventional to organic production might indeed result in higher profits for farmers. As a starting point, integration of the two markets is evaluated by looking at the price developments for organic compared to conventional pineapple.

3 Theoretical Background

Consumers who buy organic products do so because of their perceived superior attributes. Hedonic demand theory can help to formalize the relation between conventional and organic prices in order to provide an analytical framework for the interpretation of empirical results.

The hedonic approach disaggregates commodities into characteristics and estimates implicit values for units of the characteristics. The hedonic price function $p(z)$ specifies how the market price (p) of the commodity varies as its characteristics *(z)* vary (Ladd and Suvannunt, 1976). The simple assumption behind this theory is that utility is derived from the properties or characteristics of goods. We focus on one attribute of interest only, the organic nature of a product which is assumed to be otherwise homogeneous.

Standard maximization of a consumers' utility function *U(z, x; α)* subject to a budget constraint, where *x* is the commodity, and $\boldsymbol{\alpha}$ is a vector of parameters characterizing the individual consumer, gives rise to a vector of demand functions for the characteristics of the good:

$$p_{\boldsymbol{z}} = \frac{U_{\boldsymbol{z}}(\boldsymbol{z}, y - p(\boldsymbol{z});\ \boldsymbol{\alpha})}{U_x(\boldsymbol{z}, y - p(\boldsymbol{z});\ \boldsymbol{\alpha})} = F_z(\boldsymbol{z}, y - p(\boldsymbol{z});\ \boldsymbol{\alpha}) \tag{3.1}$$

p_z denotes the vector of first derivatives of a hedonic price function with respect to its arguments, i.e. the vector of implicit prices of each property. If the distribution of $\boldsymbol{\alpha}$ and $\boldsymbol{z}$ is known, then the hedonic price function can also be written as a function of these arguments, and hence the price function depends on the parameters that characterize the distribution of preferences and supply (Epple, 1987)[5].

Our case is a simple hedonic model, where the number of characteristics is fixed and *z* has only two values; let *z = 1* if a product is organic and *z = 0* otherwise. We add a time dimension in which the price when z=1 in time *t* depends on past prices of the good in both states (organic and conventional) and other hedonic characteristics of the good. We assume that the other hedonic characteristics are time invariant. Hence if organic pineapple is on average yellower from the outside in time *t=1*, we assume that this is also the case in all other periods. In addition, if information is imperfect, rational consumers gather information about a characteristic if the marginal cost of obtaining the information is smaller than or equal to the marginal utility it generates (Combris et al., 1997). For most consumers, it is not easy to judge the taste from the outside of a pineapple. Accordingly consumers may decide to make their choice primarily on the basis of the easily accessible characteristics, for instance size and certification status. This limits the number of relevant characteristics. Hence, if the status of *z* is valuable and easy to assess, ignoring other product characteristics may not be a problem. These simplifications make it easier to estimate the value of the organic attribute, which can then be approximated by the price difference between organic and conventional pineapple. Furthermore, we ignore the household budget constraint because, by focusing on the organic pineapple price premium, we touch such a tiny part of the overall household budget that we can safely assume the constraint to be non-binding. Hence, we refer to the case in which households have identical incomes and characteristics, and different tastes.

We do not estimate a (reduced form) hedonic model, but use it to understand the empirical results from the estimation of the dynamic relationship between the conventional and organic prices. For this purpose we derive a number of hypotheses from the above described hedonic price theory that can be investigated with our price transmission analysis.

Hypothesis 1: *The organic price moves along with the conventional price, but with a lag*.

This phenomenon can be explained with imperfect information. In Rosen's original framework, consumers and producers make their decisions on the basis of perfect information. This assumption is in reality often not met. In our simple example the consumer might not observe the prices for $z=1$ and $z=0$ at the same time and might consider it too costly to look for the reference product in another shop as long as the price stays within a certain range that is perceived as “normal”. On the other side, assuming that the wholesaler estimates the size of the WTP for an organic premium, he will use the conventional prices as reference. But he might only have knowledge about yesterday’s pineapple prices not about pineapple sold at the same time. FOB (free on board) prices may also be pre-fixed with the supplier for a certain shipload (which takes between 10 and 15 days). These two considerations would lead to lags in the dynamic relationship between the observed prices.

Hypothesis 2: *Cross-price elasticities are low within a certain range of price changes, and high when crossing a certain threshold*.

This can be represented by two related demand curves that are connected by cross-price elasticities. Imagine the price for the good where $z=0$ falls, while the price stays constant for *z=1*. Then we assume that there is a tolerance range in which consumers do not react to this price change. This range exists due to imperfect information about the price difference between the two regimes and sluggish demand response which can be explained by habits. Since pineapple is a perishable non-staple food product, small price ranges will not switch, postpone or anticipate buying decisions. This causes low cross-price elasticities within this tolerance range of price changes and considerably higher ones when crossing the tolerance threshold. This threshold cannot be expected to be the same for all consumers, but again falls within a certain range, and hence a (fuzzy) jump in the elasticity is expected. Because markets for perishable products have to adjust fast to changes, this hypothesis should be reflected in prices changes.

Hypothesis 3: *The organic premium and hence the WTP for organic products depends on the relative size of the two markets in a non-linear way*.

When the organic market is expanding at a different speed than the conventional market, the premium is likely not constant over time. The demand curves shift with changing consumer preferences. The supply curves move to the right as more farmers start to produce pineapple, and the movements of the curves are interrelated, but not perfectly collinear. Changes in preferences affect both demand curves, but the size and timing of the effect may differ. We expect the demand for organic pineapple to shift faster than the demand for conventional pineapple, since the former market is in an earlier stage of the product life cycle. This may trigger several countervailing effects.

On the one hand, the WTP for the organic attribute may decrease when the size difference between the two markets decreases. This would be in line with observations in marketing research, that the price difference between a standard product and a specialty product decreases when the latter becomes less rare, and therefore less special. This also makes sense when we separate the hedonic demand into consumer groups with different marginal monetary values of the organic characteristic (Ladd and Suvannunt, 1976) and assume that the relative WTP between groups is constant. The first consumer group that buys organic products is the one with the highest WTP, the second group has the second highest WTP, and so on. When the market grows beyond the core market (the first consumer group), it can do so only by expanding into consumer groups with lower WTP for organic. Hence, as the organic pineapple market expands, prices for organic pineapple might drop.

On the supply side economies of scale in production, transport (which are included and comprise up to 50% of import prices), distribution and marketing could also lead to decreasing premia due to decreasing costs that affect the supply curve.

On the other hand, if consumer preferences for organic expand fast enough, they might absorb the increasing supply. When the core market for the organic attribute increases against an inelastic short run supply, the premium rises. In the longer run more producers can start producing organically and the premium will be adjusted downwards. Since conversion to organic takes several years, where preferences can change very rapidly, shifts in the supply curve occur much slower than they may in the demand curve.[6]

In sum, we can derive information about the hedonic demand forces at work by studying the transmission between organic and conventional prices over time. The interaction between demand and supply for the organic attribute will determine the development of the organic relative to the conventional price. We have described three different effects: lagged response, a threshold effect, and demand and supply shifts.

4 Descriptive Analysis of Price Data

4.1 Prices for Conventional Pineapple

Average monthly wholesale market prices in € per kg from Europe[7] are used in our empirical analysis. As data on organic pineapple prices are neither publicly recorded, nor readily available from the parties involved in the trade, the data collection process was tedious, and we had to use a number of data sources. The data is taken from International Trade Centre's market news service and from several European fruit trading companies. We distinguish between organic and conventional and focus on sea transported pineapple, hence exclude air transported pineapple[8]. We limit ourselves to the currently dominant MD2 variety. By doing so, we deliberately exclude a number of hedonic characteristics (such as the variety) that might otherwise bias our results.

The data could be obtained from the two dominant regions of origin for fresh and dried pineapple in Europe, Latin America (in our dataset - as in reality - mainly Costa Rica and less dominant Ecuador) and West Africa (Côte d'Ivoire, Ghana and Togo). Due to severe gaps in the data for single destination countries, the monthly prices for conventional pineapple were averaged over all destination countries for each of the two regions of origin. Through this averaging, a conventional time series over the period January 2001 to July 2011 could be obtained. The data for organic pineapple prices covers the period September 2007 to August 2011. In this section, the time series for organic and conventional prices is analyzed using descriptive and graphical methods separately and jointly. Whenever we examine both prices jointly, we restrict ourselves to the shorter period (2007 – 2011). Nevertheless showing the longer time series for conventional pineapple allows us to explain some general trends.

The evolution of prices over the last 10 years for conventional pineapple from the three sample countries is shown in Figures 3.1-3.3. There is a general trend towards lower pineapple prices observed in the market. The widening gap between volumes and values of EU pineapple imports in Figure 3.1 makes the fall in prices in general for pineapple clear. Whereas the volume of pineapple imports has more than doubled since 2003, the value of pineapple imports has increased only by about 50%.

We then look at the prices in more detail. Figure 3.2 shows the evolution of prices over the last 10 years for conventional pineapple from the two major origins. The graph, which includes only sea-freight MD2 pineapple, shows clearly the strong downward trend in its price until 2005[9]. The price development for both regions of origin is similar. However, up to 2007 the price for African pineapple was consistently lower than for Latin American pineapple. According to information obtained through interviews with experts in Europe in September 2009 and Ghanaian producers, this fact is attributed this to the initial difficulties with the cultivation, and thus the quality, of the MD2 variety in West Africa. In addition, Costa Rica had a first mover advantage.

Figure 3.3 shows the development of organic pineapple prices. The graph right of the vertical line in Figure 3.2 corresponds to the period that organic pineapple data was available data for. During this period the price for conventional pineapple stabilized around a mean of 0.83 (0.15) €/kg for African and 0.79 (0.13) for Latin American pineapple and 1.34 (0.23) €/kg for African organic and 1.29 (0.19) for Latin American organic pineapple. Standard deviations are in parenthesis and the differences between the origins are not statistically significant. There are seasonal fluctuations in pineapple prices with usually low prices early in the year and in (European) summer and high prices around Christmas and Easter.

4.2 Organic Premia

Organic certification is a value-addition method. In fact, organic products are usually sold at significantly higher prices than conventional products. According to CBI (2008) organic products generally fetch price premia of between 15 and 25% and numerous scientific studies have also shown the existence of price premiums for organic products (e.g. Teisl et al., 2002; Nimon and Beghin, 1999; Bjorner et al., 2004).

With regard to the potential benefits of organic farming for producers, an important question is if such price premia can be sustained in the long run or if they will vanish, as in the case of the MD2 variety. The recent developments in typical agricultural commodities like wheat or milk show that the price premium for organic products seems to be relatively constant[10]. Whether this is a temporary development or a long-term trend depends on changes in supply characteristics and in consumers' perception about the value added by the organic certification label (hypothesis 3).

The data shows that, for the period from September 2007 to July 2011, price premia have fluctuated between €0.14 and €1.02 with mean (standard deviation) of €0.51 (0.20) respectively on average (Figure 3.4)[11]. A declining trend cannot be observed over this period. This might tell us which forces are at work with respect to hypothesis 3[12]. The comparison of the price behavior in Figure 3.4 also shows that the premium is far from stable over the observed time period. Obviously the two curves are interdependent. In this context we should take note of a particularity of the pineapple market. The supply of conventional pineapple is highly dependent on harvests in Latin America, especially in Costa Rica (see section 2 above), whereas organic pineapples are reported to come from a variety of source countries. Hence, for instance weather conditions or new plant diseases in Latin America would influence the two markets differently. This is unobservable without information about such supply shocks. However apart from this, there are potentially market inherent explanations for these fluctuations, which will be studied in the next section, the econometric study of price transmission.

5 Econometric Analysis of Spatial Price Transmission

The notion of price transmission is used in different contexts in the literature. First of all, some authors test for price transmission within the value chain of a product. For example, it is analyzed if the world market price of a commodity is transmitted to domestic producers. Other authors are interested in the difference of prices between different markets within one country, the so-called spatial price transmission. In this paper however, we study spatial price transmission between the markets for organic and conventional pineapple from Latin America and Africa in the European market. We do not use panel data methods, since there are only two regions for which data are available, which can arguably be hardly called a panel. As a result there is no information loss from analyzing the two regions separately.

We test the hypothesis that prices in the organic market are dependent on prices in the conventional market due to its dominance in size (hypothesis 1). Secondly, we analyze if small and large price changes have different effects on the respective other price (hypothesis 2). Finally, we explore if such a possible integration between the two markets decreases or increases over time as a result of the growth of the organic market and possible supply and demand shifts (hypothesis 3).

When analyzing price transmission, different price series are usually regressed on each other in order to find a possible relationship between them. However, if the time series are non-stationary, it might be the case that a relationship is established even though the series are independent from each other as shown by Granger and Newbold (1974). In order to avoid these spurious regressions in case of non-stationarity, many authors have used cointegration techniques to study price transmission and long-run relations between different prices (for example Meyer and von Cramon-Taubadel, 2004 and Abdulai, 2000). Rapsomanikis et al. (2003) also use cointegration methods and error-correction models, and develop a comprehensive framework to test for the price transmission between local coffee markets of Ethiopia, Rwanda and Uganda and the international market.

5.1 Unit Root Tests

As in Rapsomanikis et al.'s framework, we start our analysis by testing prices in the organic and conventional markets for unit roots. As explained above, this is important in order to avoid spurious regressions when studying spatial price transmission. The time series of the two regions of origin are tested separately.

For the individual time series unit root tests, the traditionally employed Augmented Dickey Fuller (ADF) test has been used. However, it has recently been documented that this test performs badly in the presence of small samples as the ones used in this paper. In addition, the ADF test has low power in distinguishing highly persistent stationary processes from non-stationary processes and the power of these unit root tests diminishes as deterministic terms are added to the test regressions. Elliot, Rothenberg and Stock (1996) have proposed an alternative test that addresses the above shortcomings and that has also been used to test for unit roots in the variables. For this DF-GLS test the data is first de-trended using generalized least squares. In order to employ the tests, it is necessary to determine the optimal number of lags of the prices to be included. One approach often employed is to use the Schwartz or the AIC criterion. However, as shown by Ng and Perron (2001), in the presence of large negative moving-average components of the error term, these information criteria usually choose a lag length that is too short. This in turn leads to size distortions and hence overrejection of the null hypothesis. Ng and Perron (2001) propose a modified version of the AIC (MAIC) that improves on these problems. In the analysis below both the Schwartz criterion as well as the MAIC are employed.

As is visible from Tables A.3.1 and A.3.2, the time series for the prices of conventional pineapple from Latin America are clearly I(1). This is largely supported by both the standard ADF test as well as the modified DF-GLS test. For African conventional pineapple the case is less clear. Only when using the MAIC criterion for lag length selection the time series might be I(1), but the results of the tests point generally toward stationarity[13].

The unit root test results for organic prices are similar but clearer. Latin American pineapple prices have one unit root and African pineapple prices seem to be stationary. Hence, we test Latin American pineapple for cointegration next. Since African pineapple prices are presumably stationary there is no need to test for cointegration.

5.2 Analysis of Cointegration and Price Dynamics between Markets

Since both Latin American price series are integrated of order one we test for cointegration. If the linear combination of the two time series is stationary, it would describe the long-run relation between the two variables. The number of cointegrating vectors in the system is determined using the Johansen test. We consider the cases without a constant or trend and with a constant in the cointegrating relationship because the series do not exhibit an apparent trend when plotted in levels (over the period 2007 to 2011, see Figure 3.4). The results are illustrated in Table A.3.5. There is clearly one cointegrating vector. We then test for granger causality. Table A.3.6 shows that Latin American conventional prices granger cause organic prices, that is lags of conventional prices improve the forecast of organic prices but not vice versa. We expected the conventional market to act as a leader due to its dominance in size; hence this result confirms our a priori expectations. The results on cointegration mean that there exists a long-run relation between the conventional and organic Latin American pineapple prices and a linear combination of the two prices that is stationary.

For African pineapple prices, since they are stationary, we do not test for cointegration. Even though we would be able to analyze the data on African pineapple in levels, for reasons of comparability we use the same models as for Latin American pineapple.

Let $p = (p_c\, p_o)$ where p_c and p_o are the conventional and organic prices respectively. Then there exists β such that βp is stationary. Then, the long-run relation between the two prices has to be taken into account by a cointegrated version of the VAR. Therefore, the following vector error correction model (VEC) has been applied in our analysis:

$$\begin{pmatrix} \Delta p_{ct} \\ \Delta p_{ot} \end{pmatrix} = c + \sum_i \Gamma_i \begin{pmatrix} \Delta p_{ct-i} \\ \Delta p_{ot-i} \end{pmatrix} + \Pi \begin{pmatrix} p_{ct-1} \\ p_{ot-1} \end{pmatrix} + u_t \qquad (3.2)$$

Δ is the difference operator, c indicates a constant, p_{ct-i} *and* p_{ot-i} indicate the i^{th} lag of p_{ct}, *and* p_{ot}, Γ_i describes the short-run relation among p_t and the i^{th} lag, and $\Pi = \alpha\beta$, where β is the cointegrating vector defined above and α measures the speed of adjustment of the two prices to deviations from their long-run relation. All variables are transformed into natural logarithms. In order to employ this approach, the optimal lag length for the differenced price vector has to be determined. Akaike and Schwarz's Bayesian and Hannan and Quinn information criteria were used to determine the optimal number of lags to include in the cointegrated VAR. All of them suggested that estimating the model by using one lag was optimal. Therefore, the model above with only one lag has been estimated. Results are reported in Table 3.1. The cointegration equation for Latin American prices is given by:

$$p_o = 0.273 + 0.089\, p_c \qquad (3.3)$$

This represents the long-run relation between the two Latin American prices. Estimating the VEC model indicates that a price increase in the conventional market, which generates a deviation from this long-run relation between the two prices, generates a price increase in the organic market, whereas an equivalent price increase in the organic market produces no significant change in the price for conventional pineapple. We see differential responses to price changes between the two markets in the sense that organic prices do not respond in the same way to changes in conventional prices as conventional prices to changes in organic prices[14].

Considering the short-run dynamics, Δp_{c-1} has significant effects on both Δp_c and Δp_o. The cross-price elasticity of current organic prices with respect to lagged conventional prices is 0.36 for Latin America and 0.38 for Africa (i.e. a one percentage change in conventional prices changes organic prices by 0.38%). This effect is larger than the effect of the organic price AR term (0.28 in Africa, not significant in Latin America). The highest and most significant effect is of lagged on current conventional prices. On the other hand, lagged organic prices do not have a significant effect on conventional prices. Hence, both the adjustments to deviations from the long-run equilibrium as well as the short-run adjustments suggest that organic prices are strongly influenced by conventional price movements, whereas this is not true in the opposite direction. This confirms our hypothesis 1 that the conventional market acts as a price leader for the organic one.

Although our results suggest that organic prices follow prices in the conventional market, there is no reason to believe that this relation is linear. Niche markets might change at a different speed than the main market for various reasons (see hypothesis 3). Hence, the following section investigates the possibility of a non-linear relation with a threshold autoregressive (TAR) model and thereby tests hypotheses 2 and 3.

5.3 Testing for Nonlinear Price Dynamics between Conventional and Organic Markets

Previous studies explained non-linearities by transaction costs of spatially separated markets for the same good (e.g. Baulch, 1997; Fafchamps, 1992; Sexton et al., 1991). Unlike in these studies, in our example transaction costs are not the result of costs and risks associated with trade between such separated markets and the speed of adjustment is not necessarily dependent on the traders' access to market information. At the wholesale level information about prices in conventional markets is readily available. And we have found out that organic prices follow the price in the main market (that is the conventional market) and not vice versa.

In our case, thresholds may exist when consumers see conventional and organic pineapple as two different products. This may happen when there is a physical separation - still a considerable part of organic pineapple is traded by way of organic specialty markets as opposed to mainstream food multinationals - or when marketing and branding efforts of companies are successful. A threshold also exists due to the switching behavior of consumers: when the price difference between the organic and the conventional pineapple increases beyond the willingness to pay for an organic pineapple, then the consumer may switch and buy a conventional pineapple instead, and vice versa.

The organic premium is not constant over time (Figure 3.2). If hypothesis 2 is correct, it is possible that due to a certain willingness to pay for organic products *relative* to conventional goods, organic prices only respond to movements in conventional prices when the difference between these two prices exceeds a certain threshold. On the supply side, both thresholds and non-immediate adjustment can be caused by differences in competitive structures: a small number of fiercely competing food multinationals in the conventional market versus a larger number of smaller competitors and limited possibilities consumers to compare prices in the niche market. In addition, if conventional prices vary as a result of changing supply conditions from Costa Rica, organic prices might not adjust or not as much. The possibility of a threshold would in this case be owed to menu costs and competitive structures.

In addition, the size of thresholds themselves may vary over time with the relative WTP of consumers for organic over conventional products. As stated in hypothesis 3, the threshold may vary when cross-price elasticities change over time.

In this paper, we follow the analysis by Van Campenhout (2007) who uses a threshold autoregressive model to test for integration of several Tanzanian maize markets over time. As explained by the author, the threshold autoregressive (TAR) model can be preferred over a parity bounds model (PBM) because the TAR model allows separating the two market components of transaction costs and speed of adjustment of prices. Moreover, it allows for time-varying thresholds. To analyze possible non-linearities in the relation between organic and conventional prices, we estimate the following TAR model:

$$\Delta m_t = \begin{cases} \rho_{out}\, m_{t-1} + \varepsilon_t & m_{t-1} > \theta \\ \rho_{in}\, m_{t-1} + \varepsilon_t & -\theta \le m_{t-1} \le \theta \\ \rho_{out}\, m_{t-1} + \varepsilon_t & m_{t-1} < -\theta \end{cases} \qquad (3.4)$$

where $m_t = p_{c,t} - p_{o,t}$ is the difference between the conventional and the organic price in period t, $\varepsilon_t \sim N(0, \sigma^2)$. ρ_{in} and ρ_{out} measure the adjustment speed, the change in the price difference as result of the previous difference itself, within the band created by the threshold θ and outside this band respectively. If the hypothesis of a threshold was wrong, these two parameters should be the same.

It is possible that the threshold is not constant but changing over time. To incorporate this possibility, the threshold θ can be modeled as a function of time:

$$\theta_t = \theta_0 + \frac{(\theta_t - \theta_0)}{T} t \qquad (3.5)$$

where $t \in (0,T)$.

In addition, we will allow for a time trend in the adjustment parameters ρ_{in} and ρ_{out}. These two extensions can be expressed by the following second model:

$$\Delta m_t = \begin{cases} \rho_{out}\, m_{t-1} + \rho'_{out}\, t\, m_{t-1} + \varepsilon_t & m_{t-1} > \theta_t \\ \rho_{in}\, m_{t-1} + \rho'_{in}\, t\, m_{t-1} + \varepsilon_t & -\theta_t \le m_{t-1} \le \theta_t \\ \rho_{out}\, m_{t-1} + \rho'_{out}\, t\, m_{t-1} + \varepsilon_t & m_{t-1} < -\theta_t \end{cases} \qquad (3.6)$$

To estimate these two models, the data was converted into first differences. Data in this form was stationary for all the time series. To determine the threshold parameters θ, θ_o and θ_T, a grid search over all possible values has been performed. Furthermore, according to the hypothesis that prices only respond if the difference between them is large enough, ρ_{in} is set to zero in the analysis.

The results are shown in Table 3.2. The threshold is at 63% (Latin America) and 53% (Africa) of the average differenced price in the simple TAR model, confirming hypothesis 2. This number is quite high, but one should remember that the price changes are rather small compared to the absolute value of the price. When including time trends, thresholds for Latin American pineapple stay the same and thresholds for African pineapple increase from 46% to 61%. On the other hand, above the thresholds, adjustment speeds (ρ) are almost unaffected by the inclusion of a trend and the coefficients that measure the interaction between adjustment and time are not statistically significantly different from zero. The adjustment speeds in the model without time trends outside the band formed by theta are -0.335 (Latin America) and -0.479 (Africa), which imply a half-life of 1-2 months. In the model with time trends the adjustment speeds outside the band are -0.365 (Latin America) and -0.350 (Africa), which imply a half-life of 1.350 (Latin America) and 1.609 (Africa) months, not very different from the regression without trend. Hence, there is no evidence for an overestimation of half-lives and underestimation of adjustment speeds by simple TAR models as stated by Van Campenhout (2007). The results indicate that over time there is not much change in thresholds below which no adjustment of organic prices to conventional price changes takes place. This implies that these markets do not become more integrated and cross-price elasticities remain indeed constant over time. Adjustment speeds also remain unchanged, which suggests that neither market information nor competitive structures change. Hence, hypothesis 3 cannot be confirmed.

There is also no indication that the premium on organic pineapple is bound to decrease. However, since our database covers only four years, this rather indicates that more research should be done to answer this question when more data is available than a strong rejection of the hypothesis. Still, overall these results indicate thresholds in price responses that did not change significantly over the past four years, and there is also no difference in regions of origin. These results may help farmers, traders, retailers, and agencies promoting organic certification to better understand the market and predict future price movements. The availability of more data over time will improve the results.

6 Conclusions

As the demand for organic products is growing, this paper has tried to shed light on the longer-term profitability of organic production. Taking hedonic demand theory as basis, we empirically analyzed spatial price transmission between organic and conventional pineapple on the world's largest organic market Europe as a case study. The analysis is set up with a development perspective since organic products in general and organic pineapple in particular are niche markets that exhibit premium prices. As a result, organic production is currently promoted as a valuable agricultural alternative for developing countries. Our results imply that the conventional market acts as a price leader for the organic one. While prices for conventional pineapple are independent of organic prices, organic price movements are responding to their conventional counterparts. However, threshold analysis indicates that organic prices only react to changes in conventional prices if these changes are sufficiently large. In addition, this threshold does not change over time. Hence, despite an expanding organic niche, market integration does not increase. Our observations also do not show an upward or downward trend for the organic price premium in the pineapple market. When there is neither more integration, nor a declining price premium to be observed, while the organic market is expanding faster than the main market, this happens, according to theory, only when the core market expands faster than supply. One important implication of this observation is the potential for the scalability of the organic market. Accordingly, these results suggest that organic production can indeed be a profitable alternative for small farmers in developing countries, and it is likely to remain so in the near future. Furthermore, being founded in hedonic demand theory allows this analysis to be applied to other similar niche-main market situations. Other environmental or ethical certifications such as Fair trade may provide a very similar context.

However, some questions remain to be analyzed. In order to understand price premia and their behavior in more detail, future research might investigate what part of the price premium can be attributed to the organic nature and what part to other product characteristics such as quality using hedonic demand models. We have deliberately chosen a relatively homogeneous experience good for our analysis, assuming that it is relevant for search goods as well. However this remains to be shown. In addition, longer time series data would help to strengthen the analysis of the sustainability of the organic premium on the producer and retail level and may be able to show when the current dynamics of demand and supply shifts are likely to change in the future.

7 References

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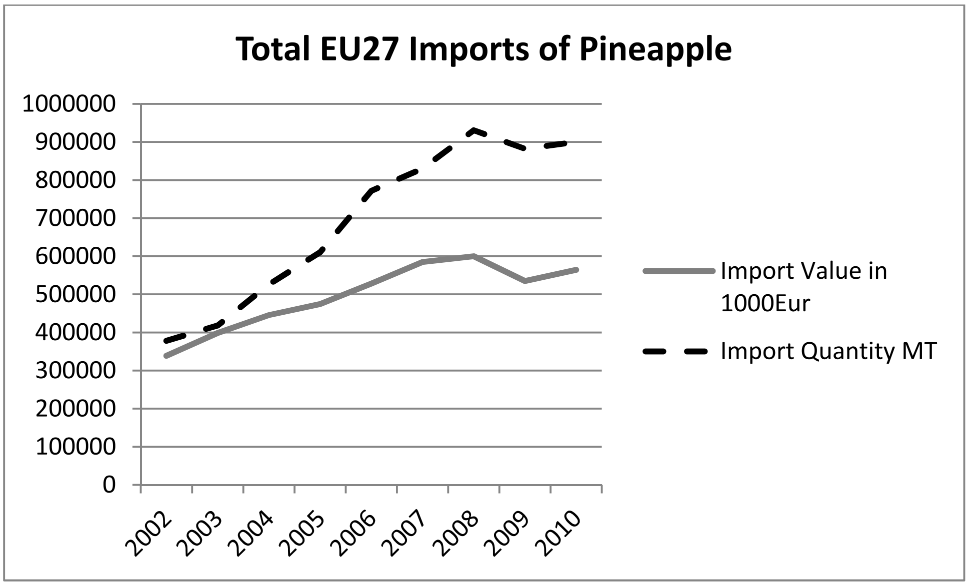
Figures and Tables

Figure 3.1: Volumes and values of EU pineapple imports



Source: Eurostat Comext 06/06/2011

Figure 3.2: Wholesale prices for conventional pineapple from different origins

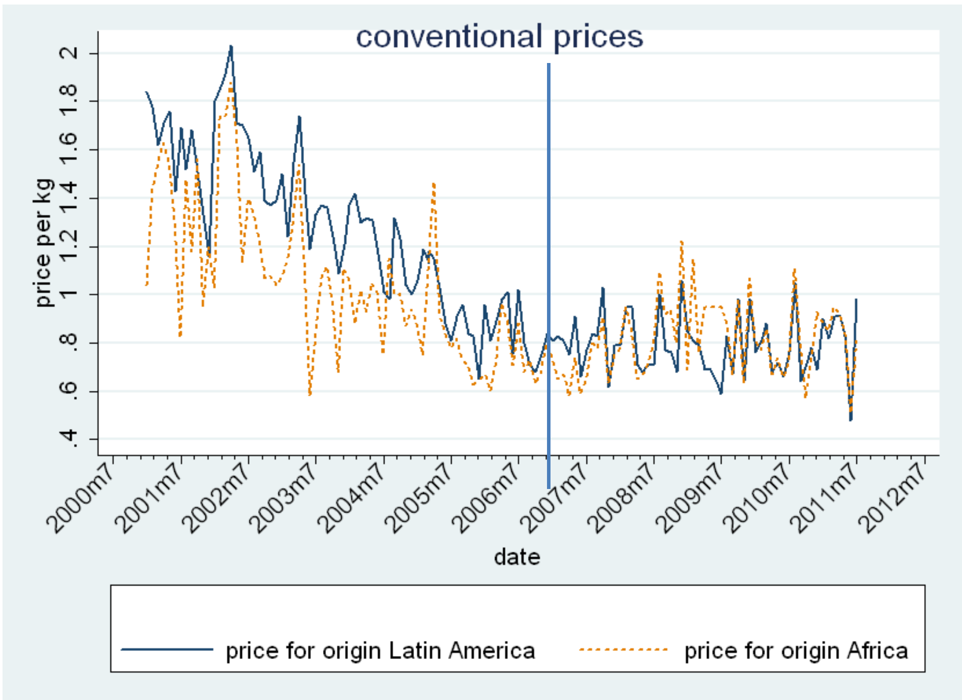
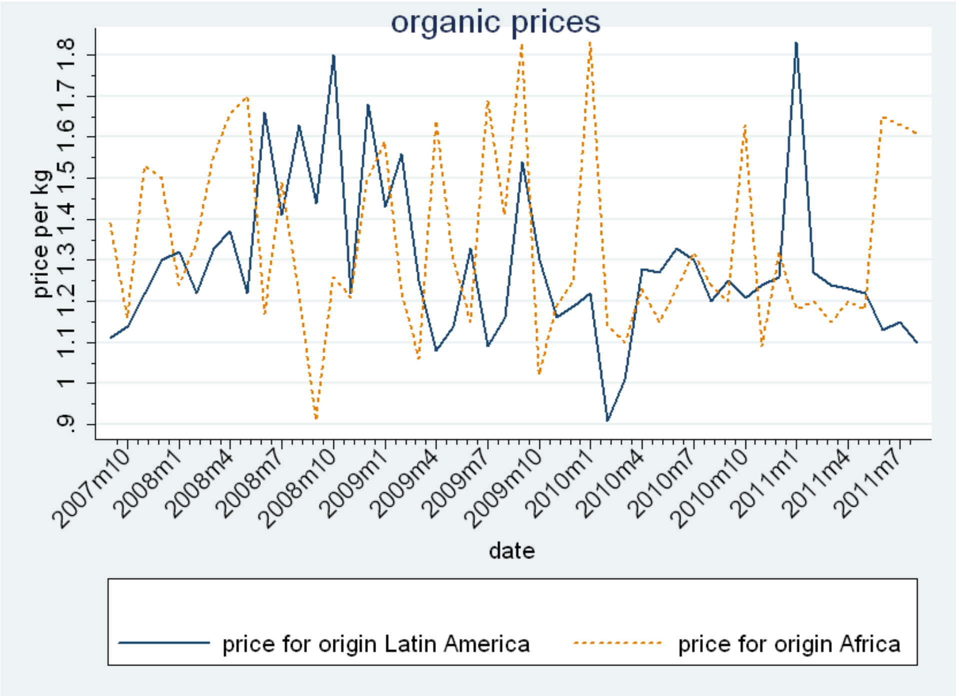
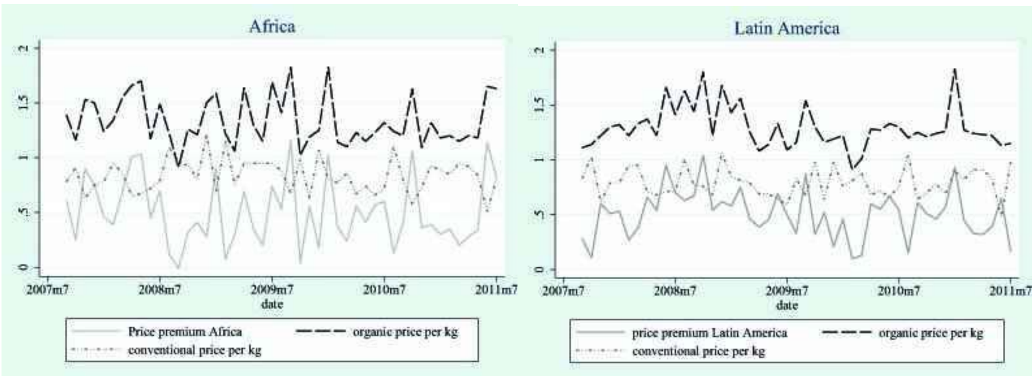


Figure 3.3: Wholesale prices for organic pineapple from different origins



Source: International Trade Centre's market news service and European fruit trading companies.

Figure 3.4: The price premium for organic pineapple



Notes: Prices are average monthly European wholesale prices in €/kg.
Source: International Trade Centre's market news service and European fruit trading companies.

Table 3.1: Estimation Results for VEC

	LATIN AMERICA		AFRICA	
	Δp_c	Δp_o	Δp_c	Δp_o
Δp_{c-1}	-1.191***	0.361***	-1.07***	0.382**
	(0.153)	(0.153)	(0.16)	(0.196)
Δp_{o-1}	-0.084	-0.084	0.120	0.283*
	(0.149)	(0.149)	(0.215)	(0.155)
c	-0.001	0.005	0.001	0.003
	(0.025)	(0.025)	(0.029)	(0.035)
α	-0.580***	0.073	-0.497***	0.150
	(0.172)	(0.323)	(0.197)	(0.236)
Test results				
R²	0.428	0.174	0.428	0.174
F-statistic	6.988**	3.181*	6.988**	3.181*
Log Likelihood	30.87		16.57	
LM-Test (p-values) for autocorrelation, lag 1	0.252		0.511	
lag 2	0.413		0.508	

Notes: p_c is the conventional price, p_o is the organic price in natural logarithms.

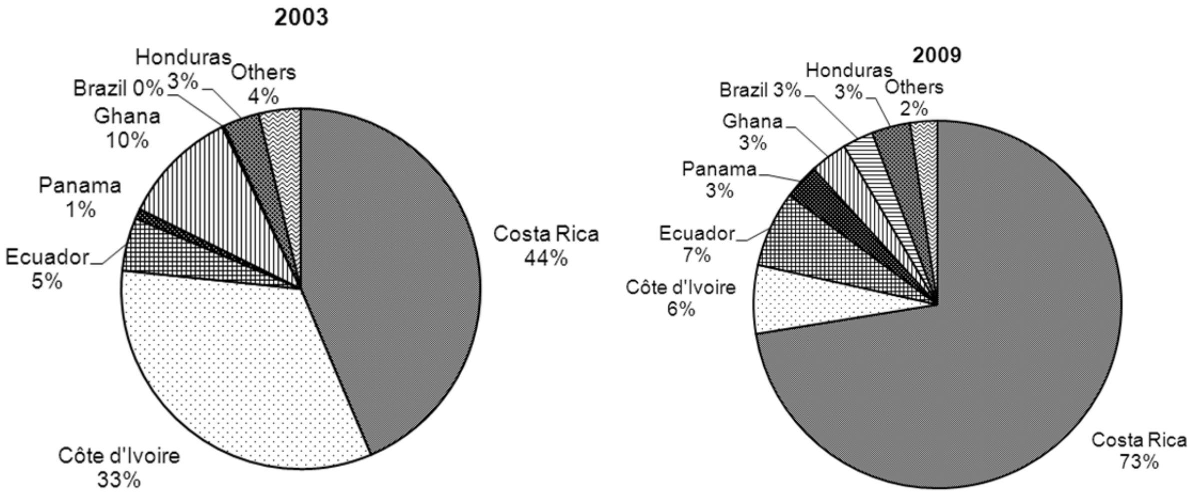
Table 3.2: Estimation results for TAR model and TAR model with trend

	LATIN AMERICA		AFRICA	
	TAR model	**TAR model with trend**	**TAR model**	**TAR model with trend**
θ	0.630		0.530	
$\theta(t=1)$		0.630		0.460
$\theta(t=34)$		0.630		0.610
ρ	-0.335***	-0.365*	-0.479***	-0.350*
	(0.095)	(0.197)	(0.102)	(0.194)
$\rho * t$		-0.012		-0.007
		(0.008)		(0.008)
half-live	1.697	1.350	1.064	1.609
N	46	46	46	46
R²	0.217	0.258	0.330	0.352
F-statistic	12.47***	7.65***	22.13***	11.93***

Notes: Dependent variable is the change between two periods in the price difference between the two market prices. All models are estimated without a constant. Rho (ρ) denotes the adjustment parameter on the lagged price difference expressed as the percentage of mean price in the two markets, theta (θ) is the threshold expressed again as the percentage of mean price in the two markets and t is a time trend. The TAR models are three regime symmetric models with unit root behavior imposed within the band formed by the thresholds. The thresholds are identified through a grid search over candidate thresholds with as model selection criterion the minimal sum of squared residuals. As starting values for the thresholds, at least 20% of the observations were either within or outside the band formed by the thresholds. Half-lives are expressed in months and in brackets when they are based on a coefficient that was estimated not significantly different from zero. Standard errors are in brackets. *, ** and *** denote parameter estimates significantly different from zero at the 10%, 5% and 1% significance, respectively. N is the number of observations used in the estimation.

Appendix

Figure A.3.1: European Market Shares in Fresh and Dried Pineapple 2003 and 2009



Source: Eurostat Comext
Notes: Classification: pineapple fresh or dried, 90percent sea, 10 percent air freight,
Varieties: Smooth Cayenne, MD2, Victoria

Table A.3.1: T-statistics of ADF-test for conventional prices

	Lags by Schwartz criterion		Lags by MAIC	
	no trend	trend	no trend	trend
Levels				
Latin America (1/11)[a]	-2.476	-3.922**	-1.558	0.224
Africa (1/11)	-3.617***	-4.787***	-3.501**	-3.031*
First Differences				
Latin America (1/6)[a]	-11.056***	-11.047***	-6.300***	-6.433***
Africa (3/3)	-9.856***	-9.878***	-9.856***	-9.878***

Note: (***) indicates a rejection of the null hypothesis at the 1% significance level, (**) at the 5% significance level, (*) at the 10% significance level. [a] In brackets are the number of lags by Schwartz/ MAIC criterion.

Table A.3.2: Test statistics of DF-GLS test for conventional prices [a]

	Lags by Schwartz criterion	Lags by MAIC
Levels		
Latin America (1/11) [b]	-2.927	-0.378
Africa (1/11)	-4.455***	-1.420
First Differences		
Latin America (1/6) [b]	-8.662***	-2.543*
Africa (3/3)	-3.174**	-3.174**

Note: (***) indicates a rejection of the null hypothesis at the 1% significance level, (**) at the 5% significance level, (*) at the 10% significance level.
[a] By default, the test includes a trend. [b] In brackets are the number of lags by Schwartz/ MAIC criterion.

Table A.3.3: T-statistics of ADF-test for organic prices

	Lags by Schwartz criterion		Lags by MAIC	
	no trend	trend	no trend	trend
Levels				
Latin America (1/3)[a]	-2.915*	-3.272*	-1.954	-2.389
Africa (1/1)	-4.502***	-4.545***	-4.502***	-4.545***
First Differences				
Latin America (1/1)[a]	-6.743***	-6.740***	-6.743***	-6.740***
Africa (1/1)	-7.570***	-7.535***	-7.570***	-7.535***

Note: (***) indicates a rejection of the null hypothesis at the 1% significance level, (**) at the 5% significance level, (*) at the 10% significance level. [a] In brackets are the number of lags by Schwartz/ MAIC criterion.

Table A.3.4: Test statistics of DF-GLS test for organic prices [a]

	Lags by Schwartz criterion	Lags by MAIC
Levels		
Latin America (1/3)[b]	-2.685	-1.911
Africa (1/1)	-3.990***	-3.990***
First Differences		
Latin America (1/1)[b]	-6.080***	-6.080***
Africa (1/1)	-6.843***	-6.843***

Note: (***) indicates a rejection of the null hypothesis at the 1% significance level, (**) at the 5% significance level, (*) at the 10% significance level.
[a] By default, the test includes a trend. [b] In brackets are the number of lags by Schwartz/ MAIC criterion.

Table A.3.5: Johannsen Cointegration Test for Latin American prices

rank	Trace statistic (5% critical value) No intercept, no trend	Max. eigenvalue (5% critical value) No intercept, no trend
0	33.51 (12.53)	33.34 (11.44)
1	0.17*** (3.84)	0.17*** (3.84)
	Intercept	Intercept
0	50.62 (19.96)	41.83 (15.67)
1	8.80** (9.24)	8.80** (9.24)

Note: ** indicates the rank selected by a trace statistics test at 5% level.
*** indicates the rank selected by maximum eigenvalue statistic test at 5% level.

Table A.3.6: Granger Causality Test (p-values) for Latin American prices

p_c	0.67
p_o	0.07

Notes

[1] Since in market statistics fresh and dried pineapple are generally grouped together, we do so too in this paper.

[2] Because the analysis is concerned with prices for fresh pineapple only, figures for processed pineapple are omitted here.

[3] GLOBALGAP is a private standard founded in 1997 as EurepGAP by European retailers. It is a business-to-business standard with the aim to establish one standard for Good Agricultural Practices (GAP).Many of the large European retail and food service chains, producers/suppliers are members (www.globalgap.org).

[4] The US National Organic Program allowed the use of ethylene gas for flower induction in pineapple in 2002, the EU only in 2005. It is therefore expected that this difference is even larger today.

[5] Rosen (1974) provides a theoretical framework in which $p(z)$ is endogenously determined by the interaction between suppliers and demanders of the commodity. Since, without information on quantities and consumer characteristics, we cannot use the full model for our example, we refrain from describing it here.

[6] The production cycle for pineapple is between 11 and 18 months. Conversion to organic production takes on average three years.

[7] The countries included in the analysis are the following: Austria, Belgium, Denmark, Finland, France, Germany, Holland, Italy, Spain, Sweden, Switzerland and United Kingdom.

[8] Transport costs constitute an important factor for pineapple pricing in Europe. They account for up to 50% of the price for both sea and air transport (€0.38 and €0.83 respectively). Consequently, the prices for sea- and air-transported pineapple differ greatly and are hardly comparable. Since the majority of pineapple is transported by sea, we focus on pineapple transported by sea. Surprisingly, sea transport costs do not differ greatly between Latin America and West Africa even though the former is further away from European harbors (e.g. Achuonjei, 2003). The difference is negligible in per kilo prices and conventional and organic fruit can be transported in the same container.

[9] Compared to other pineapple varieties MD2 had the highest start and the strongest downward development in prices (see section 2). By today, the difference in prices between varieties has vanished according to International Trade Centre's market news service.

[10] Information from AMI for Germany: http://www.ami-informiert.de/.

[11] Means and standard deviations for Africa are 0.50 (0.31) and for Latin America 0.50 (0.22) respectively.

[12] However, since the available time series is short and we do not have sufficient data about the development of the size of the two markets, our conclusions have to be taken with care.

[13] This result might reflect the problem of overrejection of the null hypothesis when using the Schwartz criterion, as explained above. The larger number of lags is also able to account for seasonality in the price data. On the other hand the large number of lags might reduce the significance of the results.

[14] We could extend the model to incorporate asymmetries in the transmission of positive price changes in contrast to negative ones. Apart from data constraints (short time series), this is also questionable for other reasons in this case. Since it would mean that price increases in conventional prices are transmitted more rapidly or slowly to organic prices than price decreases, the rationale behind different adjustment speeds for price increases and price decreases are according literature usually market power. In our case this would mean that wholesalers in the organic market would have the market power to asymmetrically transmit prices changes in the conventional pineapple market to their customers (retailers and specialty shops). As retailers often also engage in wholesales, this is not very plausible on aggregate level. Alternatively exporters in developing countries would have the market power to asymmetrically adjust organic prices when conventional ones change. This is even more unlikely because pineapple is a perishable fruit so exporters are dependent on selling fast. In such cases actors at the beginning of the value chain usually have relatively little power. The second possibility would be information asymmetries, that is exporters or importers having different information about market prices than wholesalers and retailers, which is quite unlikely in this case at least when regarding monthly data. It might be more relevant with price data of higher frequency.

Chapter 4

Organic Farming in Ghana - A Good Choice for Smallholders?

Linda Kleemann°

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° Contact: Kiel Institute for the World Economy, Hindenburgufer 66, 24105 Kiel, Email: linda.kleemann@ifw-kiel.de.
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Organic Farming in Ghana - A Good Choice for Smallholders?

Abstract

The rapid growth of the high value certified food and drinks sector, far higher than that of the conventional market, creates niche market opportunities. Since organic food in general, and organic pineapple in particular, are strongly growing niche products that earn a premium price on the market compared to conventional varieties, organic certification is increasingly promoted in many developing countries as a valuable alternative for smallholders, as well as a solution to environmental and health problems related to chemical input use. Using the case of the pineapple sector in Ghana as an example, this paper sheds light on the feasibility and profitability of organic small-scale production for the farmer. In addition we study the use of organic and soil fertility enhancing production methods among conventional and organic smallholders. We find that, even though smallholders tend to have quality problems with their fruit and large farms benefit from economies of scale, production for the export market is a realistic option for both organic and conventional smallholders. The results suggest a positive effect of switching from conventional to organic production when competing on the global market for pineapple and farmers collect a fair share of the price premium on the retail level. Even more, from a theoretical perspective, organic farmers should also be more likely to get into contractual relations with exporters. However, due to a lot of variation in the use of organic production methods, it is less clear if environmental problems can be solved by promoting organic production for smallholders. The results are set into perspective with relation to the debates on small versus large farms, and the selection effect of private voluntary standards.

Keywords: private voluntary standards, organic agriculture, trade in organic products, GLOBALGAP, value chain analysis

JEL classification: F14, L11, L15, O13, Q13, Q17

1 Introduction

The rapid growth of the organic food and drinks sector with an average growth rate of 13% between 2002 and 2006, far higher than that of the conventional market, creates niche market opportunities for farmers. More specialized stores for organic products are opening up and supermarkets started offering organic food as part of their normal range of products. Consumer demand for organic products is concentrated in North America and Europe; these two regions comprise 97% of global revenues (Willer and Kilcher, 2009). Within this sector, pineapple is a case in point for our study, because fresh pineapple, like other tropical fruit, is grown mainly in developing countries, where two thirds of rural people live on small-scale farms of less than two hectares (IFPRI, 2005). Organically grown pineapple is becoming more popular among consumers and certified organic pineapple exports are rapidly increasing since 2005.

Pineapple is well suited for this analysis because it is a homogeneous high value crop, compared to, for instance, coffee where a lot of different varieties and quality grades prevail. Nevertheless, production of conventional pineapple is mostly dominated by big transnational companies that own large-scale plantations. As a consequence, it is difficult for small farmers to participate profitably in the market. The market for organic pineapple is still a niche market, which is not yet controlled by a few big companies. Like other organic products, organic pineapple earns a premium price on the market compared to conventional varieties. Hence, the shift from conventional to organic production might be an opportunity for small-scale farmers to reap higher returns from their investments. If viable this is interesting for development actors, as smallholders include the majority of the absolute poor in developing countries.

Since the switch from conventional to organic production technologies requires costly adjustments of the land, for example, several aspects of the market need to be considered when trying to determine its profitability. One aspect is the size of the price premium and if it can persist over time. A second important aspect when studying the profitability of organic production is what percentage of the organic price premium received by retailers is actually passed on to the producers themselves and if costs differ for the two production techniques. In this paper we focus on the second aspect. In doing so, it is important to fully understand the value chain of organic pineapple and how it differs from conventional fruit. Ghana is a case in point because pineapple is one of its most important non-traditional export crops and it is a leading supplier of organic pineapple to the European market.

A few studies have recently found that certified organic agriculture is more profitable than conventional agriculture in developing countries, due to the higher price farmers receive for their product (e.g. Bolwig et al., 2009; Maertens and Swinnen, 2009). Rieple and Singh (2010) have shown that organic production adds value throughout the production and processing of cotton. Other studies have explained the size of the premium and the willingness to pay a premium for organic products (e.g. Teisl et al., 2002; Nimon and Beghin, 1999; Bjorner et al., 2004). We provide the missing link between these two strands of research by showing how the premium for organic produce at the farm level is formed and how it develops along the value chain.

The paper also sets a focus to the specific conditions in Ghana. Fold and Gough (2008) illustrate that the export pineapple industry did provide benefits for significant numbers of smallholders in the South of Ghana between 1983 and 2005. Yet, since the introduction of a new variety a lot of smallholders have been excluded from the export pineapple value chain due to perceived high smallholder production costs and frequent contract breaching. Several cooperatives disappeared and the surviving ones were weakened (Fold and Gough, 2008). With regard to donor efforts to bring back smallholders into export production, it is central to know if this is a viable possibility. The evidence on the ability of smallholder cooperatives to compete in high-value international supply chains is mixed (see e.g. Markelova et al. 2009; Roy and Thorat, 2008; Wollni and Zellner, 2007 for positive and negative examples). By investigating the complete fresh pineapple value chain, we aim to find out if smallholders have a chance to be reintegrated into the exporter value chain. In addition, within the export value chain and in line with our focus on organic production, we investigate if it makes more sense for small farmers to invest in niche markets. This analysis informs us on the efficiency and efficacy of using certifications to further environmental protection or producer welfare. This aspect has not been studied before from both the production and market perspective, despite its importance for the growing promotion of organic certification in developing countries. To be able to evaluate the profitability of organic production for smallholders, we calculate the costs and revenues of production for these farmers and compare them with those for conventional smallholders and large farms. Our results demonstrate that, contrary to a widely held opinion in Ghana, both organic and conventional smallholders can potentially and profitably participate in the export market. Among smallholder farms, organic production is more advantageous than conventional production, and our findings suggest that in percentage terms organic price premia are fully passed from retail level to Ghanaian farmers. From a theoretical perspective organic farmers should also be more likely to get into contractual relations with exporters.

The rest of the paper is organized as follows. In the next section we briefly describe pineapple market trends in the world and Ghana and price developments on the conventional and organic market. In section 3 all stages of the value chain, from production to supermarket, are discussed in detail. Section 4 discusses the results with respect to three current debates: small versus large farms, the link to environmental effects and the selection effect of standards. Section 5 concludes.

2 The Market for Fresh Pineapple

2.1 World Market Trends

The world market for fresh pineapple is dominated by one variety and kilogram prices are relatively uniform across fruit sizes and qualities. The fresh pineapple market has been recording exceptional growth rates: the share of fresh pineapple in the whole pineapple market has risen from 12.5% in the early 1960s to 26% in 2005 (FruiTrop, 2008). In 2007, the main consumers of fresh pineapples were the US (2.5 kg per capita per year), followed by the EU (2.1 kg per capita per year) and Japan (1.3 kg per capita per year) (FruiTrop, 2008). Fresh and dried pineapple in Europe comes mainly from Latin America (around 80%)

and Africa (10 - 15%, Figure 4.1). Africa had been Europe's major supplier of fresh pineapples until it was taken over by Central America by way of the introduction of a new pineapple variety called MD2. Meanwhile, the formerly dominant variety, Smooth Cayenne (SC henceforth), slipped to the bottom of the price spectrum for fresh pineapple and lost market share from over 90% at the end of the 1980s to almost nonexistence today (Loeillet, 2004). More than 75% of all pineapple sold in the EU are now of the MD2 variety (Pay, 2009).

As one of the two most globally traded fresh tropical fruits (bananas being the other), conventional pineapples are primarily produced in large-scale plantations owned by large multinational food companies who also engage in contractual arrangements with local producers. These companies control not only the market but also the supply of pineapples to the large retailers within a tightly structured supply chain[1]. This is not yet the case for organic produce, which is mostly produced by smallholders and does not rely as much on vertically integrated supply chains. For developing countries with a significant share of smallholders in production such as Ghana, the support for diversification of exports towards niche markets (e.g. organic markets) could therefore increase the profitability of production. In niche markets, which tend to be smaller by definition, farmers can exercise more bargaining power whilst at the same time meeting the latest requirements on quality, traceability, packaging, and standards such as Fairtrade or organic, which might hold the key to good profits as our empirical analysis below suggests.

2.2 The Organic Market

Data on the European pineapple market was collected in January and February 2009 and in summer 2009 through structured interviews with traders, wholesalers, and retailers and a pilot survey of European fruit importers. Additional data comes from Eurostat, International Trade Centre's market news service, and CIRAD's market news service. Most organic pineapples for the EU market are produced in Ghana with an increasing amount coming from Costa Rica (CBI, 2008). Taken as a whole, Europe is the largest market for organic products, and although the available data is very sketchy and often outdated, it is assumed that this holds also for the organic pineapple market. It is estimated that up to 40% of total pineapple exports from Ghana are organic and/or fair trade certified[2].

2.3 The Pineapple Sector in Ghana

In Ghana, the pineapple industry is the most developed horticultural sector. Pineapple is a non-traditional export crop grown mainly in the Greater Accra, Central, Eastern, and Volta regions. According to the Ghana Living Standards Survey (2009) Ghana's pineapple production is estimated between 120 000-150 000 tons annually. Between 2003 and 2007 on average 63% of Ghana's pineapple production was exported. The current structure of the Ghanaian pineapple industry is characterized by rapid changes due to changing regulations and the shift of international demand from the formerly dominant SC variety to the MD2 variety. As shown in Figure 4.2, pineapple exports started in the 1980s, increased rapidly after 2000, and decreased after 2004 due to the slow uptake of the production of the new variety. Pineapples from Ghana are almost entirely directed to the EU.

Even though the Ghanaian agricultural sector is smallholder-based, the main private pineapple exporters are large-scale plantations that also offer contract farming to smallholders (so called outgrower schemes, Fold and Gough, 2008). The shift to the MD2 variety has driven a lot of farmers, in particular smallholder-based cooperatives, out of the export market due to initially high costs of investment into the new variety and prevalent contract breaching from both sides during the breakdown of pineapple exports. Efforts by the government and donors are under way trying to re-link smallholders to the export market for fresh and processed pineapple.

In 2008 the share of smallholder production in exportable pineapple was estimated to be 40-45% (UNCTAD, 2008). According to the Sea-Freight Pineapple Exporters of Ghana (SPEG), today 39% of exports of pineapple are produced by smallholders.

5453 hectares in Ghana where planted with organic pineapple in 2008. In addition to smallholders, there are two relatively large farms that produce organic pineapple for fresh export and several processing firms.

To understand the profitability of organic production for smallholders compared to conventional and large-scale farms, as a starting point, potential revenues might be evaluated by looking at the development of the price premium for organic pineapple. This is the focus of the next section.

2.4 Evolution of Prices

Numerous scientific studies have shown the existence of price premia for organic products (e.g. CBI, 2008; Bjorner et al., 2004; Teisl et al., 2002; Nimon and Beghin, 1999). Using average monthly wholesale market prices in US$ per kg from several European destination countries from the International Trade Centre's market news service and several European fruit trading companies, we describe the price premium over the period September 2007 to June 2010. Figure 4.3 illustrates that, over this period, price premia have fluctuated between US$0.0 and US$1.17 with a mean of US$0.76.

However, not only the growing demand and the willingness to pay a premium for the product make organic cultivation attractive for producers. Some studies explain the growing interest in organic agriculture in developing countries also by the fact that it requires less financial input and places more reliance on the natural and human resources available (e.g. Willer et al., 2008). Hence, it is worthwhile to analyze if switching from conventional to organic production might indeed result in higher profits for farmers. To evaluate the standing of organic smallholder farms in the market, an analysis of the whole value chain is necessary. This is done in the next sections.

3 Value Chain Analysis for Ghanaian Pineapple

Value chain analysis studies how value is added in different stages of production through analyzing the costs and organization of these activities (e.g. Azqueta and Sotelsek, 2007).

Here we use this technique to find out whether it makes sense at all to integrate smallholders into the pineapple export value chain and if the organic pineapple value chain is a better option for smallholders than the conventional one. We use value chain analysis because it focuses on international business organization and profitability contrary to other forms of agricultural production-consumption systems analyses[3].

In the literature a distinction is made between ‘buyer-driven’ and ‘producer-driven’ value chains. In traditional producer-driven value chains, the producers (in this case the farmers) dominate the industry through concentration of knowledge and capital. Agricultural value chains, including pineapple, are increasingly buyer-driven.[4] This means that the buyer exercises control over the chain even in the absence of ownership (Humphrey, 2006). Buyer-driven value chains usually have low barriers of entry in production (Gereffi, 1994). In buyer-driven chains, the buyers, e.g. European retail chains or fruit multinationals, can dictate the adherence to their standards as a requirement to enter the export value chain. Certification to such, so-called private voluntary standards, is therefore primarily an export marketing tool (UNCTAD, 2006) and can be seen as a form of product upgrading. It is only worth going to the trouble of obtaining certification if the price obtained for the certified product exceeds any extra certification, production and management costs incurred compared to the local market price.

3.1 The Post-Farm Gate Value Chain

The data for this section was gathered from personal interviews with 26 farmers, exporters, exporter associations, and government agencies in Ghana in 2009 and 2010 and 14 structured interviews with traders, wholesalers, retailers, and fruit importers in Europe. The data on local production and marketing was collected during two visits to Ghana in March 2009 and from January to March 2010. Interviewees were selected for their expertise and knowledge of the different stages of the pineapple value chain. A semi-structured format was adopted, in that certain information (prices, market knowledge, farm/company size, and demographic and personal data) was obtained from all interviewees.

Figure 4.4 describes the post-farm gate value chain for Ghanaian pineapple. It is focused on fresh and processed export production and therefore excludes farmers that produce primarily for the local market. Smallholders can either sell to larger exporting farmers, local or exporting processors, or market women. Prices for fresh and processed export produce are the highest. Therefore only fruit that does not meet fresh export standards is sold to local processors or market women.

The organic and conventional pineapple value chains are at first sight very similar. The need for certification could be assumed to be one of the main differences. However, more than 80% of all fresh conventional pineapples are certified under GLOBALGAP[5]. GLOBALGAP certified fresh fruit and vegetables have a 76% market share on the European market. In a survey of fruit and vegetable exporters, all respondent companies in Ghana indicated that all of their buyers had requested GLOBALGAP certification and all of them eventually complied with the requirement (PIP, 2009). Thus, GLOBALGAP certification has become a quasi-requirement for export of conventional fresh fruit. Certification under GLOBALGAP can therefore be considered as reactive upgrading. Contrarily, organic can be classified under proactive upgrading. It is a formal requirement for organic sales in Europe. Hence, the existence of certification does not differ between the organic and conventional value chains, but the nature of certification differs. The need to undergo certification and auditing procedures poses no disadvantage for organic producers when conventional farmers need to undergo comparable procedures.

As explained above, conventional pineapples are primarily produced in large-scale plantations owned by a small number of transnational companies. A few multinational companies control the supply of pineapples to the large retailers within a tightly structured supply chain, such as in Costa Rica, the world market leader in fresh pineapple. This is not yet the case for organic produce, which is based to a larger extent on smallholders and medium-sized exporters. Between 11 and 40% of organic products are sold through specialized organic foods shops in Europe (Willer et al., 2008). The survey of the European market in this study confirmed the existence of two prevalent regimes. A specialty niche market regime is characterized by high prices, high quality and low volumes, and comes with organic, fair trade, or similar certification requirements. A supermarket regime combines lower prices and large volumes. In this regime GLOBALGAP is a standard requirement, and there is certain space for organic and/or fair trade certified pineapple. Naturally this regime is favorable for large-scale farms. Several exporters in Ghana mentioned that organic premia are higher for small volumes, which supports the notion of the two regimes. The export value chains reflect these regimes. The majority of organic exporters from Ghana sell directly to organic specialty shops or supermarkets. In the conventional value chain most exporters sell on consignment to intermediaries (Suzuki et al., 2008), which then sell to supermarkets. This difference is still existent despite the trend in Europe towards direct sourcing by supermarkets and the increasing number of fruit multinationals that are opening up their own organic product lines.

Smallholder cooperatives are linked to exporters that deal with retailers (supermarkets, specialty shops) and/or intermediaries. In the conventional chain a common set-up is one characterized by an intermediary with links to a retailer, who in turn is linked with a limited number of preferred suppliers (exporters). In both value chains, but more so in the conventional chain, the typical exporter in the developing country is also a producer for a fraction of his exports. The rest is bought from his contracted smallholder cooperatives or middle-sized farms. Some exporters do not engage in production at all, but only buy from producers with whom they have developed a relationship of trust. Exporters ensure that the product meets the private standards' requirements and quality standards set by the intermediary or retailer and the volume and delivery schedule set by the foreign buyer. They thus have a key role in integrating small and medium-sized producers into export markets (Fulponi, 2007), in addition to managing volumes and guaranteeing quality and food safety. Because this role is central, we study exporters, in addition to producers, in more detail below.

We take into account three farming models: small-scale organic, small-scale conventional and large-scale conventional. Small-scale farmers are supported by donors and

NGOs because they are assumed to be the weakest part of the chain and the one with the highest potential poverty impact. We therefore focus on this group. More precisely, we analyze if small-scale organic producers can be integrated into the international value chain at all and if they do better in the organic than in the conventional market in order to assess the potentials and intervention points for this group of farmers. For simplicity, since there are many types of processing, we reduce the analysis to fresh export only when studying post-farm gate costs and prices.

3.2 Production

Pineapple production takes 12-18 months from planting to harvest, depending on the soil quality, water availability, and other input use. There are several factors that influence the production cost structure in addition to the organic or non-organic production method, in particular the variety planted and the size of the plantation. Therefore we distinguish between varieties, farm sizes, and production methods in the production cost calculations. Detailed calculations and explanations of the data used are in the appendix.

First we compare different varieties and farm sizes. MD2 has higher production costs than SC or Sugarloaf varieties (Tables A.4.1 and A.4.2). Production on larger farms is known to be more input intensive, and economies of scale are evident in fixed inputs and planting costs. Nevertheless, overall production costs are lower on small-scale farms due to lower input and labor costs.

Next we compare production costs for MD2 and SC on small farms only. Total costs for organic MD2 production is higher than that for conventional production, whereas for SC production the opposite is true. As explained above, MD2 is a relatively new variety in Ghana and knowledge on organic production is still largely lacking. This is very likely one reason for the higher cost. It is noteworthy that the production of one kilogram organic SC comes at almost half the cost of one kilogram conventional SC. In detail, suckers, planting, and labor turned out to be more costly on organic farms, whereas in particular sucker treatment, and fertilizers and pesticides are less expensive.

In a 2009 survey of Sub-Saharan fruit and vegetable exporting companies, the impact of private voluntary standards certifications was identified as the second most important factor affecting export business over the period 2000 to 2007, after freight costs (PIP, 2009). So far we have ignored the costs for such certifications. The costs of certification are the costs of implementing the standard, i.e. compliance costs, and the costs of the actual certification, i.e. fees and costs for certifying agencies. Developing-country products are mostly certified by foreign agencies that have their headquarters in the target markets. This is true for all prevalent certifiers in Ghana. Both organic according to EU regulation (EC) 834/2007 and (EC) 889/2008 and GLOBALGAP have group certification options for organized farmer cooperatives. Nevertheless, most certifications favor large farms[6]. But because the small farms in our sample get support from donors or buyers to make up for this disadvantage we estimate certification costs at 1% of total production costs (Table A.4.2, see appendix for explanation of the estimation).

Figure A.4.1 exemplarily compares the production costs for MD2 on small farms in detail. It is evident that suckers and fertilizer constitute the most important cost factors for MD2 production, adding up to over 40% of production cost. As expected, in organic production labor cost is higher than in conventional production. Overall, organic production is cheaper than conventional production for smallholders (on average US$0.085 per kg as compared to US$0.093 per kg).

3.3 Yields and Sales

We now study the variation in yields and prices achieved. Table 4.1 shows, as expected, that planting densities and yields are higher on large farms than on small farms regardless of the variety. Comparing organic and conventional small farms, Table 4.1 demonstrates that planting densities are lower on organic farms except for one case, where planting densities are the same. Yields are lower on organic farms both in absolute terms and in relation to the number of plants per acre, i.e. fewer plants reach the harvest stage and their weight is lower on average. The most common explanation for this phenomenon is that the fertilization regime is better developed on conventional farms and that pest outbreaks can be dealt with better. Converted into metric tons (mt) per hectare (ha), conventional yields are between 76 and 96 mt/ha for SC and between 71 and 86 mt/ha for MD2. This is within the range of country average estimations by the Ghanaian Ministry of Food and Agriculture (MOFA) (50-80 mt/ha for SC and 60-72 mt/ha for MD2) and also with international standards. Yields for organic fruit are 16% lower with 62 mt/ha for SC and 59 mt/ha for MD2. As pineapple is a perishable non-staple crop, own consumption is very limited; even for very small farms it is usually below two percent of harvest and includes mainly slightly damaged or overripe fruit. Weights of pineapple are important because first exporters only take fruit above a certain weight (often 1.2 kg), and second prices are often paid per box and weight determines how many pineapple fit into one box (commonly there are 6 to 10 pineapple per box of approx. 12 kg).

Local and export market prices compared in Table 4.2. Farm gate prices range from high to low in the following order: fresh and processed fruit exporters, market women, local processors. The export price given in Table 4.2 is the weighted average of the fresh export and processers' price[7]. Generally, the fruit that does not meet export quality standards is sold to local processors or market women. Selling to processors has the advantage that fruit in various stages of ripeness, size, and also bruised fruit can be sold, whereas market women select the best fruit and leave the rest. Therefore large farms often prefer selling to processors what they cannot sell on the fresh export market, despite higher prices offered by market women. For small-scale farmers, the opposite is true, because of close connections, often through family links, to the village markets. It became clear during the interviews that coordination of harvesting and sales with smallholder groups is frequently a problem for exporters, whereas the coordination of exports among larger farms is not. Therefore large farms can sell a bigger part of their fruit on the export market than small-scale cooperatives (Table 4.2). Smaller farms do not only send a lower percentage to the export market, of this lower percentage a considerable amount goes into processing for export. This is a clear sign of inferior quality of small farmers' produce. Significantly higher prices for fresh export pineapple compared to the local market can be explained by high quality requirements, the need for certification, and the need to avoid side-selling by contracted cooperatives. In addition, this difference could also be an indicator of fruit quality. Pineapples from small farmers often experience gaps in the cool chain, in particular at the farm level. This may reduce the shelf life of the fruit and thus the price that is paid on the European market which reflects back to the export stage. However, the price difference may be underestimated because exporters might offer services to their contracted cooperatives, for instance the payment of certification fees (e.g. GLOBALGAP or organic), degreening or harvesting of fruit or the provision of loans, which they deduct from the price paid for their fruit. Although we tried to account for these factors during the data collection, we are aware that this is not always successful when the value of these services is not clear or smallholders do not relate their fruit prices directly to these services.

When comparing organic and conventional fruit it is evident that export prices are significantly higher for organic fruit, whereas prices on the local market are similar. On average organic export prices are 55% higher than conventional ones. Although we have experienced interest in and appreciation of chemical-free fruit in Ghana during our study period, the market for these products is based on trust, not on certification.

Despite these disadvantages that are associated with organic production, the profit from organic production is more than twice as high as from conventional production due to higher prices and lower or similar production costs.

3.4 Ghanaian Pineapple on the International Market

Next, we look at fresh export postharvest operations depicted in Table A.4.4. The focus is on the exporter who buys fruit from small-scale farmers or cooperatives. In value chain analysis, all inputs and outputs carry forward their inherited value, in this case the price, from the previous stage, in this case the field production.

Farmers sell their fruit at the farm or at the exporter's pack house (we call this "factory gate"). Postharvest costs like washing, grading, and packing, do not differ for organic and conventional fruit except for waxing, which is only done only on conventional fruit. Postharvest loss is generally low for pineapple, due to alternative uses (processing and local market). Times needed to port are similar for organic and conventional fruit, but the time span between harvest and cooling varies a lot among farmers. Most pineapple leaves the producing country free on board (FOB), which means the transport cost is paid by the European importers, which regularly dictate the FOB price (Suzuki et al., 2008). Overall postharvest operations amount to 74% of the FOB price for conventional fruit and to 60% of the FOB price for organic fruit. Hence at this stage, the part of the value added that can be assigned to the farmer is higher in the organic value chain.

Freight costs and times are the same for organic and conventional fruit at 20-30% of the import prices[8]. Equally to the farm-level, profits in the organic value chain are also higher at postharvest levels (i.e. exporter and importer) but not at the retail level. The lower profit at this level could indicate a higher fruit loss due to lower turnover in this niche market or a highly competitive retail market. Yet, as these costs and prices are just averages reported by several industry experts and traders, we have to take them as an indication rather than a fixed number.

3.5 Price Premia along the Value Chain

In the following paragraph, we compare the organic price premium that growers receive with the organic premia that consumers pay and how this premium develops over the stages of the value chain. The prices that producers receive for their products depend on international commodity prices, which are known to be very volatile (e.g. Deaton and Miller, 1996). Many studies have documented the fact that producers typically receive a small fraction of the international price. The difference is often explained by high transport and transaction cost and monopsonic rents captured by private traders or public marketing boards (e.g. Coulter and Poulton, 2001; Fafchamps et al., 2003). Nevertheless, Table 4.3 demonstrates that, in percentage terms, price premia are fully transmitted to local producers. In absolute terms, mark-ups therefore build up over the value chain. As explained above, there is no local market for certified organic produce. Price premia for exported fruit are between 20 and 68%. On the one hand they reflect costs that occur on different levels. This is clearly visible at the FOB level. Transport and packaging cost comprise a large part of FOB prices. On the other hand they are a sign of the valuation of the organic nature of a pineapple. After import, mark-ups stay literally the same in absolute terms. We do not expect a big difference in cost structures from this point on, but it has to be taken into account that our data on cost structures of intermediaries and retailers is very limited. At the retailing stage branding or reputation building effects possibly have influence on the mark-up.

4 Discussion of Results

4.1 Integration of Small Farms in the Export Value Chain

Looking at these results, the prospects for the re-integration of smallholders in the Ghanaian pineapple export sector look promising, in particular for organic farmers. However production costs are not the only relevant factor. Swinnen et al. (2010) develop a model that tries to explain under which conditions contracts with smallholders successfully take place and benefit poor farmers. According to this model, contracts are more likely to exist if the surplus - i.e. the buyer’s sale price minus his costs for input supply to smallholders, production and supervision costs - is high. Similarly to Key and Runsten (1999), we found that production costs are lower for smallholders than for large farms. For labor intensive crops such as pineapple and labor intensive production regimes such as organic agriculture, the availability of relatively cheap family labor is a key factor of production costs. Consequently, smallholder participation in the export value chain is not hindered by high production costs. The alternatives are own plantation or sourcing from few large suppliers. Processors and exporters may not like to become dependent on a small number of sources (Swinnen et al., 2010). Besides they could buy from varying numbers of smallholders to dampen EU demand fluctuations (Suzuki et al., 2008). Finally insecure land rights could force foreigners to source from smallholders instead of establishing their own plantations.

Contractual relations of smallholder cooperatives with exporters are successfully managed in other countries and used to be common also in Ghana. During the interviews with exporters and large farmers we learned that contract enforcement costs are currently perceived as very high. In the model by Swinnen et al. (2010) this would be reflected by very large supervision costs that could reduce the surplus enough that contracts do not take place. Hence, the re-establishment of trust is necessary for successful re-generation of contract farming in Ghana.

If organic certification raises the European wholesale price more than the sum of input, production and supervision costs, contracts with smallholders should be more likely in organic value chains. The model by Swinnen et al. (2010) also states that the existence of many alternative sales outlets for the farmer reduces the likelihood of contracts. As demand for certified organic produce is almost inexistent in Ghana, organic farmers count with less alternative sales outlets for their organic pineapple and a large price difference if they decide to sell it as conventional produce. Hence contracts with organic farmers should be more likely.

Furthermore organic production is often claimed to be easier to learn for small-scale farmers in developing countries, because it is related more closely to traditional methods. Since, however, sophisticated organic production using positive and negative methods is quite demanding, further investigations into the learning processes are needed to verify this claim.

4.2 Standards as Barriers or Catalysts

In this study we focused on monetary effects on the pineapple farm in a static environment. We did not study other aspects of livelihoods such as other income sources, market risk, access to credit and inputs and inequality among rural households. For instance, the contract farming that typically comes with smallholder certification under GLOBALGAP or organic may raise rural inequality, because the already better-off smallholders are recruited. For those farmers who are certified access to inputs and credit may increase.

In addition, more research is needed in order to verify if production for niche markets in general is a more profitable alternative for small farmers in developing countries than producing for mainstream markets. Apart from prices and market access, certifications necessary for market entry are an important factor in particular for smallholders. Lack of access to financial as well as qualified human capital poses important barriers for upgrading. This is due to the high initial investment not only in buying the necessary equipment, but also in learning how to produce the product according to new standards.

Due to the large coverage and therefore potential impact there is already a debate over the impacts of GLOBALGAP and similar mainstream standards on developing country producers ongoing in the literature. The increasing standards set by developed country importers have been described both as a hindrance and as a chance for smallholder market inclusion (e.g. Henson, et al., 2010; Swinnen et al., 2010; Maertens and Swinnen, 2009; Minten, et al., 2009; Jaffee, 2003). Certification costs are often too high and investments too risky for smallholders with low access to credits. On the other hand standards might channel the development of more advanced smallholders and offer on-farm rural employment opportunities for the others (Swinnen et al., 2010). Undergoing the audit procedure may improve farming practices and use of inputs (Dolan and Humphrey, 2000; Fulponi, 2007; PIP, 2009 for Chile, Peru, Ghana and South Africa). In addition, the necessary investments for the certification can lead to productivity improvements and boost the adoption of new technologies. Certification can tie exporters to producers, because exporters invest in the certification and hence in the relationship. As the process of certification is similar for smaller niche market standards, these arguments are also valid for the latter. In our analysis we have assumed that the initial compliance costs and training (for GLOBALGAP and organic certification) are not borne by the smallholders. This is usually the case and Raynolds (2004) amongst others shows that under different circumstances smallholders would not be able to receive organic certification. Therefore the process of upgrading is dependent on assistance.

4.3 The Link between Environmental and Monetary Effects

Overall, our results suggest a positive financial effect of switching from conventional to organic production when competing on the global market for pineapple. However, evidence is so far scarce on the question if organic small-scale farming is environmentally sustainable in a developing country-small farm context. If farmers do not maintain soil fertility using organic production techniques, then organic production might be more environmental friendly in terms of chemical use but less sustainable in terms of soil fertility levels. This is reinforced if there is a selection bias where small-scale farmers that are already producing in a low input organic way by default are more likely to apply for certification. Anecdotic evidence indicates this risk in several African and Latin American countries for smallholder farms. For coffee in Costa Rica Blackman and Naranjo (2010) show what many suspect, namely that negative practices such as the use of herbicides are reduced, but the effect on positive practices such as the use of organic fertilizer is very limited. On the other hand wider environmental benefits have been shown to exist for instance in Fließbach et al. (2007), but the conditions under which they occur are not researched well yet. The use of positive organic methods may affect production costs. However, since our data does not include information on the use of production practices we cannot report on the sustainability of the farms with the cost structure presented here.

5 Conclusions

As the demand for organic products is growing, this paper has tried to shed light on the profitability of organic small-scale production in the pineapple sector using Ghana as a case study. The analysis is set up with a development perspective. Since organic food in general, and organic pineapple in particular, are strongly growing niche products with value chains that are not yet dominated by large multinationals, organic production might be a valuable alternative for developing countries with many smallholders.

In Ghana, many small-scale farmers, both conventional and organic, have been excluded from the export pineapple value chain during past world market changes. Hence, in a first step we analyzed if these farmers could be re-integrated in the Ghanaian pineapple export sector. Even though they tend to have quality problems with their fruit and large farms have advantages compared to smallholder cooperatives due to economies of scale, production for the export market is feasible for both organic and conventional smallholders irrespective of the variety produced. Contrary to initial expectations, production costs are generally lower for smallholders. Consequently the re-integration of smallholders into the export value chain is not hindered by high smallholder production costs. Besides, contractual relations of smallholder cooperatives with exporters are successfully managed in other countries. In Ghana, the re-establishment of trust and closer coordination between exporters and smallholders are assumed to be necessary for successful re-integration. Then, both organic and conventional small farms as well as exporters could benefit from a higher percentage of export sales.

Second, our results demonstrate that, in comparison with conventional smallholders, certified organic production is more profitable for smallholders and in percentage terms price premia on the retail level are fully passed on to farmers. Even more, organic pineapple can add value at each stage of the value chain, both to farmers and further up the chain. In detail, for smallholder production of SC pineapple, the profitability of organic production is superior both in terms of production costs and the price premium received. For organic production of MD2, the profitability depends entirely on the price premium received. Overall, our results suggest a positive effect of switching from conventional to organic production when competing on the global market for pineapple.

The analysis has focused on monetary effects in a static environment. It is therefore not possible to judge on social and environmental factors from this paper. Moreover, it has introduced the vertical dimension of the price transmission in the organic pineapple market. While the results tell us already what part of the premium is forwarded to producers, it has not been possible to investigate how changes in prices at the retail level are translated into changes in farm gate prices and if prices are transmitted symmetrically or asymmetrically. Future research might also focus on this question.

In the light of the variations in the organic premium along the value chain, it would also be interesting to investigate in further research what part of the premium can be attributed to the organic nature, what part to other product characteristics such as quality, and if unobserved transaction costs play a role in the premium in order to fully understand the dynamics in this value chain. This would also help to make predictions about the development of the organic premium on the producer level in the future and hence its sustainability over time.

6 References

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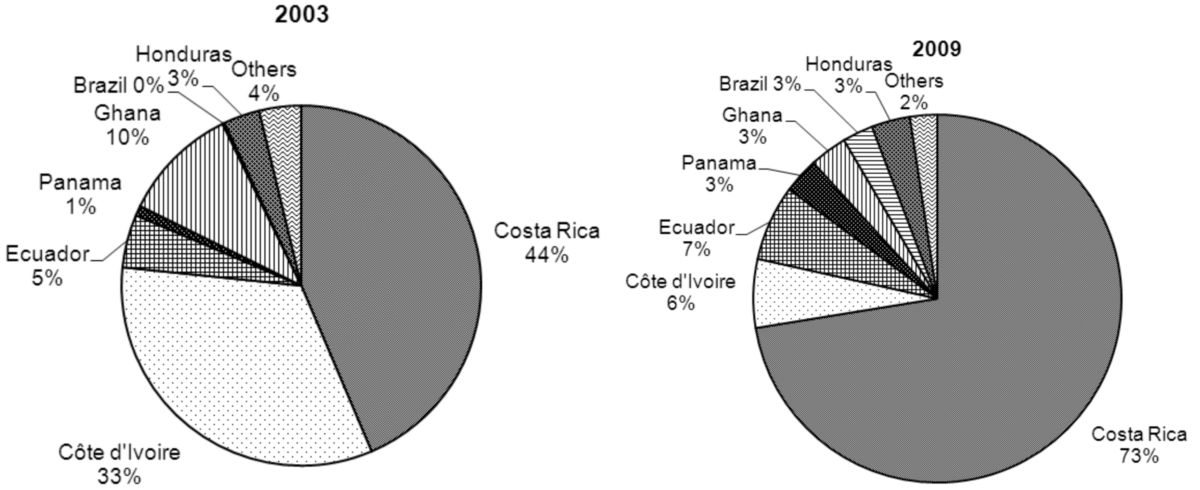
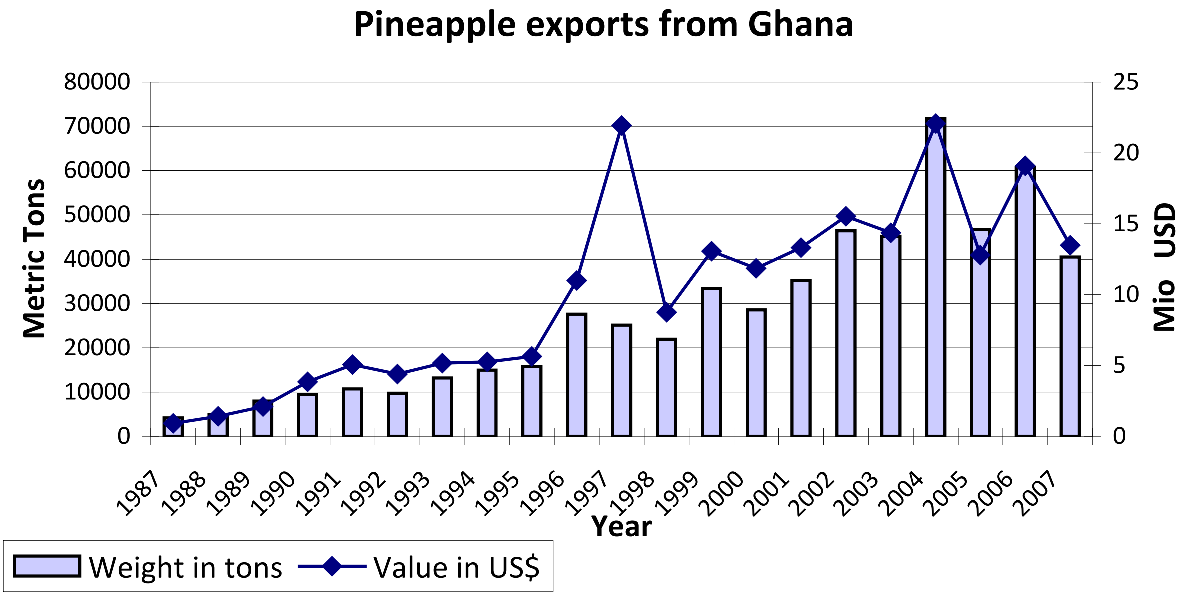
Tables and Figures

Figure 4.1: European Market Shares in Fresh and Dried Pineapple 2003 and 2009



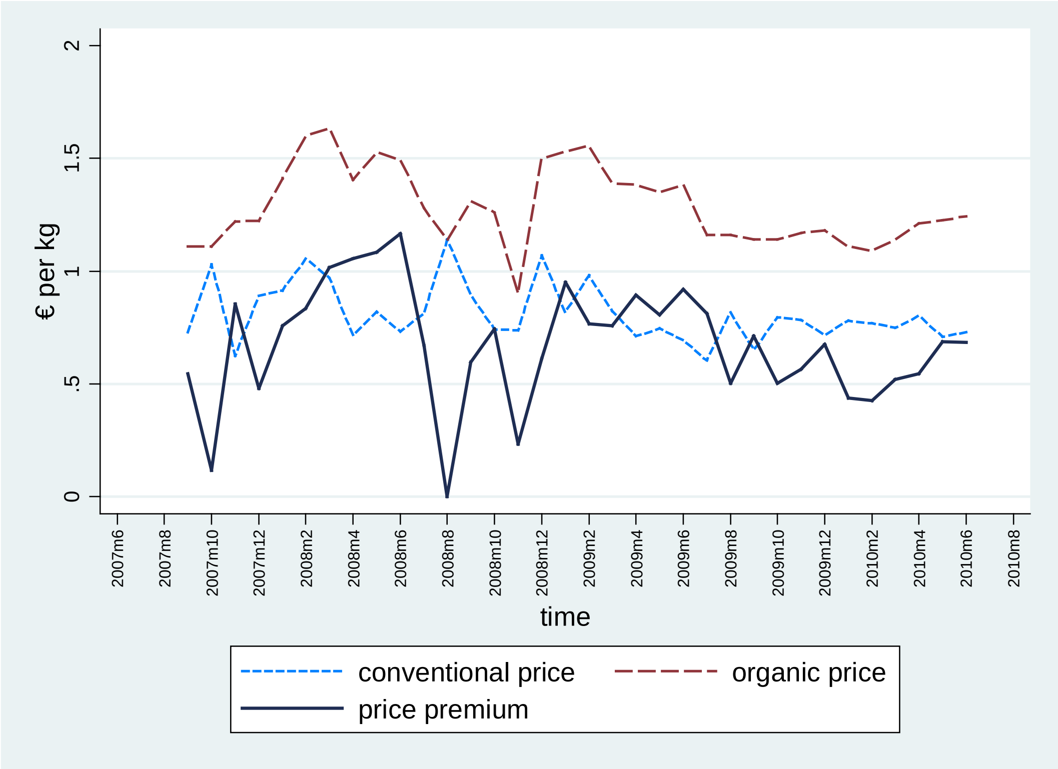
Source: Eurostat Comext
Notes: Classification: pineapple fresh or dried, 90percent sea, 10% air freight,
Varieties: Smooth Cayenne, MD2, Victoria

Figure 4.2: Volume and Value of Pineapple Exports from Ghana 1987-2008



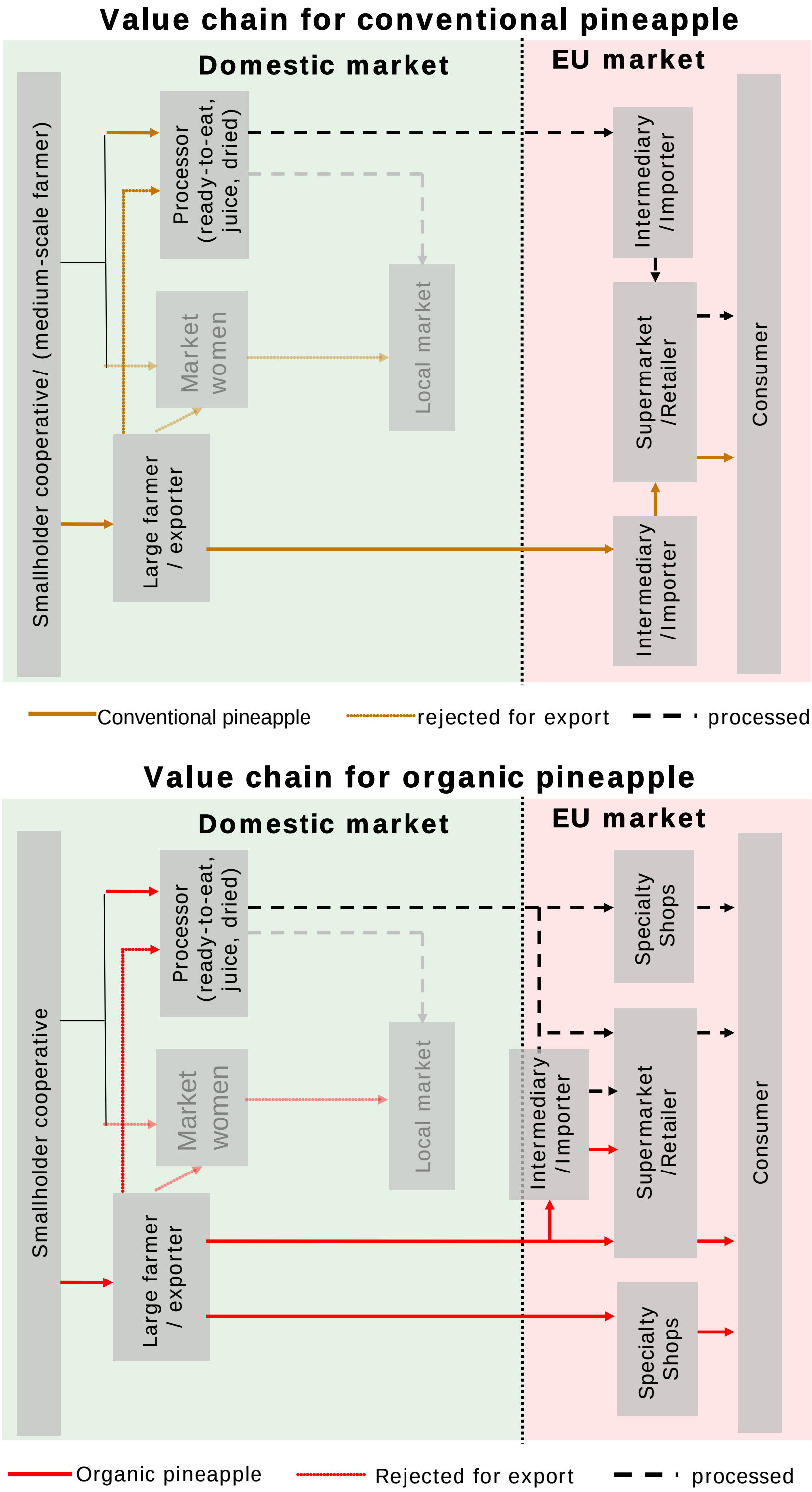
Source: Data from sea-Freight Pineapple Exporters of Ghana (SPEG)

Figure 4.3: The Price Premium for Organic Pineapple and the Prices for Organic and Conventional Pineapple



Notes: Prices are average monthly European wholesale prices per kilogram.
Source: International Trade Centre's market news service and European fruit trading companies.

Figure 4.4: The Value Chain for Ghanaian Pineapple



Source: author's own design

Table 4.1: Pineapple Yields per Acre

	conv. MD2 (large)	conv. SC (large)	conv. MD2 (small I)	conv. MD2 (small II)	conv. SC (small)	organic SC (small)	organic MD2 (small)
Plant population (#)	24000	24000	20000	24000	20900	20000	20000
Total yield of suckers planted (kg)	35000	38884	30000	33000	30760	25261.6	23800
Av. fruit weight (kg)	1.5	1.62	2	1.5	1.6	1.5	1.5
Yield % of planted	97.2 %	100.0%	75.0%	91.7%	92%	90.2%	85.0%

Abbreviations: #= number; SC= Smooth Cayenne variety.
Sources: Interviews with medium or large-scale producers and data from prior studies.

Table 4.2: Sales and Farm Gate Profits

	conv. MD2 (large)	conv. SC (large)	conv. MD2 (small I)	conv. MD2 (small II)	conv. SC (small)	organic SC (small)	organic MD2 (small)
Total cost (US$/kg)	0.14	0.10	0.10	0.10	0.08	0.05	0.12
Cost excl. sucker cost (US$/kg)	0.12	0.09	0.08	0.06	0.06	0.03	0.09
Export price farm gate (US$/kg)	0.15	0.11	0.12	0.10	0.10	0.16	0.23
Local price farm gate (US$/kg)	0.08	0.09	0.08	0.07	0.09	0.08	0.09
Export sales (%)	80%	80%	80%	70%	50%	50%	60%
Local sales (%)	20%	20%	20%	30%	50%	50%	40%
Av. return (average price US$/kg)	0.13	0.11	0.11	0.09	0.09	0.12	0.17
Profit incl. sucker cost (US$/kg)	-0.01	0.01	0.00	0.00	0.01	0.07	0.05
Profit excl. sucker cost (US$/kg)	0.02	0.02	0.03	0.03	0.03	0.09	0.09

Notes: The term “export sales” here includes selling to a fresh exporter as well as selling to an exporting processor.
Source: Interviews with medium or large-scale producer-exporters and cooperatives and data from existing studies.

Table 4.3: Price Premia along the Value Chain

	%	US$
Av.farmgate export price	68%	0.079
Av. farmgate local price	5%	0.013
FOB price	20%	0.100
Price at import	49%	0.520
Wholesale price	59%	0.590
Retail price	33%	0.560

Source: own calculations

Appendix

Detailed production and postharvest cost analysis

Organic production can take the same time or longer than conventional production. This depends on the variety, water and fertilizing regime. Many organic smallholders in Ghana use no or very little organic fertilizer and no organic pesticides. Weeding is then mostly done by hand. For the local Sugarloaf variety a field trial has shown that organic fertilizers such as cocoa husk or compost give better results in terms of ripeness after a certain number of months, levels of PH and acidity, crown size and fruit weight. This might not be true for other varieties, but shows that production is not necessarily faster and more efficient when using chemical inputs[9].

When the fruit is almost ripe, each fruit is inspected by the buyer for its Brix value[10], shape, color, and size. If it satisfies the quality standard, the fruit is harvested. Conventional pineapple is degreened shortly before harvesting using a chemical to achieve uniform color of the fruit. Degreening is not allowed in organic production. Harvest takes places all year round. Pineapple is an off-season fruit on the European market with peak seasons for exports from October to December and from February to April/May and low exports and low prices in the rest of the year.

Multiple data sources were used for the study of production costs. It consists of both secondary data from 11 prior studies that document data from one or several smallholder cooperatives or large farms and primary data that were gathered during interviews with 10 producers during two visits to Ghana in March 2009 and from January to March 2010. Of these producers 20 cultivated MD2, 8 SC, 8 were considered large and 20 small. 11 produced organic certified pineapple and 17 conventionally. From the remaining 3 studies only non-production data was taken, such as postharvest costs. The data on costs and prices was averaged over categories. Most interviews were in person and a small number were conducted over the phone.

In general MD2 has higher production costs than SC or Sugarloaf varieties (Tables 4.1 and 4.2). Sugarloaf, the variety that is traditionally produced in Ghana, is not included in the calculations because it is very rarely exported fresh. In particular costs for suckers, sucker treatment, fixed inputs, and labor are lower in SC production. In addition, MD2 has been found to be a more sensitive crop that is more susceptible to pests and diseases compared to SC. In order to achieve the same yield MD2 is fertilized up to twice the number of times as other varieties. Farmers perceive SC (and Sugarloaf) to be easier to produce, because these varieties have been produced in Ghana for many years and therefore there is ample local knowledge on production. Nowadays SC is often processed into juice, fresh cut or dried before exporting. The switch from the SC to the MD2 variety caused major structural transformations in the pineapple sector in Ghana (see section 2). Even the farmers that successfully managed the change had initial difficulties. Exportable yields were lower and investment costs very high. When the MD2 variety was first introduced in Ghana, costs for MD2 suckers were up to 70% of production cost. Today the prices for MD2 suckers have decreased and vary around 20-30% of production cost. It is only necessary to buy suckers in the first year. Afterwards they can be extracted from the existing plants, but with decreasing quality of the planting material over time. Therefore costs that include costs for suckers can be interpreted as initial costs, whereas all other costs occur every planting period[11].

In Table A.4.1 we compare small and large-scale production for MD2 and SC. For simplicity of exposition, we use only data from conventional farms in this table. There are two columns for conventional MD2 production. This is because the data comes from two very differently managed cooperatives. Therefore, we did not want to average over two such different production management systems. Also, there are only two relatively large organic MD2 pineapple farms in Ghana. Of both data is very erratic. This is however not a big issue as our main interest is in small farms. In this table, we are interested in the possible advantages large-scale production due to economies of scale (bulk purchasing of inputs, mechanization, etc.) and modern, professional farm management. On the other hand, family labor, which is typically employed on small farms, is habitually characterized through higher intrinsic motivation and dependability and may be cheaper to employ (Swinnen et al., 2010). We assume that this applies in the same way to both organic and conventional farms.

Production on larger farms is known to be more input intensive, whereas smallholders often practice low-input production. This is reflected in considerably higher costs for chemical inputs (i.e. fertilizer, pesticides, fungicides, and herbicides). Economies of scale are evident in fixed inputs and planting costs. Nevertheless, overall production costs are lower on small-scale farms due to lower input and supervision costs and cheap and easily available family labor[12].

Table A.4.1: Production Cost Comparison of Large versus Small-Scale Production

Production cost (US$/kg)	conv. MD2 (large)	conv. MD2 (small I)	conv. MD2 (small II)	conv. SC (large)	conv. SC (small)
Land lease		0.0005	0.0003		0.0015
Suckers	0.0229	0.0241	0.0336	0.0132	0.0122
Sucker treatment	0.0010	0.0010	0.0031	0.0010	0.0000
Land preparation	0.0315	0.0084	0.0061	0.0053	0.0108
Planting	0.0017	0.0019	0.0011	0.0012	0.0061
Chemical & organic inputs	0.0532	0.0322	0.0320	0.0666	0.0316
Labor cost	0.0205	0.0236	0.0096	0.0055	0.0042
Fixed inputs	0.0110	0.0149	0.0110	0.0078	0.0096
Certification	0.0014	0.0011	0.0010	0.0010	0.0008
Total cost	0.1432	0.1077	0.0978	0.1016	0.0768
Cost less sucker cost	0.1204	0.0836	0.0642	0.0883	0.0647

Notes: There is no data for land lease for large farms, because all of these plantations in our sample were owned by the farmer and we did not get data on the depreciation of the purchase price.
Sources: Interviews with medium or large-scale producers and cooperatives and data from prior studies.

Table A.4.2 contains production costs for MD2 and SC on small farms only. We can see that the total costs for organic MD2 production is higher than that for conventional production, whereas for SC production the opposite is true.

Suckers, planting, and labor are more costly, whereas sucker treatment, and fertilizers and pesticides are less expensive on organic farms. All of the organic cooperatives covered in the survey use some organic fertilizer, but we are aware that there are organic-certified farmers that do not use any organic inputs. Generally organic fertilizer use is less costly than synthetic fertilizer[13]. Ghana imports all its synthetic fertilizer, which raises the price compared to organic fertilizer that can be sourced locally. Consequently, the high cost of fertilizer is owed to the high international and domestic transports costs. Own compost and manure, processed organic fertilizer or debris from local processing of agricultural products, such as cocoa husk, is used in organic production. As large amounts may be needed, transport is often the biggest cost. Currently the use of leftovers from processing is a popular option. However, if more and more farms switch to organic, it remains to be seen if enough organic material for widespread organic production is available in the country.

Costs of certification to private voluntary standards are estimated from certifier and farm level data. The costs of certification are the costs of implementing the standard, i.e. compliance costs, and the costs of the actual certification, i.e. fees and costs for certifying agencies. The differences in (recurring) actual certification costs are minimal between GLOBALGAP and organic certification. They vary depending on the size of the group and/or the farmland to be certified, the crop, the certifier, and the country where the certification is conducted. According to Fulponi (2007) the recurrent costs borne by the producer vary between one and four, in some cases up to 15% of the farm gate price received (1% in Chile and Ghana, 4% in South Africa and between 4 and 15% in Peru). The non-recurring initial costs of compliance depend on the initial situation of the farm. According to Asfaw et al. (2009), the non-recurring investment cost for GLOBALGAP certification borne by individual farmers account for approximately 30% of their total annual crop income. 90% of this is the cost for initial compliance, e.g. infrastructure and equipment that farmers must have as a pre-condition for implementing standards.

As donors frequently support the initial certification, we assume that the farmer only has to pay for the recurrent costs[14]. Everything else is assumed to be borne by a donor or exporter. As for the yearly certification fees, there are two dominant models. Either the smallholder group itself pays for the renewal of the certification or the exporter pays for it and deducts his costs from the fruit price that is given to the farmers. As we do not know exactly how much the farmers in our sample had to invest in certification, we try to approximate. Taking the results from Fulponi (2007), we estimate these costs at 1% of total production costs (Table A.4.2).

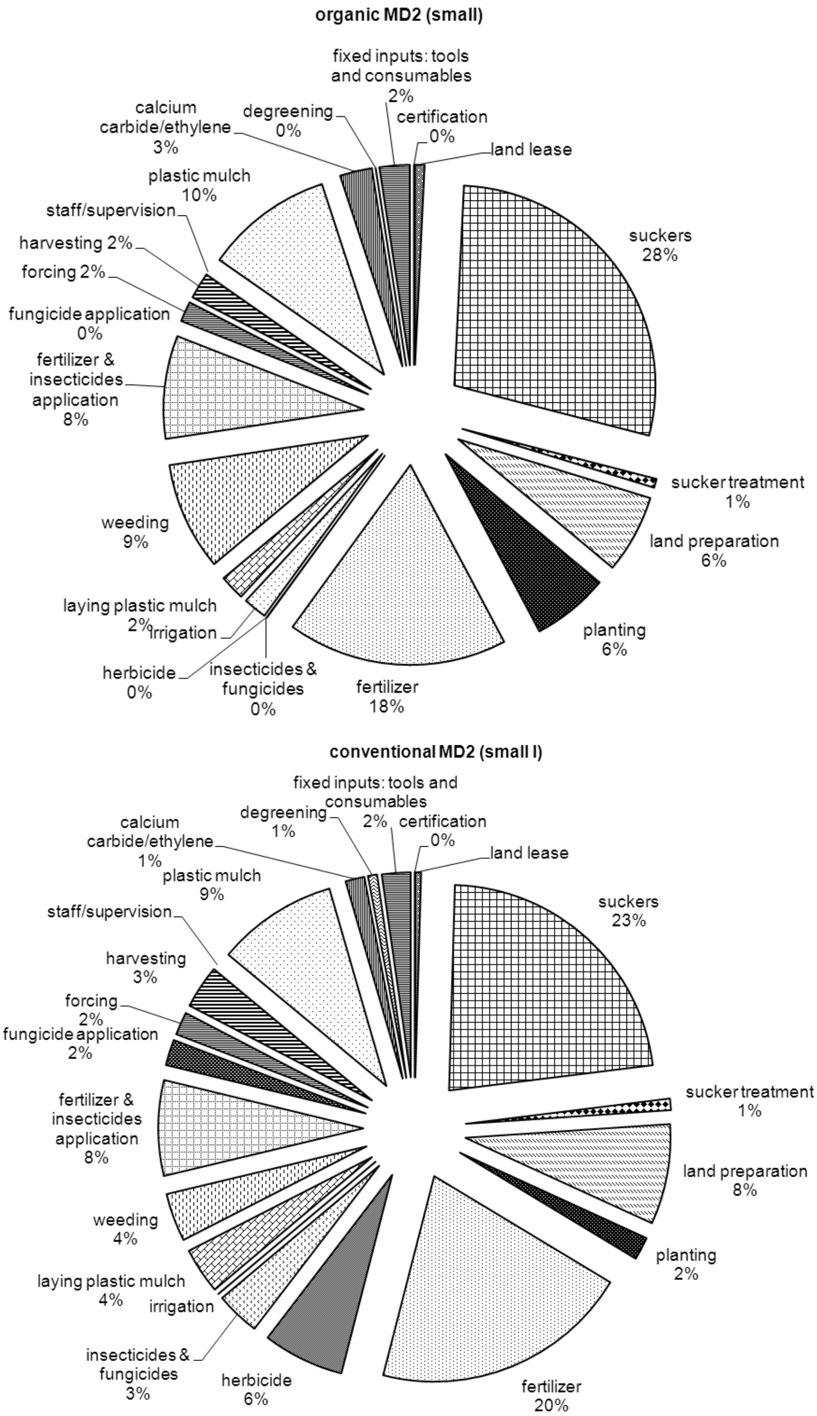
Table A.4.2: Production Cost Comparison of Conventional and Organic Small-Scale Production

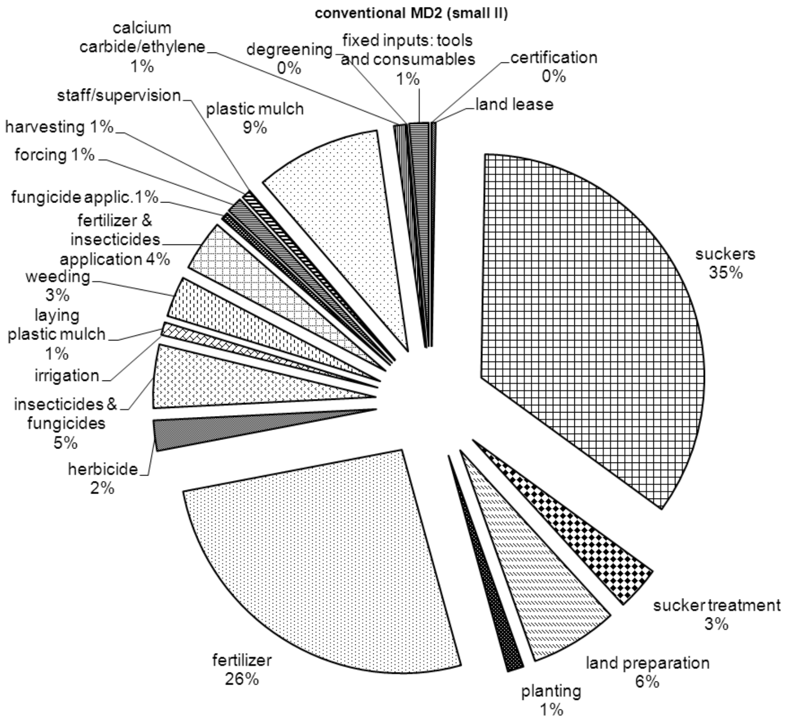
Production cost (US$/kg)	conv. MD2 (small I)	conv. MD2 (small II)	organic MD2 (small)	conv. SC (small)	organic SC (small)
Land lease	0.0005	0.0003	0.0009	0.0015	0.0013
Suckers	0.0241	0.0336	0.0343	0.0122	0.0132
Sucker treatment	0.0010	0.0031	0.0009	0.0000	0.0000
Land preparation	0.0084	0.0061	0.0077	0.0108	0.0070
Planting	0.0019	0.0011	0.0075	0.0061	0.0066
Chemical & organic inputs	0.0322	0.0320	0.0238	0.0316	0.0008
Labor cost	0.0236	0.0096	0.0277	0.0042	0.0160
Fixed inputs	0.0149	0.0110	0.0185	0.0096	0.0028
Certification	0.0011	0.0010	0.0012	0.0008	0.0005
Total cost	0.1077	0.0978	0.1225	0.0768	0.0482
Cost less sucker cost	0.0836	0.0642	0.0882	0.0647	0.0351

Sources: Interviews with cooperatives and data from prior studies.

SC and large farms are not included for reasons of space. The Figure displays the percentage contributions of detailed production cost factors to the total cost of production. Besides the most important cost factors for MD2 production, suckers and fertilizer, other important cost factors include plastic mulch, which is generally used for MD2 but not always for SC production. The reason for this seems to be historical. Irrigation costs are very low as pineapple in Ghana is rarely irrigated and only some of the organic farms have reported some cost for dry season irrigation. Labor for fertilizer and insecticide application are also considerable cost factors. In organic production labor need for weeding is high, as expected, in particular in the rainy season. Another minor difference between conventional and organic production is the cost of the substance used for flower induction. Organic regulation currently allows only calcium carbide, whereas ethylene gas is usually used in conventional production. Calcium carbide is considered to be more expensive. However, as Figure A.4.1 illustrates this difference is minimal (about 2%) in relation to the total cost. The spraying of chemicals for uniform color shortly before the harvest (degreening) is also not allowed in organic production. For conventional production it was repeatedly reported to be quite expensive due to its labor intensive nature. Unfortunately, we cannot show this using Figure A.4.1, because only the cost of the chemical itself and labor in general is reported. Moreover the decision to degreen depends on importer requirements and exporters frequently do that on behalf of small farmers. Therefore the costs for degreening might have been underreported when collecting data from the cooperatives.

Figure A.4.1: Production Cost Details





Sources: Interviews with cooperatives and data from prior studies (details of data in Table A.4.2).

Finally, Fairtrade minimum prices are interesting for comparison, because they are cost-based, with the price being calculated on the basis of estimated costs (on average in a given country) of production and processing according to Fairtrade standards. For Ghanaian pineapple these are currently US$0.205 per kg (excluding the Fairtrade premium of US$0.03 per kg) for conventional pineapple for processing and US$0.285 per kg for organic fruit (Table A.4.3).

Next, we look at fresh export postharvest operations depicted in Table A.4.4. For simplicity and because post-harvest operations do differ between varieties, we now restrict our analysis to the dominant variety on the world market, MD2. We do not include possible own production of the exporter here, because we are interested in the role of the smallholder. If the exporter would have his own (large) farm, he would be able to buy MD2 from smallholders at a cheaper price than his own production cost. For SC, the prices would be the same as his production cost. Of course this disregards supply conditions and transaction costs.

Table A.4.3: Fairtrade Prices for Ghanaian Pineapple

Product Specification	Price level	Fairtrade minimum price US$/kg	Fairtrade premium US$/kg
Pineapples (conventional, fresh)	factory gate*	0.50	0.05
Pineapples (conventional, for processing)	farm gate	0.205	0.03
Pineapples (organic, fresh)	factory gate*	0.65	0.05
Pineapples (organic, for processing)	Farm gate	0.285	0.03
Pineapples (conventional, fresh)	FOB	0.60	0.05
Pineapples (organic, fresh)	FOB	0.75	0.05

Notes: *Prices for fresh fruit are at "at the exit of the pack house", i.e. stored, cleaned, packed, and refrigerated. Prices for pineapple for processing are shown because these were the only ones for which farm gate prices were available.

Source: Fairtrade Labelling Organization (FLO) website; Fairtrade price announcement of January 27, 2010.

Farmers sell their fruit at the farm or at the exporter's pack house (we call this "factory gate"). Some large exporting farms have a fully integrated supply chain with cooling and packing facilities on site. Other small and medium-sized farms either sell their fruit to these large farms (factory gate), or, in case medium-sized farms have packing but no cooling facilities, send their packed produce to the harbor for pre-cooling. The average cost for the transport to the exporter that was reported by farmers corresponds to the average price difference between farm and factory gate prices. Therefore we do not distinguish between the two options and assume that the exporter buys all fruit at the farm gate. The fact that market margins are the same as the cost of transporting the fruit from one place to another also indicates market efficiency at this stage. At the pack house, the fruit is washed, graded according to sizes, waxed, and packed. Postharvest costs do not differ for organic and conventional fruit except for waxing, which is only done on conventional fruit. Imported packaging material - cardboard boxes fitting approximately 12 kg of pineapple - are expensive in Ghana. Currently no qualitatively satisfactory local supply exists. The actual postharvest loss is on average very low, because fruit with inferior quality is sold to the local market or for processing at a lower price. As we do not have exact numbers, we assume on average 5% postharvest loss.

Table A.4.4: Post-Farm Gate Operations

	conv. MD2	organic MD2
Av. farm gate price	0.116	0.195
Transport to exporter	0.020	0.020
Sorting, grading, packaging	0.001	0.001
Packaging material	0.115	0.115
Waxing	0.008	0.000
Cooling	0.019	0.019
Postharvest loss	0.006	0.010
Transport to harbor	0.020	0.020
Port handling	0.006	0.006
Administrative costs[1]	0.170	0.170
Total cost at port	0.482	0.557
FOB price[2]	0.490	0.590
Exporter profit (FOB)	0.008	0.033
Shipping	0.302	0.302
Price at import	1.070	1.590
Local transport	0.018	0.018
Marketing	0.130	0.130
Wholesale price	1.300	1.890
Estimated profit for importer	0.082	0.153
Marketing at retail	0.310	0.310
Retail price	1.680	2.240
Estimated profit for retailer	0.070	0.040

Notes: Average costs and prices are reported.
[1] Administrative costs cover all costs at port except the handling of the good, e.g. phytosantiary checks. [2]FOB (Free on Board) is the price of traded goods at the port of origin, excluding the cost of sea-freight and insurance. It includes transport to the harbor, customs' costs, export administrative costs, and unloading at the port.
Sources: Interviews with medium or large-scale producer-exporters; shipping cost estimates are estimates from exporters, SPEG, and prior studies; wholesale prices are from International Trade Centre; costs at destination country are from interviews with importers, traders, wholesalers and retailers; retail prices are from interviews with retailers and the author's own study in supermarkets between January and August 2009.

Times needed to port are generally the same for organic and conventional fruit, but the time span between harvest and cooling varies a lot among smallholders, from harvesting directly into a vehicle to be sent to the pack house up to leaving the fruit one day on the side of the field. The transport from the smallholder to the exporter is in most cases done in small pickups or non-cooled trucks. This transport adds to the time that the fruit spends before entering the cool chain and is therefore likely to deteriorate the quality of the fruit. Hence, we have to be aware small farmers, have higher postharvest loss due to storage and transport problems, but this happens usually at the farm and hence before the factory gate stage and has been taken account of in the previous section.

Handling at port and export bureaucracy is done by the Sea Freight Pineapple Exporters of Ghana (SPEG) or another professional agent. Most pineapple leaves the producing country free on board (FOB), which means the transport cost is paid by the European importers. The EU importers normally have the power to decide the FOB price (Suzuki et al., 2008). Overall postharvest operations amount to 74% of the FOB price for conventional fruit and to 60% of the FOB price for organic fruit. Hence at this stage, the part of the value added that can be assigned to the farmer is higher in the organic value chain. For comparison, farm gate Fairtrade prices are on average 76% (conventional) and 52% (organic) higher than in our examples. Fairtrade FOB prices are 22% (conventional) and 27% (organic) higher than our average prices (Table A.4.3).

Sea- and air-freight costs are the same for organic and conventional fruit, because they can be transported in the same vessel, and even the same container. Costs for shipping comprise 20-30% of the import prices. Freight times to Europe are again the same for all; 10-12 days to Antwerp and 9-10 days to France. Airfreight is an alternative, although the proportion of air freighted pineapple from Ghana has been decreasing over the last 20 years and is now around 10%. Ghana has competitive airfreight rates of about US$1.1 per kg. To this add US$0.057 per kg for transport to the airport. The prices for sea- and air-transported pineapple differ greatly and hence following stages of the value chain are hard to compare. Furthermore, the market for air-freight pineapple is limited and the majority of pineapple is transported by sea (see section 2.3). We therefore focus on sea-freight pineapple. Because pineapples are seen as part of an export diversification strategy, there are no export restrictions on exports of both organic and conventional pineapple from the Ghanaian side and no tariff barriers on the European side except the food safety and health requirements.

Equally to the farm-level, profits in the organic value chain are also higher at postharvest levels (i.e. exporter and importer) but not at the retail level.

Notes

[1] In 2005 five multinationals (Chiquita, Dole, Del Monte, Noboa, and Fyffees) all integrated backwards into transport and in most cases production controlled about 40% of all globally traded fruit. For bananas, this share was even 84% (Gibbon and Ponte, 2005).
[2] This figure includes fresh, fresh-cut, and dried pineapple, as well as pineapple juice. The Ghanaian pineapple producer and processor Blue Skies was the first exporter of organic cut pineapple to the United Kingdom in 1998. Later, Waitrose became the first retailer in the United Kingdom to sell whole organic pineapples, supplied by Blue Skies, in 2005 (Pay, 2009).
[3] Commodity systems analysis focuses on national labor organization and relations, commodity chain analysis focuses on worldwide temporal and spatial relations, and filiere analysis focuses on national political regulation and institutions (Raynolds, 2004).
[4] The governance structure of the fresh pineapple value chain is analyzed in more detail in Faure et al. (2009).
[5] GLOBALGAP is a private standard founded in 1997 as EurepGAP by European retailers. It is a business-to-business standard with the aim to establish one standard for Good Agricultural Practices (GAP). Many of the large European retail and food service chains, producers and suppliers are members (www.globalgap.org).
[6] The bureaucratic conventions imposed may be more difficult to install and follow on traditional small farms and economies of scale in certification fees and indirect costs for investments that are necessary (Raynolds, 2004). Empirical results show that resource poor farmers with limited access to information and services are less likely to adopt standards and are potentially marginalised in the export market.
[7] SC is almost exclusively grown for processing; hence SC export prices reflect exporting processors' prices, whereas MD2 is usually sold fresh with only rejects sold to processors.
[8] However, there are economies of scale in shipping for Ghanaian pineapple as a whole. Larger volumes exported from Ghana would make the sea-freight cheaper and faster, giving Ghana a competitive edge over the world market leader Costa Rica, due to its proximity to Europe.
[9] The same is true for pests and diseases. As an example, due to the use of ethylene instead of calcium carbide for flower induction, the PH-level of the soil on organic fields is less favourable for a common root rot called phytophtora.
[10] The Brix value measures the percent of sugar solids in a product, providing an approximate measure of sugar content. It gives an indirect estimate of the degree of fruit ripeness.
[11] Land preparation costs are also higher in the first year of a plantation, if virgin land has to be converted into farmland. However, since this also happens when a plantation is extended or shifted we cannot assign this cost clearly to the initial investment cost.
[12] If labor for farm activities and supervision would be measured at market rates, small farms may have higher production cost. This is the case in a recent study for Ghana, which states that the production costs of large farms are 38% lower than those of small farms (Natural Resources Institute, 2010).
[13] In one example a conventional cooperative has reduced the cost of fertilizer inputs by US$175 per acre by replacing chemical fertilisers partly with organic fertiliser purchased from a local processing factory (Natural Resources Institute, 2010).
[14] In an example from Kenya, Graffham et al. (2009) show that farmers in the horticultural sector pay on average 36% of nonrecurring and 14% recurrent costs.

Chapter 5

Is Organic Farming Worth its Investment?
The Adoption and Impact of Certified Pineapple Farming in Ghana

Linda Kleemann°, Awudu Abdulai and Mareike Buss

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°Contact: Kiel Institute for the World Economy, Hindenburgufer 66, 24105 Kiel, Email: linda.kleemann@ifw-kiel.de. We would like to thank the Poverty Reduction, Equity and Growth Network (PEGNet) and the H. Wilhelm Schaumann Stiftung for financial support and Lisa Fiedler for valuable input.

Is Organic Farming Worth its Investment?
The Adoption and Impact of Certified Pineapple Farming in Ghana

Abstract

Global food markets demand the adoption of food standards by small-scale farmers in developing countries to assure their access to international markets. While certification with GlobalGAP is a market entry condition for conventional food, especially for horticultural products, organic certification is required for the increasing organic food market that is usually associated with higher prices. Aiming to analyze whether organic certified farming is worth its investment, this paper examines the impact of organic certification on the return on investment (ROI) of small-scale pineapple farming in Ghana. Using GlobalGAP certified farmers as control group, we are able to single out the effect of certification vis-à-vis contract farming and exporting. Data of 359 Ghanaian pineapple farmers obtained over one production cycle are evaluated using an endogenous switching regression model. The results indicate that farmers with either certification gain on average a positive ROI. However, organic certified farming yields a significantly larger ROI than GlobalGAP farmers mainly due to price premiums on the organic market. Thus, organic certification is found to be the more profitable.

Keywords: return on investment, impact assessment, organic agriculture, GlobalGAP certification, contract farming
JEL codes: O13, Q13, Q17, Q56

1 Introduction

Three trends make our research question an interesting one. First, in recent years, the restructuring of global food value chains and the increasing importance of private voluntary standards (PVS) have led to the marginalization of developing country producers, in particular small-scale farmers, which form the majority of the rural population in developing countries, and favored large scale plantations (e.g. Jaffee et al., 2011). In Ghana, it is estimated that about 90% of all farmers are smallholders (MOFA, 2010). Since several PVS such as organic and GlobalGAP have introduced group certification options for small farmers, it is critical to know if this helps smallholders to integrate in the global food market.

Second, during the same period of time, a horticulture industry in Sub-Saharan Africa (SSA) has emerged facilitated by diversification policies and the demand for tropical vegetables and fruit all year round by industrialized country consumers. These policies are part of an agricultural modernization effort in Africa. Within the agricultural sector, horticulture may provide an opportunity for small-scale farmers, because of it labor intensity and high production value per unit.

Third, agriculture is responsible for environmental damage such as underground water depletion, land degradation, soil erosion water and soil pollution and health problems, loss of biodiversity, deforestation, and global climate change. Crops that are produced for export are usually strongly treated with pesticides to assure the required quality. However, today, more and more consumers demand healthy, non-genetically modified, environmental friendly produced food. With this comes an increasing demand for organic certified products in the global market, which provides an opportunity for developing countries. Organic certified food usually achieves a price premium and gives access to new fast growing high-end markets and attracts new classes of investors (UNEP, 2007). Thus, there is a chance that organic certification serves to reduce poverty fostering smallholders who are engaged in the agricultural sector and it may additionally be more environmental friendly than conventional agriculture.

These three trends lead to the question whether sustainable agriculture approaches for small-scale farmers can provide an alternative development model for specific definable parts of the rural population, and if yes which parts of the rural population they favor. Only to the degree that it improves livelihoods of the rural poor, such an approach should be supported by development aid and local governments.

Despite its important role in diminishing poverty in developing countries, the agricultural sector in most African countries including in Ghana is characterized by low levels of technology and productivity as well as low international competitiveness in production, processing and distribution (Breisinger et al., 2008; Government of Ghana, 2010) and the expansion of this sector is constrained by access to technology and capital. Additionally, Ghana faces environmental pressure due to population growth and already highly degraded soils (Diao and Sarpong, 2007).

Therefore, the Ghanaian government emphasizes the necessity to modernize the agricultural sector to improve its performance in its “Ghana shared growth and development agenda” as part of an export-led growth strategy in agriculture (Government of Ghana, 2010). At the same, the government wants to address the problem of declining yields through environmental protection (Government of Ghana, 2010) and has established an organic agriculture desk in the Ministry of Food and Agriculture (MOFA).

One approach to enhance agricultural export activities in the food sector is the certification of food producers with internationally approved food labels. This is driven by the recent trend towards stricter food safety and traceability standards in the major importing countries (Henson et al., 2011; Suzuki et al., 2011). A well-known example is the GlobalGAP certification. Retailers usually require that their suppliers are GlobalGAP certified (Henson et al., 2011), which makes it a quasi-precondition for export (to Europe and North America) of horticultural produce. By contrast, organic certification meets the rising demand for natural products and also acts as substitute for GlobalGAP certification.

Several studies have analyzed the impact of these certifications for small-scale farmers in developing countries. Most of this literature concentrates on organic, GlobalGAP and Fairtrade certifications, a large amount of studies deal with coffee, and often Fairtrade and organic overlap.[1] Most researchers find modest positive impacts of different certifications on farmer welfare or household income using different measures (see e.g. literature reviews by Blackman and Rivera, 2010; ITC, 2011; and papers by Asfaw et al., 2009; Valkila, 2009; Bolwig et al., 2009; Fort and Ruben, 2009); Henson et al., 2011; Maertens and Swinnen, 2009), while some researchers are skeptical about the ability of organic and Fairtrade to help poor farmers (Valkila, 2009; Beuchelt and Zeller, 2011; Lynbæk et al., 2001) because of access barriers, ambiguous yield or productivity impacts, or price premiums that may be too small to compensate for investment costs. Although the yield potential is estimated to be high on non-ideal tropical soils (Kassie et al., 2008; and others), in fact yields are often lower on organic farms in these countries (Beuchelt and Zeller, 2011; Lynbæk et al., 2001; Valikila, 2009) and the reduced dependence on potentially expensive external inputs from ill functioning markets is replaced by a reliance on the export market for price premia (Lynbæk et al., 2001).

However, the methods used are not undisputed. Few of the above mentioned studies use sound analytical methods, in particular in terms of finding credible counterfactuals and controlling for selection bias. Even if the effort is made, the analysis regularly lacks external validity because the data used comes from a case study of one project, Non-Governmental Organization (NGO) or exporter which makes it impossible to distinguish between the effects of the management of this particular initiative or exporter and the effect of certification per se. In addition, we doubt that using non-certified, non-exporting farmers as counterfactual is a good idea, because the effects measured will be a mixture between certification, contract farming, and export effects. Finally, with the exception of organic and Fairtrade different certifications have not been compared. Since nowadays on the export market GlobalGAP is commonplace, a relevant question is if other certifications, like organic, can outperform it. This and the weakness of the evidence base on the impact of certifications in general motivates this paper that is based on treatment and control groups that use two different export-market oriented certifications, organic and GlobalGAP.

Hence, we take a new approach and select our sample to provide a representative picture of one sector, take certification costs into account and use a more credible counterfactual, which makes it possible to disentangle the effects of being under contract, exporting and certification. We explicitly address the problem that has been identified amongst others by Bolwig et al. (2009), of distinguishing between the effect of contract farming and of certifications. Existing studies essentially mix up contract farming, exporting and organic farming because the treatment group usually consists of certified exporting contract farmers, whereas the reference group consists of non-contracted uncertified non-exporting farmers. However, farmers that target the local market are different in range of ways: they have different networks, produce different quality, and are often not under contract, unlike exporting smallholders. Therefore, they can hardly be compared to organic farmers that produce under contract for the European market. Any effects measured would mingle up the effects of export market participation, contracting and organic production, and in fact all existing studies seem to suggest that the export market channel is very relevant for any positive impact.

We single out the effect of certification by choosing a reference group that also produces under contract and for the export market. Because export market requirements are more costly to meet than local market requirements, we can safely assume that farmers do not easily and quickly switch from export back to local market production. From a development perspective this analysis answers the question whether organic certified farming offers new possibilities to farmers in contrast to export oriented GlobalGAP certified farming.

Moreover, while impact assessments of food standards in developing countries usually concentrate on the effect on different welfare-indicators like the productivity, revenue and household income (Bolwig et al., 2009; Kassie et al., 2008; etc.), we focus on the return on investment (ROI), an impact measure that has only been used in this context so far by Asfaw et al. (2009) and Barham and Weber (2012). The ROI is a simple instrument that sees farmers as entrepreneurs. It takes into account that the challenge of an entrepreneur is not only to concentrate on improving his net income, but also to invest most profitable. A related ratio was in this context so far only used by Udry and Anagol (2006) aiming to provide evidence about rates of return to capital in Ghana.

As the underlying treatment is not a development program but a longer term initiative of the private sector (certification processes take up to three years), it is very unlikely to convince the private sector to agree to randomization and in addition without disturbing behavioral effects. In addition randomization over which households participate in which certification would be difficult to realize due to likely issues with voluntariness of take-up from both sides, farmers and buyers, as well as questionable external validity (as with contract farming described in Bellemare, 2012 and Barrett et al., 2012). Hence we have to rely on regression techniques. We use an endogenous switching regression model (ESR) to control for selection bias based on observables and unobservables. Since we find no significant influence of unobservables we also use propensity score matching to verify the results.

The rest of this paper is structured as follows: Section 2 gives an overview of the development of the pineapple sector in Ghana to clarify the challenges and the potentials of conventional and organic production. It is followed by an overview of the data on which the impact evaluation of organic certification is based on and the presentation of the corresponding descriptive statistics. Subsequently, section 3 derives the theoretical and empirical framework of this paper. The empirical strategy to estimate the effect of organic certification is then exposed and leads to the analysis of the regression results. The paper concludes with a discussion and policy recommendations in section 4.

2 Background and Data

2.1 Background

Development of the Pineapple Sector in Ghana

The agricultural sector in Ghana amounts for about 30% of gross domestic product (GDP) and employs over 50% of the Ghanaian working population (WDI, 2011). In recent years non-traditional exports of horticultural products experienced a large growth. Exports of fresh fruits and vegetables, especially to Europe, are now the most important growth sector in Ghana's agriculture.

Ghanaian pineapple farmers produce the varieties MD2, Smooth Cayenne, Sugar Loaf and Queen Victoria, where Sugar Loaf is mainly produced to sell fresh on the local market or for processing and Queen Victoria plays a minor role as a high-priced specialty product. Pineapples were the first non-traditional export crop which Ghana started to cultivate in small quantities in the 1980ies. Since then, the amount of pineapple exports increased rapidly until 2004 (Figure 5.1; UNCTAD, 2008), when about 95% of the pineapples exported from Ghana were Smooth Cayenne (FAO, 2009). Subsequently exports decreased due to a change in the pineapple variety demanded on global markets as can be seen in Figure 5.1. The market share of Ghanaian pineapple on the European market fell from 10.5% in 2003 to 5.2% in 2006. Many farms stopped producing pineapple or went bankrupt, others switched to MD2 production.[2] Subsequently, alternative pineapple industry strategies rose in importance such as processing of Smooth Cayenne and Sugar Loaf. It is estimated that 40.000 tons of pineapple were exported from Ghana in 2010 (Figure 5.1). Note that these numbers should be taken as approximations, the Sea Freight Pineapple Exporters Association of Ghana (SPEG), cites different numbers.

Pineapple farming in Ghana is mainly located in a radius of 100 km north-west of the capital Accra in the regions of Greater Accra, and the Central and Eastern Region (Danielou and Ravry, 2005). There are two dominant actors, on the one hand there are a few large/medium-sized producers, and on the other hand there is a large amount of small-scale farmers, who sell their fruits on the local market or as outgrowers to an exporter, processor or large farm for export. The latter are the farmers we focus on in this paper. Pineapple export in Ghana is predominantly organized by export companies which mostly also have own farm production.

The Pineapple Market

At maximum 40% of all exported pineapples come from smallholders (UNCTAD, 2008; personal information given in interviews with GEPC and SPEG). The relationship between exporter and smallholder is usually oral or written contract based (Suzuki et al., 2011). Exporters may additionally provide farm inputs like pesticides and herbicides, extension services or credit.

Exporting has several advantages and disadvantages for small-scale farmers. On the upside, export markets prices are usually higher, and depending on the form of the contract, sales may be guaranteed up-front and access to inputs and training may improve. On the downside, information constrained small-scale farmers become dependent on unknown volatile international markets, which may increase perceived risk or lower trust in exporters (Schipmann and Qaim, 2011).

In addition, to assure high food safety and traceability standards most European food retailers demand GlobalGAP certification for horticultural products. In 2009 already 80% of all exported fresh conventional pineapples were GlobalGAP certified in order to satisfy this demand (PIP, 2009). GlobalGAP includes detailed regulations concerning food safety, hygienic and environmental standards. In Ghana, group certification schemes are supported by international development programs, namely the Trade and Investment Programme for Competitive Export Economy (TIPCEE) funded by USAID, the Pesticide Initiative Program (PIP) funded by the EU and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Particularities of the Organic Market

According to a report of the United Nations Conference on Trade and Development (UNCTAD, 2008), the worldwide organic food markets expanded by 10-15% in the last ten years, whereas conventional markets only grew by 2-4%. In Europe, the market has grown from 10.8 billion to 18.4 billion Euros between 2004 and 2009 (FiBL, 2009).

Requirements of organic certification concentrate on guaranteeing consumers that the products they buy fulfill organic production standards. In the EU the regulations (EC) 834/2007 and (EC) 889/2008 control the production, processing and trade of organic products.

Organic certified pineapples from Africa receive a positive price premium on the European market, which is passed on to the producers (Kleemann, 2011a and 2011b). The organic specialty market offers a possibility to sell other varieties than MD2 internationally, such as airfreighted Sugar Loaf. As with GlobaGAP certification, several organizations support organic agriculture aiming to aid small-scale farmers. For instance GIZ, Agro Eco/Louis Bolk, West African Fair Fruit (WAFF), but also the Ministry of Food and Agriculture (MOFA) promote organic farming in Ghana. About 0.19% of the agricultural land in Ghana is organic certified, with a presumably higher part in pineapples[3]. Next, the survey methodology and data is presented.

2.2 Data

A farm household survey was conducted from January to March 2010 in six different districts (Ajumako Enyan Esiam, Akuapem South, Ewutu-Efutu-Senya, Ga, Kwahu South and Mfantseman) of the Central, Eastern and Greater Accra regions in southern Ghana, where pineapple cultivation is mostly located. Stratified random sampling in three stages was used. First, districts with significant amounts of commercial smallholder pineapple production were selected, using information from SPEG. Next, lists of all pineapple farmer groups in the selected districts that are GlobalGAP or organic certified were obtained. Finally, in each group a percentage of farmers proportional to the total number of farmers in the group was selected randomly from the lists. The farmer, which corresponded in over 95% to the household head, answered a detailed questionnaire on the household's management of the pineapple farm, inputs into the pineapple production, harvesting and marketing of the pineapples, the certification process, and relations with exporters. Besides, information on household characteristics, social capital and land disposition were requested as well as data concerning non-income wealth indicators and perceptions of different statements about environmental values, organic farming techniques and the use of fertilizers and pesticides[4].

The dataset includes 386 households from 75 villages with either GlobalGAP or organic certification for their pineapple farms. In total, 185 organic farmers and 201

GlobalGAP certified farmers were interviewed. 39 of the organic certified farmers were also GlobalGAP certified, but since the organic certification is stricter, those were counted as organic certified. All organic farmers sold part of their produce as organic certified to exporters or processors and part of it on the local market without reference to the certification. Respectively all conventional farmers sold their produce as GlobalGAP certified to exporters or processors and on the local market without reference to GlobalGAP. In theory, there could be one-directional overlaps. This means that organic certified farmers could sell as organic certified (which has the highest price) as first preference, as conventional export produce as second preference and on the local market as last option. However this is not the case in our sample. The opposite, i.e. conventional farmers trying to sell on the organic export market, is not possible. Organic farmers belong to 9 different farmer associations, GlobalGAP certified farmers to 14. Some of these groups were encouraged by exporters, but most existed before being in contact with an exporter. Organic certification refers to the European standards according to EU regulation (EC) 834/2007 and (EC) 889/2008. Due to the fact that all conventional farmers are GlobalGAP certified in our sample, the expressions GlobalGAP certified farmers and conventional farmers are used interchangeable in the following.

2.3 Descriptive Statistics

Descriptive Statistics of Sociodemographic Variables

All sociodemographic variables that are included in the estimations are presented in Table 5.1. The typical pineapple farmer in our sample irrespective of the type of certification is native to the region, male and Christian. His household has a similar income compared to the average in Ghana (country average 88.83 GHS per month, survey average: highest density in income groups 51-150 GHS per month), and a higher income share from agriculture (47.8% versus 67%; data from Ghana Living Standards Survey 5). Organic farming households have on average more often a female household head (HHH) and their household heads are older and less educated than in conventional farm households.

However, the average organic HHH stated a higher willingness to take risks in order to achieve successes and a greater openness to innovation and also received credit more often during the last five years. In addition, organic households have smaller farms, but these are more specialized in pineapple farming, 39% of the whole organic farm including the homestead and 16% of the conventional farm are occupied with pineapple. With higher labor costs in production, organic farmers more often recruit their workers from the family, which is reflected in the lower proportion of the production cost they spend on hired labor.

The land variables are likely to be subject to reporting error. Therefore we included several checks in the questionnaire like asking for the farm size as well as for field sizes for each crop and checked on the farm or verified with GPS data likely to be considerably smaller than reported[5]. Even though organic farming is more management intensive, organic farmers did not receive more training for improving farming techniques. The most likely reason is the lack of opportunities resulting from niche position of organic agriculture.

Concerning location specific variables organic farmers own a larger share of their land and grow pineapple on different soil types compared to conventional farmers. The soil variable confirms studies from developed countries in that organic production is often taking place on different soils[6]. There is also a difference concerning the variety of pineapples planted: Organic farmers prefer Sugar Loaf, whereas conventional farmers favor Smooth Cayenne or MD2. To our knowledge the reason are buyer preferences. Of relevance to the adoption mechanism is the fact that organic farmers seem to have a stronger link to the local government and visit the capital more frequently. They are also more likely to have learned pineapple farming from friends or family members compared to in training courses or as laborers on other farms. Moreover, their certification process is more often organized by the farmer organization, compared to GlobalGAP certified farmers. Note that this variable indicates who the farmers perceived as the ones organizing this process, which is not necessarily the same that financially supported it. This variable is therefore different from what Kersting and Wollni (2012) measure. The majority of farmers of both groups have been certified within the last two years and about 40 % have a written contract with an exporter, all other have an oral contract. The number of years that the farmers have been certified is slightly longer for organic farmers. Organic certification was introduced much earlier than GlobalGAP, which was called EurepGAP before. We tried to make the equivalence between GlobalGAP and EurepGAP clear in the interviews, but nevertheless we need to treat this variable with caution.

Descriptive Statistics of Production and Certification Costs

The total costs of production do not differ significantly between organic and conventional farming, but the structure of the production costs is quite different. The total production costs that are considered to generate the ROI are constructed by adding up the values of:

- costs for the agricultural equipment and inputs
- costs for the yearly renewal of certification
- costs for the farming land on which the pineapples are planted
- costs for hired workers and household labor.

Household labor is taken into account with 4 GHS per day and person to include its opportunity costs. 4 GHS/day approximately corresponds to the Ghanaian minimum wage at the time of the survey and was approximately actually paid for manual farm labor. The exact minimum wage in February 2010 was 3.11 GHS/day and was incremented to 3.73 GHS/day recently. Columns (1) and (3) of Table 5.2 show the average costs of pineapple production per Kg pineapples. The different cost composition of organic and conventional production costs becomes obvious in columns (2) and (4) of Table 5.2, which summarize the percentages attributed to each cost category.

Whereas we did not find differences in costs for land, there are large differences in the labor costs per Kg and the input costs per Kg between organic and conventional pineapple production. While organic farmers spend much more on labor hired workers as well as household labor conventional pineapple production is more input and equipment intensive. Organic farmers use no chemicals and hardly any organic fertilizers but rely on manual removing of weeds and more often produce their own planting material or exchange it with other farmers. Expenses for inputs like inorganic fertilizers, herbicides, fungicides and pesticides, as well as suckers (seedlings), are hence much higher for conventional farmers. In addition, they use chemicals to induce flowering more frequently (90% of conventional and 30% of organic farmers) and spend more for plastic foil and safety equipment for their farm, the latter forms part of the GlobalGAP requirements. However, those costs are still comparable small, because a large part of the cost is often paid for by the exporter or a donor or NGO.

On average, both initial and yearly certification costs are higher for conventional farmers (Table 5.2). This result should however not be seen as actual costs, but the part the farmers themselves cover. As Kersting and Wollni (2012) show, this fraction can be quite low, in their case four to five percent. Initial certification costs play an important role for the participation decision. Therefore, it is of particular interest how fast initial certification costs amortize. It should be noted that all farmers of this survey are taking part in a group certification; the costs for individual certification would be much higher. In addition, a large part of certification costs is covered by supporting organizations, donors or exporters (see also above and Kersting and Wollni, 2012).

In addition to actual certification costs, the initial certification costs include investments in equipment and training that are required. Time spent in training is taken into account with 4 GHS/day, as done with household labor. The percentage of initial costs for training is much higher for organic farmers, namely 59%, while it is 25% for conventional farmers. A detailed composition of initial certification costs is shown in Table A.5.2.

Initial certification costs are on average much higher than renewal costs (Table 5.2). The mean amortization times are displayed in Table 5.2. Based on the profit of one production cycle, it is about 3.5 times higher for conventional farmers, amounting to one third of the first production cycle's profits, than for organic farmers, where it is less than one tenth[7].

Descriptive Statistics of ROI Components

Out of the 386 farmers, 311 gave complete information on their sales activities, which is the precondition for the evaluation of the ROI. The remaining 75 farmers made incomplete statements about their production costs or sales, did not remember important parts of their sales data for instance the quantity of their last sales, or had not sold any pineapples since they got certified for the first time. This number is high, because we were very cautious in using only correct and complete information and because, even though it is requested for most certifications, the keeping of farm records was the exception rather than the norm.

Table 5.2 summarizes the mean values of variables which determine the ROI of one production cycle. Note that the production cycle on organic farms is on average longer than the one on conventional farms, namely 18.72 month instead of 15.46 month. The different lengths of the production cycles do not impair the informative value of the ROI, but obviously affect other key figures such as yearly income from pineapple farming. It should be noted that the data are calculated on the basis of per kilogram (Kg) instead of pieces to control for the fact that organic fruits are on average 0.18 Kg lighter than conventional fruits.

The quantity of pineapples considered for the ROI is the amount of sold pineapples adjusted for a proportionate part of the total harvest that was wasted on the field (4.85% for conventional and 3.19% for organic farmers respectively) and excludes the amount of pineapples that were self-consumed, self-processed or given away as a gift, on average 2.78% and 3.86% for organic and conventional farmers respectively. This separation is necessary for being able to calculate a sensible ROI that compares relevant investments with profits, since only the investment in pineapples later meant to be sold leads to a return.

Table 5.2 shows that conventional farmers sold 1.5 times as many pineapples as organic farmers a result of larger areas planted and higher yields. As expected, export prices were in general higher than local prices for both groups. But organic pineapple achieved a price premium on both local and export markets, even though they were not marketed as organic certified locally, pointing towards different marketing strategies by organic farmers which seem to better match local preferences, a presumption for which we however do not have further information for verification. One hint is that the Sugar Loaf variety yielded the highest prices on the local (and export) market and was produced more frequently by organic than by conventional farmers. Conventional pineapple farmers sold mostly Smooth Cayenne and MD2. Smooth Cayenne had the lowest price for either certification on the local market. For an overview of the prices for each variety see Table A.5.1.

Hence, organic farmers benefited from producing Sugar Loaf on both, the local and the export market. Conventional farmers produced mainly pineapple varieties which are more specialized on the mass export market, and also sold a greater fraction of their harvest to exporters. It should be noted that, independent of certification, farmers who got a higher price than the average price on the export market also sold a larger part of their pineapples on this market. However, as a consequence of the higher prices, the average revenue per Kg for organic pineapples exceeds the one of conventional pineapples. And since there is no significant difference in production costs per Kg, the average profit per Kg is significant higher for organic pineapples. This results in a larger mean ROI of organic farming. One should also point out that the ROI is on average positive for both certifications and similar in size to Udry and Anagol (2006) who find an internal rate of return of pineapple farming in Ghana around 250 to 300% per year (not considering any certifications). The framework for the evaluation of the impact on ROI is described in the next section.

3 Conceptual Framework and Empirical Specification

3.1 Conceptual Framework

The individual decision to become organic certified can be modeled in a random utility framework, which is widely used to analyze adoption under uncertainty (Feder et al. 1985). Organic certification is a binary choice in which the producer weighs up the expected net utility from organic certification against the one of conventional certification. Because the farmer needs at minimum one of the two certifications to enter or remain in the export market, the situation can be seen as a two-stage decision process, where the first stage decision whether to produce for the export or local market has been taken already in favor of the export market. We now exclude all farmers that have decided for the local market in the first stage. The second stage that remains is the question among the group of exporters which export market to target, conventional or niche market. This approach reduces the variance, increases the statistical power and solves the problem of distinguishing between export market participation, contract farming and organic certification effects.

The adoption decision can then be viewed as a standard binary choice problem that is based on the maximization of an underlying utility function. Let D_{1i}^{*} denote the expected utility of getting organic certification (adoption), and D_{0i}^{*} denote the expected utility of getting GlobalGAP certification (non-adoption) of an individual $\mathrm{i}(\mathrm{i} = 1, \ldots, \mathrm{N})$ of an observed population of size *N*. The differences between the expected utilities of the two certifications is $D_i^* = D_{1i}^* - D_{0i}^*$. When D_i^* is greater than zero adoption of organic certification occurs. Since GlobalGAP adoption will form the reference group, we follow standard denominations and refer to it as non-adoption in the following paragraphs. The actual level of utility of each farmer cannot be observed, but can be represented by a latent variable whose value can be represented by the observed choice D_i where $D_i (D_i \in \{0, 1\})$ is a dummy with $D_i = 1$ being attributed to the treatment, i.e. adoption and $D_i = 0$ to non-adoption. The adoption decision can then be modeled as an index function model:

$$\begin{aligned} D_i^* &= Z_i' \alpha + \epsilon_{D_i} \\ D_i &= 1 \quad \text{if} \quad D_i^* > 0 \\ D_i &= 0 \quad \text{if} \quad D_i^* \leq 0 \end{aligned} \tag{5.1}$$

where D_i^* depends on a vector of observable variables Z and an error term ϵ_D, with mean zero variance σ_D^2 . The error term includes errors in measurement and unobserved factors.

The probability of adoption can then be expressed by:

$$\begin{aligned} Pr(D_i = 1|Z_i) &= Pr(D_{1i}^* > D_{0i}^*) \\ &= Pr(D_i^* > 0) \\ &= Pr(Z_i'\alpha + \epsilon_{D_i} > 0) \\ &= Pr(\epsilon_{D_i} > -Z_i'\alpha) \\ &= F(Z_i'\alpha) \end{aligned} \tag{5.2}$$

where F is the cumulative distribution function of ϵ_D.

Based on this theoretical framework, the empirical strategy applied to evaluate the impact of organic certification on the ROI is presented in the next section.

3.2 Empirical Specification

The outcome variable is the return on investment (ROI), a widely used relative profitability performance measure. The ROI of a single investment is:

$$\text{ROI}= \frac{\text{Profit}}{\text{Investment}}$$

The advantage of the ROI compared to other measures such as net income is that it relates the profit to the farmer's investment decision and consequently indicates how well the available assets have been used. The ROI presents the results of one period, in our case one crop cycle, a well-defined timeframe with clear costs and revenues. Since the ROI is measured ex post without the farmers' ex-ante knowledge, the usual concerns against the use of ROI such as an induced focus on short term profit maximization is of no concern here. We are however aware that using longer time periods (e.g. three years, which is the usual length of the conversion period to organic) could change the results[8].

We assume that the status of D influences the outcome variable Y, in this case ROI. This is plausible because D opens up new marketing opportunities and requires different production methods. We strive to reduce selection bias by careful selection of treatment and control group and appropriate estimation strategies. We are aware that measurement errors are frequent in measuring agricultural inputs and outputs in developing countries. However, when farmers in both groups are sufficiently similar in their sociodemographic characteristics we can assume that measurement errors do not significantly differ between the two groups.

When the status of D influences Y this can be expressed in the relationship between Y, a set of exogenous variables X and the certification dummy D as:

$$Y_i = f(X_i;\ D_i) \tag{5.3}$$

When Y_{D_i} is the outcome variable of individual *i* as a function of the adoption status D, Y can take two forms, Y_{1i} and Y_{0i}. One of the biggest challenges in impact evaluations is finding an adequate control group. To illustrate this, defining τ_i as the treatment effect, a simple comparison of the outcome dependent on the adoption status:

$$\tau_i = Y_{1i} - Y_{0i} \tag{5.4}$$

This will likely lead to biased results, because it is impossible to observe Y_{1i} and Y_{0i} for the same individual. This implies first that it is necessary to use a counterfactual outcome instead and second that not the individual treatment effect, but only average treatments effect (ATE) in the population can be estimated. When treatment is non-random untreated individuals may differ systematically because of self-selection into treatment. Non-random assignment implies the average treatment effect on the treated (ATT) as the effect of interest.

The ATT can be defined by the following equation (Caliendo and Kopeinig, 2008):

$$\tau_{ATT} = E(\tau|D = 1) = E[Y_1|D = 1] - E[Y_0|D = 1] \tag{5.5}$$

where τ denotes the treatment effect, in this case the ATT and $\mathrm{E}[.]$ represents an expected value operator.

A popular approach to avoid biased results is to randomize treatment. Because randomization is not possible in our case, we have to solve the problem of finding a credible counterfactual and choosing the appropriate quasi-experimental techniques to correct for selection bias when estimating treatment effects. Selection bias caused by observables (e.g. farm size) can be controlled for using regression techniques. When the selection is based on unobservables that simultaneously influence the adoption decision as well as the outcome variable (e.g. ability, risk aversion, trust) or discrimination by firms or NGOs as argued in Bellemare (2012) and Barrett et al. (2012) this will lead an omitted variables problem. We can account for these points when the data is sufficiently rich. For instance, firms are likely to discriminate on the basis of observables that are potentially also available to the researcher. We conducted interviews with most of the exporting firms and farmer organizations to verify that selection is based on available data such as farm size. In addition, selection criteria did not differ between organic and conventional firms. We carefully choose our reference group among exporting, non-organic smallholders to minimize the influence of unobservables on our results. Many of the unobservables mentioned in the literature are assumed to apply in the same or a very similar way to both groups, such as entrepreneurship, risk preferences, and trustworthiness (Barrett et al., 2012; Blackman and Rivera, 2010).

Among the relevant methods treatment effect models e.g. instrumental variable (IV) or Heckman selection models are quite restrictive, because they assume that the estimated outcome functions differ only by a constant and other potentially suitable methods such as a regression discontinuity design cannot be used due to the lack of a suitable threshold variable. Based on these observations with regards to the available data and with respect to taking into account the influence of unobservables, we rely on an endogenous switching regression model (ESR henceforth) for our analysis.

The endogenous switching model (Lee, 1978 and Maddala, 1983) is a parametric approach that uses two different estimation equations for organic and GlobalGAP certified farmers while controlling for the selection process by adding the inverse Mills ratio that is calculated via a selection equation in a first step. Thus, outcome equations are disposed differently for each regime, conditional on the adoption decision, which is estimated by a probit model. Previous impact evaluations as for example Fuglie and Bosch (1995), Alene and Manyong (2007) and Kassie et al. (2008) have used an endogenous switching regression model to estimate the effect of different technology adoptions in agriculture.

In the endogenous switching model, the adoption decision is modeled like in the previous section with $D_i^* = Z_i'\alpha + \epsilon_{D_i}$ (equation (5.1)). $Y = f(X)$ representing the relationship between the outcome variable of interest and a set of exogenous variables X. Y_0, Y_1 define the outcomes of interest separately for the two regimes of adopting and of not adopting the technology, and $\epsilon_{0i}, \epsilon_{1i}$ are the error terms.

$$Y_{0i} = X_i'\beta_0 + \epsilon_{0i} \qquad \text{if} \;\; D_i = 0 \tag{5.6}$$

$$Y_{1i} = X_i'\beta_1 + \epsilon_{1i} \qquad \text{if} \;\; D_i = 1 \tag{5.7}$$

Self-selection based on observables is thereby taken into account but unobservable factors could create a correlation between ϵ_D and ϵ_0, ϵ_1. To solve this problem, in an endogenous switching regression model the sample selectivity is treated as a missing value problem. The error terms are assumed to have a joint-normal distribution with a variance-covariance structure as follows:

$$cov(\epsilon_0, \epsilon_1, \epsilon_D) = \begin{pmatrix} \sigma_0^2 & \sigma_{01} & \sigma_{0D} \\ \sigma_{01} & \sigma_1^2 & \sigma_{1D} \\ \sigma_{0D} & \sigma_{01} & \sigma_D^2 \end{pmatrix} \tag{5.8}$$

With $\sigma_0^2 = var(\epsilon_0)$, $\sigma_1^2 = var(\epsilon_1)$, $\sigma_D^2 = var(\epsilon_D)$, $\sigma_{01} = cov(\epsilon_0, \epsilon_1)$, $\sigma_{0D} = cov(\epsilon_0, \epsilon_D)$, $\sigma_{1D} = cov(\epsilon_1, \epsilon_D)$. σ_D^2 is assumed to be one as α is estimable only up to a scalar. Furthermore, $\sigma_{01} = 0$ because one cannot observe Y_{1i} and Y_{0i} at the same time. The expected values of the truncated error terms $E(\epsilon_1 | D = 1)$ and $E(\epsilon_0 | D = 0)$ can then be expressed by:

$$E(\epsilon_{1i} | D_i = 1) = E\left(\epsilon_{1i} \middle| \epsilon_{D_i} > -Z'\alpha_i\right) = \sigma_{1D} \frac{\phi(Z'\alpha_i/\sigma)}{\Phi(Z'\alpha_i/\sigma)} \equiv \sigma_{1D}\lambda_{1i} \tag{5.9}$$

$$E(\epsilon_{0i} | D_i = 0) = E\left(\epsilon_{0i} \middle| \epsilon_{D_i} > -Z'\alpha_i\right) = \sigma_{0D} \frac{\phi(Z'\alpha_i/\sigma)}{\Phi(Z'\alpha_i/\sigma)} \equiv \sigma_{0D}\lambda_{0i} \tag{5.10}$$

with ϕ denoting the probability density and Φ the cumulative distribution function of the standard normal distribution. The ratio of ϕ and Φ evaluated at $Z'\alpha_i/\sigma$ is the inverse Mills ratio (λ_0 and λ_1 in equations (5.9) and (5.10). λ_0 and λ_1 are seen as missing values in equations (5.6) and (5.7). Thus, after having estimated a probit model in the first stage and having derived the Mills ratios λ_0 and λ_1, the second stage can be run using the following specification:

$$Y_{1i} = X_i'\beta_1 + \sigma_{1D}\lambda_{1i} + u_{1i} \qquad \text{if } D_i = 1 \tag{5.11}$$

$$Y_{0i} = X_i'\beta_0 + \sigma_{0D}\lambda_{0i} + u_{0i} \qquad \text{if } D_i = 0. \tag{5.12}$$

In these equations the error terms u_{0i} and u_{1i} have conditional zero means. Following Lokshin and Sajaia (2004) we use the full information maximum likelihood method (FIML) to estimate this model, i.e. the selection (probit) equation and the outcome equations are estimated simultaneously. The logarithmic likelihood function to solve equations (5.11) and (5.12) via this method is specified as:

$$lnL = \sum_{i=1}^{N} \left\{ \begin{array}{c} D_i\omega_i[ln\Phi\left(\frac{Z_i'\alpha + \rho_{1D}(Y_{1i} - X_i'\beta_1)/\sigma_1}{\sqrt{1-\rho_{1D_i}^2}}\right) + ln(\phi\,((Y_{1i} - X_i'\beta_1)/\sigma_1)/\sigma_1)] + \\ (1-D_i)\omega_i\left[ln\left(1-\Phi\left(\frac{Z_i'\alpha + \rho_{0D}(Y_{0i} - X_i'\beta_0)/\sigma_0}{\sqrt{1-\rho_{0D_i}^2}}\right)\right) + ln(\phi\,((Y_{0i} - X_i'\beta_0)/\sigma_0)/\sigma_0)\right] \end{array} \right\} \quad (5.13)$$

where ω_i denotes an optional weight for observation i , $\rho_{0D} = \sigma_{0D}/\sigma_0\sigma_D$ is the correlation coefficient of ϵ_0, and ϵ_D and $\rho_{1D} = \sigma_{1D}/\sigma_1\sigma_D$ is the correlation coefficient of ϵ_1 and ϵ_D .

When ρ_{0D} and ρ_{1D} are significant, the model has an endogenous switch. The signs of ρ_{0D} and ρ_{1D} can also be interpreted economically. Alternate signs signal that the individuals have adopted the technology according to their comparative advantages. When ρ_{0D} and ρ_{1D} have the same sign this implies "hierarchical sorting", i.e. adopters have an above-average return compared to the non-adopters independent of the adoption decision (Fuglie and Bosch, 1995; Alene and Manyong, 2007; Maddala, 1983).

The ATT τ_{ATT}^{ESR} in this case is:

$$\tau_{ATT}^{ESR} = E(Y_1|D=1) - E(Y_0|D=1) = X'(\beta_1 - \beta_0) + (\sigma_{1D} - \sigma_{0D})\lambda_1. \quad (5.14)$$

We now give a short overview of the specification of the endogenous switching regression model thereby presenting the underlying hypothesis drawn from previous literature and the nature of the respective standards. In total, complete data for 359 farmers (184 GlobalGAP certified and 175 organic certified) exists and the estimations are based on these 359 farmers[9].

The vast literature on technology adoption offers only limited guidance to derive hypotheses on the influence that certain variables may have on farmers' adoption decisions for one or the other certification, because this paper differs from most previous analyses because it compares two different certifications. Hence, while previous studies have shown that exporting farmers and certified farmers alike are younger, more innovative, better educated, better connected, wealthier and have larger farms, we try to distinguish differences within this group according to farming type.

The farmers' decision to enter the export market is the precondition for each of the two certifications and we are thus left with characteristics that differ in their influence on the decision to apply for organic or GlobalGAP certification respectively. To start with, the selection equation includes covariates covering GENDER and AGE as in most of the existing literature. Our prior is that, if anything, older female farmers are likely to choose organic production. This assumption is based on the literature about the participation in innovations (Bellemare, 2012; Kersting and Wollni, 2012; Wollni and Zeller, 2007; etc.) as well as literature from developed countries that shows that females are more sensible towards environmental friendly production. In addition, organic production is supposedly more similar to traditional production methods, which in turn are practiced to a larger extent by older farmers.

Next, the variable RISK is constructed from a factor analysis of several questions asking the farmer directly for his or her willing to take farming risks, to make use of new farming techniques, and the necessity to take a risk to achieve success. We assume that organic farming may generally be perceived as the riskier choice, because pests and diseases can potentially not as easily be dealt with. On the other hand and specifically to Ghana, a lot of conventional farmers have made negative experiences with the volatility of the conventional export market (see section 2). A larger household (HHSIZE) may generally be more beneficial for organic farming with its higher labor requirements. However in our case we expect this effect to be minimal if existing at all, because manual labor is readily available in the region under scrutiny. On the contrary and in accordance with Fort and Ruben (2009) a higher level of education (EDUC) is expected to be negatively correlated with the organic choice because requirements, especially in traceability and record keeping, are more sophisticated in the GlobalGAP standard. The variable used here is the maximal number of years of formal education (schooling) present in the household.

Since GlobalGAP requires a larger investment than organic certification (see Table 5.2) and a larger part of it is in equipment, which potentially leads to economies of scale, larger farms (FSIZE) are expected to be more likely to invest in GlobalGAP certification beyond the decision to export (Kersting and Wollni, 2012; Kassie et al., 2008). Along the same lines wealthier farmers could be more likely to invest in GlobalGAP certification (WEALTH). Security of tenure rights is expected to be more important for organic farmers, which we measure directly through the share of the total farmland owned (OWNLAND) and indirectly through the connection to the local government and local authorities (GOVERN), similar to Goldstein and Udry (2008)[10]. Another proxy that covers a different aspect of tenure security is the length of the stay in the same village, which we approximate by a dummy on whether or not someone is native to the community (NATIVE). For similar reasons specific soil characteristics (SOIL) may be more or less suitable for one or the other production technique. In addition, certain crop varieties might be preferable for organic and conventional production respectively. However, in our case it was consistently reported by all farmers that the decision to produce under a specific certification is taken simultaneously with the varietal decision.

Usually a farmer group does not organize the certification process alone. It is aided by the exporter, government, an NGO or international donor to varying extents. If these groups give different measures and degrees of support (which we cannot observe) and different groups support different certifications (which we know is the case) they may thereby influence the certification process in different ways. We try to capture this by the dummy ORGA. In our sample, farmers have generally been part of their respective farmer organizations for considerably more time than they are certified. Thus, the variable ORGA captures group effects that are present independent of the decision to certify. In the same way, personal networks to other farmers, neighbors and family may be conducive for both certifications in a different manner (e.g. Conley and Udry, 2005). A strong personal link is where or from whom pineapple farming was learned (LEARN1 and LEARN2). This could impact on the openness towards one or the other production method by way of the attitudes that the teachers display towards certain practices. More directly the variable ENV captures the stated level of importance that farmers attribute towards preserving the natural environment and thus an implicit preference for or against environmental friendly certifications. Since organic cannot only be regarded as a technology, but also as an ideological question, the attitudes of farmers towards environmental protection and chemical use may play a significant role in the choice.

Distance to major markets is usually a relevant factor for certification (e.g. Fort and Ruben, 2009; Kassie et al., 2008). Since in our case all farmers export through Accra airport or Tema harbor, distance to alternative local markets, represented by the variable DIST, may be more relevant.

Finally, ENV captures the implicit preference for or against environmental friendly production standards. This makes it a suitable candidate for the exclusion restriction, because it is correlated with the certification decision but has certainly no influence on the ROI. The selection equation of the endogenous switching regression model needs an exclusion restriction to avoid collinearity, because the covariates included in the selection equation enter the second stage estimation twice, non-linear through the inverse Mills ratio and linear as a coefficient for the ROI. Since most of the observations lie in a quasi-linear range of the inverse Mills ratio the model would lead to weak results due to collinearity. To reduce this problem one or more exclusion restrictions are needed, that are not added to the regression equation of the ROI. ACCRA, the frequency of visits to the capital, is a second potential exclusion restriction. This variable measures private (as opposed to farm-related) visits to the capital and therefore forms part of the social environment of the farmer, which in turn shapes his beliefs. These beliefs in turn influence the adoption decision, but should be of minor importance for the ROI. We captured farming related information exchange in the variables covering training, inspection, and contacts to other farmers. We hence report the results when using ACCRA as exclusion restriction in Table A.5.3.

Some of the variables used in the selection equation are potentially relevant for our outcome variable as well. For instance, following Bellemare (2012) a higher education is expected to lead to a higher return to better productivity. Age may have a nonlinear effect on productivity (Abdulai and Binder, 2006) and the distance to the next market may have an effect through lower transport costs or better access to inputs and information.

The following variables are added in the outcome equation: the number of farm inspections and trainings conducted by the exporter or extension services (INSPECT). In addition, whether farmers have a written (as opposed to oral) contract with an exporter (CONTR) and whether they have access to credit (CREDIT) is included, which may both affect agricultural productivity (e.g. Abdulai and Binder, 2006). Since conventional farming is more capital intensive, while organic production is more labor intensive, the productivity of household or hired labor could have a disparate effect on the performance of organic and GlobalGAP farmers. The ratio of costs for hired workers to the total labor costs (HIRED) is added in the model. BANK is used as a proxy for savings, assuming that the decision to open a bank account and invest in savings is not directly related to this year's ROI.

Moreover, whether or farmers produce the modern world-market variety (VARIETYMD2) could be relevant since it is considered to be harder and more expensive to grow, but also achieving relatively high export prices. Finally the number of years that a farmer has been certified (here represented by the variable (CERTIFYEARS) may have an effect on the agricultural income as farmers may be able to increase their returns over time.

3.3 Results

The results of the endogenous switching regression model are presented in Table 5.3. Columns (1) and (2) present the estimated coefficients and standard errors of the selection equation (equation (5.1). Columns (3) to (5) due the same for the outcome equations (equations (5.11) and (5.12)).

From the selection equation we can confirm that younger, higher educated, wealthier but more risk averse farmers with larger farms but a lower share of own land tend to opt against organic and for GlobalGAP certification. Whereas experience does not play a significant role, how it was learned does. This is likely so, because the decision to produce organically is at least partly a question of belief and farming values are also transmitted during the learning process. Learning from the family almost surely means to learn more traditional ways of farming.

When the farmer organization organized the certification process organic certification is more likely. GlobalGAP certification is more often NGO induced, organic certification is more often farmer group supported. Organization by the farmer group may allow less educated farmers to participate in the standard adoption, reducing the influence of education[11].

Surprisingly, being less concerned about the environment makes farmers more likely to choose organic production (ENV). This is at first sight counterintuitive. However judging from the training material and discussions with farmers, GlobalGAP certification is presented to the farmers as particularly environmental friendly, whereas organic is simply presented as organic. As expected OWNLAND is positive and highly significant indicating that farmers that own their land are more likely to invest in long-term measures, i.e. organic certification. However, NATIVE does not have the expected sign. Our possible explanation is specific to Ghana. The tenure system in Ghana has been reformed recently. The region around Accra is an immigration area for people from the rest of the country. Thereby people moving to the Accra region may acquire land under the new tenure system, which could imply that they feel that their land is safer than land still managed under the old system. The significance of the variable NATIVE in the outcome equations confirms this supposition. Finally, GENDER, DIST, HHSIZE and GOVERN are insignificant, which shows that variables that have repeatedly been shown as highly important determinants of adoption of any standard may be not so relevant for the choice between different standards.

Those variables that have the same sign in both outcome estimations matter in the same way for both groups' ROI, such as age, household size, access to credit, years of certification, whereas those that have alternating signs like NATIVE and EXPER, exert a positive influence on one and a negative influence on the other group. The latter include WEALTH and savings (BANK), which exert a positive influence on GlobalGAP and a negative influence on organic farmers. The positive sign is expected, since production according to GlobalGAP standards requires higher capital investments savings will help to realize them. The negative sign for organic farmers is not so clear. Smaller farms are not only more likely to become organic certified; they are also more successful than organic farmers with larger farms, whereas the farm size has no significant influence on GlobalGAP farm ROI. This may be a hint for confirmation of the occasional claim that smaller farms may be more suitable for organic production. It also supports the theory of an inverse farm-size productivity relationship for organic farmers, but not for GlobalGAP ones.

VARIETYMD2 also has alternating signs. In the expert interviews prior to the survey we repeatedly heard that ”MD2 is too difficult to produce organically”. Further discussions with tropical fruit experts in Germany revealed that it may rather be experience in Ghana with this relatively new variety that is lacking. Therefore those who try might not be successful (yet). While for both groups receiving more farm inspections increases the ROI, organic farms are better off spending a larger part of their production cost on labor, whereas GlobalGAP farms should rather buy labor saving inputs, which clearly reveal the proclaimed comparative advantages of the two production techniques.[12]

Previous studies have found that women are less productive in farming and this result is confirmed here in the outcome equation with respect to organic farms. We must however note that the overall number of women farmers is very small in our sample. Education loses its significance in the outcome equations, meaning that while education selects farmers into certain innovation groups, it are not relevant for their success. It is further found that the larger the distance from the farm to the local market the greater the ROI of GlobalGAP farmers. One possible explanation is that distance to the exporter-buyer, not the local market is relevant. Farmers that are far away from local markets, but along the main road, may benefit from better accessibility and lower land costs.

Finally, we studied the contract variable more closely. Farmers with written contracts are found to have significantly higher equipment and certification costs (per kg). This does not necessarily mean that farmers with a less formal contract do not invest, but rather that they only invest if they find support from a donor or NGO to finance their investment. This is true unless we assume that farmers with a formal contract overinvest. Organic farming does not require large investments, hence here the positive effects of a having a more secure contract dominate.

The correlation coefficients ρ_{0D} and ρ_{1D} of the endogenous switching regression model are not significantly different from zero (last row of Table 5.3) and the Wald test of independent equations provides that there is no significant correlation between the error terms of the selection and the regression equations. Therefore, impacts of certification can be calculated correctly, given observed characteristics (Alene and Manyong, 2007), i.e. there is no endogenous switch and unobservables do not influence the certification decision significantly.

Having estimated the coefficients that determine the ROI of organic and GlobalGAP farmers, it is possible to predict the potential outcomes of adopters and non-adopters. The results are presented in 4. The ESR results in a significant positive impact of organic certification on the ROI of the small-scale pineapple farmers. Their ROI is on average 0.6 larger than it would be if they were GlobalGAP certified instead. The results illustrate that, while both organic and GlobalGAP certified pineapples farmers achieve a positive ROI, it is higher for organic farming. This is evidence in favor of organic farming being worth its investment. In line with the conclusions of previous studies, the underlying data indicates that the reason is the price premium received for organic certified products and not lower production costs.

3.4 Robustness Checks

First, the robustness of the ESR is checked by using different exclusion restrictions. The first one is using ACCRA instead of ENV, reported in detail in Table A.5.3. Further the following variations are made: using all possible combinations of ENV, WEALTH and ACCRA. The estimated ATTs then vary between 0.651 (when using ACCRA and ENV) and 0.986 (when using only WEALTH), i.e. the results are quite robust to changes in the exclusion restriction.

Second, because we find no significant influence of unobservables, we additionally test the robustness of the results using a non-parametric technique that accounts for observables only, i.e. propensity score matching (PSM henceforth). Since there is no endogenous switch, the results should not change. PSM assumes selection on observables only which is manifested in the conditional independence assumption (CIA), i.e. that potential outcomes are independent of the technology choice conditional on covariates Z. If this is so, they are also independent of the technology choice conditional on the propensity score $P\ (Z)$. $P(Z_i) = Pr(D_i = 1|Z_i) = F(Z_i'\alpha)$ gives the probability of an individual adopting a technology depending on the observed covariates Z. Given this, the ATT can be generated by comparing treated and untreated individuals with similar propensity scores.

The results are very similar to the ones of the ESR explained above and will not be discussed in detail. The matching algorithms used are kernel matching with a bandwidth of 0.4, radius matching with a caliper of 0.05 and nearest-neighbor matching with different amounts of neighbors (the tables only display the results for four neighbors and kernel). The balancing property is satisfied with the underlying probit model used to generate the propensity scores (Table A.5.4). We use several methods to test the matching quality.

Rosenbaum and Rubin (1985) suggest that the differences in the means of the covariates between the two groups should vanish after matching. Table A.5.5 shows that t-tests result are insignificant after matching for all covariates except FSIZE. Next, the standardized bias before and after matching is shown in Table A.5.6. It is reduced by 70% from 27.67 to 8.19 when using the kernel algorithm. A reduction of the mean bias by 3-5% is considered as sufficient in most empirical studies (Caliendo and Kopeinig, 2008). As a further indicator for matching quality, the pseudo-R2 reports how well the probit model explains the participation probability. After the matching procedure it should be very low to indicate that there are no significant differences between adopters and non-adopters that are used for matching. With 0.03-0.05 depending on the matching algorithm this is the case. The same idea is used when testing likelihood ratio of joint significance. While the p-value of the likelihood ratio should be significant before matching it should be insignificant afterwards, which is the case for all applied matching algorithms. Since the balancing tests hold for the specified probit model, the ATT can be generated. It is reported in Table 5.5. Taking the common support assumption into account, 12 organic farmers are not considered in the calculation because the propensity score of those farmers are larger than the maximum of the propensity scores of the GlobalGAP farmers (Figure A.5.1).

The results of the ATT for the PSM are shown in Table 5.5. They are slightly higher than the ATT generated by the ESR; they differ between 0.914 and 0.958 depending on the matching algorithm that was used[13]. We also perform several robustness checks for the PSM. To test the sensitivity of the results vis-à-vis unobservables Rosenbaum bounds were calculated (Rosenbaum, 2002). The critical values of $\Gamma(\Gamma^{*})$ =1.3 (kernel) and 1.4 (nearest neighbor) indicate that the ATT would still be significant even if matched pairs differ in their odds of certification by the factor 1.3 or 1.4 respectively, showing a moderate sensitivity to the influence of unobservables. However, since the ESR indicates that there is no endogenous switch, we do not need to be very worried. In addition, higher ordered variables were included in the base probit model (Dehejia, 2005). Exemplary results using squared FSIZE, EDUC, and HHSIZE are in Table A.5.7. The results appear robust to small changes in the underlying probit model.

Then, we also used a weighted least squares regression (WLS) using the inverse of the propensity score as weighting scheme as proposed by Hirano and Imbens (2001), which again results in similar values for the ATT and similar values of the coefficients shown in Table A.5.9. Finally, we also conduct an OLS estimation of the two equations (5.6) and (5.7), which also does not change most coefficients significantly compared to the ESR (not shown).

Table 5.5 summarizes the estimated ATTs of PSM, ESR, WLS and OLS. One can see that, via WLS and OLS the ATT is estimated to be a little bit larger than the other approaches indicate, which indicates that these methods tend to overestimate the ATT slightly. The most conservative estimate comes from our main model and still results in a significant positive impact.

4 Conclusions and Discussion

In order to expand and diversify agricultural export activities, policies promote the participation of small-scale farmers in developing countries in international markets. These markets require certification with internationally approved food labels. We have measured the returns to the investment in organic and GlobalGAP certification in this paper. Both are worth their investment because they achieve on average a positive ROI, however organic certification is the more profitable option, i.e. the one with a higher ROI. The reason lies in higher prices for organic fruit which overcompensate for lower yields on organic farms, 86% of the yield of GlobalGAP farms based on the number of pineapples harvested and 73% on kilogram basis. Employment effects are also likely to be higher for organic production, because this method is more labor intensive. This result is valid when we control for selection bias and single out the effect of certification vis-à-vis contract farming and exporting.

We are able to see from the adoption pattern that relatively poorer, less educated households are more likely to produce organically. Whether they are more attracted by this form of production or whether this reflects how exporters and NGOs target farmers cannot be determined. Nevertheless, it implies that organic certification has the potential to reduce poverty and inequality. This is a twofold positive result, because at the same time the demand for organic products is increasing faster than the demand for conventional food. However, the production cycle on organic farms is on average longer than the production cycle on GlobalGAP farms. When boiled down to the same period, e.g. one year, the income from farming is about the same for organic and GlobalGAP farms, so that the starting point of being less wealthy than conventional farmers is not reversed.

Not being able to measure risks of certification for instance by collecting information about survival rates is a limitation of our analysis. We also did not take into account long-term externalities of organic certified farming, such as the effects of increased rural labor demand and environmental effects, such as whether organic farming is able to diminish the problem of declining soil fertility in Ghana and whether there is a trade-off between environmental and economic objectives. There is hence ample opportunity for further research, in particular using panel data.

5 References

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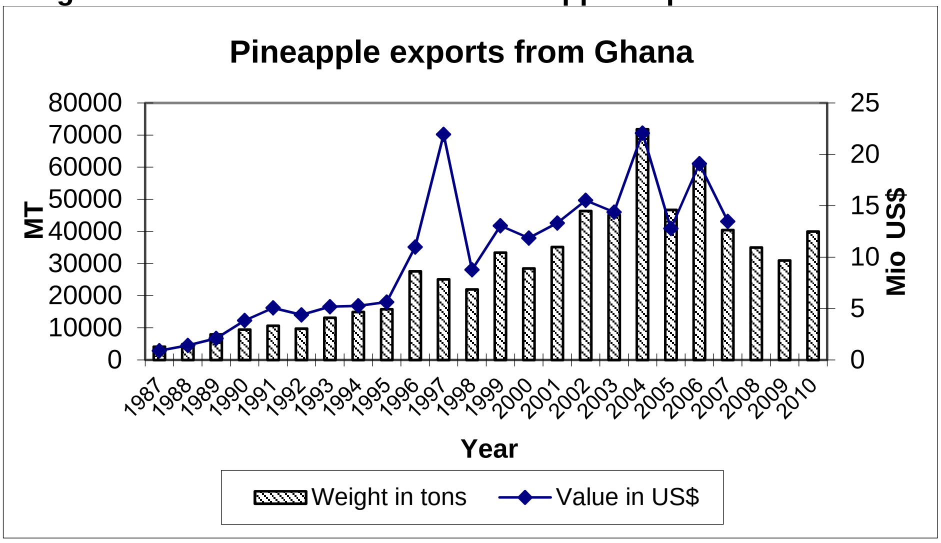
Tables and Figures

Figure 5.1: Volume and Value of Pineapple Exports from Ghana



Source: SPEG

Table 5.1: Descriptive Statistics of Variables Included in the Estimations

Definition	Variable	Organic Farmers (N=185)	Convent. Farmers (N=201)	t-Stat.
Gender of household head (HHH) 1 if HHH is male, 0 otherwise	GENDER	0.891	0. 982	-3.51***
Age of HHH	AGE	46.313	42.970	2.82***
Household size (persons living in household)	HHSIZE	5.230	5.917	-2.35**
Fraction of adults (older than 15) in household	ADULT	0.684	0.665	0.75
Being native in community (1 if yes, 0 otherwise)	NATIVE	0.738	0.738	-0.01
Maximal educational level in household (years)	EDUC	9.470	10.195	-3.19***
Farm size (acre)	FSIZE	10.35	18.720	-5.02***
Share of land owned	OWNLAND	0.549	0.204	7.628***
Pineapple land (acre)	PINLAND	4.014	3.066	2.07**
Access to credit during the last 5 years 1 if yes, 0 otherwise	CREDIT	0.317	0.232	1.78*
Bank account with more than 200 GHS 1 if yes, 0 otherwise	BANK	0.339	0.512	-3.21***
Number of durable goods owned	WEALTH	4.765	8.481	-10.875***
Relation to the local government 1=none, 2=HHH knows someone in the local government, 3=HHH has friends in the local government, 4=strong relation/politically active	GOVERN	2.257	1.774	4.27***
Self-stated openness to innovation and risk (factor analysis: the stronger the agreement, the larger)	RISK	0.152	-0.166	3.01***
Years of experience in pineapple farming	EXPER	11.557	11.595	-0.05
How pineapple farming was learned				
from family members and friends (1 if yes, 0 otherwise)	LEARN 1	0.863	0.501	7.97***
as a laborer on a farm or from (1 if yes, 0 otherwise)	LEARN 2	0.071	0.286	-5.51***
Frequency of being in Accra 1=never, 2=once, 3=at least once a year, …, 6=at least once a week	ACCRA	3.661	1.976	11.07***
Importance of preserving the environment 1= very important, ..., 4= not important	ENV	1.775	1.281	6.91***
Number of years being certified	CERTIFYEARS	3.165	2.032	3.875***
Distance to the closest local market (hours)	DIST	0.698	0.804	-1.59
Soil characteristics 1=red or black sandy, 2=white sandy, 3=white rocky, 4=rocky red or black, 5=sandy or rocky clay, 6=clay, 7=other	SOIL	2.781	2.304	2.13**
Variety Smooth Cayenne (1 if yes, 0 otherwise)	SC	0.098	0.351	-5.99***
Variety Sugar Loaf (1 if yes, 0 otherwise)	SL	0.634	0.036	15.06***
Share of labor cost for hired workers	HIRED	0.484	0.607	-3.13***
Assistance or training for farming received during last 5 years (1 if yes, 0 otherwise)	ASSIST	0.732	0.708	0.50
Number of farm inspection during the last 5 years	INSPECT	1.913	2.619	-0.94
Written contract with exporter (1 if yes, 0 otherwise)	CONTR	0.410	0.417	-0.13
Organizer of the certification process 1 if farmer organization, 0 otherwise	ORGA	0.508	0.143	7.84***

Significance levels: *: 10% **: 5% ***: 1%

We use a conversion factor of 1 GHS = 0.46 Euros (calculated on the basis of the exchange rate on January 12, 2010).

Table 5.2: Descriptive Statistics of Economic Variables

Variable	Organic Farmers	Conventional Farmers	t-Stat.
Agricultural equipment	0.002	0.009	-2.77 ***
Agricultural inputs	0.011	0.077	-5.97 ***
Renewal of certification	0.000	0.006	-4.27 ***
Land used for pineapple	0.004	0.004	-0.004
Hired workers	0.037	0.019	3.77 ***
Household labor	0.034	0.009	5.68 ***
Yield (pineapple per acre)	15780	18259	-4.11 ***
Quantity sold (in Kg)	23486	36235	-2.81 ***
Average local price (GHS per Kg)	0.210	0.131	8.50 ***
Average export price (GHS per Kg)	0.251	0.196	5.40 ***
Share sold on local market	0.495	0.354	3.00 ***
Revenue (GHS per Kg)	0.219	0.170	5.80 ***
Production costs (GHS per Kg)	0.105	0.118	-0.94
Profits (GHS per Kg)	0.114	0.052	4.01 ***
ROI	2.760	1.800	3.11 ***
Initial certification costs (GHS)	70.497	444.116	-12.18***
Renewal of certification (GHS)	0.732	93.089	-6.16***
Amortization (years)	0.083	0.283	-3.28***

We use a conversion factor of 1 Ghana Cedi (GHS)=0.46 Euros. The t-statistic belongs to the mean difference test between column (2) and (3). Significance levels: *:10% **:5% ***:1%

Table 5.3: Estimation Results of ESR

Variable	Selection Eq. Coefficient (1)	Std. Err. (2)	Organic farmers Coefficient (3)	Std. Err. (4)	Convent. farmers Coefficient (5)	Std. Err. (6)
GENDER	-0.410	0.487	0.921**	0.452	-0.147	0.695
AGE	0.039**	0.014	0.004	0.015	0.057	0.023
NATIVE	-0.009	0.298	-0.424***	0.047	0.253	0.401
RISK	0.310**	0.111	0.130	0.207	-0.423*	0.242
HHSIZE	-0.044	0.045	-0.004	0.079	-0.025	0.065
EDUC	-0.414***	0.143	-0.218	0.164	-0.177	0.152
FSIZE	-0.018**	0.010	-0.048***	0.010	0.007	0.013
OWNLAND	0.764***	0.266	-0.061	0.387	0.712	0.639
GOVERN	0.177	0.128	0.198	0.185	-0.234	0.180
EXPER	-0.006	0.017	0.004	0.021	-0.048	0.031
LEARN1	0.297	0.415	-0.536	0.471	-0.088	0.514
LEARN2	-0.979***	0.488	-1.147	0.838	-1.025**	0.496
DIST	-0.266	0.221	0.069	0.195	0.859**	0.394
SOIL	0.168***	0.044	-0.052	0.075	0.099	0.112
ORGA	1.243***	0.341	-0.231	0.487	-0.856	0.697
WEALTH	-0.411***	0.087	-0.245*	0.113	0.097	0.056
ENV	0.502**	0.213				
BANK			-0.770**	0.354	0.807**	0.401
CREDIT			-0.193	0.354	-0.420	0.424
VARIETYMD2			-2.143***	0.775	0.208	0.528
HIRED			0.512	0.524	-2.234***	0.464
INSPECT			0.054***	0.014	0.050**	0.024
CONTR			0.405**	0.219	-1.150***	0.436
CERTIFYEARSNO			-0.010	0.057	-0.287	0.248
INTERCEPT	2.899***	1.065	2.659**	1.327	2.712*	1.523
ρ_{1D}			-0.405	0.972		
$ln\sigma_1$			0.584***	0.081		
ρ_{0D}					0.438	0.419
$ln\sigma_0$					0.517***	0.112
Log-Likelihood:			-595.538			
Wald test of indep. eqns.:			$\chi^2(2)$ = 16.21***			

Significance levels: *: 10% **: 5% ***: 1%

Table 5.4: ATT Measured by the ESM

	Predicted ROI of adopt. (mean)	Predicted ROI of non-adopt. (mean)	ATT	t-Statistic
Organic farmers	2.412	1.732	0.680	3.37***
Conventional farmers	-0.140	1.996		

Table 5.5: Summary of Results ATT

Method	Predicted ROI of adopt.	Predicted ROI of non-adopt.	ATT	t-Statistic
ESR				
Organic farmers	2.412	1.732	0.6809	3.37***
Conventional farmers	-0.140	1.996		
ESR using ACCRA				
Organic farmers	3.111	1.212	0.899	4.97***
Conventional farmers	0.181	1.796		
Weighted Least Squares				
Organic farmers	3.967	2.677	1.113	5.69***
Conventional farmers	1.799	1.565		
OLS				
Organic farmers	2.662	1.282	1.180	5.92***
Conventional farmers	1.983	1.777		
	ROI of treated	**ROI of control group**	**ATT**	**t-Statistic**
PSM				
Kernel (bandwidth=0.4)	2.819	1.900	0.919	2.91**
Radius (caliper=0.05)	2.818	2.091	0.914	2.22**
Nearest-neighbor	2.818	1.861	0.958	2.04**

Significance levels: *: 10% **: 5% ***: 1%

There are 125 adopters whose propensity scores lie within the common support region.

For PSM, standard errors are calculated with bootstrapping using 1000 replications. Bootstrapping of standards errors is necessary because the estimated variance does not include the variance that may appear due to the estimation of the propensity score and the imputation of the common support assumption (Caliendo and Kopeinig (2008), p.51). Even though Abadie and Imbens (2008) criticism the use of bootstrapping for the nearest-neighbor algorithm, its application is still common practice.

Appendix

Table A.5.1: Average Pineapple Prices (GHS per Kg)

Variety	Organic Farmers		Conventional Farmers	
	Local	Export	Local	Export
Smooth Cayenne	0.14	0.16	0.12	0.19
Sugar Loaf	0.22	0.28	0.24	0.21
MD2	0.10	-	0.14	0.20

Table A.5.2: Composition of Initial Certification Costs (in GHS)

Variable	Organic Farmers (N=142)		Conventional Farmers (N=111)		t-Statistic
	(1)	(2)	(3)	(4)	(5)
Certification	36.866	19.127 %	303.815	54.970%	8.44***
Training	27.661	56.516%	51.171	25.834%	6.2***
Equipment	9.394	22.622%	69.153	19.165%	12.70***
Other	1.211	1.733%	0.108	0.031%	-0.86

Significance levels: *: 10% **: 5% ***: 1%
Column (2) and (4) present the part of each cost category on the total initial certification costs of organic and conventional farmers. The t-statistic belongs to the test of difference in means of column (1) and (3).

Table A.5.3. Estimation Results of ESR using ACCRA

Variable	Selection Eq. Coefficient (1)	Selection Eq. Std. Err. (2)	Organic farmers Coefficient (3)	Organic farmers Std. Err. (4)	Convent. farmers Coefficient (5)	Convent. farmers Std. Err. (6)
GENDER	-0.457	0.487	0.872*	0.472	-0.029	0.751
AGE	0.042**	0.014	0.004	0.014	0.068	0.025
NATIVE	-0.289	0.308	-0.478***	0.038	0.302	0.384
RISK	0.208	0.134	0.117	0.170	-0.419*	0.246
HHSIZE	-0.085*	0.051	0.006	0.065	-0.069	0.083
EDUC	-0.378**	0.161	-0.225	0.177	-0.242	0.246
FSIZE	-0.018**	0.009	-0.040***	0.010	0.006	0.014
OWNLAND	0.769***	0.218	-0.054	0.412	0.669	0.688
GOVERN	0.200*	0.124	0.173	0.220	-0.331	0.281
EXPER	-0.023	0.018	0.005	0.022	-0.049*	0.027
LEARN1	0.471	0.302	0.367	0.481	-0.872	0.505
LEARN2	-0.881**	0.421	-0.866	0.838	-0.926*	0.504
DIST	-0.287	0.185	0.179	0.216	0.995**	0.402
SOIL	0.136**	0.077	0.022	0.075	0.093	0.114
ORGA	1.711***	0.645	-0.533	0.515	-0.790	0.668
WEALTH	-0.403***	0.067	-0.167	0.118	0.007	0.053
ACCRA	0.413***	0.116				
BANK			-0.741**	0.367	0.924**	0.402
CREDIT			-0.122	0.358	-0.270	0.398
VARIETYMD2			-2.021*	1.084	0.126	0.506
HIRED			0.491	0.536	-1.921***	0.480
INSPECT			0.051***	0.015	0.061**	0.026
CONTR			0.474**	0.276	-1.280***	0.447
CERTIFYEARSNO			-0.024	0.058	-0.271	0.233
INTERCEPT	3.090***	1.097	2.141*	1.273	2.780*	1.532
ρ_{1D}			-0.336	1.159		
$ln\sigma_1$			0.534***	0.088		
ρ_{0D}					0.303	0.252
$ln\sigma_0$					0.493***	0.108
Log-Likelihood:		-552.494				
Wald test of indep. eqns.:		$\chi^2(2)$ = 18.50***				

Significance levels: *: 10% **: 5% ***: 1%

Table A.5.4. Estimation Results of Probit Model

Variable	Coefficient	Std. Err.
GENDER	-0.691*	0.367
AGE	0.033***	0.040
NATIVE	0.004	0.190
RISK	0.176**	0.083
HHSIZE	-0.030	0.033
EDUC	-0.116***	0.398
WEALTH	-0.418***	0.074
FSIZE	-0.026***	0.005
OWNLAND	0.679***	0.237
GOVERN	0.287***	0.075
EXPER	0.008	0.129
LEARN1	0.191	0.341
LEARN2	-1.230***	0.406
DIST	-0.245*	0.127
SOIL	0.038	0.036
ORGA	1.101***	0.193
INTERCEPT	0.366	0.647

Significance levels: *: 10% **: 5% ***: 1%

Table A.5.5: Results of T-tests Before and After Kernel Matching

		Mean					
Variable	**Sample**	**Treated**	**Control**	**%bias**	**%reduc. bias**	**t**	**p> |t|**
GENDER	Unmatched	0.88028	0.97297	-37.6		-2.74	0.007
	Matched	0.90244	0.93456	-12.1	65.6	-0.27	0.778
AGE	Unmatched	48.489	42.541	54.0		4.18	0
	Matched	47.043	46.317	11.2	79.3	0.81	0.424
NATIVE	Unmatched	0.73239	0.74775	-3.5		-0.27	0.784
	Matched	0.73729	0.77324	-8.2	134.2	-0.64	0.523
RISK	Unmatched	0.14748	-0.18867	34.5		2.69	0.008
	Matched	0.13624	0.14944	-1.3	90.3	-0.12	0.904
HHSIZE	Unmatched	5.4577	6.2342	-27.1		-2.16	0.031
	Matched	5.5366	5.6321	-3.5	85.2	-0.33	0.740
EDUC	Unmatched	9.470	10.195	-32.7		-3.19	0.002
	Matched	9.6524	9.5154	6.2	81.1	0.51	0.614
WEALTH	Unmatched	4.765	8.481	-109.5		10.875	0
	Matched	5.521	5.958	-12.9	88.2	-1.09	0.317
FSIZE	Unmatched	10.151	18.797	-59.1		-4.76	0
	Matched	10.347	14.424	-27.9	52.9	-2.57	0.011
OWNLAND	Unmatched	0.549	0.204	53.35		-7.628	0
	Matched	0.437	0.402	7.6	65.8	-0.91	0.361
GOVERN	Unmatched	2.1972	1.8919	27.6		2.17	0.031
	Matched	2.178	2.2313	-4.8	82.5	-0.34	0.732
EXPER	Unmatched	11.986	13.288	-18.4		-1.43	0.153
	Matched	11.738	11.774	-0.5	97.3	-0.04	0.964
LEARN1	Unmatched	0.83099	0.57658	59.8		4.64	0
	Matched	0.80508	0.78239	12.9	78.3	0.34	0.733
LEARN2	Unmatched	0.7042	0.31532	-65.0		-5.31	0
	Matched	0.8475	0.14237	-15.3	76.5	-1.39	0.164
DIST	Unmatched	0.72889	0.82065	-19.9		-1.11	0.27
	Matched	0.70296	0.76285	-9.9	50.2	-0.89	0.377
SOIL	Unmatched	2.9507	2.4054	25		1.98	0.049
	Matched	2.7881	2.8872	-4.5	81.8	-0.34	0.737
ORGA	Unmatched	0.34507	0.07207	71.1		5.43	0
	Matched	0.315	0.233	21.4	69.8	1.49	0.138

Table A.5.6: Mean bias, Pseudo R^2 and Likelihood Ratio Before and After Matching

Algorithm	Sample	Mean bias	Pseudo R^2	LR χ^2	p>χ^2
Kernel	Unmatched	27.671	0.309	161.41	0.000
	Matched	8.189	0.046	18.43	0.299
Radius (0.05)	Unmatched	27.671	0.309	161.41	0.000
	Matched	11.278	0.041	14.84	0.462
Nearest-neighbor	Unmatched	27.671	0.309	161.41	0.000
	Matched	9.398	0.030	13.45	0.492

Table A.5.7: Results of Extended Models Before and After Matching

Specification	ATT	t-Stat.	Mean bias	Pseudo R^2	LR χ^2	p>χ^2
Baseline kernel matching						
Unmatched			27.662	0.332	173.54	0.000
Matched	0.954	2.90**	8.190	0.045	20.34	0.159
+ $FSIZE^2$						
Unmatched			27.830	0.334	174.71	0.000
Matched	0.963	3.07**	8.213	0.048	21.87	0.190
+ $FSIZE^2$ & $EDUC^2$						
Unmatched			28.115	0.361	173.25	0.000
Matched	0.916	2.82**	8.253	0.056	22.51	0.210
+ $FSIZE^2$ & $EDUC^2$ & $HHSIZE^2$						
Unmatched			27.807	0.358	164.21	0.000
Matched	0.951	2.19	8.386	0.066	23.68	0.209

Significance levels: *: 10% **: 5% ***: 1%

Table A.5.8: Results - ATT (reduced equipment costs)

Method	Predicted ROI of adopt. (mean)	Predicted ROI of non-adopt. (mean)	ATT	t-Statistic
ESR				
Organic farmers	2.825	2.205	0.803	5.361***
Conventional farmers	2.784	1.722		
	ROI of treated (mean)	**ROI of control group (mean)**	**ATT**	**t-Statistic**
PSM				
Kernel	2.892	2.283	0.609	1.86*
Radius (0.05)	2.892	2.250	0.642	1.44
Nearest-neighbor	2.892	2.016	0.782	1.76*

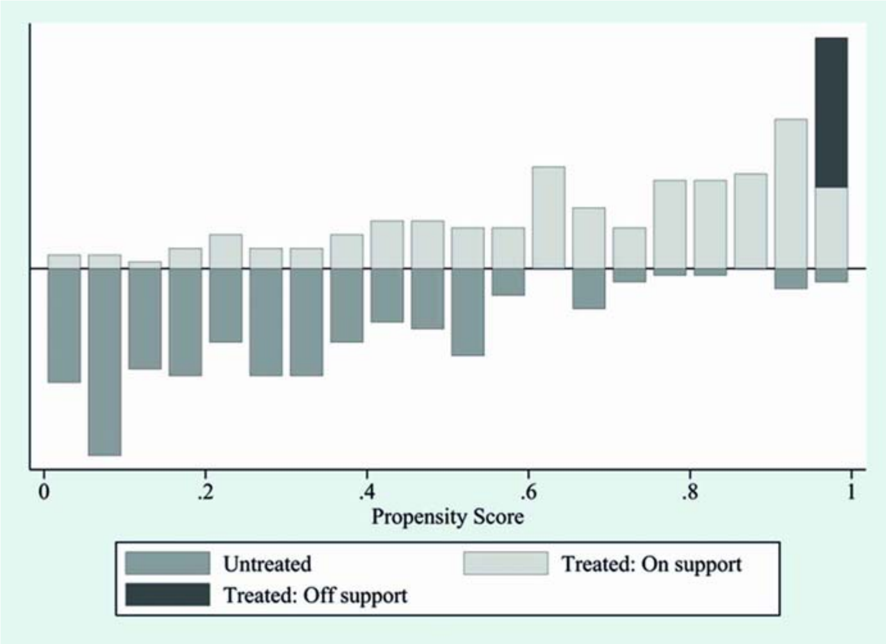
Significance levels: *: 10% **: 5% ***: 1%

Table A.5.9: Estimation Results of WLS Regression

Variable	Organic farmers Coefficient	Organic farmers Std. Err.	Convent. farmers Coefficient	Convent. farmers Std. Err.
GENDER	0.723	0.506	-0.154	0.464
AGE	-0.014	0.015	0.021	0.019
NATIVE	-0.618**	0.243	0.657*	0.407
RISK	-0.188	0.167	-0.165	0.221
HHSIZE	-0.06	0.065	0.010	0.061
EDUC	-0.055	0.067	-0.161	0.102
FSIZE	-0.035***	0.011	0.005	0.011
OWNLAND	0.178	0.365	0.259	0.497
GOVERN	0.208	0.163	-0.194	0.179
EXPER	0.018	0.024	-0.027	0.024
LEARN1	-0.410	0.468	-0.261	0.488
LEARN2	-0.501	0.890	-0.717**	0.405
DISTANCE	0.124	0.290	0.623**	0.307
SOIL	-0.093	0.076	0.043	0.104
ORGA	-0.193	0.424	-1.099*	0.568
WEALTH	-0.142	0.096	0.107**	0.045
BANK	-0.826**	0.347	0.827**	0.351
CREDIT	0.120	0.382	-0.418	0.477
VARIETYMD2	-2.108***	0.520	0.321	0.410
HIRED	0.389	0.581	-1.779***	0.495
INSPECT	0.061***	0.014	0.040	0.031
CONTR	0.420	0.362	-0.720**	0.364
CERTIFYEARSNO	-0.031	0.059	-0.219	0.256
INTERCEPT	2.502	2.265	2.555*	1.438
N	176		173	
R^2	0.412		0.249	

Significance levels: *: 10% **: 5% ***: 1%

Figure A.5.1: Distribution of Propensity Scores and Common Support for Propensity Score Estimation



Source: STATA output of own calculation

Note: "Treated: on support" indicates that organic certified farmers have a suitable comparison.
"Treated: off support" indicates that organic certified farmers do not have a suitable comparison.

Notes

[1] In addition, since certification often comes with a contract with an exporter, the literature on impacts of contract farming is similar in terms of empirical strategy and in some cases overlaps. The link between contract farming and certification is that a contractual relationship can facilitate value addition through certification. In some cases certification is a prerequisite for contracts. The literature on contract farming that is not specifically related to certification under a private voluntary standard (e.g. Bellemare, 2012) is skipped here.

[2] This switch was difficult for many farmers, in particular small-scale farmers, due to the necessary investment in expensive planting material and initial lack of information on production particularities and timing of inputs for MD2. Initially mainly large companies shifted to MD2 production (FAO, 2009). There were efforts made by the Ghanaian government and other donors to support the small-scale pineapple producers with the new variety, for instance through the distribution of MD2 suckers. During the same time Costa Rica, where the MD2 originated, increased its pineapple market share in Europe from 43.1% to 65% (UNCTAD, 2008). It is nowadays at over 70%.

[3] Source: http://www.organic-world.net/statistics-data-tables-dynamic.html.

[4] Out of the 386 farmers, one farmer had to be deleted because of answers that did not seem to be realistic and the ROI and other variables resulted in extreme outliers.

[5] We speak of "smallholders" or "small-scale farmers" even though we do not adhere to the definition of a smallholder, which is less than two hectares. However, apart from over-reporting of land sizes, all farmers in the sample are sufficiently small to fall strictly under group certification schemes. This is the relevant measure for us.

[6] Since our focus is not on the soil, we did not ask more detailed questions about the different soil types and their advantages and disadvantages for pineapple production.

[7] Amortization is only generated for positive profits, which is the case for 271 farmers (organic: 154, conventional: 117). This falsifies the result but is the only reasonable calculation.

[8] As mentioned by Hottel and Gardner (1983) and others it is difficult to measure the adequate wage rate in agriculture and the exact amount of labor used for production which are needed to calculate the ROI (and all other measures in use, such as farm income). We will explain further below how we dealt with this problem. In addition, if organic production does not only affect the farmer's profit, but also his welfare in other ways (e.g. health) our measure will be incomplete. There are two reasons why this does not bother us. First, since the farmers under study are poor there should be at least a small monetary gain associated with the adoption of a new agricultural technology when a partial aim is to lift farmers out of poverty. Second, non-financial welfare gains are hard to measure, let alone to monetize. Therefore incorporating them into the return on investment might not improve our measure compared to reporting them separately.

[9] It is of interest to not reduce the sample further as already done by missing ROI components. Therefore the few single missing values where imputed using several methods. None of them changed the values presented. Missing household head ages were replaced with the age of the wife plus six years, if available, or the age of the oldest child plus 23 years. 23 and six are found to be the average differences of the households age and his wife/children. The education variable (EDUC) has one missing value which could not be replaced reasonably. The same applies for one farmer that misses information on AGE.

[10] Goldstein and Udry (2008) concluded from a study in Akwapim, Ghana, that individuals who have a more powerful position in the local hierarchy have more secure tenure rights and are thus more willing to invest in soil fertility.

[11] Literacy has been mentioned as an important entry barrier for certifications that require the keeping of farm records. When the certification process is organized by the farming group, and the latter takes care of the record keeping as well, education of a single farmer may not as important.

[12] To assure that farming equipment bought by the farmers during the evaluation period are not influencing the result of the ATT robustness checks were made. Therefore, the same estimations were done excluding the equipment costs of knifes, motor-driven vehicles, safety equipment for farm and storage facilities. The results can be found in Table A.5.8.

[13] Calipers were actually varied, but only one result is presented here. The 1-nearest-neighbor matching generates the same ATT like caliper matching with a caliper being greater than 0.032 and is therefore assumed to be sufficiently precise. Radius matching with varying calipers of 0.05 and 0.1 also generates likewise results that do not differ significantly from the other results. Furthermore, as Abadie et al. (2004) suggest, we also apply the STATA command nnmatch to estimate the ATT with analytical estimators of the asymptotic variance for the nearest-neighbor algorithm to avoid bootstrapping of standard errors. The value of the ATT stays very similar.

Chapter 6

Organic Certification, Agro-Ecological Practices and Return on Investment:

Farm Level Evidence from Ghana

Linda Kleemann and Awudu Abdulai

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Contact: Kiel Institute for the World Economy, Hindenburgufer 66, 24105 Kiel, Email: linda.kleemann@ifw-kiel.de. We would like to thank the Poverty Reduction, Equity and Growth Network (PEGNet) and the H.Wilhelm Schaumann Stiftung for financial support. In addition, the author thanks Christian Kuhlgatz for his help with an improved GPSM code in STATA.

Organic Certification, Agro-Ecological Practices and Return on Investment:

Farm Level Evidence from Ghana

Abstract

The recent empirical literature on economic sustainability of certified export crops shows that certification standards that enhance yields are important for improving farm revenues and farmer welfare. However, limited evidence exists on the impact of organic certification on the adoption of agro-ecological practices. In this study, we use unique farm-level data from Ghana to examine the impact of organic certification on the use of agro-ecological practices to improve environmental conditions, as well as how using these measures affect farm outcomes such as return on investment. In the former, we utilize an endogenous switching regression approach to account for selection bias due to unobservable factors. Our empirical results reveal that organic certification increases agro-ecological practice use, although from a very low starting point. Using a generalized propensity score approach, we show that there is a nonlinear relationship between the intensity of agro-ecological practice use and return on investment.

Keywords: organic agriculture, certification, agro-ecological practices, return on investment, impact assessment

JEL codes: O13, Q13, Q17, Q56

1 Introduction

Concerns over climate change and increasing pressure on land have resulted in increased promotion of sustainable production methods that increase yields, while protecting the environment as well as increasing the resilience of crops to climatic change (Kassam et al., 2012; Branca et al., 2011; FAO, 2011; Knowler and Bradshaw, 2007; Erenstein, 2002). Such agro-ecological practices form part of organic agriculture principles, but in practice low-input production with no or very little sustainable soil and water management is frequently certified as organic in many developing countries.

To encourage the adoption of sustainable production methods, national governments, NGOs and international donors have promoted the marketing of export crops through certified marketing channels, mostly through farmer-based groups, as an attractive business model for smallholders in developing countries (Beuchelt and Zeller, 2011). These sustainable certification schemes have become increasingly popular in many countries because they combine valued traits that are related to the environment, poverty alleviation, and health outcomes into a single commodity (Barham and Weber, 2012). Consumers generally show their preferences for such products by paying higher prices to support an environmentally healthy world. On the other hand, the success of these schemes depends to a large extent on prices received and incomes earned by the farmers.

The significance of these schemes in promoting sustainable farm practices and improving the incomes of smallholders in developing countries has attracted the attention of many policy analysts over the last few years. In particular, several studies have examined the impacts of certification schemes on farm outcomes such as farm revenues, profits, and household poverty (Pretty et al., 2003; Ninan and Sathyapalan, 2005; Bolwig et al., 2009; Valkila, 2009; Beuchelt and Zeller, 2011; Barham and Weber, 2012). Most researchers find modest positive impacts of organic certification on farm revenues and household income, using various measures and econometric approaches. Most studies attribute the positive impacts of certification to price premiums that are paid at least for part of the crop sales (e.g. Valkila, 2009; Bolwig et al., 2009; ITC, 2011), although it is usually not clear whether the effect comes from certification, contract or export market access. It is important to note that some researchers have been rather skeptical on the ability of certification to lift farmers out of poverty, given the usually low revenue increases. The main reasons for this skepticism are the high certification and investment costs involved in the process (Calo and Wise, 2005; Valkila, 2009; Beuchelt and Zeller, 2011).

Despite this increasing number of impact assessment studies, very few studies have considered the environmental outcomes of different certification programs (Barham and Weber, 2012). Philpott et al.'s (2007) study on Mexico examines environmental outcomes by analyzing the impact of certification on vegetation and ant and bird diversity in coffee farms and forests. Rather surprisingly, their findings show no differences between in vegetation characteristics, ant or bird species richness, or fraction of forest fauna in farms based on certification. Pretty et al. (2006) conduct a review of 286 interventions to show that the use of sustainable agricultural practices increases productivity on developing country farms, albeit using best practices. Bolwig et al. (2009) studied the effect of organic contract farming and adoption of organic practices on 112 coffee producing smallholders and conclude there are somewhat higher revenues for farmers that adopt organic farming techniques, findings confirmed by Blackman and Naranjo (2010) who find that organic certified farmers in Costa Rica use less chemicals and adopt some environmental friendly management practices. However, they base their analysis on only 35 certified coffee farmers in Costa Rica.

With the notable exception of the study by Pretty et al. (2006), which includes countries from sub-Saharan Africa, we find no empirical evidence on the impacts of certification on environmental outcomes in sub-Saharan Africa. In particular, the dependence of the yield impact of organic certification on the intensity of agro-ecological practice use has hardly been studied in the existing literature. Some authors have argued that organic farming in Africa mostly implies the non-application no chemical inputs, without necessarily adopting alternative soil fertility management practices. This is particularly so for the many smallholders in Africa, who traditionally produce ”organically by default”, since they virtually use no external input. The smallholders who use no chemical inputs or very low levels of external inputs normally face lower entry barriers into organic certification programs, since they require small adjustments to meet certification requirements. Organic certification only requires abstaining from the use of chemical substances, but not the active use of alternative inputs.

However, Barham and Weber (2012) suggest that improving productivity by means of agronomic practices may be more important than focusing on price increases by means of certification. On the other hand access to higher-priced organic markets may provide incentives to adopt (more) agro-ecological practices as suggested by (Wollni et al., 2010).

This study contributes to the literature by examining the effect of organic certification on the extent to which agro-ecological practices are used, as well as the impact of the intensity of use on the return on investment (ROI). We employ data from a recent farm-level survey of 386 small-scale pineapple farmers in the Greater-Accra and Central Regions of Ghana. The study accounts for selection bias due to unobservable factors by using the framework of endogenous switching regression approach (Lee, 1978). The approach allows us to analyze the determinants and effects of the adoption decision of organic farming on the use of agro-ecological practices separately for adopters and non-adopters among the sample of 386 pineapple farmers. In investigating the impact of agro-ecological practice on ROI, we use the generalized propensity score approach developed by Hirano and Imbens (2004) to control for selection bias.

As in many other developing countries, agricultural production in Ghana contributes to environmental damage such as underground water depletion, soil erosion, water and soil pollution, loss of biodiversity, deforestation, and global climate change. In particular, crops that are produced for export are usually intensively treated with pesticides to assure the required quality and uniformity. This is also the case for pineapple, the third most important agricultural export product of the country after cocoa and palm oil. On the environmental side, climate change is expected to have negative effects on agricultural production, while population pressure will contribute to increased soil degradation and consequently lower crop yields (Diao and Sarpong, 2007). The Ghanaian government has attempted to address these problems through environmental protection (Government of Ghana, 2010) and has established an organic agriculture desk in the Ministry of Food and Agriculture (MOFA). Our findings show that organic certification increases agro-ecological practice use, suggesting that certification already serves as a catalyst for the use of agro-ecological practices. We also find that the use of agro-ecological practices generally has a positive and nonlinear effect on the return on investment.

The remainder of the study is structured as follows: The next section gives an overview of the pineapple sector in Ghana and the data used in the analysis. It is followed by the presentation of the corresponding descriptive statistics. Subsequently, section 3 derives the theoretical framework and the empirical strategy. The empirical results are presented in section 4. The final section provides concluding remarks and implications.

2 Background and Data

2.1 Background

The agricultural sector in Ghana accounts for about 30% of gross domestic product (GDP) and employs over 50% of the Ghanaian working population (WDI, 2011). Since certifying organic implies a focus on the export market we will briefly summarize this sector[1]. In recent years non-traditional exports of horticultural products experienced a large growth. Exports of fresh fruits and vegetables, especially to Europe, are now the most important growth sector in Ghana's agriculture. Pineapples were the first non-traditional export crop which Ghana started to cultivate in small quantities for ex- port in the 1980ies. Ghanaian pineapple farmers produce the varieties MD2, Smooth Cayenne, Sugar Loaf and Queen Victoria, where Sugar Loaf is mainly produced for the local market or for processing and Queen Victoria plays a minor role as a high-priced specialty product. The amount of pineapple exports increased rapidly until 2004. Exports then experienced a dip due to a change in varieties demanded on world markets to which the Ghanaian pineapple sector reacted slowly. Subsequently, many farms switched to other crops or went bankrupt. Survival strategies for pineapple were switching to the new world market variety (MD2), switching to production for processing and subsequent export or/and to organic production, because this smaller market did not change as extremely and rapidly.

It is estimated that 75.000 tons of pineapples were produced in Ghana in 2009, of which 18.000 tons were exported according to FAO (FAOSTAT, 2011). However these numbers should be taken as approximations. The Ghanaian export promotion council (GEPC) and the Sea Freight Pineapple Exporters Association of Ghana (SPEG) claimed that the amount of exported pineapples is much higher, namely 31.000 tons (GEPC, 2010). Worldwide organic food markets expanded by 10-15% in the last ten years and are expected to continue to grow strongly, whereas conventional markets only grew by 2-4% (Willer et al., 2008).

Actors in the Ghanaian Pineapple Sector

Pineapple farming in Ghana is mostly located in a radius of 100 km north-west of the capital Accra in the regions of Greater Accra, and the Central and Eastern Region. The pineapple industry is driven by two dominant groups of producers. On the one hand there are a few large or medium-sized producers, and on the other hand there are a large number of small-scale farmers, who sell their fruits on the local market or as outgrowers to an exporter or large farm for export. Among these smallholders, there are two clusters, traditional low-input "organic-by-default" producers and a group that we call "modern imitators", i.e. farmers that strive to imitate large-scale high-input production.

Smallholders prefer selling their fruits on the export market because of higher prices, but due to high quality requirements, fruits for export are also more expensive to produce (Suzuki et al., 2011). Pineapple export in Ghana is predominantly organized by export companies which mostly also have own farm production. The relationship between exporter and smallholder is usually oral or written contract based and ex- porters may provide farm inputs like pesticides and herbicides, extension services or credit. Furthermore, smallholders might be encouraged by exporters to form groups or cooperatives in order to ensure a high quality and stable supply of pineapples and facilitate certifications. In our case, some groups were formed in this process; some existed before being in contact with an exporter.

Organic Production

Certified organic products achieve price premia and access to new markets. According to Kleemann (2011a and 2011b) organic certified pineapples from Africa indeed receive a (non-declining) positive price premium on the European market, which is passed on to the producers.

About 0.19% of the agricultural land in Ghana is organic certified, with a presumably higher part in pineapples[2]. Organic certification in our case refers to the European standards according to EU regulation (EC) 834/2007 and (EC) 889/2008. It entails, amongst others, to largely refrain from using synthetic inputs and to use only certain inputs for flower induction. These requirements lead to a higher labor intensity of organic farming by way of more manual weeding, pest control and possibly own production of fertilizers. The resulting use of on-farm/local inputs in organic farming can be an advantage when markets are missing or do not function well. However, a major disadvantage of organic farming is potentially a lower yield, in particular when synthetic inputs are not replaced by organic inputs and when knowledge about soil nutrient and plant pest and disease management is not sufficient. In addition, since organic production involves a long-term investment in soil fertility and sustainability time lags between investment and profit may prove an entry barrier for small resource- constrained farmers in insecure environments. In Ghana, amongst others GIZ, Agro Eco/Louis Bolk, West African Fair Fruit (WAFF), and the Ministry of Food and Agriculture (MOFA) promote organic farming in Ghana.

2.2 Data

Our dataset comes from a farm household survey that was conducted from January to March 2010 in six different districts[3] of the Central, Eastern and Greater Accra regions in southern Ghana, where pineapple cultivation is mostly located. Stratified random sampling in three stages was used. First, districts with significant amounts of smallholder pineapple production for export were selected, using information from development agencies and SPEG. Next, lists of all pineapple farmer groups in the selected districts that are certified (organic or

GlobalGAP if conventional) and producing for the export market certified were obtained. Finally, in each group a percentage of farmers proportional to the total number of farmers in the group were selected randomly from the lists. The farmer answered a detailed questionnaire on the household's management of the pineapple farm, inputs into pineapple production, harvesting and marketing, the certification process, and relations with exporters. Besides, information on household characteristics, social capital and land disposition were requested, as well as data concerning non-income wealth indicators and perceptions of different statements about environmental values, organic farming techniques and the use of fertilizers and pesticides.

The dataset includes 386 households from 75 villages and 9 (organic) and 14 (conventional) different farmer associations. In total, 185 organic farmers and 201 conventional farmers were interviewed. All organic farmers sold part of their produce as organic certified to exporters or processors and part of it on the local market without reference to the certification. Respectively all conventional farmers sold their produce preferably to exporters or exporting processors, but also on the local market. In theory, there could be one-directional overlaps. This means that organic certified farmers could sell as organic certified (which has the highest price) as first preference, as conventional export produce as second preference and on the local market as last option. However, this is not the case in our sample. The opposite, i.e. conventional farmers trying to sell on the organic export market, is not possible.

Descriptive Statistics of Sociodemographic Variables

The typical household in our sample has a similar income compared to the average in Ghana (country average 88.83 GHS per month, survey average: highest density in income groups 51-150 GHS per month), and a higher income share from agriculture (47.8% versus 67%; data from Ghana Living Standards Survey 5). All sociodemographic variables that are included in the estimations are presented in Table 6.1.

Organic farm household heads are older and less educated than in conventional farm households. They have smaller farms, but are more specialized in pineapple farming. On average 39% of the whole organic farm including the homestead and 16% of the conventional farm are occupied with pineapple[4]. They also seem to have fewer assets. However, the average organic HH head received credit more often during the last five years and stated a higher willingness to take risks in order to achieve successes and a greater openness to innovation.

Even though organic farming is supposedly more management intensive, organic farmers did not receive more training for improving farming techniques. The most likely reason is the lack of opportunities resulting from niche position of organic agriculture. Even with more labor needed for production, organic farmers more often recruit their workers from the family than hiring farm workers, which is reflected in the lower proportion of the production cost they spend on hired labor. Concerning location specific variables organic farmers own a larger share of their land and grow pineapple on different soil types compared to conventional farmers. This confirms studies from developed countries[5]. There is also a difference concerning the variety of pineapples planted: Organic farmers prefer Sugar Loaf, whereas conventional farmers favor Smooth Cayenne or MD2. To our knowledge this difference is caused by the buyers' preferences.

Of relevance to the adoption mechanism is the fact that organic farmers seem to have a stronger link to the local government and visit the capital more frequently. They are also more likely to have learned pineapple farming from friends or family members compared to in training courses or as laborers on large farms. Moreover, their certification process is more often organized by the farmer organization, compared to conventional farmers. Note that this variable indicates who the farmers perceived as the ones organizing this process, which is not necessarily the same that financially supported it, different from the similar variable in Kersting and Wollni (2012). The majority of farmers of both groups have been certified within the last two years and about 40 % have a written contract with an exporter, all others have an oral contract. The number of years that the farmers have been certified is slightly longer for organic farmers.

Descriptive Statistics of Economic Variables

Differences in economic characteristics of the farmers are presented in Table 6.2. Columns (2) and (3) of Table 6.2 show the average costs for each category per kilogram of pineapples. Kilogram is taken as a base factor instead of pieces to control for the fact that organic fruits are on average smaller than conventional fruits, they are on average 0.18 kg lighter than conventional fruit.

As expected, there are large differences in labor, equipment and input costs per Kg between organic and conventional pineapple production, and costs for land are similar for both groups. While organic farmers spent much more on labor - hired workers as well as household labor - conventional pineapple producers use more inputs and equipment[6]. We also observed that organic farmers do not use any chemicals, utilize very little organic fertilizers, spent a lot of time with manual removal of weeds and more often produce their own planting and mulching material, or exchange it with other farmers (not presented in the Table). Expenses for inputs like inorganic fertilizers, herbicides, fungicides and pesticides, as well as suckers (seedlings), are hence much higher for conventional farmers. In addition, they use chemicals to induce flowering more frequently (90% of conventional but only 30% of organic farmers) and spend more on plastic foil and safety equipment for their farm.

Certification costs are higher for conventional farmers, but in total they are small, because this Table shows only the part that the farmers themselves cover. A large part is often paid for by the exporter or a donor or NGO. As shown by Kersting and Wollni (2012), this fraction can be quite high, in their case around 95 per cent for both recurrent and initial costs.

Overall, these cost differences form the individual investment that each farmer makes in his production structure. For instance, for organic certification as such the farmer has to invest in certification, and potential changes in production.

Note that the production cycle on organic farms is on average longer than the production cycle on conventional farms, namely 18.72 month instead of 15.46 month. The different lengths of the production cycles do not impair the informative value of the ROI.

However, it obviously affects other key figures such as yearly income from pineapple farming. The average ROI of certified organic farming is higher than that of conventional farming, due to higher prices and lower production costs.

It is evident from Table 6.2 that conventional farmers sold 1.5 times as many pineapples as organic farmers. This is mainly because of the larger areas under conventional farming, as well as the higher yields obtained from this farming method.

As expected, export prices were in general higher than local prices for both groups. But organic pineapple achieved a price premium on both local and export markets, even though they were not marketed as certified locally. This points towards different marketing strategies by organic farmers, which seem to better match local preferences, a presumption for which we however do not have further information for verification. One hint is that the Sugar Loaf variety yielded the highest prices on the local (and export) market and was produced more frequently by organic than by conventional farmers.

Descriptive Statistics of Intensity of Agro-ecological Practice Use

To examine the impact of organic agricultural practices on the ROI we employ the framework proposed by Rigby et al (2001) to construct a variable that consists of the different organic cropping practices most relevant for pineapple production. The framework is based on a scoring system that ranges from 0 (technique not used) to 5 (highest frequency or intensity this technique was used also taking into account the type of material used). The practices considered include organic fertilizer, non-chemical weeding, mulching, manure, trash lines, infiltration ditches and crop rotation. The information on relevant practices was given by an agronomist and included in the questionnaire. Weeding seems to be out of range at first sight; however it is very important in pineapple production. Since pineapple grow relatively small, apart from using herbicides or not, the weeding technique is relevant for soil water management and erosion control. Variables for organic pesticide use, cover crops, and leguminous residues use are zero when not used, and one when used[7]. All the variables were weighted according to the average importance of each practice for sustainability given by 13 Ghanaian agronomists. The variable used in the analysis (AGRECPRAC) was then constructed by adding up.

Table 6.3 shows the descriptive statistics for each method. Robustness checks were made by a) repeating the analysis without any weights and b) using an alternative weighting scheme which consisted in giving similar practice groups (fertilizers and fertilizing material, soil cover, and weeding and pesticides) the same overall weights, and c) by excluding weeding, since we cannot distinguish between weeding by hand (which is not strictly a sustainable practice) and weed prevention using e.g. beneficial organisms. For a), b) and c) all regressions were replicated.

Figure 6.1 presents kernel density estimates of the intensity of agro-ecological practices by the two categories of farmers. The estimates reveal that although conventional farmers also use sustainable farming methods, their intensity of use is generally less than that of their counterparts practicing organic farming. Moreover, it is clear from the results that there are hardly any organic farmers that do not employ these farming practices, whereas some conventional farmers never employed agro-ecological practices.

3 Conceptual Framework

The conceptual framework employed here is based on the assumption that farmers choose between adopting organic farming and practicing conventional farming. For analytical purposes, we assume here that farmers are risk neutral, and take into account the potential benefit derived from adopting organic farming or non-adoption in the decision making process. Farmers are therefore assumed to choose the technology that provides maximum benefits. Under the assumptions, let us represent the net benefits farmer *i* derives from adopting the technology as D_{iA} and the net benefits from non-adoption represented as D_{iN}. These two regimes can be can be specified as

$$D_{iA} = Z_i\beta_A + u_{iA} \qquad (6.1)$$

$$D_{iN} = Z_i\beta_N + u_{iN} \qquad (6.2)$$

where Z_i is a vector of variable factor prices, fixed factors, as well as farm and household characteristics; β_A and β_N are vectors of parameters; u_{iA} and u_{iN} are iids. The farmer will normally choose the organic technology if the net benefits obtained by doing so are higher than that obtained by not choosing the technology, that is $D_{iA} > D_{iN}$.

The individual preferences of the farmers are normally unknown to the analysts, but the characteristics of the farmer and the attributes of the technology under consideration are observed during the survey period. Given the available information, net benefits can be represented by a latent variable D_i^*, which is not observed, but can be expressed as a function of the observed characteristics and attributes, denoted as Z, in a latent variable model as follows:

$$D_i^* = \beta Z_i + \mu_i, \quad D_i = 1[D_i^* > 0] \tag{6.3}$$

where D_i is a binary indicator variable that equals 1 for household *i*, in case of adoption of the technology and 0 otherwise, β is a vector of parameters to be estimated, Z_i is a vector of household and plot-level characteristics as defined earlier, and μ_i is an error term assumed to be normally distributed. The probability of adoption can then be expressed as

$$\Pr(D_i = 1) = \Pr(D_i^* > 0) = \Pr(\mu_i > -\beta Z_i) = 1 - F(-\beta Z_i) \tag{6.4}$$

where *F* is the cumulative distribution function for μ_i.

Impact of organic farming on agro-ecological practices

As indicated earlier, the intensity of use of agro-ecological practices vary between organic farm practices and conventional farm practices. To capture the effects of the different farm practices on the use of agro-ecological farm methods, we employ a specification from the impact assessment literature on outcomes to participation choice. Specifically, we hypothesize that adoption or non-adoption of organic technology, positively influences the use of agro-ecological farm practices. This may be expressed as

$$Y_i = X_i\beta + \delta D_i + \varepsilon_i \tag{6.5}$$

where Y_i represents the intensity of agro-ecological practices and D_i is the adoption dummy; X_i is a vector of farm-level and household-level characteristics, such as age and education of farmer, access to credit, social network variables, farm size, and soil quality variables. The coefficient δ in the specification captures the impact of adoption on the use of agro-ecological practices. The issue of self-selection is crucial here because the decision of households to adopt or not to adopt organic farming may be associated with the net benefits of adoption. Selection bias arises if unobservable factors influence both the error term of the technology choice, μ_i, in equation (6.13) and the error term of the outcome specification (ε_i), in equation (6.5), resulting in correlation of both error terms. When the correlation between the two error terms is greater than zero, OLS regression techniques tend to yield biased estimates. To address these issues, we employ an endogenous switching regression model (ESR) to jointly examine the determinants of adoption and the impact of adoption on the intensity of agro-ecological practice use[8].

The parametric approach of the endogenous switching regression (ESR) model goes back to Lee (1978) and Maddala (1983), and accounts for self-selection and systematic differences across groups. Outcome equations are specified differently for each regime, conditional on the adoption decision, which is estimated by a probit model. Thus, if we define Y_{iA} and Y_{iN} as the intensity of agro-ecological practices for organic and non-organic farmers, we can specify the outcome equations as:

$$Y_{iA} = X_i'\beta_A + \xi_{iA} \quad \text{if} \quad D_i = 1 \tag{6.6}$$

$$Y_{iN} = X_i'\beta_N + \xi_{iN} \quad \text{if} \quad D_i = 0 \tag{6.7}$$

Although self-selection based on observables is taken into account in the above specification, unobservable factors could still create a correlation between $\mu_i$and ξ_{iA}, ξ_{iN}. The endogenous switching regression model treats the sample selectivity problem as a missing value problem, which can be estimated and plugged into the equations (6.6) and (6.7). Thus, after estimating a probit model in the first stage, the Mills ratios λ_N and λ_A and the covariances $\sigma_{\mu A} = Cov(\mu\xi_A)$ and $\sigma_{\mu N} = Cov(\mu\xi_N)$ and can be computed and employed in the following second stage specification:

$$Y_{iA} = X_i'\beta_A + \sigma_A\lambda_{iA} + u_{iA} \quad \text{if} \quad D_i = 1 \tag{6.8}$$

$$Y_{iN} = X_i'\beta_N + \sigma_N\lambda_{iN} + u_{iN} \quad \text{if} \quad D_i = 0 \tag{6.9}$$

In these equations the error terms u_{iA} and u_{iN} have conditional zero means. Following Lokshin and Sajaia (2004) we use the full information maximum likelihood method (FIML) to estimate this model, i.e. the selection equation and the outcome equations are estimated simultaneously.

When the correlation coefficients of μ and ξ_A ($\rho_{iA} = \sigma_{\mu A}/\sigma_\mu\sigma_A$) and of μ and ξ_N ($\rho_{iN} = \sigma_{\mu N}/\sigma_\mu\sigma_N$) are significant, the model has an endogenous switch, i.e. selection on unobservables is substantial. The coefficients obtained from the endogenous switching regression model can be employed to derive the average treatment effect (ATT) τ_{ATT}^{ESR} as:

$$\tau_{ATT}^{ESR} = E(Y_{iA}|D=1) - E(Y_{iN}|D=1) = X'(\beta_{iA} - \beta_{iN}) + (\sigma_{\mu A} - \sigma_{\mu N})\lambda_1 \tag{6.10}$$

4. Empirical Results

4.1. Empirical Results for Adoption

The full information maximum likelihood estimates of the determinants of adoption of organic farming, as well as the impact of adoption on the intensity of use of agro-ecological practices are presented in Table 6.4. As mentioned earlier, identification of the model requires that there is at least one variable in the selection equation that does not appear in the outcome equation. The variable representing relation to the local government is used as identifying instrument, and as such dropped from the outcome equations. Quite interesting is the insignificance of the correlation coefficients presented in the Table. This finding indicates the absence of any endogenous switch, suggesting that there is no substantial selection on unobservables.

The selection equation, which can be interpreted as probit estimates of determinants of adoption generally indicate that farm-level and household characteristics do influence adoption decisions of farmers. The estimates of the impact of adoption on the intensity of use of agro-ecological practices show that the farm-level and household characteristics influence the behavior of adopters and non-adopters differently. In particular, education and wealth appear to have positive and significant effects on organic farmers using more agro-ecological practices, while no significant effect is observed for conventional farmers. Land ownership also appears to influence the intensity of use by organic farmers, but not by conventional farmers. Similarly, the number of years being certified positively and significantly influences the intensity of agro-ecological practices by organic farmers, but exerts a negative, *albeit* insignificant effect on conventional farmers.

The estimates for the average treatments effect (ATT), which shows the impact of organic certification on the use of agro-ecological practice was computed with equation (6.10). The results are presented in Table 6.5. Unlike the mean differences in the use of agro-ecological practices shown in Table 6.3, the ATT estimate accounts for selection bias arising from the fact that adopters and non-adopters may be systematically different. The estimated ATT is positive and highly significant, suggesting that organic certification does indeed act as a catalyst for the increased use of agro-ecological practices. Specifically, organic certification moves the farmer up 15-20% on the full range of possible intensities, or by about 80% taking the overall mean use as a reference point. It is interesting to note that when asked directly for changes in production methods after certification, 67% of organic and only 35% of conventional households claimed to have changed their use of agro-ecological practices. The robustness of the ESR is checked by estimating the same model, but using the three other specifications described in section 3.2. The estimates, which are reported in the Table 6.5, also confirm the positive and highly significant impact of organic certification on the intensity of agro-ecological practices.

Given the absence of any endogenous switch, we also employed propensity score matching (PSM) approach to compute the ATT and compare with those from the ESR. PSM is basically a technique that mimicks an experiment *ex post*. The results, which are presented in the lower part of Table 6.5, show that the ATT ranges between 4.07 and 4.23, depending on the matching algorithm used. Overall, the results confirm the positive and significant impact of organic certification on the intensity of agro-ecological practices. The matching quality test conducted with the Rosenbaum and Rubin (1985) test show that differences in the means of the covariates between the two groups vanish after matching. The sensitivity of the estimates to unobservables was also tested with the Rosenbaum (2002) bounds. Based on kernel matching, the critical value of Γ(Γ*) =1.35 indicates that the ATT would still be significant even if matched pairs differ in their odds of certification by the factor 1.35.

4.2. Impact of Intensity of Agro-ecological Practice Use on ROI

In this section, we examine the impact of agro-ecological practices on the return on investment (ROI), in order to ascertain whether using these practices tend to affect the economic viability of the farm. Given that the intensity of agro-ecological practices is a continuous variable, we employ the generalized propensity score (GPS) approach developed by Hirano and Imbens (2004). Thus, the analysis in this section considers the treatment variable as a continuous variable, and not a dichotomous decision variable as was assumed in the previous analyses.

In line with GPS approach, equation (6.5) can be re-specified as $Y_i = f(X_i T_i)$, where Y_i refers to the return on investment and T_i is the actual level agro-ecological practice of the farm. Of significance is the average dose response function (DRF), which relates to each possible treatment level t_i, the unbiased potential outcome $Y_i(t)$ of the farmer i:

$$\theta(t) = E[Y_i(t)] \; \forall \; t \; in \; T \qquad (6.11)$$

where θ represents the DRF. In line with Hirano and Imbens (2004), we presume that the assignment to the treatment is weakly unconfounded given the controls, i.e.

$$Y_i(t) \perp T_i \mid X_i \; \forall \; t \; in \; T \qquad (6.12)$$

Thus, the treatment assignment process is supposed to be conditionally independent of each potential outcome given the control variables, hence there is no systematic selection into specific levels of agro-ecological practice intensity caused by unobservable characteristics (Flores et al., 2009). Weak unconfoundedness means that this independence only has to hold for each level of treatment t but not jointly for all potential outcomes. The generalized propensity score (GPS) suggested by Hirano and Imbens (2004) is defined as the conditional probability of a particular treatment given the observed covariates. When

$r(T_i, X_i) = f_{T \perp X}(t \perp x)$ is the conditional density of potential treatment levels given specific covariates, then the GPS of a household *i* is given as $R_i = r(T_i, X_i)$. The GPS is a balancing score, i.e. within strata with the same value of $r\,(t, X)$ the probability that *T* = t does not depend on the covariates X_i. Given this balancing property and weak unconfoundedness, Hirano and Imbens (2004) show that using the GPS to remove the selection bias allows the estimation of the average DRF of equation (6.11).

In the first step the conditional expectation of the outcome as a function of treatment *T* and GPS *R* is estimated:

$$\beta(t, r) = E(Y | T_i = t, R_i = r) \tag{6.13}$$

Then, the DRF at each level of treatment can be estimated by averaging the conditional expectation over the GPS at that treatment level:

$$\theta(t) = E[\beta(t, r(t, X_i))] \tag{6.14}$$

In our application, the GPS is estimated using a normal distribution of the logarithmic treatment given covariates X_i. The validity of the assumed normal distribution is assessed using the Kolomogorov-Smirnov test for normality. We followed Hirano and Imbens (2004) and took the logarithm of the treatment variable, because the distribution of the agro-ecological practices was skewed. This procedure yielded low skewness (0.090) and kurtosis (1.698) values and a positive Kolmogorov-Smirnov test for normality at the 5% level of significance. The balancing property of the estimated GPS is tested by employing the method proposed by Hirano and Imbens (2004). The common support condition, i.e. that households in one group have to match with comparable households in other treatment groups, is imposed by employing the method suggested and Flores et al. (2009). After estimating the GPS, the DRF is estimated using a flexible polynomial function as in Bia and Mattei (2008). The average potential outcome at each treatment level is estimated using a quadratic approximation of the treatment variable and a linear one for the GPS. The specification is estimated using OLS regression for the ROI. Confidence bounds at 95% level are estimated using the bootstrapping procedure.

Results of Generalized Propensity Score Matching

The treatment variable is AGRECPRAC as indicated previously. The results of the maximum likelihood estimation of the GPS, which are presented in Table A.6.1 in the appendix, are not discussed here, since the estimates only serve to balance the observed distribution of covariates across the treated and untreated groups (Hirano and Imbens, 2004). It is however interesting to note that as in the regressions in the previous section, the organic certification dummy is again highly significant in the probit regression. Balancing tests indicate that the GPS has quite well balancing properties, i.e. the GPS eliminates bias in the estimates of the dose-response function[9]. Regarding the common support condition, 278 farmers were on support, which represents 87% of the initial 311 farmers for which we have sufficient data to calculate the ROI.

Figure 6.2 shows the dose response function of the impact of the use of agro-ecological practices on pineapple farming ROI[10]. There is a non-linear hook shaped relationship, whereby the effect on the ROI is positive, but in different ways at different levels. At very low levels of agro-ecological practice use the impact is high, but declines with more intensive use, before rising again. It is significant to note that in our analysis a low level of the index implies very little use of agro-ecological practices and even a high level is still low compared to developed country agriculture. At the lowest point the estimated ROI is just below the mean of the sample (2.265). While the impact of using agro-ecological practices is overall positive, relatively low and relatively high levels do much better than a medium level of agro- ecological practice intensity. This implies that the motivation to increase the use may be low when farmers are unaware of the shape of this impact curve or have a high discount rate into the future. A look at the kernel density estimates in Figure 6.1 shows that most farmers are exactly in this impact dip.

To understand the differential behavior of the farmers, we examine the composition of agro-ecological practices used at different intensities. Specifically, we divided the sample into several equally sized groups, according to the AGRECPRAC, below and above the low impact dip. As a tendency, at low levels of intensity the average farmer restricts the use very few practices and first starts to use them more intensively before adding different practices. Strikingly though it is not the potentially costly organic fertilizers and pesticides that are used significantly less in the low-use groups, but rather animal manure, mulch, and cover crops. Since the farmers stated that they know what each practice is, the problem cannot be information. We suppose that a decisive factor may be economies of scale in transport cost.[11]

Robustness Checks

The large confidence bands at the ends of the distribution in Figure 6.2 suggest that impacts are less clear among the non- and very intensive users. We therefore conduct a robustness check in which we exclude values of AGRECPRAC of over 13. The result obtained is shown in Figure A.6.1 in the appendix. It is slightly different at high values, with no flattening out, with the predicted impact higher at the right end. However, the shape the curve, which is of primary interest, remains the same. As a further robustness check, we use different specifications of the agro-ecological practice index. The results are presented in Figures A.6.2 (different weights described in section 3.2), A.6.3 (no weights), and A.6.4 (weeding excluded) in the appendix and are all sufficiently similar to the original version.

5 Concluding Remarks

Some concerns have been raised that organic certification and sustainable farming practices are insufficiently linked on farms in developing countries. Most farmers certified as organic producers have therefore been considered to be producing organic-by-default, with very little or no use of productivity-enhancing inputs and soil-improving measures, and often resulting in low yields and unsustainable production.

In this paper we examine the impact of organic certification on the intensity of agro-ecological practice use, as well as the return on investment of such practices, using recent farm-level data from the Greater Accra and Central regions in Ghana. Our empirical results show that organic certification increases agro-ecological practice use, suggesting that certification already serves as a catalyst for the use of agro-ecological practices.

The estimates of the economic impacts of agro-ecological practices generally reveal a positive and nonlinear relationship between the ROI and the intensity of agro-ecological practice use, indicating that more intensive use of agro-ecological practices is economically beneficial for farmers. This finding suggests that from an environmental policy perspective this link needs to be strengthened considerably, since the intensity of agro-ecological practice use is overall quite low. The low level of use is probably because of the nonlinear relationship, which suggests economic benefits at low levels and high levels. However, farmers need to surmount a low impact gap to attain high levels, including availability of organic material and high transport costs for organic material. Given that external inputs from cocoa production and juice factories are normally available for use, but at prohibitive transport costs for individual farmers, government agencies or certification agencies could organize intermediates to fill this gap by purchasing these organic materials from juice factories and cocoa producers and selling to farmers. Certification may therefore help ease the problem through high prices on the produce and the support by buyers. Moreover, certification systems could also require the active use of organic soil fertility management methods to increase their intensity of use.

Overall, such a strategy could provide an alternative sustainable development strategy for parts of the rural population. If successfully managed, organic certification for the dominantly small farmers in Africa may provide two types of economic benefits. It may reduce rural poverty by providing market access and higher profits through a combination of high prices and better or more resilient yields, and it may provide environmental benefits for the local economy in the long term.

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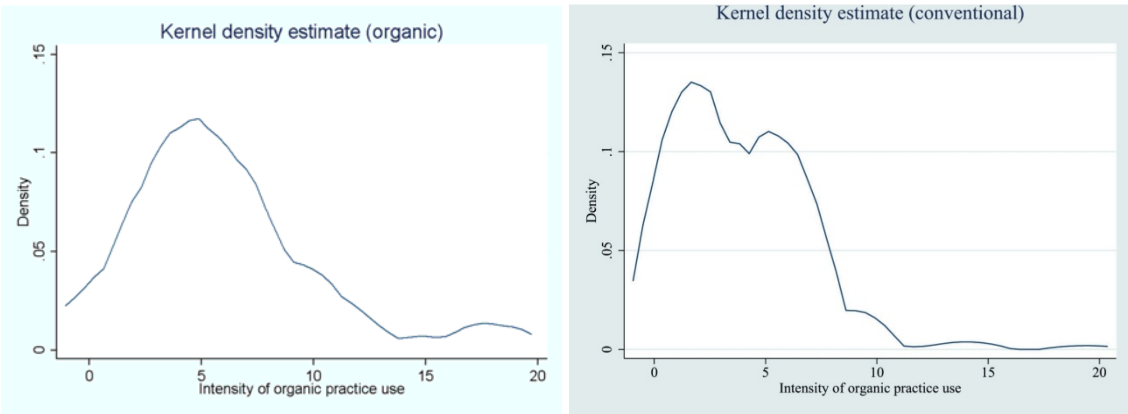
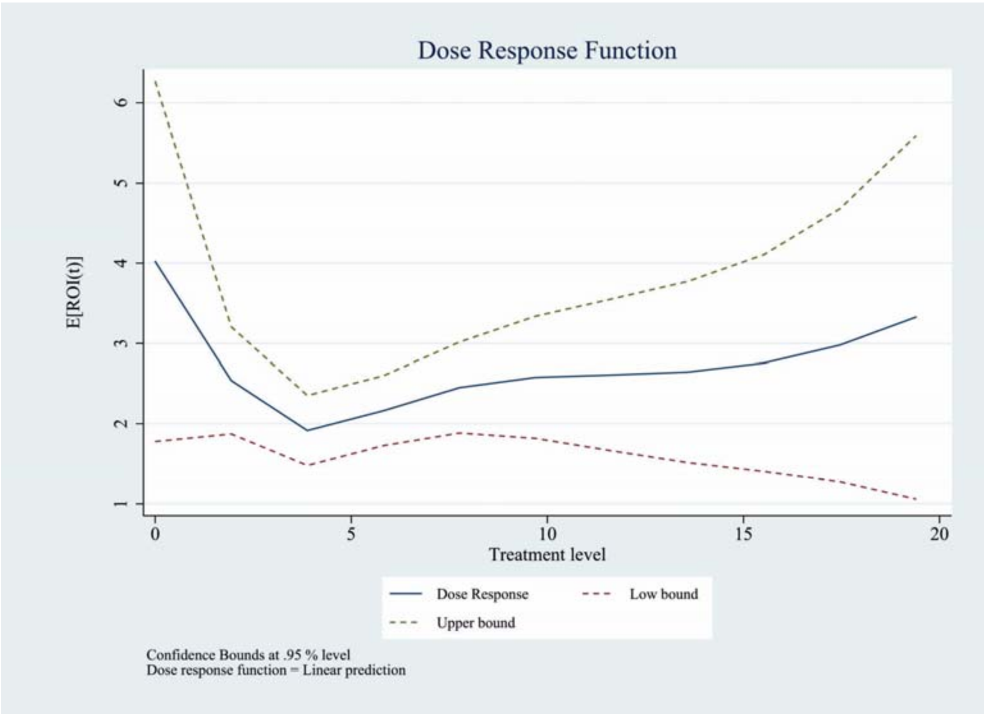
Figures and Tables

Figure 6.1: Intensity of Agro-ecological Practice Use and Certification



Source: own estimation.

Figure 6.2: Impact of Intensity of Agro-ecological Practice Use on ROI



Source: own estimation.

Table 6.1: Descriptive Statistics of Variables Included in the Estimations

Definition	Variable	Organic Farmers (N=185)	Convent. Farmers (N=201)	t-Stat.
Gender of household head (HHH) =female, 1=male	GENDER	0.891	0. 982	-3.51***
Age of HHH	AGE	46.313	42.970	2.82***
Household size (persons living in household)	HHSIZE	5.23	5.917	-2.35**
Fraction of adults in household (older than 15) (%)	ADULT	0.684	0.665	0.75
Being native in community 0=no, 1=yes	NATIVE	0.738	0.738	-0.01
Maximal educational level in household 1=none, 2=primary school, 3=junior secondary, 4=senior secondary, 5=technical/vocational training, 6=tertiary/university	EDUC	9.470	10.195	-3.19***
Farm size (acre)	FSIZE	10.35	18.720	-5.02***
Share of land owned	OWNLAND	0.549	0.204	7.628***
Pineapple land (acre)	PINLAND	4.014	3.066	2.07**
Access to credit during the last 5 years 0=no, 1=yes	CREDIT	0.317	0.232	1.78*
Bank account with more than 200 GHS 0=no, 1=yes	BANK	0.339	0.512	-3.21***
Number of durable goods owned	WEALTH	4.765	8.481	-10.875***
Relation to the local government 1=none, 2=HHH knows someone in the local government, 3=HHH has friends in the local government, 4=strong relation/politically active	GOVERN	2.257	1.774	4.27***
Self-stated openness to innovation and risk (factor analysis: the stronger the agreement, the higher the factor)	RISK	0.152	-0.166	3.01***
Years of experience in pineapple farming	EXPER	11.557	11.595	-0.05
How pineapple farming was learned				
from family members and friends 0=no, 1=yes	LEARN 1	0.863	0.501	7.97***
as a laborer on a farm or from 0=no, 1=yes	LEARN 2	0.071	0.286	-5.51***
Importance of preserving the environment 1= very important, ..., 4= not important	ENV	1.775	1.281	6.91***
Number of years being certified	CERTIFYEARS	3.165	2.032	3.875***
Distance to the closest local market (hours)	DIST	0.698	0.804	-1.59
Soil characteristics 1=red or black sandy, 2=white sandy, 3=white rocky, 4=rocky red or black, 5=sandy or rocky clay, 6=clay, 7=other	SOIL	2.781	2.304	2.13**
Smooth Cayenne	SC	0.098	0.351	-5.99***
Sugar Loaf	SL	0.634	0.036	15.06***
Share of production cost for (of total labor costs) hired workers	HIRED	0.484	0.607	-3.13***
Assistance or training for farming received during last 5 years 0=no, 1=yes	ASSIST	0.732	0.708	0.50
Number of farm inspection during the last 5 years	INSPECT	1.913	2.619	-0.94
Written contract with exporter 0=no, 1=yes	CONTR	0.410	0.417	-0.13
Organizer of the certification process 0=else than farmer organization, 1=farmer organization	ORGA	0.508	0.143	7.84***

Significance levels: *: 10% **: 5% ***: 1%.
We use a conversion factor of 1 GHS = 0.46 Euros (calculated on the basis of the exchange rate on January 12, 2012).

Table 6.2: Descriptive Statistics of Economic Variables

Variable	Organic Farmers	Conventional Farmers	t-Stat.
Agricultural equipment	0.002	0.009	-2.77 ***
Agricultural inputs	0.011	0.077	-5.97 ***
Renewal of certification	0.000	0.006	-4.27 ***
Land used for pineapple	0.004	0.004	-0.004
Hired workers	0.037	0.019	3.77 ***
Household labor	0.034	0.009	5.68 ***
Yield (pineapple per acre)	15780	18259	-4.11 ***
Quantity sold (in Kg)	23486	36235	-2.81 ***
Average local price (GHS per Kg)	0.210	0.131	8.50 ***
Average export price (GHS per Kg)	0.251	0.196	5.40 ***
Share sold on local market	0.495	0.354	3.00 ***
Revenue (GHS per Kg)	0.219	0.170	5.80 ***
Production costs (GHS per Kg)	0.105	0.118	-0.94
Profits (GHS per Kg)	0.114	0.052	4.01 ***
ROI	2.760	1.800	3.11 ***

We use a conversion factor of 1 Ghana Cedi (GHS)=0.46 Euros. The t-statistic belongs to the mean difference test between column (2) and (3). Significance levels: *:10% **:5% ***:1%

Table: 6.3 Descriptive Statistics of Agro-Ecological Practices

Variable	Organic Farmers (N=176)	Conventional Farmers (N=168)	t-Statistics
Organic fertilizer	2.164	0.030	8.288***
Organic pesticides	0.083	0.082	-0.032
Mulch	1.590	1.328	5.294***
Manure	1.998	0.912	3.543***
Weeding	2.410	2.327	0.566
Cover crops	0.175	0.161	0.353
Crop rotation	0.980	0.132	6.343***
Trash lines	2.932	1.043	9.451***
Infiltration ditches	1.066	0.721	1.979**
Leguminous residues	0.066	0.018	2.217**

Significance levels for the t-statistics of the mean difference test: *: 10% **: 5% ***: 1%

Table 6.4: Estimation results of ESR for Impact of Organic Certification on Agro-ecological Practice Use

Variable	Selection Eq. Coefficient (1)	Selection Eq. Std. Err. (2)	Organic farmers Coefficient (3)	Organic farmers Std. Err. (4)	Convent. farmers Coefficient (5)	Convent. farmers Std. Err. (6)
GENDER	-0.122	0.513	0.173	0.101	1.769	0.597
AGE	0.004	0.018	-0.006	0.023	-0.056**	0.024
NATIVE	-0.151	0.275	0.443	0.513	0.401	0.399
RISK	0.306***	0.095	-0.133	0.207	0.135	0.196
HHSIZE	-0.058	0.052	-0.146	0.099	-0.068	0.071
EDUC	-0.094*	0.059	0.323**	0.096	0.135	0.286
WEALTH	-0.296***	0.090	0.397***	0.142	0.138	0.089
FSIZE	-0.012	0.010	-0.006	0.012	0.0001	0.011
OWNLAND	0.586**	0.236	1.051**	0.558	0.927	0.827
EXPER	0.034	0.032	0.020	0.036	0.024	0.033
LEARN1	0.829**	0.597	1.053	1.146	-0.774	0.440
LEARN2	-0.537**	0.217	0.357	1.387	-0.223	0.530
DIST	-0.341**	0.164	-0.130	0.405	-0.947**	0.373
SOIL	0.008	0.058	-0.316***	0.1281	-0.268***	0.085
ORGA	1.403***	0.218	-1.232*	0.665	0.828	0.747
ENV	1.431***	0.325	-1.423***	0.412	0.038	0.388
GOVERN	0.445***	0.164				
BANK			-0.468	0.558	0.403	0.497
CREDIT			-0.526	0.466	-0.239	0.487
VARIETYMD2			2.550***	0.989	-0.128	0.396
HIRED			-0.569	0.821	0.452	0.578
INSPECT			-0.113	0.026	0.074**	0.029
CONTR			1.154**	0.543	-0.083	0.380
CERTIFYEARSNO			0.299**	0.141	-0.203	0.457
INTERCEPT	1.038	0.985	1.027	1.347	3.455**	1.754
ρ_{1D}			-0.320	0.466		
$ln\sigma_1$			0.916***	0.070		
ρ_{0D}					0.260	1.048
$ln\sigma_0$					0.744***	0.104

Log-Likelihood: -993.143
Wald test of indep. eqns.: $\chi^2(2)$ = 3.69***

Significance levels for the t-statistics of the mean difference test: *: 10% **: 5% ***: 1%

Table 6.5: Results of Impact of Organic Certification on Agro-ecological Practice Use

Method	Predicted Use of certified	Predicted Use of non-certified	ATT	t-Statistic
ESR				
Organic certified farmers	5.921	2.518	3.403	13.314***
Conventional farmers	8.135	3.788		
Alternative Specifications				
ESR using different weights				
Organic certified farmers	6.102	3.046	3.056	11.465***
Conventional farmers	7.979	3.594		
ESR using no weights				
Organic certified farmers	5.986	2.136	3.851	12.258***
Conventional farmers	8.115	3.266		
ESR (weeding excluded)				
Organic certified farmers	5.728	2.667	3.061	10.894***
Conventional farmers	7.934	3.363		
PSM				
Kernel (bandwidth=0.4)	6.751	2.680	4.071	7.98***
Radius (caliper=0.05)	6.751	2.523	4.228	7.34***
Nearest-neighbor	6.751	2.351	4.400	6.98***

Significance levels for the t-statistics of the mean difference test: *: 10% **: 5% ***: 1%
For PSM, standard errors are calculated with bootstrapping using 1000 replications. Bootstrapping of standards errors is necessary because the estimated variance does not include the variance that may appear due to the estimation of the propensity score and the imputation of the common support assumption (Caliendo and Kopeinig (2008)). Even though Abadie and Imbens (2008) criticism the use of bootstrapping for the nearest-neighbor algorithm, its application is still common practice.

Appendix

Table A.6.1: Estimation Results of Generalized Propensity Score

Variable	Coefficient	Std. Err.
Equation 1		
ORGANIC	0.165***	0.026
GENDER	0.050	0.052
AGE	-0.005**	0.002
RISK	0.019	0.048
HHSIZE	-0.041***	0.018
EDUC	0.101**	0.079
FSIZE	0.003**	0.001
OWNLAND	0.283***	0.096
EXPER	0.042*	0.021
LEARN1	-0.101*	0.060
LEARN2	0.108*	0.074
DIST	-0.152	0.135
ORGA	-0.126	0.114
SOIL	-0.112***	0.022
WEALTH	0.165***	0.071
ENV	0.266**	0.170
INTERCEPT	0.935***	0.149
Equation 2		
INTERCEPT	0.31***	0.014

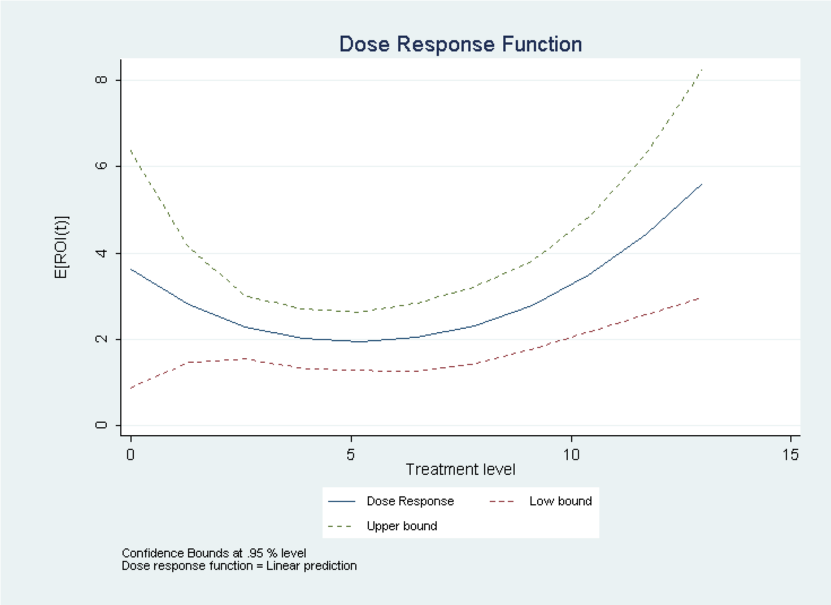
Significance levels for the t-statistics of the mean difference test:*: 10% **: 5% ***: 1%

Table A.6.2: Estimation Results of the Coefficients of the Dose Response Function

Variable	Coefficient	Std. Err.
T	-0.305**	0.121
T^2	0.019***	0.004
GP S	-3.252**	1.401
T * GP S	0.385	0.259
INTERCEPT	4.638***	1.251

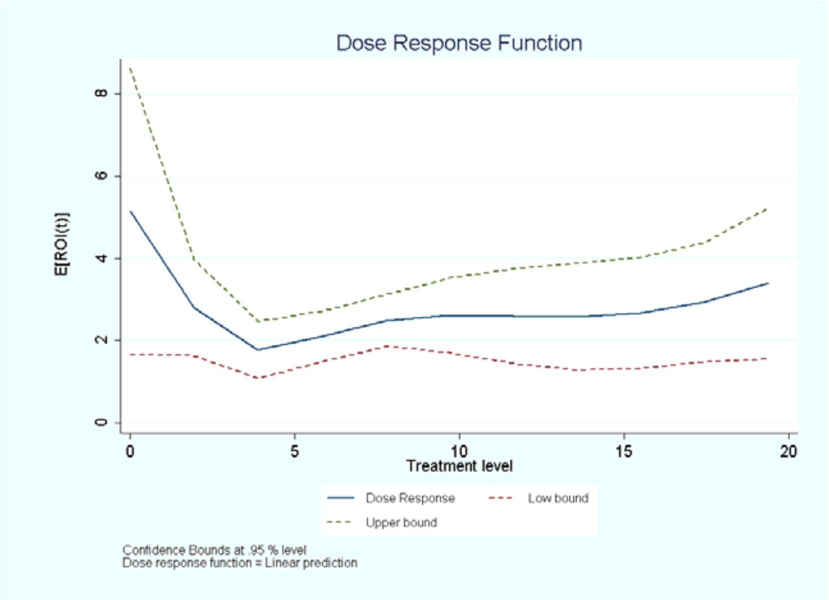
Significance levels for the t-statistics of the mean difference test:*: 10% **: 5% ***: 1%

Figure A.6.1: Impact of Intensity of Agro-ecological Practice Use on ROI (restricted to values lower than 13)



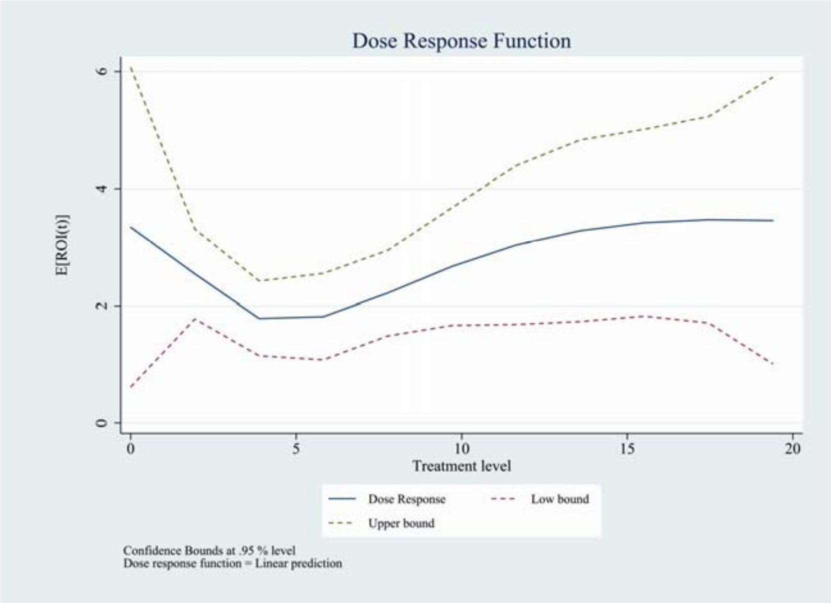
Source: own estimation.

Figure A.6.2: Impact of Intensity of Agro-ecological Practice Use on ROI (different weights for agro-ecological practices)



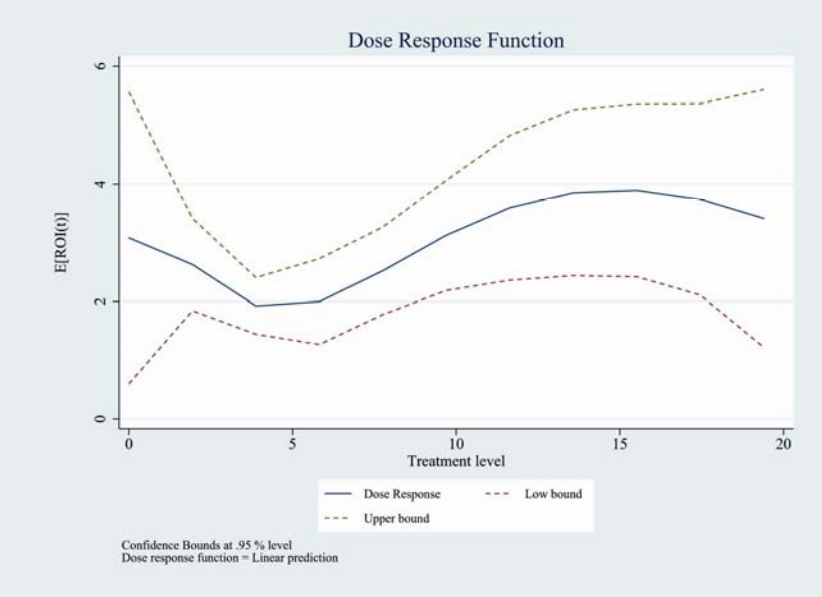
Source: own estimation.

Figure A.6.3: Impact of Intensity of Agro-ecological Practice Use on ROI (no weights)



Source: own estimation.

Figure A.6.4: Impact of Intensity of Agro-ecological Practice Use on ROI (weeding excluded)



Source: own estimation.

Notes

[1] Because we study the same sector and make use of the same dataset as Kleemann et al. (2012) this section is very similar to the respective one in that paper. More detailed information about the export market for pineapple is provided in Kleemann (2011a).

[2] Source: http://www.organic-world.net/statistics-data-tables-dynamic.html.

[3] Ajumako Enyan Esiam, Akuapem South, Ewutu-Efutu-Senya, Ga, Kwahu South and Mfantseman.

[4] The land variables are likely to be subject to reporting error. Therefore we included several checks in the questionnaire (like asking for the farm size in one part and for field sizes for each crop in another part) and checked on the farm or verified with GPS data when available. Nevertheless we are aware that farm sizes are still likely to be smaller than reported. In addition, we speak of "smallholders" or "small-scale farmers" even though we do not adhere to the definition of a smallholder, which is less than two hectares. However, apart from over-reporting of land sizes, all farmers in the sample are sufficiently small to fall strictly under group certification schemes. This is the relevant measure for us.

[5] Since our focus is not on the soil, we did not ask more detailed questions about the different soil types and their advantages and disadvantages for pineapple production.

[6] We are aware that measurement errors are frequent in measuring agricultural inputs and outputs in developing countries. However, when farmers in both groups are sufficiently similar in their sociodemographic characteristics we can assume that measurement errors do not significantly differ between farmers.

[7] In these cases either it was logical to pose the question with a yes/no option only, as in the case of cover crops or the quality of the data retrieved from the survey did not allow the division into frequency of use, as in the case of organic pesticides and leguminous residues.

[8] The unbiased treatment effect is hard to measure because, when treatment is non-random as in our case, untreated individuals may differ systematically because of self-selection into treatment. A popular approach to avoid biased results is to randomize treatment. In our case randomization over which farmers use which agro-ecological methods is impossible to realize because all the methods in question are already common or widely known by the farmers. The underlying treatment is not a development intervention, but the outcome of various interventions in a longer time horizon.

[9] For testing the balancing property of the GPS, the treatment variable was divided into 4 intervals with cut-off points at 25%, 50%, etc. Without adjusting for the GPS, t-tests of mean difference between the intervals revealed that 14 t-tests were significant at the 5% level, after dividing into 4 intervals and conducting block-wise t-tests this number was reduced to 2. We repeated the analysis with more intervals, namely 7, which did not affect our conclusions, but the number of observations in each interval becomes quite small, so the results are weaker.

[10] The estimated quadratic dose response function regression is shown in Table A.6.2 in the appendix. All GPSM regressions were also repeated with net farm income as impact variable. Due to the low investment level of the farmers, the results did not change significantly. Therefore the results are omitted here, but are available upon request from the author.

[11] This is explained as follows using the examples of mulch and manure. When the farm is relatively strongly specialized in pineapple, mulching material and manure cannot be produced on the farm (see also e.g. Branca et al. (2011) and several others). Often, the needed material would be available at no or low cost, but needs to be transported to the farm. Since this material is relatively bulky, transport costs can impede their use in case of lack of cash or if their perceived benefits are lower than the effort of organizing and paying for their transport.

Chapter 7

Concluding Remarks

This dissertation has tried to shed light on the profitability and ecological sustainability of certified organic small-scale production in Africa against the background of a strongly growing organic niche market.

In Africa, certified organic agriculture appears as a luxury at first sight. The challenge to increase agricultural production and food security and the desire to catch up economically appear more relevant and urgent than any concern for the environment. The phenomenon of the „Environmental Kuznets Curve“ that describes an inverted U-shaped empirical relationship between environmental quality and economic development can be applied as well to this sector of the economy. Yet there is traditionally a high affinity to nature in Africa that is determined by cultural traditions - natural religions - and the large proportion of people living off the land in rural areas. In addition, continuing population growth, impacts of climate change and environmental degradation are a topic of a broad population stratum. Consequently there is a tendency for general increased awareness of the importance of environmental protection and thus a tunneling through the sectoral Environmental Kuznets Curve by implementing sustainable agriculture approaches is thinkable. Against this background strategies are required that combine agricultural development for higher incomes for the rural poor and natural resource protection. Organic farming could be one option that connects these two factors. Its big advantage is its involvement in all three sustainability criteria. The high prices paid for organic certified products on international markets make it economically attractive.

Working from large to small, we first analyzed the international market integration for premium-priced organic certified products. The conventional market acts as a price leader for the organic one where organic prices react to changes in conventional prices only if these changes are sufficiently large. This implies that general demand shocks are transmitted to the organic market through the conventional market with a time lag and lower intensity.

Because these thresholds do not change over time, we conclude that market integration has not increased. Moreover, the price premium on organic pineapple does not decline. According to hedonic demand theory, the combination of these two elements happens when the organic core market expands faster than supply. This conclusion implies potential for up scaling the organic market, i.e. increasing the number of farmers potentially benefitting from the increasing demand, a result that increases the relevance of the analyses on the local level presented in the following chapters.

Using the example of the pineapple sector in Ghana as a case study, we then studied conditions and effects for the participating farm households. In Ghana, many small-scale farmers, both conventional and organic, have been excluded from the export pineapple value chain due to recent world market changes. In a first step we consider the question whether these farmers can successfully be reintegrated in the Ghanaian pineapple export sector. We find that, even though smallholders tend to have quality problems with their fruit and large farms have advantages due to economies of scale, production for the export market is feasible for both organic and conventional smallholders provided that mutual trust is reinstalled and thereby transaction costs reduced. Moreover, organic production is the more profitable due to the retail level price premium on organic products that is passed on to farmers and that overcompensates lower yields on organic farms. Being founded in hedonic demand theory allows this analysis to be applied to other similar niche-main market situations. Other sustainability standards or ethical certifications such as Fair trade may provide a very similar context. However, a premium is paid for certified products only and the certification with internationally approved labels requires a substantial investment on the side of the farmers. Whether or not the investment in organic certification proves to be beneficial for farmers was analyzed next.

Using detailed primary data from our own survey of small-scale pineapple farmers in Ghana in 2010 and controlling for selection bias, we find a positive effect of organic certification on the return on investment in organic farming. Contrary to previous research we can single out the effect of certification vis-à-vis the effect of contract farming and exporting.

The data also shows that relatively poorer, less educated households are more likely to adopt organic production. While we cannot determine whether this happens because they are more attracted by this form of production or because of targeting by exporters and NGOs, it nevertheless implies that organic certification is pro-poor. Hence, overall, our results suggest a positive effect of switching from conventional to organic production when competing on the global market for pineapple, particularly for relatively poorer farmers.

But does organic farming also deliver on its core value ecological sustainability? Due to its holistic approach that acknowledges the multifunctionality of agriculture, organic agriculture has a weakness in its complex implementation. While long-term trials show that organic agriculture in tropical countries can achieve (almost) equal yields as conventional production, this dissertation shows that this is not – or not yet - the case for African small-scale farmers, with a major reason being that active agro-ecological soil and plant management is very limited. The intensity of agro-ecological practice use on small farms in our sample is in fact very low.

A common concern is that organic certified small-scale farmers in Africa remain in a state of ”organic-by-default” production with little or no use of inputs or other soil enhancing methods and consequent low yields and unsustainable production. This is because in practice low-input “organic-by-default” producers tend to be certified organic easiest as they already fulfill the requirement of no chemical use which lead to shorter transition periods. The spread of agro-ecological techniques is thus a key factor for the sustainability of organic agriculture in Africa. This is relevant, because agriculture contributes strongly to environmental damage and global climate change, which makes it an important point of action for international policies for sustainable and green development.

In the last chapter, we showed that certification already serves as a catalyst for the use of agro-ecological practices and that using them more intensively is on average economically useful for the farmers, i.e. our results suggest that there is not necessarily a trade-off between economic efficiency and environmental friendly farming practices. Still, from a policy perspective this link has to be strengthened considerably, because the intensity of agro-ecological practice use is overall unsatisfactory, which leads to both lower yields and soil degradation. The question remains why this level is so low. As shown by our example, insufficient infrastructure may represent a strong barrier for the use of agro-ecological practices. Organic farmers often do not produce sufficient organic material to manage soil nutrients efficiently. In Ghana external organic inputs from cocoa production or juice factories are available but transport costs are prohibitive for a single farmer. Organization of intermediation through the buyer or another external actor could solve this problem. On a higher level, certification systems could require the active use of agro-ecological production methods. While this would certainly increase their use, a drawback is that this would also raise the already high entry barriers to certification especially for resource-poor farmers. We therefore suggest that not only support for the certification process and financing should be given, but that it is equally important to tailor the technical support to the ecological and social goals that are implicit in organic certification systems.

If successfully managed in such a way, organic certification for the dominantly small farmers in Africa may provide an alternative sustainable development strategy for parts of the rural population. It may reduce rural poverty by providing market access and higher profits through a combination of high prices and better or more resilient yields, and it may provide environmental benefits for the local economy in the long term.

Appendix

Impact of Certified Organic Pineapple Farming on Sustainability and Livelihoods of Farmers in Ghana

Research Project by:

Kiel Institute for the World Economy (Linda Kleemann) and University of Kiel, Germany (Prof. Dr. Awudu Abdulai) in collaboration with Department of Agricultural Economics (Dr. Victor Owusu), Kwame Nkrumah University of Science and Technology, Kumasi

Main researcher: Linda Kleemann
IN CASE OF URGENT QUESTIONS, PLEASE CALL ME ON: 0205670697

PART 0. PINEAPPLE SURVEY IDENTIFICATION

Questionnaire Number: _______

Date of interview: Day: _______ Month: ____________ Year: 2010____

Time started: ________________________ Name of enumerator: _________________________

District: ________________________________ *DISTCODE:* ___________

Village: ________________________________ *PARCODE:* ___________

Household code: ____________________________

GLOBALGAP (EurepGAP) or ORGANIC? * __________________________________

Name and surname of household head __________________________

Name of respondent (if different from household head) ____

Sex of respondent (F/M): ____________________ Relation to head: ______________________________

Mobile number of household head (or respondent): ____

Email address of household head (or respondent): ____

Language in which the interview was conducted: ____

IF FARMERS ARE BOTH ORGANIC AND GLOBALGAP CERTIFIED, THEN WRITE 'ORGANIC**'; IF FARMERS ARE NOT ORGANIC CERTIFIED, THEN WRITE '**GLOBALGAP**'. **PLEASE REFER TO THIS SPECIFICATION THROUGHOUT THE WHOLE QUESTIONNNAIRE.***

[BASIC INFORMATION ABOUT THE SURVEY. PLEASE EXPLAIN TO THE FARMER:]
Thank you for participating in this interview. The interview contributes to a research project on economic and environmental aspects of pineapple farming. We want to compare organic and GLOBALGAP (formerly called EurepGAP) certification for pineapples. This research project is carried out by the Kiel Institute in Germany in collaboration with Department of Agricultural Economics (Dr. Victor Owusu), University of Kumasi. Please be assured that everything you tell me will be kept confidential by the research team and will not used for other purposes than research. If you cannot answer some of the questions please leave them blank. The information we collect about your household and pineapple enterprise will be mixed with information about many other pineapple farmers and there will be no reports about you personally but only about pineapple farming in the area

or in Ghana in general. The research team is **not** related by business ties or employment to pineapple exporters. If you are interested, you can receive information on your farm or farmer group in comparison with the other groups that have been interviewed after the finalisation of the data analysis. In this case, please let the interviewer know at the end of the interview. The interview will take about 1.5 hours. Do you have any questions before I start?

PLEASE FEEL FREE TO ADD ADDITIONAL INFORMATION THAT MIGHT BE RELEVANT FOR THE STUDY. IN CASE YOU NEED MORE SPACE, THERE IS ADDITIONAL FREE SPACE ON THE LAST SHEET.

PART 1. HOUSEHOLD CHARACTERISTICS & SOCIAL CAPITAL

1.1. **How many people do usually live in your house?**
______________________________ *[Number (#) of people]*

1.2. **What is the status of the household head?** *[TICK ONLY ONE.]*
☐ (1) A married man or woman who presently lives in the house;
☐ (2) A married man or woman who lives somewhere else but supports the household, e.g. by going there occasionally or giving or sending money;
☐ (3) A married man who is absent and does not support the household (the wife is in fact the acting head)
☐ (4) A single, widowed or divorced woman/man;
☐ (5) A child;
☐ (6) Other (specify) ________________________________

1.3. **What is the religion of the household head?** *[TICK ONLY ONE. **DO NOT READ OPTIONS TO THE FARMER.**]*
☐ (1) Christian; ☐ (2) Muslim; ☐ (3) Traditional;
☐ (4) Other (specify)_____________________________

1.4. **Please tell me about the members in your household[1], including own children, adopted children, orphans, elders, and others who are residing and working with you.**
[1]A household is a group of people, often related by family ties, who reside and farm together and 'eat from the same pot'. Children in boarding school are also considered members.
PLEASE FIRST LIST ALL MEMBERS, AND THEN ASK QUESTIONS FOR EACH.

Name (& surname if different from household head)	**Relation to household head**	CODE	**Sex**	**Age**	**What is his/her most important activity (time-wise)***	**What is his/her highest level of formal education**	**For how many months during the past 12 months has he/she been away from this household?** *[WRITE NUMBER (#) OF MONTHS]*
	1=spouse 2=child 3=adopted child 4=niece/nephew 5=cousin 6=Other (specify)		*M=1 F= 2*	*in years*	*1=Pineapple farming (own farm) 2=Other farming activities (own farm) 2=Farm labour on other farms 3=Other non-farm work (specify which) 4=Day school 5=Boarding school 6=Other (specify)*	*1=None 2= Primary school 3= Junior Secondary 4=Senior Secondary 5= Technical / Vocational Training 6=Tertiary / University 7 = other(specify)*	
	Self	1					
		2					

		3					
		4					
		5					
		6					
		7					
		8					
		9					
		10					
		11					

* *'Activity' **includes** domestic work (cooking, cleaning, etc.) and **includes** schooling and higher education and **includes** farming activities for self consumption.*

1.5. **What is the average <u>monthly</u> cash income level of your household including donations, gifts and remittances? Do not include your own consumption and gifts in kind.**
[*NEW GHC;* PLEASE TICK ONLY ONE.*]*
☐ (1) <50 GHC; ☐ (2) 51-150 GHC; ☐ (3) 151-300 GHC; ☐ (4) 301-500 GHC;
☐ (5) >500 GHC

1.6. **Does this household have electricity?**
___________ *[0=No; 1=Yes;]*

1.7. **Are you native in the community?**
___________ *[0=No; 1=Yes;]*
1.7.1. **IF YES (1),** have you ever lived in another place, such as another village or town, or abroad, for six or more months at a time?
___________ *[0=No; 1=Yes]* **If YES (1),** where? ____________________
1.7.2. **IF NO (0),** for how long do you live in the community? _________________ [*years*]
1.7.3. **IF NO (0),** which community or town do you come from? _________________________ [*name*]

1.8.1. **When you think of the people you meet regularly and consider as friends; are most of them** …
[TICK ONLY ONE.]
☐ (1) pineapple farmers; ☐ (2) other farmers (they are farmers, but do not grow pineapple on a commercial basis); ☐ (3) no farmers?

1.8.2. **When you think of the people you meet regularly and consider as friends; are most of them** …
[TICK ONLY ONE.]
☐ (1) native to this community; ☐ (2) native to a neighbouring community;
☐ (3) living in the nearest city; ☐ (4) none of the above?

1.8.3. **What is the household head's relationship to the traditional local authority?**
☐ (1) relative; ☐ (2) close friend; ☐ (3) know him a bit;
☐ (4) do not know him personally.

1.8.4. **What is the household head's relationship to the local government?**
[TICK ONLY ONE.]
☐ (1) strong relation/household head is politically active; ☐ (2) …has friends in the local government;
☐ (3) …knows someone in the local government; ☐ (4) no relation.

1.8.5. **What is the household head's relationship to the local MOFA[1] office?** *[TICK ONLY ONE.]*
☐ (1) strong relation/household head is politically active; ☐ (2) …has friends in the local government;
☐ (3) …knows someone in the local government; ☐ (4) no relation.
[1]Ministry of Food and Agriculture

1.9. **How often has someone from your household been in one of the following places in the last five years?**
[*1= at least once every week; 2= at least once a month; 3= at least once every 6 months; 4= at least once a year; 5= at least once; 6= never; WRITE THE CODES ON THE CORRESPONDING LINES.]*
Local market ________
Accra ________
Other districts of the same province ________
Other provinces ________
Bordering countries ________
Other countries ________

1.10. **Does someone from your family live in another country?**
___________ *[0=No; 1=Yes]* **If YES (=1), in which country:** ______________________________________

1.11. **Besides your mother-tongue, which languages do you speak?** [*MORE THAN ONE OPTION IS POSSIBLE*]
☐ (1) other local languages, which ones ____
☐ (2) English
☐ (3) other foreign languages, which ones ____

1.12. **Membership of farming-related groups and organisations**
1.12.1. Is anyone in the household a **member** of a **local farmers' organisation or association, a cooperative, a common interest group, a committee, a self help group**, or any other local group that has to do with farming or marketing of farm produce? And/Or is anyone in the household a member of a local **savings group or micro-credit project/scheme**?
_______ *[0=No; 1=Yes]*

IF NO (0), GO TO THE NEXT QUESTION.
1.12.2. **If YES (1),** let us talk about each organisation or group that household members belong to (e.g. farmer association, pineapple value chain committee, church group, savings group, Ghana Organic Agriculture Network, …) *[PLEASE NOTE THAT THE TABLE COVERS MORE THAN ONE PAGE]*

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
What is the name of the organisation or group?					
Who in the household is member of this group?					
What is the focus of the organisation? [*1=Political party; 2=Farmer group; 3= Pineapple Cooperative; 4=Agricultural organisation;5= Religious; 6=Other (Specify)]*					
When did the household member join the organisation or group? *[Year]*					
How much money did the member spend on the					

organisation or group last year? *[New GHC]*					
How much <u>time</u> did the member spend on the organisation or group last year? *[days]*					
What are the main farming-related activities of the organisation or group, if any?					
How often does the group/organisation usually meet?					
How many members does this group have nowadays? *[# of people[1]]*					

[1] *# = number*

PART 2. LAND OWNERSHIP, LAND DISPOSITION, AND LAND USE

2.1. **Which of the following varieties of pineapple are you farming/producing <u>at the moment?</u>**
[PLEASE PROVIDE THE NUMBER (#) OF ACRES FOR EACH OF THEM. THE TOTAL NUMBER (#) OF ACRES PER VARIETY SHOULD BE THE SAME AS THE SUM OF ORGANIC AND CONVENTIONAL ACREAGES FOR THE SAME VARIETY. IF THIS IS NOT THE CASE, PLEASE TRY TO CLARIFY.
IN CASE OTHER AREA UNITS ARE USED, USE THE CONVERSION TABLE TO CALCULATE ACREAGE.]

[*please tick, when acreage >0*]	**Variety**	**Total Acreage**	**Acreage per production system**		**# of plants per acre**	**<u>Total</u> production cost[1] per crop cycle**
			conventional	**organic**		
☐ (1)	Smooth Cayenne					
☐ (2)	Sugar Loaf					
☐ (3)	MD2					
☐ (4)	Queen					
☐ (5)	Other (specify) _______________					
SUM	*[PLEASECOMPUTE]*					

[1]*PLEASE ASK THE FARMER TO ESTIMATE THE TOTAL PRODUCTION COST, TAKING INTO CONSIDERATION ALL THE INPUTS (LAND, WORKFORCE, CUTLERS, FERTILIZER, TRANSPORT COSTS, ETC.).*

2.2. **Why did you decide to plant this variety/-ies and not another one/other ones?**
☐ (1) Buyer demands or market need; ☐ (2) lower cost of production; ☐ (3) availability of suckers;
☐ (4) other (specify): ____________________

2.3. **In which year did you start pineapple farming?**
______________ [*year*]

2.4. **Have you been working in the pineapple sector before starting your own farm?**
____________ *[0=No; 1=Yes;]*
2.4.1. **If YES (1), in what position were you working?** ___________________________________

2.5. **How did you learn pineapple farming?**
☐ (1) From family members; ☐ (2) As a labourer on a farm; ☐ (3) From friends
☐ (4) From a training course; ☐ (5) By myself.

2.6. **Do you farm any crop or fruit other than pineapple on a commercial basis** (i.e. produce for the market)**?**
___________ *[0=No; 1=Yes]*

2.6.1. **If YES (1),** please specify on how many acres: __________ *[acres]*.
2.6.2. **If YES (1),** please specify which crop(s) ____.

2.7. **Do you produce any crop or fruit other than pineapple for consumption by the household/family?**
___________ *[0=No; 1=Yes]*
2.7.1. **If YES (1),** please specify on how many acres: __________ *[acres]*.

2.8. **How long does it take you to produce pineapple on one plot* from planting to harvest, i.e. how long is one crop cycle?**
_______________________________ *[# of months]*
**A plot is an. area with a homogenous cropping pattern. There may be one or several plots on a parcel.*

Now, let us talk about the last crop cycle.
2.9. **Which of the following varieties of pineapple did you produce <u>in the previous crop cycle?</u>**
[SAME AS QUESTION 2.1]

[*please tick, when acreage >0*]	**Variety**	**Total Acreage**	**Acreage per production system**	
			conventional	**organic**
☐ (1)	Smooth Cayenne			
☐ (2)	Sugar Loaf			
☐ (3)	MD2			
☐ (4)	Queen			
☐ (5)	Other (specify) _______________			
SUM	*[PLEASECOMPUTE]*			

2.10. **Did you produce any crop or fruit other than pineapple <u>in 2008</u>?**
___________ *[0=No; 1=Yes]*
2.10.1. **If YES (1),** please specify how many acres: __________ *[acres]*.

2.11. Let us now talk about your future plans. **Do you intend to cultivate more, less or the same amount of pineapple next year?**
☐ (1) more; ☐ (2) less; ☐ (3) the same.

2.12. And how about the past?
In total, did you cultivate more, less or the same amount of pineapple <u>5 years ago</u>?
☐ (1) more; ☐ (2) less; ☐ (3) the same.

Let us now talk about your present farm again.
2.13. **Do you prepare your land for planting pineapples manually or do you plough it by tractor or animal draft?** *[TICK ONLY ONE.]*
☐ (1) Manually; ☐ (2) Tractor; ☐ (3) Animal draft

2.14. **How many <u>acres</u> of land does this household operate, including fallowing and including the one on which the homestead is located?** ____________ *[acres; FOR OTHER UNITS PLEASE SEE CONVERSION TABLE.]*

2.15. **How would you describe this land and how much do or did you pay for it?**
[MULTIPLE CHOICES POSSIBLE]

Description of land	[*Please tick*]	**Acres**	**Percentage of total land operated***	**Since when** *[year]* **do you operate this land?**	**Cost** *[total payment per year (new GHC)]*
Outright purchase	☐ (1)				*[total payment <u>at purchase</u>]*
Stool land	☐ (2)				
gift	☐ (3)				
Share tenancy (abunu/abusa)	☐ (4)				
family land	☐ (5)				
leased	☐ (6)				
other; specify	☐ (7)				
Total *[PLEASE COMPUTE]*					

*PLEASE NOTE WHATEVER CLASSIFICATION IS EASIEST FOR THE INTERVIEWEE.

2.16. **What is the present use(s) of the land where pineapple is not produced?**
[MORE THAN ONE OPTION IS ALLOWED!]
☐ (1) food crops; ☐ (2) cash crops; ☐ (3) grazing; ☐ (4) fallow
☐ (5) other (specify): __________________

2.17. **Currently, does your household operate all of your land?**
___________ *[0=No; 1=Yes]*

2.17.1. **If NO (0), do you rent* out a part of your land?**
[**Rent out refers to any agreement where the household receives money for not using the land themselves]*
___________ *[0=No; 1=Yes]*
2.17.2. **If YES (1),** how many acres do you rent out?
____________________ [acres]

2.18. **How many acres of your land do you leave fallow currently?**
__________________ [*acres*]

2.19. **Which share of your household's food consumed do you produce by yourself?**
☐ (1) Almost everything; ☐ (2) about half or less; ☐ (3) less than one quarter.

2.20. **What do you do with your agricultural production waste?**
☐ (1) I burn it; ☐ (2) I throw it away; ☐ (3) I re-use it as manure; ☐ (4) I sell it;
☐ (5) Other (specify) ______________________________ .

PART 3. CERTIFICATIONS FOR PINEAPPLE

3.1. **Which certifications do you currently have <u>for your pineapple</u>?**
[CERTIFICATIONS HAVE TO BE RENEWED ANNUALLY OR BI-ANNUALLY. PLEASE ASK WHEN THE CERTIFICATION HAS BEEN RENEWED LAST TO MAKE SURE THAT IT IS STILL VALID.
PLEASE TICK THE RELEVANT ONES. SEVERAL OPTIONS ARE ALLOWED.]

Certification	[*Please tick*]	**Single farmer (=1) or Group certification (=2)**	**If group certification, name of the group**	**First year of certification** *[month/year]*	**Date of last renewal** *[month/year]*
(1) GLOBALGAP (formerly Eurepgap)	☐				
(2) Organic	☐				
(3) Fairtrade	☐				
(4) Other (specify): ____________________	☐				

3.2. **Did you have certifications in the past that you did not renew?**
___________ *[0=No; 1=Yes;]*
3.2.1. **If YES (1),** which ones:
☐ (1) GLOBALGAP (EurepGAP); ☐ (2) Organic; ☐ (3) Fairtrade;
☐ (4) Other (specify): _______________________

3.2.2. **If YES (1), why did you not renew this certification/these certifications?**

Reasons for abandoning certification	Reason(s) for **not** renewing certifications ***A maximum of two options is allowed (DO NOT read all the options to the farmer)***: ☐ (1) The pineapple exporter/international organisation/NGO* did not pay for the renewal; ☐ (2) We did not have the means or the money to pay for the renewal; ☐ (3) We did not know that we had to renew the certification; ☐ (4) We thought we would not need the certification anymore; ☐ (5) It was too difficult. ☐ (6) Other (specify): ____

** NGO = Non-Governmental Organisation. This term refers to any aid or similar organisation, that is not controlled by local or foreign government and includes e.g. Ghana Organic Agriculture Network (GOAN).*

FROM NOW AND THROUGHOUT THE WHOLE QUESTIONNAIRE WHENEVER CERTIFICATIONS AER MENTIONED IN THE QUESTIONNAIRE: IF FARMERS ARE BOTH ORGANIC AND GLOBALGAP CERTIFIED, THEN WRITE 'ORGANIC'; IF FARMERS DO NOT PRODUCE ORGANIC CERTIFIED PINEAPPLE, THEN WRITE 'GLOBALGAP'. THIS SHOULD CORRESPOND WITH THE SPECIFICATION AS ON THE FIRST PAGE (PART 0).

3.3. **Concerning your ORGANIC <u>or</u> GLOBALGAP certification, can you tell me what, in your opinion, are the 3 most important features of being certified in terms of production, farm management, etc?**
[*PLEASE CONSIDER ONLY ORGANIC <u>OR</u> GLOBALGAP (FORMERLY EUREPGAP) FOR THIS QUESTION*.]
Certification: ____________________ *[1=Organic; 2=GLOBALGAP]*

1. ____
2. ____
3. ____

3.4. **Let us now talk about your ORGANIC <u>or</u> GLOBALGAP certification.** *In the following table, the questions on the left side are only for ORGANIC certified farmers. The questions on the right side are only for conventional GLOBALGAP certified farmers.*

A) ONLY ORGANIC FARMERS	B) ONLY CONVENTIONAL FARMERS
3.4.1. **How did you get to know about the possibility to get ORGANIC certification?** *[MORE THAN ONE OPTION IS ALLOWED.]* ☐ (1) from other farmers/producer's groups; ☐ (2) from relatives; ☐ (3) from a government agency; ☐ (4) from an NGO/international organization; ☐ (5) from an exporter/buyer; ☐ (5) other (specify)__________________________ .	3.4.1. **How did you get to know about the possibility to get GLOBALGAP certification?** *[MORE THAN ONE OPTION IS ALLOWED.]* ☐ (1) from other farmers/producer's groups; ☐ (2) from relatives; ☐ (3) from a government agency; ☐ (4) from an NGO/international organization; ☐ (5) from an exporter/buyer; ☐ (5) other (specify)__________________________ .
3.4.2. **Why did you decide to produce organically?** [*a maximum of three options is possible*; *DO NOT READ ALL THE OPTIONS TO THE FARMER*] ☐ (1) Production costs are lower than for conventional production. ☐ (2) Prices are better. ☐ (3) Health or food safety reasons. ☐ (4) Environmental concerns. ☐ (5) Contracts with exporters are better. ☐ (6) The market is better/there is less competition. ☐ (7) Cultural reasons and/or tradition. ☐ (8) Customer/buyer demands. ☐ (9) Other farmers/friends recommended it to me. ☐ (10) Other reasons, please specify _________________________________ .	3.4.2. **Why did you get GLOBALGAP certified?** [*a maximum of three options is possible*; *DO NOT READ ALL THE OPTIONS TO THE FARMER*] ☐ (1) Yields are better ☐ (2) Prices are better. ☐ (3) Health or food safety reasons. ☐ (4) Environmental concerns. ☐ (5) Contracts with exporters are better. ☐ (6) The market is better/there is less competition. ☐ (7) Customer/buyer demands. ☐ (8) Other farmers/friends recommended it to me. ☐ (9) Other reasons, please specify _________________________________ .
3.4.3. **In your opinion, has organic farming affected your and your family's health positively?** _____________ *[0=No; 1=Yes]* **IFYES (1),** please explain why: _______________________________________ _______________________________________	3.4.3. **In your opinion, has farming according to GLOBALGAP standards affected your and your family's health positively?** _____________ *[0=No; 1=Yes]* **IFYES (1),** please explain why: _______________________________________ _______________________________________
3.4.4. **What is preventing you from switching to conventional production?** [*a maximum of three options is possible*] ☐ (1) Lack of money/capital to invest. ☐ (2) Lack of market/buyers. ☐ (3) Lack of time and/or knowledge. ☐ (4) Conventional production is too difficult. ☐ (5) Conventional production is less profitable. ☐ (6) Never though about it. ☐ (7) Other reasons, please specify _________________________________ .	3.4.4. **What is preventing you from switching to organic production?** [*a maximum of three options is possible*] ☐ (1) Lack of money/capital to invest. ☐ (2) Lack of market/buyers. ☐ (3) Lack of time and/or knowledge. ☐ (4) Organic production is too difficult. ☐ (5) Organic production is less profitable. ☐ (6) Never thought about it. ☐ (7) Other reasons, please specify _________________________________ .
3.4.5. **Has the ORGANIC certification strongly affected the way you do your farming** (in terms of land maintenance, input use, harvesting methods)**?** ___________________________ *[0=No; 1=Yes;]*	3.4.5. **Has the GLOBALGAP certification strongly affected the way you do your farming** (in terms of e.g. land maintenance, inputs, harvesting methods)**?** ___________________________ *[0=No; 1=Yes;]*

From here on, the questions are again for all farmers. *AGAIN, IF FARMERS ARE BOTH ORGANIC AND GLOBALGAP (FORMERLY EUREPGAP) CERTIFIED, THEN REFER TO ORGANIC CERTIFICATION; IF FARMERS ARE NOT ORGANIC CERTIFIED THEN REFER TO GLOBALGAP CERTIFICATION.*

3.5.1. **Who organised the certification process?** *[PLEASE TICK ONLY ONE]*
☐ (1) Me myself; ☐ (2) The farmer group; ☐ (3) The exporter; ☐ (4) An international aid organisation; ☐ (5) NGO; ☐ (6) Other, specify: ___________________________ .

3.5.2. **Who paid for the certification?** *[PLEASE TICK ONLY ONE]*
☐ (1) Me myself; ☐ (2) The farmer group; ☐ (3) The exporter; ☐ (4) An international aid organisation; ☐ (5) NGO; ☐ (6) Other, specify: ___________________________ .

3.5.3. **How much did you have to pay for the initial certification?**
[WRITE 0 IF THE FARMER DID NOT HAVE TO PAY FOR IT.]
_________________ [*new GHC*]

3.5.4. **How much do you have to pay for the yearly renewal of the certification?**
[WRITE 0 IF THE FARMER DID NOT HAVE TO PAY FOR IT OR DID NOT HAVE TO RENEW IT YET.]
_________________ [*new GHC*]

3.5. **Did you receive special training in preparation of the certification?**
___________ *[0=No; 1=Yes]*
3.6.1. **If YES (1),** have you implemented any of the techniques or methods that you have learned in the training?
☐ (0) No; ☐ (1) No, was not suitable for my farm; ☐ (2) No, but I am planning to do so;
☐ (3) Yes.

3.7. **What kind of investments did you have to make in order to achieve the certification?**
Please tell me about all the investments that you had to make. *[DO NOT READ THE OPTIONS TO THE FARMERS.]*

Investment	**Costs in new GHC** *[WRITE ZERO IF NO COST]*	**Time spent on this investment** *[days]*
Equipment (like chemical storage facilities, protective clothing, toilets, etc.)		
Training		
Other, specify: ________________________		

3.8. **Are you planning or would you like to get any (additional) certification in the near future?**
___________ *[0=No; 1=Yes]*
3.8.1. **If YES (1),** which one?
____

3.9. **Has your farm been GIS mapped?** *[GIS=geographical information system]*
___________ *[0=No; 1=Yes]*
3.9.1. **If YES (1), when (month/year) and by which organisation?**
_______/________ *[mm/YYYY]* ______________________________ *[organisation name]*

3.10. **Would you renew your certification even if the exporter would no longer buy from you?**
☐ (0) No.
☐ (1) Yes, I would find another exporter.
☐ (2) Yes, in any case.

PART 4: PINEAPPLE PRODUCTION AND MANAGEMENT BY THE HOUSEHOLD

[AGAIN, IF FARMERS ARE BOTH ORGANIC AND GLOBALGAP (FORMERLY EUREPGAP) CERTIFIED, THEN REFER TO ORGANIC CERTIFICATION; IF FARMERS ARE NOT ORGANIC CERTIFIED THEN REFER TO GLOBALGAP CERTIFICATION.]

[IF THE FARMER HAS PLANTED MORE THAN ONE VARIETY OF PINEAPPLE AND TREATS THESE VARIETIES DIFFERENTLY IN TERMS OF THE QUESTIONS THROUGHOUT THE QUESTIONNAIRE, ASK FOR THE VARIETY THAT IS PRIMARILY SOLD FOR EXPORT & THEN REFER TO THIS VARIETY.]

4.1.	**# of pineapple plants; changes in productivity**	
1.	Has the number of plants that you have per acre changed since you received GLOBALGAP (formerly EurepGAP) /ORGANIC certification? *[0=No; 1=Yes, increased; 2=Yes, decreased]*	
2.	Has the productivity of your farm changed since you received GLOBALGAP/ORGANIC certification? *Productivity change could be more (positive change) / less (negative change) harvested amount (# of pineapple) per hectare.* *[0=no, remained constant; 1=Yes, increased; 2=Yes, decreased]*	
4.	If YES (1 or 2), can you estimate by how much it has decreased or increased? *[IF POSSIBLE, GIVE %, OTHERWISE CLEARLY STATE THE UNIT USED]*	
5.	What part of your pineapple harvest did you sell to exporters before you received GLOBALGAP/ORGANIC certification? *[WRITE DOWN UNIT, E.G. %]*	
6.	What part of your pineapple harvest do you sell to exporters now (after receiving GLOBALGAP/ORGANIC certification)? *[WRITE DOWN UNIT]*	

4.2. **Did you grow any other crop aside pineapple on any of your pineapple plots during the last 5 years (since 2005)?**
________________ *[0=No; 1=Yes]*

4.2.1. **If YES (1),** on what part of your pineapple plots? *[WRITE DOWN UNIT]*
____

4.3.1. **How many years have you used the same land for pineapple?** ____________ [# of years]
4.3.2 **How many years do you leave a pineapple plot fallow?** ___________ [# of years]

4.4. **What kind of soil do you have on most of your pineapple plots?** *[PLEASE TICK ONLY ONE]*
☐ (1) Red or black Sandy; ☐ (2) White Sandy; ☐ (3) White rocky; ☐ (4) Rocky red or black;
☐ (5) Sandy or Rocky Clay; ☐ (6) Clay; ☐ (7) Other (specify): _______________________.

4.5. **How big a problem is soil erosion (i.e. washing away of soil when it rains) on your pineapple plots?**
☐ (1) not a problem (no erosion); ☐ (2) a small problem (mild erosion);
☐ (3) a big problem (severe erosion).

4.6. **Compared to other farmers in the region, do you think your pineapple yields are:**
☐ (1) higher; ☐ (2) average; ☐ (3) lower.

4.7. **Which factors are for you the most important constraints to pineapple production expansion?**
[A MAXIMUM OF TWO OPTIONS IS POSSIBLE.]
☐ (1) lack of suckers; ☐ (2) lack of market; ☐ (3) lack of time; ☐ (4) lack of land;
☐ (5) lack of credit; ☐ (6) other (specify) ____________________ .

4.8. **Soil fertility and water conservation management practices applied on pineapple plots**
Let us talk about what you do to improve the soil fertility and conserve water on your pineapple plots. I will now mention different ways of managing soil fertility and conserving water. Please then tell me if you use this method or practice currently, if you have used it before joining the GLOBALGAP (formerly EurepGAP) /ORGANIC certification scheme, and how you have changed it because of the certification.
[PLEASE NOTE THAT THE TABLE COVERS MORE THAN ONE PAGE]

Soil fertility and water conservation management practices?	**Current Pineapple Plots**	**Did you apply this method on your pineapple plants before starting the certification process?** *[0=No; 1=Yes]*	**How have you changed the way you use this method since joining the certification scheme, if at all?** *[0=no change, 1=reduced frequency &/or amount, 2=increased frequency &/or amount]*
Trash lines [*# per pineapple plot, leave blank if not used*]			
Infiltration ditches [*# per pineapple plot, leave blank if not used*]			
Live cover crops (types) (e.g., peas, beans, etc.) [*name types of cover crops, if any; leave blank otherwise*]			
Live cover crops [*estimated part of pineapple plots; WRITE DOWN UNIT, E.G. %]*			
Mulch [*estimated part of pineapple plots; WRITE DOWN UNIT]*			
Type of mulching materials (e.g. maize stalks, banana leaves, pineapple husks, grass, plastic mulch) [*name material of mulch, if any; leave blank otherwise*]			
Organic fertilizers, compost or green manure (made from grass, cocoa husk, palm branches, other crop residues, etc) or black soil [*estimated amount in kg per pineapple plot, leave blank if not used*]			
Chemical fertilizers (NPK, Urea, etc.) [*amount in kg per pineapple plot, leave blank if not used*]			

Animal manure (poultry (chicken droppings), goat, pig, cattle) or cow dung [*amount per pineapple plot, leave blank if not used*]			
Leguminous residues mixed into the soil [*amount in kg per pineapple plot, leave blank if not used*]			
Other soil & water conservation methods *[specify type & amount or frequency]*			

4.9. **Have you changed the way you manage soil and water on your other plots (plots with other crops, not pineapple) since joining the GLOBALGAP (EurepGAP) /ORGANIC certification scheme?**
____________ *[0=No; 1=Yes]*

4.10. **Change in biophysical features of pineapple plots since joining the GLOBALGAP (**EurepGAP**)/ORGANIC certification scheme**
For each feature, please tell me how it has changed on your pineapple plots since entering into the certification process or if there has been no change.

Perceived changes in biophysical feature since joining the GLOBALGAP/ORGANIC certification scheme	**CODE**	**Pineapple Plots** *[0=no change, 1=declined, 2=increased]*
Good cover with pineapple plants (i.e. absence of gaps) *[0=no change, 1=improved, 2=worsened]*	1	
Incidence of phytophtora	2	
Other pest and disease infestation	3	
Weed infestation	4	

4.11. **Do you irrigate your pineapple plots?**
☐ (0) No; ☐ (1) Yes, partly; ☐ (2) Yes, fully.

4.12. **Pineapple planting methods and plant spacing**
Let us talk about the methods you currently use to plant pineapple.
IF THE FARMER HAS FARMS MORE THAN TWO DIFFERENT VARIETIES, ONLY REPORT THE TWO MOST IMPORTANT ONES IN ECONOMIC TERMS.

Planting methods and plant spacing	**CODE**	**Current Pineapple Plots Variety 1**	**Current Pineapple Plots Variety 2**
When was the last time you planted pineapple? *[year and month*]?	**1**		
Did you produce the suckers yourself? *[0=No; 1=Yes]*	**2**		
How many of the suckers have later died? [*WRITE DOWN UNIT, E.G. PART OR %]*	**3**		
Did you practice sorting and grading of your planting material (suckers, slips) before planting? *[0=No; 1=Yes]*	**4**		
Did you disinfect the suckers? *[0=No; 1=Yes]*	**5**		

4.13. **Current pineapple plant management practices**

Let us talk about what you do to manage the pineapple plants. I will mention different management practices. Please then tell me then whether you have applied or are planning to apply this practice on your current pineapple plots, and if so, how many times you used it. Please also tell me, if you have applied it before joining the GLOBALGAP (formerly EurepGAP) /ORGANIC certification scheme, and how you have changed it because of the certification.

Pineapple plant management practices	**CODE**	**Current Pineapple Plots**	**Did you apply this practice on your pineapple before achieving the certification?** *[0=No; 1=Yes]*	**How have you changed the way you use this practice since achieving, if at all?** *0=no change, 1=reduced frequency &/or amount, 2=increased frequency &/or amount*
Clean weeding (with a hoe) or slashing weeds (cutting without uprooting or turning the soil) *[# of times weeded this way]*	**1**			
Apply chemical pesticides (against pests and diseases) and/or herbicides and/or fungicides (against weeds and fungi) *[# of times done]*	**2**			
Apply organic pesticides (e.g., Tephrosia vogelii, Neem extract, wood ash, red chillies, Tithonia ash, marigold solution, stinging nettle, urine) *[# of times done]*	**3**			
Applying ethylene/ethrel or calcium carbide for flower induction (forcing)? *[0=No; 1=Yes]*	**4**			
If YES (1), ethylene (e.g. ethrel) [=*1*] or calcium carbide [=*2*]?	**5**			
If YES(1), how many months after planting [*this might be several times]*	**6**			
Do you apply the ethylene/calcium carbide yourself or does the exporter do that? [*1=self, 2=exporter*]	**7**			

4.14. **Have you changed the way you manage soil and water on your other plots** (plots with other crops, not pineapple) **since joining the GLOBALGAP/ORGANIC certification scheme?**
___________ *[0=No; 1=Yes]*

PART 5. PINEAPPLE HARVESTING & MARKETING

5.1. **Changes in pineapple quality**
[*AGAIN, IF FARMERS ARE BOTH ORGANIC AND GLOBALGAP CERTIFIED, THEN REFER TO ORGANIC CERTIFICATION; IF FARMERS ARE NOT ORGANIC CERTIFIED THEN REFER TO GLOBALGAP CERTIFICATION.]*

	How specifically has the quality of your pineapple (at time of sale) changed since you received GLOBALGAP (formerly EurepGAP) **or ORGANIC certification with respect to:**	
1	**Size and weight of the pineapple?** *0=no change; 1=bigger/heavier now, 2=smaller/lighter now; 3=Other (specify)*	
2	**Colour of pineapple?** *0=no change; 1=improved (specify); 2=worsened (specify); 3=Other (specify)*	
3	**Bruises, sunburn, or similar?** *0=no change; 1=improved; 2=worsened; 3=Other (specify)*	
4	**Internal browning?** *0=no change; 1=improved; 2=worsened; 3= don't know; 4=Other (specify)*	

5.2. **Are you keeping records on your farming activities, such as harvest, production or sales records?**
_______________ *[0=No; 1=Yes]*

5.3. **Pineapple harvested in the last year (January 2009 to today)**
Let us talk about each of the seasons you harvested pineapple in the last year (2009) and up to today.
IF THE FARMER HAS HARVESTED AND SOLD MORE THAN TWO DIFFERENT VARIETIES, ONLY REPORT THE TWO MOST IMPORTANT ONES IN TERMS OF QUANTITY. IF THE FARMER HAS ONLY 1 VARIETY, THEN REPORT ONLY 1.

Year	**Quantity harvested** *[UNIT: Kg, pieces, boxes, other (specify)]*	**Con-version factor into kg**[1]	**Corresponding number of acres** *[# of acres that the pineapple was harvested at]*	**Variety of pineapple harvested** *[1=Smooth Cayenne, 2=Sugar Loaf, 3=MD2, 4=Queen, 5=Other (specify)]*	**Quantity sold to exporters** *1=%; 2= units from 1st column [WRITE UNIT IN BRACKETS.]*	**Quantity sold on the local market** *1=%; 2= units from 1st column [WRITE UNIT IN BRACKETS.]*	**Quantity consumed/ self-processed/ gift** *1=%; 2= units from 1st column [WRITE UNIT IN BRACKETS.]*	**Quantity wasted on the field** *1=%; 2= units from 1st column [WRITE UNIT IN BRACKETS.]*
2009 First variety								
2009 Second variety								
2010 First variety								
2010 Second variety								

[1]*PLEASE ASK THE FARMER FOR THE AVERAGE WEIGHT OF THE PINEAPPLE HARVESTED AND/OR # OF PINEAPPLE IN BOX IF APPLICABLE.*

5.3.1. **How many plants did you force (i.e. induce flowering) in 2009?**
____ [# of plants]
5.3.2. **If you have forced some plants, how many of these were harvested later?**
____ [# of pineapples]
5.3.3. **And how many of these were sold to the exporter?**
____ [# of pineapples]

5.4. **Pineapple sales in the last year (January 2009 to today)**
Let us talk about each of the seasons you sold pineapple in the last year (2009) and up to today. Please tell me about sales to both exporters and to middlemen and other buyers. I am only interested in the sales of pineapple harvested from the fields operated by this household, and not in pineapples bought from other farmers and resold (i.e. trading in pineapple).
FINISH ONE SALE BEFORE GOING TO THE NEXT. IF THE FARMER DOES NOT REMEMBER THE SUM OF ALL SALES IN ONE OF THE SEASONS, GET AS MANY SALES AS HE DOES REMEMBER AND FILL OUT ALSO THE 'ALL SALES' COLUMN. ***WRITE '0' IF NO SALES HAVE TAKEN PLACE.*** *IF THE FARMER KEEPS RECORDS, (QUESTION 5.2.), ASK HIM/HER TO USE THEM TO ANSWER THE QUESTION. PLEASE CONTINUE ON FREE SPACE PRVIDED ON THE LAST PAGE IF YOU NEED MORE SPACE.*
FOR EACH SALE, SEPERATELY FILL IN SALES FOR THE ***local*** *AND* ***export*** *MARKET. NOTE THAT THE TABLE COVERS MORE THAN ONE PAGE.*

	Aspect of selling pineapple	**Sales**				
		2009 first variety	**2009 second variety**	**2010 first variety**	**2010 second variety**	**All Sales**
Local	**How much was sold at this instance** *[kilogramme]***?** *FILL IN FROM PREVIOUS TABLE*					
Export						
Local	**Which variety was sold at this instance?** *FILL IN FROM PREVIOUS TABLE*					
Export						
Local	**Who bought the pineapple?** *1=Middleman/Trader, 2=Exporter/Cooperative (specify) 3=Other farmer, 4=Shop keeper/ Market woman, 5=Processor for export, 6=Processor for local market, 7=Other (specify)*					
Export						
Local	**Where was the pineapple sold?** *1=On-farm; 2=Road-side; 3= Office/store of Project./Coop/Exporter;*					

	Aspect of selling pineapple	Sales				
		2009 first variety	2009 second variety	2010 first variety	2010 second variety	All Sales
Export	*4=Nearest village, or retail shop; 5=Other (specify)*					
Local	**What did it cost in total to transport the pineapple to the point of sale?** [*new GHC; LEAVE BLANK IF SOLD ON-FARM*]					
Export						
Local	**How much did the buyer pay you in this sale in total?** [*new GHC*]					
Export						
Local	**What was the unit price?** *[new GHC/Quantity unit]* [*SPECIFY UNIT!*]					
Export						

5.4. Let us talk about the way you handle your pineapple after harvesting. **How do you store your pineapple before it gets picked up or before you transport it to the exporter or to the local market?**
☐ (1) un-shaded on bare ground; ☐ (2) shaded on bare ground; ☐ (3) in bag or box on floor;
☐ (4) Stored in a cooled room; ☐ (5) other, specify:___________________

5.5. **How long do usually you store your pineapple after harvest (before it is sold)?**
___________________________ [*average # of days*]

5.6. **How long does it take you to go from your farm to the closest local market using your usual method of transportation?**
[SPECIFY UNIT: HOURS / MINUTES, OR SIMILAR]
____

PART 6. PARTICIPATION IN THE OUTGROWER SCHEME OR CONTRACT WITH EXPORTER

Let us talk about the past, i.e. before you entered into the certification process first.
6.1. **Did you participate an outgrower scheme/contract farming with an exporter before you entered into the certification process?** *[AS ALWAYS, REFER TO ORGANIC IF THE FARMER IS ORGANIC AND GLOBALGAP CERTIFIED AND TO GLOBALGAP OTHERWISE.]*
______________ *[0=No; 1=Yes]*

6.2. **Who was your main buyer of your pineapple before you received GLOBALGAP** (formerly Eurepgap)**/ORGANIC certification?**
[WRITE "1" FOR THE MOST IMPORTANT, "2" FOR THE SECOND MOST IMPORTANT, AND SO ON. LEAVE BLANK WHEN NOT SOLD TO THIS BUYER.]
(1) Market women/ shop keepers _________ ; (2) Processors for the local market __________ ;
(3) Exporters or processors for the export market ___________ ;
(4) Roadside sellers/Traders ___________ ; (5) I sold myself to consumers ___________
(6) Other (specify): _______________________________

Now let us talk about your current farm again.
6.3. **Do you sell your pineapples for export to one or more different exporters?**
☐ (1) only to one exporter; ☐ (2) to two or more exporters.

6.4. **Do you participate in an outgrower scheme/contract farming with an exporter (currently)?**
______________ *[0=No; 1=Yes]*
6.4.1. **If YES (1),** what is the name of the exporter?
____

6.4.2. **If, NO (2),** who is your most important exporter buyer (2009 to today)?
[i.e. the major buyer among the exporters that the farmer sells to]
____ [*name*]

Now let us talk about your participation in the outgrower scheme or about your most important exporter buyer. [*NAME IT! (NAME FROM PREVIOUS QUESTION* 6.4.1 or 6.4.2)] **THE FOLLOWING QUESTIONS REFER ONLY TO THIS PARTICULAR BUYER.**

6.5. **How often do you meet or talk to this exporter?**
_________________ [*times per year or month, SPECIFY UNIT*]

6.6. **Has this frequency changed since you entered into the certification process?**
☐ (0) No. ☐ (1) Yes, it we meet or talk to each other more often now. ☐ (2) Yes, it got less.

6.7. **Is there any formal agreement with this exporter that you sell to?**
_____________ *[0=No; 1=Yes]*
6.7.1. **If YES (1), i**s this agreement written or oral? ☐ (1) Written; ☐ (2) Oral
6.7.2. **If YES (1),** for what period of time is this agreement formalised (how many years or months)?
___________________________________ *[SPECIFY UNIT]*

6.8. **Does this buyer guarantee to buy a certain volume of pineapple or a certain part of your harvest?**
_____________ *[0=No; 1=Yes]*

6.9. **For how long have you been selling pineapple to this buyer?** [*PLEASE TICK ONLY ONE.*]
☐ (1) For one year or shorter; ☐ (2) For 3 years or shorter (but more than one year);
☐ (3) For five years or longer.

6.10. **How would you describe the quality of the relationship between you and this buyer?**
☐ (1) Very good; ☐ (2) Good; ☐ (3) OK; ☐ (4) Not very good.

6.11. **Has this quality of the relationship changed since you entered into the certification process?**
☐ (0) No change. ☐ (1) Yes, it got better. ☐ (2) Yes, it got worse.

6.12. **Is the exporter usually coming to pick up the fruit at the agreed time** (i.e. is not too late or too early)**?**
_____________ *[0=No; 1=Yes]*

6.13. **Are you happy with the amount of fruit that the exporter is buying from you?**
_____________ *[0=No; 1=Yes]*

6.14. **Who sets the price for pineapple that you sell?** [*PLEASE TICK ONLY ONE.*]
☐ (1) The buyer sets the price. ☐ (2) The price is negotiated. ☐ (3) The price is written in the contract.

6.14.1. **How often is the price for pineapple renegotiated/reset between you and this buyer?**
[*PLEASE TICK ONLY ONE.*]
☐ (1) once a year. ☐ (2) more than once a year.
☐ (3) less than once a year. ☐ (4) at every purchase.

6.14.2. **Has the way prices are negotiated changed since you received GLOBALGAP/ORGANIC certification?**
☐ (0) No change. ☐ (1) Yes, prices are reset/ renegotiated more frequently. ☐ (2) Yes, …less frequently.

6.15. **As a rule, how many weeks after the harvest does this buyer usually pay you?**
☐ (1) the same day; ☐ (2) > 1 day and < than 1 week; ☐ (3) > 1 week and < than 1 month;
☐ (4) > 1 month and < than 3 months; ☐ (5) 3 months or more.

6.15.1. **Has this changed since you received GLOBALGAP (**EurepGap**)/ORGANIC certification?**
☐ (0) No change. ☐ (1) Yes, the buyer pays faster after harvest. ☐ (2) Yes, the buyer pays later.

6.16. **Do you have the phone number of this buyer?**
_____________ *[0=No; 1=Yes]*

6.17. **Does this buyer visit your plots in order to inspect the fruits before harvesting?**
☐ (0) No; ☐ (1) Yes, sometimes; ☐ (2) Yes.

6.18. **Does this exporter have cold storage facilities?**
_____________ *[0=No, 1=Yes, 2= I don't know]*

6.19. **Reason(s) for not selling pineapple as ORGANIC or GLOBALGAP certified**
For all pineapple sales in 2009 and up to today where the pineapple was not sold under this certification (including sales to the local market), please tell me why you did not sell this pineapple as certified ORGANIC or GLOBALGAP?
A MAXIMUM OF THREE OPTIONS IS POSSIBLE. DO NOT MENTION ALL THE OPTIONS TO THE FARMER.
☐ (1) The pineapple exporter was not buying during this period;
☐ (2) The pineapple was rejected by exporter(s);
☐ (3) The pineapple exporters' buying post was too far away and we did not have the means or the money to transport the pineapple to the place of sale;
☐ (4) We urgently needed cash;
☐ (5) The middleman paid a higher price than exporter(s);
☐ (6) Other (specify): ____ **.**

6.20. **How do you get information on the export market for pineapple?** [*MORE THAN ONE OPTION IS POSSIBLE*]
☐ (1) From the exporter/main buyer; ☐ (2) from other buyers; ☐ (3) from other farmers;
☐ (4) from a market news service (radio, sms, etc) ; ☐ (5) from MOFA (Ministry of Food and Agriculture)
☐ (6) elsewhere (please specify): ______________________________________

6.21. **Does the buyer process your pineapple (to e.g. sliced or dried pineapple or pineapple juice) or does he/she export your pineapple fresh?**
☐ (1) fresh; ☐ (2) processed; ☐ (3) both; ☐ (4) don't know.

6.22. **Is your pineapple exported by air or sea?**
☐ (1) Air; ☐ (2) Sea; ☐ (3) don't know.

6.23. **Change in income from pineapple since receiving certification**

How has your income from pineapple changed since receiving the certification? *[ONLY ONE ANSWER IS POSSIBLE]*	☐ 1. It has not changed. ☐ 2. It has increased. ☐ 3. It has reduced.
How has the <u>stability</u> of your pineapple income changed since receiving the certification? *[ONLY ONE ANSWER IS POSSIBLE]*	☐ 1. It has not changed. ☐ 2. It has become more certain. ☐ 3. It has become less certain.

6.24. **Equipment, training, and inputs received from this buyer (exporter) or another organisation**
Have you received any of the following types of support (buy or get for free) from this **buyer** or other organisations **(NGOs, aid organisations, etc. like MOFA, GTZ, TIPCEE, SNV, WAFF, Technoserve, GOAN, etc.**) in the last 5 years (since 2005)? Please tell me about each input, equipment or training that you received. Training includes any training on demonstration plots, agricultural extension, etc., which is related to farming or marketing of farm produce.
[LEAVE CELLS BLANK IF NOT RECEIVED/NOT APPLICABLE. NOTE THAT THE TABLE COVERS MORE THAN 1 PAGE.]

Input or equipment received in the last 5 years *(since 2005)*	**CODE**	**Name/s of institution/s/ person/exporter/s granting this support**	**When was the last time you received it?** *(year)*	**Approx. # of times support received** (since 2005)	**Did you have to pay for it directly or indirectly?** *0=No; 1=Yes*
Provision of a loan	1				
Payment in advance	2				
Help in getting loan from a bank	3				
Provision of fertilizer or chemicals	4				
Provision of equipment (specify): ________________________ ________________________	5				
Help on how to improve your farming techniques	6				

Training	7				
Farm inspections by exporter/organisation staff or external inspection officers	8				
Exporter did forcing (spraying ethrel, calcium carbide)	9				
Exporter did spraying with pesticides	10				
Any other support (specify): ____________________	11				

6.25. **How much would you get from an exporter and on the local market for pineapple if you had another type of certification?** *[NEW GHC PER KG OR PER PIECE, **SPECIFY UNIT**]*
*PLEASE ASK THE FARMER, **NO MATTER IF HE/SHE IS ORGANIC OR CONVENTIONAL GLOBAL GAP CERTIFIED, FOR BOTH PRICES,** ORGANIC AND CONVENTIONAL. ASK THE FARMER TO GUESS IF HE/SHE DOES NOT KNOW THE EXACT PRICE. WRITE"DON'T KNOW" ONLY IF THE FARMER HAS NO IDEA.*

	Exporter	**Local Market**
	On average in 2009	**On average in 2009**
Organic certified		
Conventional GLOBALGAP certified		

PART 7. INPUTS IN PINEAPPLE PRODUCTION

7.1. **Did you hire labour to work on your pineapple farm in the last year (2009)?**
By hired labour I also mean work parties and relatives paid in cash or kind.
__________ *[0=No; 1=Yes]*
IF NO, ONLY FILL OUT THE FIRST TWO COLUMNS IN THE FOLLOWING TABLE.

7.2. **Labour Inputs: participation in pineapple production, and marketing by different labour types in the last crop cycle (i.e. from planting to harvest)**
Let us talk about whom did what kind of work on all your pineapple plots in the last crop cycle. I will now mention the different work tasks in pineapple; for each task, if done at all, then please tell me who in the household participated in this work, and whether you hired labour to carry out the work. By hired labour I also mean work parties and relatives who you paid in cash or kind. Please also tell me the amount of work done by each group, and the cost of hiring in case of hired workers. *NOTE THAT THE TABLE COVERS 2 PAGES.*

Last crop cycle	**Family labour**		**Hired labour**					
Type of work/activity in pineapple in the last crop cycle	**How many household members worked on the pineapple plots including yourself?**	**How many days did these household members work on average on the pineapple plots?**	**How many labourers did you hire in total in the last crop cycle for these activities?**	**How many days/months did each of them work?** ***[specify unit of work:*** *day(D) or month (M)]*	**What was the rate paid per unit of work in the last crop cycle?** *[new GHC per day or month, SPECIFY UNIT]*	**How many days/months were done in total in the last crop cycle by hired labourers?** *[SPECIFY UNIT]*	**What was the total amount of cash paid for hired workers in the last crop cycle?** *[new GHC]*	**What other costs did you incur?** (e.g. food & drinks, in kind payment) *[Estimated value , new GHC; IF NO ESTIMATION CAN BE MADE, GIVE IN KIND ESTIMATIONS]*
Land preparation (ploughing, harrowing, removal of debris, plastic mulch, etc.)								
Pre-planting activities (fertilizer application, preparation of suckers, …)								
Planting of pineapple suckers								
Weed control								

Pest and disease control (insecticide/fungicide application, etc.)									
Soil fertility management and water conservation (incl. fertilizer application, manure, planting of cover crops, trash lines, etc.)									
Forcing									
Harvesting									
Negotiations with the buyer									
Total Marketing (do not fill in)									
Total Prod. (do not fill in)									

7.3. **Of the labourers you hired in 2009, can you indicate what part are casual, and what part are permanent workers on your farm?**
[*WRITE DOWN UNIT, E.G. PART OR %]*
Casual workers _________
Permanent workers _________

7.4. **Agricultural equipment and inputs used <u>for pineapple production</u> in the last crop cycle**

I will now mention different types of input and equipment that can be used in farming and especially in pineapple production. For each one, please tell me if you have used it in the last crop cycle. Please also tell me how much you had to pay for it, i.e. price at purchase, rent, or if it was given for free.

GO FIRST THROUGH ALL THE POSSIBLE INPUTS/EQUIPMENT (THE 'USED IN THE LAST CROP CYCLE?' QUESTION) AND THEN ASK THE OTHER QUESTIONS FOR THOSE WHERE THE ANSWER WAS YES(1).

Equipment/Input for pineapple production	**CODE**	**Used in the last crop cycle?** *0=No 1=Yes*	**How did you obtain the input or equipment?** *1=purchased, 2=rented, 3=given for free*	**Unit** *1=piece, 2=bag, 3=gallon, 4=basin, 5=tin, 6=kilogram, 7=litre, 8=wheelbarrow, 9=Other (specify)*	**Total # of units acquired 2009**	**What was the total cost?** *[new GHC]*	**From whom or where did you get it?** *1= private input supplier (shop, individual), 2=Another farmer, 3= the exporter, 4=other organisation (specify), 5=Other (specify)*
Pineapple suckers	1						
Inorganic fertilizers	2						
Organic fertilizers, compost, manure	3						
Mulch	4						
Herbicides/Fungicides	5						
Inorganic pesticides	6						
Organic pesticides	7						
Other chemicals	8						
Ethylene/Calcium Carbide	9						
Plastic foil/plastic mulch	10						
Knife	11						
Tractor/Motorcycle/Car/Trotro	12						
Safety equipment for farm	13						
Storage facilities	14						
Other, specify*	15						
	16						

** E.g. hoe, stumping saw, hand pulper, sprayer, etc.*

PART 8. HOUSEHOLD ASSETS OTHER THAN LAND, CASH INCOME, NON-AGRICULTURE EXPENDITURES, AND CREDIT

Let us now talk about your livestock, equipment and other items owned by the household.
8.1. **Livestock ownership.**
[MENTION ALL OPTIONS!]

Animal type	CODE	# owned end of 2009? [1]	# owned end of 2008?	Value if sold or bought? *[new GHC]*
Cattle *[bulls, heifers, calves (any type)]*	1			
Goats or sheep	3			
Pigs	4			
Chicken (poultry)	5			
Other (specify):	6			

[1] If the farmer cannot to give a precise number, ask him to say within which of the following ranges: 0 – 5, 5 – 10, 10 – 20, 20 – 30, etc.

8.2. **Equipment/durable goods owned by the household.**
[MENTION ALL OPTIONS!]

Type of equipment	CODE	# owned end of 2009? *(0=No; 1=Yes)*	# owned end of 2008? *(0=No; 1=Yes)*
Bicycle	1		
Motorcycle	2		
Car / Pick-up	3		
Wheelbarrow/push cart	4		
Animal drawn cart	5		
Bullock plough	6		
Knapsack sprayer	7		
Hoe	8		
'Slasher' /pineapple cutter	9		
Watering can	10		
Radio &/or TV	11		
Mobile phone	12		
Safety equipment	13		
Bank account	14		
Other (specify) * ______________	15		
______________________________	16		

** E.g., saw, grain mill, borehole, private well cart, tractor, etc.*

8.3. **Do you have any significant deposits in a bank account (more than 200 new GHC)?**
__________ *[0=No; 1=Yes]*

8.4. **Please tell me about your main cash income sources in the last two years (2008 and 2009)**
*FIRST ASK THE FARMER TO MENTION THE **MOST IMPORTANT** CASH INCOME SOURCES FOR THE HOUSEHOLD IN THE LAST TWO YEARS (2008 & 2009), FARM AS WELL AS NON-FARM. THEN ASK HIM TO RANK THEM ACCORDING TO ECONOMIC IMPORTANCE, STARTING WITH THE BIGGEST CASH EARNER IN 2009. IF POSSIBLE ALSO GIVE PERCENTAGES. USE PROBING TO MAKE SURE YOU CAPTURE ALL SIGNIFICANT INCOMES.*

Cash income source	**CODE**	**Farmer's rank according to economic importance 2009**	**Part or percentage of cash income in 2009** *[SPECIFY UNIT!]*	**Farmer's rank according to economic importance 2008**	**Part or percentage of cash income in 2008** *[SPECIFY UNIT!]*
Pineapple sales (excluding trade in pineapples)	1				
Other crop or livestock products sales[1]	2				
Trade	3				
Non-Farm Work Income	4				
Transfers, subsidies or donations (from the community, state, development agencies, etc.)	5				
Remittance income from family members or assistance from relatives or friends	6				
Others, specify: ________________________	7				
	8				
	9				
	10				

[1]*ONLY INCLUDE CROPS GROWN AND PRODUCTS PRODUCED BY THE HOUSEHOLD (EXCLUDING TRADE).*

8.5. **Did you receive any formal or informal credit for agricultural production in the last 5 years?**
_____________ *[0=No; 1=Yes]*

8.5.1. **If YES (1), what or who was the source of credit:** [*SEVERAL OPTIONS ARE POSSIBLE!]*
☐ (1) Bank; ☐ (2) Trader; ☐ (3) Exporter; ☐ (4) Money lender;
☐ (5) Government institution; ☐ (6); Microcredit /savings group;
☐ (7) Relatives / neighbours / friends; ☐ (8) NGO; ☐ (9) cooperative;
☐ (10) Other (specify): ______________________________

8.5.2. **If NO (0), why did you not receive credit?** *[MORE THAN ONE OPTION IS POSSIBLE]*
☐ (1) Not interested (due to high interest rate, etc.); ☐ (2) No need; ☐ (3) No credit available;
☐ (4) Others (specify): _______________________________

PART 9. SELECTED NON-INCOME HOUSEHOLD WEALTH INDICATORS AND PERCEPTIONS

9.1.	**FOOD CONSUMED IN THE HOUSEHOLD**	
.1	Usually do you manage to have the following meals during the day? *PLEASE TICK*	☐ (1) Breakfast ☐ (2) Lunch ☐ (3) Dinner
.2	During the last 12 months, has there been a period when your household didn't have sufficient food?	☐ (1)Yes ☐ (2) No ***If "NO", leave out the next question (9.1.3)***
.3	Altogether, how long did that period last? *PLEASE READ THE OPTIONS AND TICK ONLY ONE*	☐ (1) One week or less ☐ (2) Between 1 and 4 weeks ☐ (3) Between 1 and 3 months ☐ (4) More than 3 months ☐ (5) Don't know/I don't remember
.4	How often do you eat meat or fish? *PLEASE READ THE OPTIONS AND TICK ONLY ONE*	☐ (1) At least once a week ☐ (2) At least once a month ☐ (3) Less than once a month
	THE HOUSE AND ITS FACILITIES	
.5	How many rooms does your household occupy, excluding bathroom, corridors, and kitchen?	☐ (1) 1 room ☐ (2) 2 rooms ☐ (3) 3 rooms ☐ (4) 4 rooms or more
.6	What type of fuel does your household mainly use for cooking?	☐ (1) Wood ☐ (2) Coal ☐ (3) Gas ☐ (4) Electricity ☐ (5) Other, please specify ____________________ .
.7	Of which material are the walls of your house made? *IF POSSIBLE, JUST OBSERVE!*	☐ (1) Bricks ☐ (2) Plastered, cement, or cement bricks ☐ (3) Mud ☐ (4) Corrugated iron, old tins, or similar ☐ (5) Other, please specify: _________________.
.8	How is your bathroom located and do you share it?	☐ (1) inside and exclusive to the family ☐ (2) inside and shared ☐ (3) outside and exclusive to the family ☐ (4) outside and shared ☐ (5) no bathroom
	HEALTH	
.9	In the past, did someone in your family get health problems from using chemicals in farming (pesticides, fungicides, fertilizer, etc.)?	☐ (1) Yes ☐ (2) No
.10	In the last year how many working days have you lost for illness or injuries?	☐ (1) none ☐ (2) less than 5 days ☐ (3) 6-15 days ☐ (4) more than 15 days

9.2. **How much do you agree or disagree with the following statements?**

	How much do you agree or disagree with the following statements:	**Strongly disagree**	**Disagree**	**Partly Agree**	**Strongly agree**	**Do not know**	**No answer**
.1	I always want to try new farming techniques.	☐	☐	☐	☐	☐	☐
.2	I need to take risks to achieve success.	☐	☐	☐	☐	☐	☐
.3	Pineapple cultivation is very risky.	☐	☐	☐	☐	☐	☐
.4	Using new agricultural techniques significantly increases agricultural income.	☐	☐	☐	☐	☐	☐
.5	Spraying pesticide, herbicide, or fungicide affects my or my family's health negatively.	☐	☐	☐	☐	☐	☐
.6	Fertilizer is not available in time.	☐	☐	☐	☐	☐	☐
.7	Fertilizer is very costly.	☐	☐	☐	☐	☐	☐
.8	Pesticides, herbicides, & fungicides are not available in time.	☐	☐	☐	☐	☐	☐
.9	Pesticides, herbicides, & fungicides are very costly.	☐	☐	☐	☐	☐	☐
.10	Organic pineapple farming significantly reduces yields.	☐	☐	☐	☐	☐	☐
.11	Organic farming requires too much labour.	☐	☐	☐	☐	☐	☐

THE FOLLOWING QUESTIONS ASK FOR GENERAL FEELINGS OR PERCEPTIONS. PLEASE TICK ONLY ONE.

9.3. **Generally speaking how happy do you consider yourself?**

☐ (1) very happy; ☐ (2) happy enough; ☐ (3) not very happy; ☐ (4) not happy at all

9.4. **How important do you consider to preserve the environment?**

☐ (1) very important; ☐ (2) important enough; ☐ (3) not very important; ☐ (4) not important.

PART 10. END OF INTERVIEW

We have now come to the end of this interview. I want to thank you very much for all your time and effort to provide me with the answers. Is there something you want to ask in relation to the research and to being interviewed?

Time ended: ______________________

Enumerators comments on the interview, the respondent, the household, the pineapple farm, and/or important information that was revealed during the interview but that was not recorded:

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THANK YOU!!!

Enumerator Manual

Prepared by Linda Kleemann (020 567 0697)

1 GENERAL ISSUES

I have prepared a conversion table for everyone, that you can use whenever you need to convert units.

Whenever I am around I will take pictures of the interviews and the farms and I might record some interviews or parts of some with a voice recorder.

Timeline: 4 weeks

Please read the questionnaire carefully ….. Do you have any questions? Is there anything in the questionnaire that you don't understand?

This document is to provide you with answers to questions that might occur during, before or after the interviews. If the answer to your question is not provided in this manual, ask the supervisor/team leader for help.
Furthermore, you can always call me if I am not anywhere near and you have a question or one of the farmers has a question.

When you do the interviews, please ask for the household head or the person in the household that is most involved in pineapple farming on their own farm. If none of the two is present you may interview another household member, but make sure that this person is able to answer your questions. In particular, do not interview:

- Children of less than 14 years of age
- Household members that are not involved in the pineapple production of this farm.

2 INTERVIEWER'S TASK

Your role as an interviewer is crucial to the survey. The quality of the data to be collected will be determined by the quality of your work. You should keep in constant touch with your supervisor/team leader or/and the main researcher and inform him of any problems you encounter in your work in the field.

The team leader, on his part, will collect and check your work and help you solve any problems that may arise.

Your principal task is to conduct interviews with as many as possible households per day during the survey period. You must follow strictly all instructions contained in this manual. Read all questions exactly as they appear in the questionnaire.

You are solely responsible for keeping these working materials in order.

2.1 CHECKING THE COMPLETED QUESTIONNAIRE

After finishing each interview, you must verify that all the sections have been filled out correctly and legibly. This must be done immediately after the interview before you hand in the questionnaires to your supervisor/team leader and, most importantly, before leaving the area.

Although you may correct minor errors due to your having written down the answers badly, you must never under any circumstance make any other changes in the completed questionnaire without asking the respondents the same questions again. Do not copy the information you have collected into a new questionnaire. At the end of each day's work, all filled questionnaires must be submitted to your supervisor/team leader for editing. Errors detected must be corrected before submitting the questionnaires to the main researcher.

2.2 RELATIONS WITH THE SUPERVISOR/TEAM LEADER

You should always follow the advice given to you by your supervisor/team leader who is the representative of the main researcher. He/she will assign you work at the beginning of each cycle of the survey. In order to satisfy him/her that your work is up to standard, the supervisor/team leader will carry out the following checks in the field.

* He/She will examine in detail all questionnaires filled out by you to verify that each interview has been carried out properly and in full.

* He/She will randomly observe your interviews to evaluate your method of asking questions. You will not be informed in advance.

* Each day he/she will discuss your work with you and make regular reports to the main researcher on your performance in the field.

Your supervisor/team leader is the link between you and the survey organisation. Just as you will receive instructions from him/she, you must inform him/her of any difficulties or problems that you encounter. For instance, if you do not understand a procedure or the meaning of a question in the questionnaire, you should ask your supervisor/team leader for an explanation.

3 INTERVIEWING PROCEDURES

3.1 CONTACTING THE RESPONDENTS

If possible, you should contact each of the heads of households to be interviewed a day before the interview. The purpose of this is to introduce yourself, explain the purpose of the survey, and confirm that the interview will take place the next day.

3.2 EXPLANATION OF THE SURVEY

When you enter a household the first thing you should do is to greet every one, introduce yourself and say that you are conducting a survey of organic and/or GlobalGAP certified pineapple farmers in Ghana.

You should explain that:

* The interview contributes to a research project on economic and environmental aspects of certified pineapple farming. This research project is carried out by the Kiel Institute in Germany in collaboration with Department of Agricultural Economics (Dr. Victor Owusu), University of Kumasi. The survey is very important for planners to know how to improve the quality of pineapple farmers' living standards.

* The communities and the households that will be interviewed have been randomly selected. Other neighbouring communities and households have been selected in the same way.

* The survey is not concerned in any way with taxes, and all the information recorded will be regarded as confidential and covered by the obligation of statistical secrecy.

You should frequently remind the respondent of the purpose of the survey and of the fact that the data obtained would be kept confidential. This is very important at the beginning of each visit. If you are accompanied by a supervisor/team leader, you should introduce him/her at the beginning of each interview. Explanations play a great part in the willingness of people to reply to questions. Part of this is also written in the explanatory part at the beginning of the questionnaire.

3.3 THE INTERVIEW

You must be careful to follow all the instructions set out in this manual the most important of which is to ask the questions exactly in the form in which they appear on the questionnaire. The questionnaire should be filled during the interview. You must not record the answers on scraps of paper with the intention of transferring to the questionnaire later. Neither should you count on your memory for filling in the answers once you have left the household.

3.4 TEMPO OF THE INTERVIEW

You must maintain the tempo of the interview; in particular, avoid long discussions of the questions with the respondents. If you are receiving irrelevant or complicated answers, do not break in too suddenly, but listen to what the respondent is saying and then lead him/her back to the original question. Remember it is you who are running the interview and therefore you must be in control of the situation at all times.

3.5 OBJECTIVITY OF THE INTERVIEWER

It is extremely important that you should remain absolutely NEUTRAL about the subject of the interview. Most people are naturally polite, particularly with visitors, and they tend to give answers and adopt attitudes that they think will please the visitor. You must not express surprise, approval or disapproval about the answers given by the respondent and you must not tell him/her what you think about these things yourself.

You must also avoid any preconceived ideas about the respondent's ability to answer certain questions or about the kind of answer he is likely to give. Your most important task is to read the questions exactly as they are written in the questionnaire.

3.6 PRIVATE NATURE OF THE INTERVIEW

All the data collected are strictly confidential. Any breach of the confidentiality is forbidden by law. In principle all the questions should be asked in complete privacy to ensure that his answers remain confidential. The presence of other people during the interview may cause him embarrassment and influence some of his answers.

3.7 CONDUCT OF THE INTERVIEWER

The interviewer must observe the following rules:

1. You must be courteous towards everyone (the respondent and his/her family and friends, the supervisor/team leader, the other members of the team and everyone else involved). Your behaviour can have an enormous influence on people's opinions in the localities covered by the survey.

2. You must avoid disturbing or upsetting anyone by your behaviour.

3. You must be properly dressed, so that the respondent will be inclined to trust you, as a reliable and responsible person.

4. You must arrive at the stated time, and never keep the respondents waiting.

5. You must exercise patience and tact in conducting the interview, to avoid antagonising the respondent or leading him to give answers that are not in conformity with the facts.

3.8 USE OF INTERPRETERS

When you first enter a household, you must find out whether you will need an interpreter or not. If no one in the household speaks English well enough to interpret and none of the team members speaks the language of the household, you must ask the household to choose someone (for instance, a friend, a neighbour or a relative) to interpret for the interviewer. This person should be someone who speaks English well and is trusted by the household, since the questions are confidential.

You should be aware that in either case certain problems can arise from the use of interpreter:

1. It is difficult to know how good the translation is. It is possible that the respondent's friend who speaks English does not speak it well enough to translate everything said during the interview, and he will not want to admit it.

If you find that the replies do not correspond to the questions, try tactfully to help the interpreter or to replace him. You could for instance, suggest that interpreting is a very tiring job, and that the interpreter should take a rest while someone else carry on. Or you might say that you have already taken up too much of his (interpreter's) time, and that the job should be shared among a number of people.

2. Another difficulty often encountered is that the interpreter is so familiar with the household that he starts to answer for the respondent without directing the question to him (respondent). In such a situation you must politely remind the interpreter that it is the respondent that has been chosen for the interview, and that it is only his/her answers that you can write in the questionnaire.

4 GENERAL INSTRUCTIONS FOR FILLING OUT THE QUESTIONNAIRE

There are a number of basic principles that the interviewer must observe throughout the questionnaire.

1. Questions must be read to the respondent just as they are written in the questionnaire. Read all questions in a clear and comprehensive manner, and wait patiently for the reply. Respondents may delay in giving the reply because either he/she (a) has not heard the question well or (b) not understood the question or (c) does not know the answer.

   In any case, repeat the question much clearly. If there is still no answer, ask whether the question has been understood and, if necessary, reword the question without changing the sense. If it is difficult to get the right answer, you should help the respondent to consider his/her reply.

4.1 CODES

2. Most answers in the questionnaire are pre-coded. You must write only the code corresponding to the answer given by the respondent in the appropriate box or column or tick the corresbonding box ☐.

3. For those questions, which are not pre-coded, the interviewer should write the answers in figures, that is, numerals and not in words. For example, if the question is "how many acres of farm were cultivated by the member of the household in the past 12 months?" and the answer given by respondent is twenty acres, write 20 in the box or column as below:
4. Sometimes, there are special directives given to the interviewer at the end of a question or after answering a question.

5. OTHER (SPECIFY). If the reply given by the respondent does not fit in the list of pre-coded responses, you must use the code number of "other (specify)". In this case you should give details briefly in the space provided.

6. Write names of persons, places or things very legibly. This applies to figures as well.

7. Do your best to avoid accepting answers like "I don't know" by helping the respondent to consider his answer. Nevertheless, it does happen that even with the help of the interviewer, the respondent cannot give an answer. In that case, you should refer to the supervisor/team leader who will help you.

4.2 DATA ENTRY and NOTES FOR QUESTIONNAIRE

The data will be entered directly from the questionnaire. Everything that you write on the questionnaire will be entered in the computer straight away. Notes, explanations and calculations should be written onto the questionnaire in order to facilitate edit resolution. These notes, etc. should never be written in the data entry area. Consider the following points seriously;

1. Write legibly in pencil without crossing out or over writing.
2. Write in capital letters and in the case of figures don't use roman numbers: i.e. write 6 instead of VI. If you are not sure of the spelling of a place or name see the supervisor/team leader.
3. Never go beyond the space allotted for a question, even when the next space is not used.
4. In writing amounts and other figures, always separate each group of three figures with a comma, starting from the right: e.g. 100000 as 100,000; but not 100 000.
5. In a question whose reply is a quantity:
   a) write the figure and the unit if the unit is not pre-specified.
   b) write only the figure and not the unit if the unit is pre-specified.

Generally where a question specifically calls for a unit of measurement, the CODE for the unit will be shown in the appropriate page for your reference.
NOTE

i. *Persons with more than one name:* If a person has two names, one for official use and the other for use at home, write down the name(s) by which he/she is best known in the neighbourhood or village where he/she is being enumerated and then write his/her other name(s) in parenthesis. For example, Ato Safo (Charles Mensah).

ii. *Persons with identical names:* You may also come across households where two or more persons have identical names. In such a case you must record also the nick-names, or any other names by which they are distinguished in the household or by neighbours and friends, e.g., Kofi Kyamba Panyin and Kofi Kyamba Kakraba. Failing this you must distinguished them by physical characteristics such as height or fatness or shortness. Thus, for instance, you can have Abongo Jato (fair coloured) or Kofi Dogo (tall).

Sex
It is important to ask for the sex of the person when information is being given to you by a third person. Do not infer the sex from the name or names of the person. Bear in mind that some names can be misleading in this respect e.g. Kafui, Sena, Kakra, Panyin, etc. Some people also use George as a short form of Georgina and Ben for Benedicta.

Relationship
Record how the person listed is related to the head of the household. Be particularly careful in doing this if the respondent is not the head of the household; make sure that you record the relationship of each person to the household head, not the relationship to the respondent. For example, if the respondent is the wife of the head of the household and she says that Nab is her brother, then Nab should be coded as OTHER RELATIVE not BROTHER OR SISTER, because Nab is a brother-in-law of the head of the household. If the head of the household is married to a woman who has a child from a previous marriage, that child's relationship to the head of the household should be coded as ADOPTED/FOSTER/STEP CHILD.

Age
Age is to be recorded in completed years. The age is that on the last birthday. If, for instance, the respondent's eighteenth birthday falls on the following day, you must enter 17 as the answer. If the person does not know his/her age refer to events that have taken place in his/her life or in the Community (village, town, country) or the World such as the independence day of Ghana, World Wars, Earthquakes etc. as shown in the Calendar of Events.

What to do when a person does not know his/her age

(i) For such a person, use the following method to estimate his/her age:-

  (a) Ask him/her to name any historical event (preferably a local one) which occurred around the time of his/her birth.
  (b) Ask him/her to give you an indication of how old he/she was when that event occurred or how many years elapsed before his/her birth.
  (c) Then use this information to work out his/her age. For example, if a respondent tells you that he/she was about 15 years when Ghana attained her independence this person must be 15 + 47 (i.e. 6th March 1957 to May 2004) = 62 years.

(ii) If this approach does not elicit the required information, then base your estimate on biological relationships. For instance, a woman who does not know her age but who has two or three children of her own is unlikely to be less than 15 years old however small she may look. You may then try to work out her age by the following method:

  (a) Ask her, at what age she had her first child.
  (b) Determine the age of her oldest child.

Schooling

Formal schooling refers to attendance of either a Primary, Middle/JSS or Secondary school, Vocational/Technical or Professional school or Training or an Apprenticeship course. Attendance at a Koranic school, for no matter how many years, is to be included only if the person attended no other school.

Main Occupation

This is the work to which most time is devoted when a respondent has several jobs. For instance, the main occupation for the past 12 months of a respondent who farms mostly but often goes fishing during the dry season is farming.

Physical Characteristics Of The Dwelling

If the exterior walls of the dwelling are composed of several materials, for instance, one part of the wall is of bamboo, another part of earth and yet another part of concrete, choose the predominant material.

Payment in kind

This can be in the form of foodstuffs, cooked food, drinks, etc. The value of any payments in kind must be estimated and added to any cash payments and the total recorded.

AGRICULTURAL ASSETS; LAND, LIVESTOCK AND EQUIPMENT LAND.

Land rented out refers to land that has been given out for which periodic payments are received as well as land that has been leased out. You should record only those pieces of land rented out for which payment(s) have been received during the past 12 months. For example if land has been leased for ten (10) years and the amount was received in bulk during the last 12 month period, then the whole amount must be recorded. The cedi equivalent of foreign currencies should be recorded.

Share cropping is a system of sharing the produce of a farm between the landlord-farmer and the tenant farmer for a period of time. For instance, in Ghana we have the `abunu' and `abusa'. With the `abunu' system, the landlord-farmer and the tenant farmer share the produce of the farm equally while with the `Abusa' system the tenant farmer is entitled to one part and the landlord-farmer two parts of the produce.

Another variation of the `abusa' involves both the tenant farmer and the landlord-farmer each taking one part of the produce (in money value). The third part is used in maintaining or developing the land or farm. The proportion received by the household is to be entered in percentages (%) e.g. 1/2=50%, 1/3=33%, 1/4=25%, 1/5=20%.

AGRICULTURAL COSTS AND EXPENSES

Amount spent in kind must be estimated and added to the amount in cash.
NGOs refer to Non-Governmental Organizations like Global 2000, FAO, DFID, USAID, World Vision International, etc.

NOTES and DEFINITONS

Respondent

The respondent for this section is either the head of household or main respondent identified by the household.

Remittances are regular or irregular contributions in terms of money or goods and food made to person(s) living abroad or elsewhere. For example, any money, food or goods sent out or received by the household to/from a household member or relative staying abroad or elsewhere is a remittance. Read instruction at the top carefully and follow it.

END OF INTERVIEW

At the end of the interview you should express your gratitude to the household interviewed before leaving. Thank them for their co-operation and assistance.

Unit Converter:

1 new Ghanaian Cedi = 10 000 (old) Ghanaian Cedi

1 (square) pole (or perch, rod) = 30.24 square yards = 25.93 m^2 = 0.006 acres

1 hectare (ha) = 10000 m^2 = 2.5 acres = 400 (square) poles

1 acre = 0.4 ha = 4046.8 m^2 = 160 (square) poles

Square mile = 640 acres

1000 kg = 1 ton (t)

1 box of pineapples = 12 kg

1 container (on export vessel) = 16 tons

1 pallet = 65 boxes = 780 kg

Rod, Pole or Perch = 5.5 yards = 5.029 m

Rope = 20 feet = 6.10 m

1 foot (ft) = 12 inches (in) = 0.30479 m

1 m = 3.2809 feet

1 mile = 1.60934 km

1 km = 0.62137 mile = approx. 15 minutes (1/4 hour) walk

1/10 = 10%; ½= 50%; 1/3 (one third) = 33%; 2/3 (two thirds) = 66%, etc.

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Lebenslauf

Linda Kleemann

Persönliche Daten

Geboren am 19.05.1983 in Regensburg als Linda Ramcke

Deutsche Staatsangehörigkeit

Ausbildung

Seit 02/2009	Wissenschaftliche Mitarbeiterin am Institut für Weltwirtschaft in Kiel, Forschungsbereich Armutsminderung und Entwicklung; externe Doktorandin an der Christian-Albrechts-Universität zu Kiel, Institut für Ernährungswirtschaft und Verbrauchslehre
05/2008-01/2009	Wissenschaftliche Mitarbeiterin mit Zielrichtung Promotion an der Christian-Albrechts-Universität zu Kiel, Institut für Ernährungswirtschaft und Verbrauchslehre
09/2003-04/2008	Studium der Volkswirtschaftslehre (Diplom) an der Christian-Albrechts-Universität zu Kiel und Universidad de Zaragoza
09/1993-06/2002	Erwerb der allgemeinen Hochschulreife am Goethe-Gymnasium in Regensburg