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Foreign Direct Investment in Agriculture

The Impact of Outgrower Schemes
and Large-Scale Farm Employment
on Economic Well-Being in Zambia



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List of Abbreviations

ATT	Average treatment effect on the treated
CDC	CDC Group, former Commonwealth Development Corporation
CIA	Conditional independence assumption
DACO	District Agriculture Coordinator
DBZ	Development Bank of Zambia
FDI	Foreign direct investment
FE	Fixed effects
FGD	Focus group discussion
FSRP	Michigan State University's Food Security Research Project
ha	Hectare
KASCOL	Kaleya Smallholders Company Ltd
MACO	Zambian Ministry of Agriculture and Cooperatives (MAL since 2012)
MAL	Zambian Ministry of Agriculture and Livestock (previously MACO)
OLS	Ordinary least squares
PSM	Propensity score matching
RE	Random effects
SS	Supplemental Survey (to the Post Harvest Survey)
USD	United States Dollar
ZMK	Zambian Kwacha (Note that the ZMK was rebased to the ZMW (1000 ZMK = 1 ZMW) on January 1, 2013)
ZSC	Zambia Sugar Company

Abstract

Foreign direct investment (FDI) in agriculture and land has increased substantially since the 2007-2008 food price crisis. There is broad agreement that immense investments in agriculture are necessary in order to increase food supply and thus meet the projected increases in world food demand. However, FDI in large-scale agriculture has attracted growing criticism, as a large part of these investments is concentrated in developing countries, above all in Sub-Saharan Africa. Critics have dubbed these investments as “land grabs”, arguing that the low transparency in negotiation and decision processes and the serious lack of information about land transactions open the doors to corruption. This poses considerable risks, especially for population groups whose property and rights on land use are weakly defined or enforced.

The majority of small-scale farmers in Sub-Saharan Africa continue to farm at productivity levels far below their potential. They lack the necessary funds to buy high quality seed and fertilizer, to invest in infrastructure (e.g. irrigation, technology, roads, water, electricity) and are often unable to take advantage of market opportunities. In addition, rising quality and safety standards, as well as the need for higher coordination in modern food supply chains, carry the risk of increasing exclusion of smallholder farmers. This prospect is particularly critical as farming provides a living for the majority of people in many developing countries, particularly for the poor.

As there is a severe lack of quantitative evidence on the economic impact of FDI in land and agriculture, the primary goal of the study at hand was to collect and analyze empirical evidence, in order to better understand the potential benefits and pitfalls of such investments and related processes of agricultural commercialization. In particular, the study tests the effect of two strategies for including smallholder farmers into modern food supply chains: outgrower schemes, i.e. a type of contract farming whereby small-scale farmers produce crops for sale to a large-scale farming enterprise; and, on the other hand, wage employment on large-scale estates. In addition, we analyze the impact of income diversification through economic activities outside the farm (“off-farm”) in general.

The central part of the study looks at one specific investment project in the Zambian sugar cane sector. Data from a new household survey conducted in 2012 in Zambia’s “sugar capital” Mazabuka serve to assess whether or not, and how much, participants in sugar cane outgrower schemes and employees on large-scale sugar estates benefit from this investment. The

quantitative evidence from multiple regression analysis as well as propensity score matching points towards a positive and sizeable effect of participation in the sugar industry on (long-term) household wealth. Taking into account possible non-random selection, the results are robust to a wide range of different specifications. Small-scale farmers who participate in sugar outgrower schemes achieve significantly higher wealth compared to the comparison group consisting of other smallholder farmers in the region who are not linked to the sugar industry but are otherwise similar. Employees on large-scale sugar estates also appear to benefit significantly, although this effect is less pronounced. Qualitative research methods (focus group discussions and expert interviews) were used to complement the quantitative evidence; they largely corroborate the findings from the quantitative analysis.

The sectoral focus on the sugar cane industry was supplemented by a broader, cross-sectoral analysis of the impact of outgrower schemes (mostly associated with cotton production), employment on large-scale farms, and off-farm economic activities in general. Using a large, nationally representative panel survey covering more than 4'200 smallholder households in Zambia in 2001, 2004, and 2008 (MSU/FSRP/CSO), we employed panel data methods that are more suitable to solve the omitted variables problem inherent to cross-sectional studies. Controlling for unobserved time-invariant heterogeneity by using a fixed effects estimator, our analysis also suggests a significant positive effect of participating in outgrower schemes. Using several indicators to measure participation, we find significant positive effects on net agricultural incomes and also on overall net household incomes. The effect is even larger when taking into account the “degree of involvement in outgrower schemes” – it seems to pay off to intensify integration. Diversifying into off-farm economic activities is also associated with higher net incomes. At the same time, increasing diversification is accompanied by a moderate reduction in net income from agricultural production. Households that gain a greater percentage of their income through off-farm activities (running a business, carrying out wage activities, and receiving remittances) reach significantly higher incomes than households that rely on agriculture alone. Running a business or taking up wage employment in sectors other than agriculture seems to be particularly beneficial. Nevertheless, households that enter into agricultural wage employment also achieve significantly higher incomes.

Overall, the evidence in this study suggests that large-scale investments by foreign as well as domestic companies, and especially the model of cooperation with smallholder farmers in outgrower schemes, can indeed have positive and significant effects on the income and wealth of rural households.

Zusammenfassung

Ausländische Direktinvestitionen im Agrarsektor haben seit der 2007–2008-Preishausse bei Nahrungsmitteln stark zugenommen. Grundsätzlich besteht angesichts des prognostizierten globalen Anstiegs der Nahrungsmittelnachfrage ein breiter Konsens, dass erhebliche Investitionen notwendig sind, um die Nahrungsmittelproduktion zu steigern. Dennoch gerieten landwirtschaftliche Grossinvestitionen in den letzten Jahren zunehmend unter Kritik, da ein Grossteil dieser Investitionen in Entwicklungsländern und insbesondere in Subsahara-Afrika getätigt wird. Kritiker bezeichnen solche Investitionen als „Landraub“ („land grabbing“), da oftmals intransparente Verhandlungs- und Entscheidungsprozesse sowie der Mangel an verlässlichen Informationen über Landtransaktionen zur Verdrängung oder gar Vertreibung lokaler Bevölkerungsgruppen führen können, insbesondere wenn deren Eigentums- und Landnutzungsrechte gesetzlich unzureichend geschützt oder bestehende Rechte nicht durchgesetzt werden.

Die überwiegende Mehrheit der Kleinbauern in Subsahara-Afrika erzielt nach wie vor nur einen Bruchteil der möglichen Ernteerträge. Sie verfügen nicht über die notwendigen finanziellen Mittel, um qualitativ hochstehendes Saatgut und Düngemittel einzusetzen und notwendige infrastrukturelle Investitionen zu tätigen (z.B. Bewässerungsanlagen, Technologie, Strassen, Wasser, Elektrizität). Daher sind sie auf modernen Agrarmärkten kaum konkurrenzfähig. Kleinbauern können den steigenden Anforderungen bezüglich Qualität und Sicherheit sowie besserer Koordination zwischen Produzenten und Nahrungsmittelverarbeitern kaum entsprechen. Es besteht somit die Gefahr, dass Kleinbauern zunehmend marginalisiert werden, wenn nicht Wege gefunden werden, um sie in moderne Nahrungsmittelketten einzubinden. Dies ist umso dringlicher, als die Mehrheit der Menschen – und insbesondere der Armen – in vielen Entwicklungsländern von der Landwirtschaft abhängig ist.

Bislang wurden nur wenige quantitative Studien über die ökonomischen Auswirkungen von ausländischen Direktinvestitionen im Agrarsektor durchgeführt. Die vorliegende Studie bezweckt deshalb, die potenziellen positiven und negativen Effekte solcher Investitionen und damit zusammenhängender Prozesse der Kommerzialisierung der Landwirtschaft genauer zu untersuchen. Insbesondere werden zwei mögliche Strategien erforscht, um Kleinbauern in moderne Nahrungsmittelketten einzubinden. Einerseits die Möglichkeit des Vertragsanbaus, bei welcher ein privatwirtschaftliches Unternehmen Kleinbauern unter Vertrag nimmt. Andererseits die Anstellung als Arbeiter auf Grossfarmen. Zudem analysieren wir, wie sich die

Einkommensdiversifikation mittels Erwerbstätigkeiten ausserhalb des Landwirtschaftssektors auf den Wohlstand der Kleinbauern auswirkt.

Der Hauptteil dieser Untersuchung besteht aus einer Fallstudie eines Investitionsprojekts in der Zuckerindustrie in Sambia. Basierend auf Daten einer 2012 zu diesem Zweck von uns durchgeführten Haushaltsbefragung in Masabuka untersuchen wir, ob und wie stark Kleinbauern, die auf Vertragsbasis Zucker produzieren oder auf Zuckerplantagen angestellt sind, von dieser Investition profitieren. Die quantitative Analyse mittels multipler Regression sowie Matching-Modellen weist auf einen beträchtlichen positiven Effekt der Integration in die Zuckerproduktion auf den (langfristigen) Wohlstand von Haushalten hin. Die Resultate sind robust und halten auch statistischen Verfahren stand, die bezüglich Selektionsmechanismen kontrollieren. Kleinbauern, die auf Vertragsbasis Zucker herstellen, erreichen einen signifikant höheren Wohlstand als die Vergleichsgruppe von Kleinbauern in derselben Region, die nicht in die Zuckerproduktion eingebunden, aber sonst ähnlich sind. Angestellte auf grossen Zuckerplantagen profitieren auch, aber nicht im selben Ausmass. Qualitative Forschungsmethoden (Fokusgruppen sowie Experteninterviews) wurden als Ergänzung zur quantitativen Analyse eingesetzt und bestätigen die Resultate mehrheitlich.

Der sektorale Fokus auf die Zuckerindustrie wird durch eine breitere, sektorübergreifende Analyse der Effekte von Vertragsanbausystemen (vorwiegend zur Produktion von Baumwolle), Lohnarbeit auf Grossfarmen, sowie Anstellungsmöglichkeiten in anderen nicht-landwirtschaftlichen Tätigkeitsfeldern ergänzt. Ein grosser, national repräsentativer Paneldatensatz (MSU/FSRP/CSO), der mehr als 4'200 Kleinbauern in Sambia über drei Erhebungsjahre (2001, 2004 und 2008) begleitet, ermöglicht die Anwendung von Paneldatenmethoden. Ein Fixed-Effects-Modell, welches bezüglich konstanter, unbeobachteter Eigenschaften eines Haushalts kontrolliert, deutet ebenfalls auf einen positiven und signifikanten Effekt der Teilnahme in Vertragsanbausystemen hin. Teilnehmende Haushalte erzielen ein höheres Nettoeinkommen aus Agrartätigkeiten sowie höhere Netto-gesamteinkommen. Die Einkommensdiversifizierung durch Aufnahme von ökonomischen Tätigkeiten ausserhalb des eigenen Bauernhofs (z.B. Führen eines Geschäfts, Lohnarbeit innerhalb und ausserhalb des Agrarsektors) ist auch mit höheren Gesamteinkommen verbunden. Allerdings nimmt die Agrarproduktion mit zunehmender Einkommensdiversifikation leicht ab.

Insgesamt lassen die Resultate dieser Studie darauf schliessen, dass Grossinvestitionen von in- und ausländischen Firmen, und insbesondere deren Kooperation mit Kleinbauern in Vertragsanbausystemen, positive und signifikante Einkommens- und Wohlstandseffekte haben und somit einen positiven Beitrag zur ruralen Entwicklung leisten können.

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Introduction

Globally, foreign direct investment (FDI¹) in agriculture and land has increased substantially since the 2007-2008 food price crisis (UNCTAD 2009; Deininger et al. 2011). Driven in part by high prices and volatilities observed for most food commodities, public as well as private investors of food importing countries are seeking to purchase or lease large tracts of farmland for agricultural production.

In receiving countries, FDI can play an important role in promoting economic growth and in reducing poverty by providing capital, stimulating market competition and efficiency, introducing know-how, and by generating jobs. These investments have the potential to contribute to food production on a global scale and to increase food security in home and host countries. The majority of the poor live in rural areas – therefore development in the agricultural sector can have a greater impact on poverty reduction than growth in any other sector.

Despite this untapped potential, public spending in agriculture in developing countries remains limited. In 2010, governments in Africa on average allocated only around four percent of their national budgets to the agricultural sector, although expenditures reached 8.7% in Eastern and 7% in Western Africa (Benin and Yu 2013, p. 68). Parallel to low government expenditures, official development assistance (ODA) allocated to agriculture has dropped considerably over the past two decades, both in relative (from 18% to 3.5% between 1979–2004) and absolute terms (from 8 to 3.4 billion USD (2004 USD) between 1984–2004) (World Bank 2008, p. 41; Fan et al. 2009, p. 9).

Even though governments and donors have recently shown increasing interest in the sector², public investment will not be sufficient in the long run. FAO projections indicate that – in order to achieve the crop and livestock production levels foreseen for developing countries in the FAO food outlook – as much as 9.2 trillion USD (2009 dollars) need to be invested in the agricultural sector from 2005/07 to 2050 (Schmidhuber et al. 2009). In view of these immense investment requirements, the private sector will need to play an essential role, and private investors, both domestic and foreign, are in a position to make a significant contribution (UNCTAD 2009).

¹ The International Monetary Fund (IMF) defines foreign direct investment (FDI) as a “category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy”. Notably, the direct investor does not need to be in control of the enterprise, as acquisition of 10% or more of the voting power is considered a significant degree of influence (IMF 2009, p. 100f.).

² Motivated inter alia by their commitment to the Millennium Development Goal of eradicating extreme poverty and hunger by 2015, many African governments pledged in 2003 to allocate at least 10% of their national budgets to the agricultural sector by 2008 (see <http://www.nepad-caadp.net/>). However, a decade has passed since the “Maputo Declaration”, while only 13 countries have met the target (Benin and Yu 2013).

Nevertheless, the fact that FDI-driven demand for land is largely concentrated in developing countries, above all in Sub-Saharan Africa, has ignited a heated discussion about the benefits and risks of this development to host countries. While critics have dubbed these investments as “land grabs”, others claim they create a win-win situation. Anecdotal evidence suggests that outcomes for communities and whole societies may not always be positive. Low transparency in negotiation and decision processes and the serious lack of information about land transactions open the doors to corruption and may pose considerable risks. This holds true especially for population groups whose property and user rights are weakly defined or enforced.

Despite the lively debate about the potential benefits and pitfalls of FDI in land and agriculture, there is still very little *detailed* and *systematic* evidence on the extent, nature, and impact of these investments. The study at hand contributes to filling this gap by providing empirical evidence for a country case, Zambia. The study addresses the following research question:

Under which conditions does foreign direct investment in agriculture and land contribute to poverty reduction in receiving countries?

In particular, the study will test the effect of two strategies to include smallholder farmers into modern food supply chains. On the one hand, outgrower schemes, a type of contract farming where small-scale farmers produce crops for sale to a large-scale farming enterprise; on the other hand, wage employment on large-scale estates. In addition, it will analyze the impact of income diversification through economic activities outside the farm (“off-farm”) in general. The research thus aims to accumulate evidence to answer the following subquestions:

Do participants in outgrower schemes that produce crops for sale to foreign-owned large-scale estates achieve higher economic well-being than smallholder farmers?

Do workers on foreign-owned large-scale estates achieve higher economic well-being than smallholder farmers?

Do households that diversify their incomes through off-farm economic activities such as running a business or taking up wage employment achieve higher economic well-being than households relying on agriculture alone?

The study is organized as follows.

Chapter 1 presents an overview of the recent developments in the agribusiness value chain. These developments are partly driven by increasing FDI flows and pose both an opportunity as well as a threat to smallholder farmers. Contract farming and employment on large-scale estates are then discussed as possible strategies to address the challenges faced by small-scale

producers. The chapter concludes by summarizing what emerging empirical evidence tells us about the success of such approaches in developing countries.

Chapter 2 provides an overview of the general economic development in Zambia in the past decades. It describes the important role that agriculture plays in the Zambian economy. It then examines data on the evolution of FDI in the country, with a focus on recent FDI in the agricultural sector.

Chapter 3 presents an empirical case study conducted as a central part of this thesis. It looks at one specific investment project, namely FDI in the Zambian sugar cane sector. Data from a new household survey conducted in 2012 in Zambia's "sugar capital" Mazabuka serve to assess whether or not, and how much, participants in sugar cane outgrower schemes and employees on large-scale sugar estates benefit from this investment. Qualitative data gathered during focus group discussions and expert interviews in 2012 and 2013 serve to test and complement the results from the quantitative analysis.

Chapter 4 leaves the focus on the sugar sector and presents evidence on the impacts of agricultural commercialization in Zambia as a whole. Again, the emphasis lies on identifying whether farmers really benefit when they participate in outgrower schemes or diversify their income through employment on commercial farms. In addition, we address the question how off-farm activities in general impact household incomes. This study draws on panel data from a representative household survey conducted in all Zambian provinces in 2001, 2004, and 2008. Unfortunately the data does not allow to differentiate whether the outgrower schemes or companies that are linked with smallholder farmers are foreign or domestic. Nevertheless, globalization has not made halt at Zambia's borders, and many of the larger companies are at least partly foreign owned. The study thus provides some more general, cross-sectoral insights into the economic impact of contract farming schemes and off-farm employment on income levels of Zambian farmers.

The final chapter provides a synthesis of the study's key findings, draws first policy implications, and identifies issues that require further research.

Chapter 1

Transformation of the Agricultural Sector

Chapter Summary:

Globally, all levels of the agribusiness value chain have seen decisive changes since the 1980s. Foreign direct investments in agriculture as well as trade in food commodities have increased considerably in the course of globalization. At the same time the retail sector has seen a true “supermarket revolution” with traditional wholesale markets facing increasing competition through supermarket and fast-food chains. Overall, input suppliers, producers, food processors, as well as wholesale and retail are becoming increasingly more consolidated and multinational. This chapter first provides an overview of this ongoing process and then focuses on one of its key drivers, the increasing foreign direct investments. It explores the likely impacts of these developments on farmers and farm workers in rural areas. Finally, it discusses two possible strategies for the participation of smallholder farmers in modern food supply chains, either through participation in outgrower schemes or through employment opportunities provided by large-scale estates.

1.1 Increasing Vertical Integration in Food Supply Chains – Small-Scale Farmers under Pressure

Since the 1980s, all levels of the agribusiness value chain have undergone decisive change (Reardon et al. 2009). Input suppliers, producers, food processors, as well as wholesale and retail are increasingly becoming more consolidated and multinational. Trade in food commodities has more than doubled due to the liberalization of trade and improvements in logistics (Reardon et al. 2009). Along with globalizing markets came a rapid increase of foreign direct investments in all parts of the agricultural value chain (UNCTAD 2009). Changing demands of global buyers, food safety requirements, and quality standards have contributed to organizational and institutional change.

Spot or cash market transactions between trading partners of the supply chain are increasingly replaced by more coordinated modes of business relationships (Peterson et al. 2001; Humphrey and Memedovic 2006). Hybrid coordination strategies of formal nature (contract farming and equity arrangements) or informal nature (information sharing and joint planning) are increasing (Peterson et al. 2001, p. 150ff.). Similarly, the number of vertically fully-integrated organizations, where one firm is responsible for multiple market stages, is also rising.³

Agricultural production, in contrast to marketing and processing, has only few technical economies of scale, hence a wide range of production forms have been proven to operate efficiently (Binswanger and Deininger 1993; Deininger et al. 2011, p. 28f.). Historically, farms in most countries have been rather small, family-owned and family-operated. Small farmers possess know-how of local conditions and can flexibly adapt to environmental change. Family members also have greater incentive to work efficiently as they share in the risk and are the residual claimants to profit. On the other hand, large-scale estates need to spend money to supervise employees who have fewer incentives to work extra hard. A considerable body of literature suggests that the little economies of scale arising from the indivisibility of inputs (draft animals, machinery, farm management skills) are at least offset by agency costs arising from the need to supervise wage labor (Binswanger and Deininger 1993). In low wage economies where the opportunity costs of family labor are low, family operated farms may produce more efficiently and returns to scale may be constant or even decreasing.

Nonetheless, there are a number of factors that work to the disadvantage of small-scale farmers and have contributed to increasing vertical integration and commercialization of agricultural production (Humphrey and Memedovic 2006; Catelo and Costales 2008; Deininger et al. 2011).

³ Williamson (1973) introduced this vertical coordination continuum in general, while Sporleder (1992), Peterson et al. (2001), and others applied this idea to agribusiness.

Recent improvements in seed quality, pest control, as well as production and information technology have facilitated standardization (Deininger et al. 2011). This lowers the costs of supervision of large-scale operations and reduces the comparative advantage of owner-operated farming. In addition, many small farmers find it difficult to comply with rising procurement requirements imposed by retail chains or intermediary processors (Reardon and Gulati 2008, p. 19f.). The liberalization of capital markets has prompted an influx of foreign direct investment in the downstream segments of the agrifood chain. This led to a fundamental restructuring of domestic food markets (Reardon and Timmer 2007). Concentration of food and grocery retailing started in the developed world as early as 1920, but reached some parts of the developing world only in the later 1990s (Reardon and Gulati 2008, p. 2ff.). The “supermarket revolution” not only transformed the way consumers satisfy their shopping needs, but had important ramifications at all stages of the agribusiness value chain (Weatherspoon and Reardon 2003; Reardon and Gulati 2008; Reardon et al. 2009). Supermarkets – driven by the constant pressure to lower costs, to raise product quality and to introduce new differentiable products – require their suppliers to pass on cost savings and to adhere to rising public and private quality and safety standards (Reardon and Timmer 2007; Jaffee et al. 2011). Buyers also favor suppliers who can guarantee higher volumes, efficient and flexible delivery, as well as customized products (Weatherspoon and Reardon 2003; Humphrey and Memedovic 2006).

Financial constraints and the lack of access to financial services limit the ability of small farmers to make the necessary investments and to cover recurrent costs that are associated with modern food supply chains (Reardon and Gulati 2008, p. 19). This is due to the usually higher costs of providing formal credit to small farmers, as transaction costs decline with loan size. Furthermore, land can be used as a collateral and thus farms owning more land may find it easier to get credit (Deininger et al. 2011, p. 29). In addition, small-scale farmers in developing countries often don’t have formal land titles which they could use as collateral.

Even if farmers can make the necessary adjustments, economies of scale in some areas are likely to disadvantage small-scale farming. Small farmers unable to capitalize on these economies of scale will be marginalized, as buyers will prefer low-cost producers. As mentioned before, when it comes to the use of farm machinery, economies of scale usually exist. Increasing mechanization of agricultural production is therefore likely to increase the optimum operational farm size, although machine rental schemes have proven to partially overcome this constraint (Binswanger and Deininger 1993; Deininger et al. 2011, p. 30).

Likewise, economies of scale in processing combined with the need to quickly process certain plantation crops clearly favor large-scale estates. Some crops such as sugar-cane and oil palm deteriorate rapidly after harvest and need to be transported and processed within as little as 24

hours (Deininger et al. 2011, p. 31). These crops are therefore produced in proximity to a processing plant. Frequently the processor will manage a large-scale plantation to guarantee sufficient throughput for the processing unit.

Economies of scale in coordination may also lead to a superior performance of larger farms. The greater complexity of modern agricultural food systems (efficient use of inputs, cost and quality control, delivery, safety) necessitates a much higher level of coordination between stakeholders within the value chain. Larger farms will find it easier to acquire the know-how necessary to successfully manage the implementation of new production methods or introduction of new crops, or to negotiate with business partners (Deininger et al. 2011, p. 30). Buyers, on the other hand, will try to minimize transaction costs by doing business with a few large instead of a multitude of small farmers (Weatherspoon and Reardon 2003).

Finally, larger producers or producer associations may evolve with the goal to increase producer power in the face of globalizing, consolidating suppliers and buyers. Larger producers are better able to invest in product innovation, to negotiate favorable terms of trade with buyers, or to collaborate with other producers in order to guarantee a year-round supply to the markets (Humphrey and Memedovic 2006, p. 32f.). In addition, large companies may overcome market imperfections through better coordination with processors, logistics providers, and marketing companies (Deininger and Byerlee 2012). They may also vertically or horizontally integrate important services to reduce transaction costs and risks. This may further enable companies to fill gaps in public service provision (e.g. construction of roads or port terminals, investments to assure continuous electricity and water supply, or carrying out research and development).

Overall, the low average productivity of most small-scale farmers in Sub-Saharan Africa reveals that small-scale farmers are often unable to overcome the above-mentioned constraints to farming more efficiently, despite the systematic promotion of the smallholder model in the past decades (Collier and Dercon 2009). Limited access to technology, production factors and to input and output markets contribute to a large difference between achieved yields and potential yields (Deininger et al. 2011).

Unless ways are found to overcome these constraints and to raise smallholder productivity levels, the transformation of the agricultural sector may likely lead to an increasing marginalization of small-scale farmers.

1.2 Foreign Direct Investment in Land and Agriculture on the Rise

Increasing foreign direct investments are one important factor contributing to the ongoing transformation of the agricultural sector. While there are plenty of rather superficial and sometimes speculative reports on the amount and impact of real and alleged investment projects, there is a severe lack of hard and verifiable information and data. The following literature review compiles scientific information available on the scale, the drivers, and the possible impacts of agricultural investments.

Foreign direct investments in agricultural land and agricultural production have existed for a long time. Throughout the colonial period, European countries set up large plantations in many parts of Africa, Asia and Latin America, mainly for the production of cash crops (UNCTAD 2009, p. 105f.). What distinguishes recent land investments is that they are much larger in scale, they focus increasingly on staple instead of cash crops, and they are the result of investment agreements (Kugelman 2010, p. 4). In addition, new types of investors are involved and the investments are made increasingly in countries that previously did not attract strong investor interest (Deininger et al. 2011, p. 70).

Agricultural FDI has increased considerably in the recent past. The estimated global stock of inward FDI⁴ in agriculture quadrupled from eight billion US-Dollars (USD) in 1990 to 32 billion in 2007 (UNCTAD 2009, p. 112). Worldwide FDI flows into agriculture rose from less than one billion USD over the 3-year-term 1989–1991 to over three billion USD in 2005–2007.⁵ This apparent trend is likely to continue – interest in farmland is undoubtedly rising.

Although aggregated figures regarding past and planned land acquisitions vary, all evidence suggests that considerable land areas are being targeted. The “Land Matrix Global Observatory” (Land Matrix 2014) reports that transnational large-scale land deals (at least 200 hectares each) covering nearly 35 million hectares have been concluded (under contract) between 2000 and 2014. The World Bank estimated that planned large-scale farmland deals amounted to a total of roughly 56 million ha in 2009 alone (Deininger et al. 2011, p. xiv). While many of these deals are still in an exploratory stage, this is in sharp contrast to the on average less than four million ha of annual expansion of global agricultural land prior to 2008. In 2009 alone, land demand in Africa was equivalent to more than 20 years of previous land expansion (ibid., p. 218).

⁴ There is a significant discrepancy between reported global inward and outward FDI flows. These differences are due to inconsistencies in the data collection and reporting methods of different countries, but also due to difficulties in measuring FDI (see UNCTAD 2011b, p. 6).

⁵ Despite these increases, FDI inflows into agriculture remain at less than 1% of total world FDI inflows and the FDI stock in agriculture composes only 0.2% of the total stock of inward FDI.

This geographical focus is expected to persist. Agro-ecological modeling suggests that globally 446 million ha arable land are currently noncultivated, nonforested, nonprotected, and inhabited by less than 25 persons per km² (ibid., p. 75ff.). Nearly three quarters of this land lie in Sub-Saharan Africa, in Latin America and the Caribbean. More than half of this area is concentrated in only 10 countries, six of which are in Africa (Sudan, Democratic Republic of Congo, Mozambique, Madagascar, Chad, and Zambia). However, parts of these areas are located more than six hours from the nearest market (ibid., p. 79).

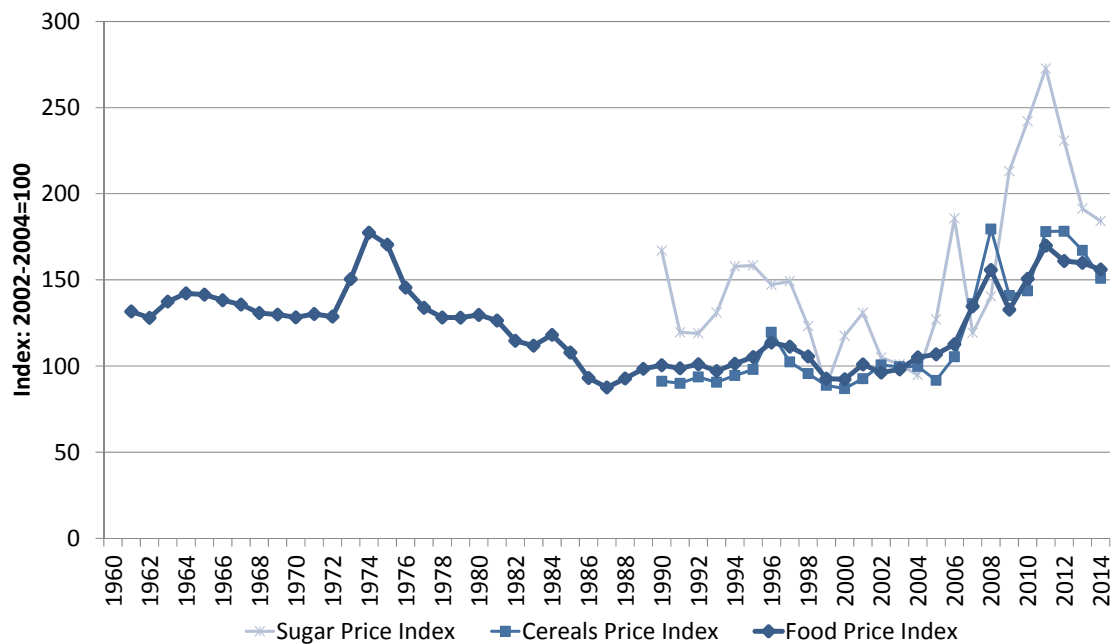
1.2.1 Factors Driving Land Acquisitions

Some of the prime factors promoting the increase in land acquisitions are growing food security concerns, the rapid increase in biofuel demand (energy security), and rising returns from agricultural investments (cf. Cotula et al. 2009; Hallam 2009; Shepard and Mittal 2009; Smaller and Mann 2009).

Food Security Concerns

A major factor has been the sharp increase in world prices of most agricultural commodities since 2002 and related fears of food insecurity (Hallam 2009, p. 1). Apart from the food price hike accompanying the first oil price crisis in the mid-1970s, the long-term trend in real food prices between the 1960s and the early 2000s has been downward (Figure 1), although the decline has slowed since the mid-1980s (Alexandratos 2008, p. 663). The 2007/2008 food price crisis, with price levels unseen in almost 30 years, raises doubts that such low prices will prevail. Although global food prices dropped in the second half of 2008, the rebound in 2010 was sharp, and overall food prices in 2014 are still as high as during the crisis.

Together with the global economic slowdown caused by the financial crisis of 2008, the food price crisis contributed to slowing down the trend of decreasing global undernourishment (FAO et al. 2012). Food insecurity was a main driver of social and political unrest in more than 60 countries (von Braun 2008, p. 6) and prompted food importing countries to reassess their strategies to ensure food security. While some exporting countries contributed to the price hike by imposing export restrictions with the aim of protecting their own, domestic consumers, net importing countries attempted to invest directly in food production abroad and thus to circumvent the vagaries of world markets altogether.

Figure 1: Annual Real Price Indices for Food, Cereals, and Sugar, 2002-2004=100, 1961 to 2014

Notes: The Food Price Index consists of the average of five commodity group price indices (meat, dairy, cereals, vegetable oils, and sugar), adjusted for inflation and weighted with the average export shares of each of the groups for 2002-2004. The Food Price Index has been calculated back to 1961 using proxy price information. The indices per commodity group are only available from 1991 on.

Source: Author's calculations using data from FAO Food Price Index (data retrieved from www.fao.org/worldfoodsituation/foodpricesindex/en/ on August 5, 2014).

The 2007/2008 price hike was largely due to imbalances of demand and supply (Kappel et al. 2010). For more than a decade, demand of food commodities had outgrown supply. This consequently resulted in a reduction of global food stocks. Demand for agricultural goods is expected to continue to rise considerably in the coming decades due to population growth, rising per capita incomes, urbanization, and increasingly protein-rich diets (OECD / FAO 2010). This makes investments in land and agriculture attractive for private investors and governments in food importing countries.

Energy Security Concerns and Climate Obligations

Another key driver behind the recent land acquisitions is the growing demand for commodities such as grains, vegetable oils, and sugar cane for the production of biofuels (FAO 2008a). Many industrial countries have defined biofuel consumption targets and provide incentives to producers of non-fossil energy, thus creating a guaranteed market for years to come (Cotula et al. 2009, p. 54). By shifting partly from fossil energy sources to biofuels, governments can increase their energy security. This at the same time decreases energy import bills in times of high and fluctuating prices for fossil fuels. In addition, the switch to renewable energy sources is part of governments' efforts to mitigate climate change (Cotula et al. 2008).

Promising Investment Opportunities

Last but not least, agricultural investments have become more attractive to large financial institutions, hedge funds, real estate investment trusts as well as private and public companies pursuing farm ownership or management strategies (HighQuest Partners 2010). Rising world food prices have increased the profitability of investments in the sector.⁶ Returns for other investments plummeted during the global financial crisis, while the agricultural sector was not hit as badly. This low correlation with equity and bond markets makes agricultural land and commodities attractive as an asset class. In addition, land lease prices are still very low in many developing countries. If land prices rise, an investor can make a profit simply by acquiring the use rights to a piece of land. An investing company may try to “reserve” a piece of land without actually putting it to use right away. The company may then scale up production, e.g. if the transportation network improves, or it may sell its use rights to other companies.

1.2.2 Impact of FDI in Agriculture on General Economic Development

The driving factors behind the recent increase in agricultural investments are unlikely to change and hence expansion of the cultivated area is not expected to slow. This raises questions about the broader impacts of this development.

The Link Between FDI and Economic Development

The discussion about the likely impact of agricultural FDI on poverty reduction and food security can be placed within the larger body of literature on linkages between FDI and economic development.

During the past three decades, policymakers around the world have made their national regulations more favorable towards FDI and have put in place a variety of fiscal and tax incentives to lure in potential investors (Aitken and Harrison 1999; UNCTAD 2009, p. 30f.; 2010). The rationale for this is that FDI flows are associated with a number of positive effects. Besides adding much needed capital to the recipient nation’s capital stock, FDI may strengthen economic growth through the transfer of technology and business know-how. FDI may benefit domestic companies through joint ventures or other linkages, including backward linkages with local input suppliers and forward linkages with local companies further downstream in the value chain.

Given the strong presumption that such investments are valuable to the recipient country, conclusions from academic literature on the linkages between FDI and development are

⁶ For instance, some fund managers presenting at the “Global AgInvesting Europe 2010 conference” expect rates of return to their investment as high as 20% for agricultural investments in developing countries.

surprisingly diverse and sometimes contradictory: while some studies find considerable positive impacts for the host country, others do not find notable or even find negative effects (Hanson 2001; Lipsey and Sjöholm 2005, p. 23; Vadlamannati and Tamazian 2009). Nevertheless, some consensus seems to be emerging that the direction of impact is contingent on the country's ability to benefit from FDI inflows. This in turn depends on a country's human resources, the degree of private-sector sophistication, and the level of competition and policies towards trade and investment (Moran et al. 2005, p. 5; Sumner 2005).

Large-N Studies on Impacts

Due to a severe lack of data, there are no studies that analyze the impact of agricultural FDI on indicators of development quantitatively. The UNCTAD's World Investment Directory provides data split into primary, secondary and tertiary sectors for many countries between 1981 and 2001, but data on a subsectoral level are only available for a very limited number of years and a rather small sample of countries. A few studies thus analyze quantitatively the impact of FDI on development in particular economic sectors, but without distinguishing agriculture from other primary sector activities (e.g. Alfaro 2003; Aykut and Sayek 2007; Chakraborty and Nunnenkamp 2008). Findings suggest that primary sector FDI has a negative effect on growth. Mihalache-O'keef and Li (2011) study the potential linkages between FDI and food security. According to their arguments, FDI in the primary sector is likely to have negative effects on food security, because investments in natural resources are often vertically integrated, produce for export, and generate insignificant spillover benefits (technology and know-how) to other economic sectors (Mihalache-O'keef and Li 2011p. 76ff.). Indeed, results using time-series cross-section data from 56 developing and transition economies indicate that FDI in the primary sector decreases food security, while FDI in the manufacturing sector has positive effects and service-sector FDI has ambiguous but sometimes negative effects.

Case Studies on Impacts

There is a growing literature that looks in detail at how large-scale investments are implemented and which actors are involved in these processes (e.g. Cotula et al. 2009; Cotula and Vermeulen 2011; German et al. 2013). Especially in countries with relatively weak governance and land rights and where formal processes of land acquisition are not enforced, the impact of agricultural investments is to a large degree shaped by the actors involved (Nolte 2014).

Case studies on the impacts of particular FDI in land and agriculture are growing rapidly as well.⁷ However, the vast majority of studies is based on literature reviews, analysis of the limited data available from governmental institutions and the media, or interviews with experts and local population groups. Here only a few larger cross-country studies shall be mentioned.

The above-mentioned 2011 World Bank report is based on 19 project case studies in seven countries (Deininger et al. 2011, p. 64ff.). The report draws some general conclusions with regard to the socioeconomic impacts of these investments. Although many investments do seem to generate benefits such as employment opportunities or provision of public goods, many projects failed to live up to expectations or even left some of the local people worse off. As agricultural investors seem to primarily target countries with limited institutional capabilities and very weak land governance, vulnerable population groups risk losing their land without being compensated sufficiently.

The German Technical Cooperation (GTZ) has conducted country studies in Cambodia, Laos, Madagascar, and Mali (Görge et al. 2009). The authors develop a theoretical framework to evaluate the likely impacts, but focus mainly on compiling an inventory of the FDI volumes and transaction processes in the selected countries.

Cotula and Vermeulen (2009) carried out qualitative research in two countries (Mozambique and Tanzania) as well as quantitative research in four additional countries (Ethiopia, Ghana, Mali, Sudan). They conclude that host country benefits are mainly observable in terms of commitments on investment levels, infrastructure development and employment creation. As many countries do not have in place adequate legal or procedural mechanisms to protect local land rights and interests, “major costs are being internalised by local people” (Cotula et al. 2009, p. 7).

A recent study by the FAO (2012) covers nine case studies in Asia, Latin America and particularly Sub Saharan Africa. The observed impacts of the studied projects varied greatly and depended to a large degree on the local context and the business model. Projects where local farmers were more involved, e.g. through outgrower schemes, seemed to have more positive effects than pure large-scale developments where locals are at best involved as wage workers. Overall, the study concludes that for investments involving large-scale land acquisitions in countries with insecure or unclear land rights, the “disadvantages often outweigh the few benefits, especially in the short run” (ibid., p. 336).

⁷ At the “International Conference on Global Land Grabbing” alone (April 6-8, 2011, University of Sussex), more than 90 papers were presented. For further information and conference outputs see <http://www.future-agricultures.org/land-grab.html>.

1.2.3 Impact of FDI in Agriculture on Economic Well-Being – Many Context-Specific Uncertainties

Both the literature review as well as the ongoing discussion about the likely benefits and risks of the recent upswing in FDI in agriculture accentuate the fact that there is much uncertainty about the impacts of such investments. Let us now look at the link between agricultural FDI and the economic well-being of rural households.

Food Supply and Food Prices

Chapter 1.1 has highlighted that the demand for many food commodities has outgrown supply for more than a decade and thus contributed substantially to the high prices since 2008. FDI in the agricultural sector could contribute to increasing global food supply within a relatively short time and thus contribute to reducing the risks of future food shortages and price hikes. Increases in food supply can be achieved in two ways, and the entry of foreign companies can contribute to both. First, additional land can be allocated to food production. Second, land already cultivated can be farmed more efficiently. In most developing countries, particularly in Sub-Saharan Africa, agricultural productivity levels lag far below potential (Deininger et al. 2011, p. 81ff.). FDI may reduce this yield gap by providing financial capital and introducing advanced agricultural technologies as well as the needed skills to employ them efficiently (UNCTAD 2009, p. 133ff.). Local producers may gain access to modern technologies and management techniques, either through direct cooperation with foreign companies (e.g. as contract farmers) or indirectly through spillovers effects (UNCTAD 2009, p. 160). Furthermore, demonstration effects or increased competition may lead local firms to increase their efficiency in order to remain competitive. Conversely, spillovers to local companies may be negligible if foreign investments create enclave economies only weakly connected to the host economy, which import most inputs and export virtually all outputs without further processing (Hallam 2009).

The extent to which rising agricultural FDI will increase domestic food supply depends on its impact on the national balance of agricultural commodities (Weingärtner 2010, p. 17ff.). If FDI contributes, directly or indirectly (e.g. through spillovers in technology, know-how and infrastructure), to raising production for the internal market as well, domestic food supply is more likely to increase. On the other hand, if the increase in production is largely for export, food supply in the host country may not increase (UNCTAD 2009, p. 160). Even then, this does not need to be negative. For example, a country with a comparative advantage in the production of a certain cash crop will be better off producing this crop and importing food crops. Still, increased foreign production puts further pressure on land and water resources, which could negatively affect local food production (Weingärtner 2010, p. 19).

Another likely channel through which agricultural FDI may affect poverty reduction is by reducing the volatility in food production. Large fluctuations in food production can lead to severe temporal food shortages. The improvement of irrigation systems, research of special seeds and fertilizers adapted to local conditions, and the introduction of modern farming techniques will decrease output volatility.

Agricultural products are generally regarded as tradables. They can flow relatively freely across borders and typically are very standardized. Therefore national price levels are highly correlated with international price levels.⁸ Under the assumption that FDI in agriculture will likely continue to rise, this will contribute to increasing global food production and thus lead to discernibly lower agricultural commodity prices (Kappel et al. 2014).⁹

The effects of changes in food prices vary greatly across countries and population groups (von Braun et al. 2008). At country level, net food exporters see their terms of trade improve when food prices rise. Net food importers, on the other hand, face more expensive food imports. The 2007-2008 food price crisis motivated affluent states with limited soil and water resources, e.g. many Gulf States, to seek opportunities to produce food abroad (Shepard and Mittal 2009). Many developing countries, including most countries in Africa, are also net food importers but have a low price elasticity of supply. They are hit the hardest and struggle to meet domestic food demand (von Braun et al. 2008, p. 6).

At the household level, net sellers of food¹⁰ are the beneficiaries of rising food prices, especially those growing internationally traded food staples. However, the majority of the world's poor, even those in rural areas, are net buyers (FAO 2008b, p. 22) and end up paying more for their nutritional needs. Even worse, they are hit doubly by high food prices (FAO 2008b, p. 22ff.; von Braun 2008, p. 5f.). First, households with incomes below the poverty level are least able to

⁸ The law of one price states that identical goods sold in different countries must sell for the same price, provided that markets are competitive, and free of transaction costs and official barriers to trade (Krugman and Obstfeld 2009). Undoubtedly, transport costs, trade restrictions such as tariffs, and departures from free competition (monopolistic or oligopolistic practices) exist on agricultural markets and lead to certain differences in price levels. Overall, however, domestic prices for food products are largely determined by world prices.

⁹ Kappel et al. (2014) simulate how additional FDI to the tune of five, 10, and 15 million hectares between 2011 and 2020 would impact world market prices for cereals. Their simulations indicate that prices would decline by between 7 and 21% relative to reference scenarios with no additional FDI. When allowing for repercussions from declining prices on global production, the impacts vary between 5 and 13%. This shows that FDI in agriculture are not a panacea to high prices, but certainly not negligible either.

¹⁰ A household is considered a net food seller / net food buyer when the value of food staples it sells is greater/less than the value of food staples it buys.

cushion the impact of price rises. Second, poor people spend 50 to 70% of their income on food and therefore their purchasing power is affected disproportionately, limiting further their ability to purchase other goods (von Braun et al. 2008). Although some net food buyers in developing countries may – in the medium term – reduce the negative impact or even benefit from higher prices by shifting production to more profitable crops (FAO 2008b, p. 23), this is unlikely to happen for many poor rural, and even less so for poor urban households.

Impact on Employment and Wages

As mentioned above, agricultural FDI may increase food production and productivity in host countries. If higher production increases demand for agricultural labor, this should eventually translate into rising wages in the agricultural sector. Given that roughly three out of four poor individuals in developing countries live in rural areas and that most depend directly or indirectly on agriculture, it is hardly surprising that agricultural growth has proven to be particularly effective in reducing poverty, especially if small-scale producers increase their productivity as well (Diao et al. 2007; World Bank 2008, p. 26ff.; World Bank / FAO 2009).¹¹ Higher productivity and incomes will also spur demand for non-agricultural goods and services and thus have broader positive economic impacts (FAO 2008b, p. 26).

One concern voiced by various critics is that large-scale foreign owned farms may not result in increased demand for agricultural labor. Indeed, the extent to which jobs are generated depends decisively on the commodity produced¹², the mode of production, and country-specific factors. In addition, if qualified local personnel is lacking, labor may frequently be sourced from other regions or even from abroad. This holds especially for highly skilled jobs. Finally, employment opportunities may likely decrease if the foreign-owned company crowds out small local farmers (UNCTAD 2009, p. 143). For this reason it has been argued that mechanized large-scale farms should only be envisaged in land abundant regions with low population densities (Deininger et al. 2011, p. 39).

Infrastructure Development

The prevalent lack of infrastructure presents one important cause of poverty and one of the main constraints to doing business in many developing countries. This makes it harder for larger companies to remain competitive within regional or global markets, but also negatively

¹¹ Theoretical and empirical studies corroborate that growth in the agricultural sector has, on average, a considerably greater poverty-reducing effect than growth in non-agricultural sectors (Cervantes-Godoy and Dewbre 2010).

¹² For example oil palm and (manual) sugar-cane generate between 10 and 30 times more jobs per hectare than large-scale mechanized grain farming (Deininger et al. 2011, p. 38f.).

affects small businesses and farmers. Poverty levels tend to be higher in remote regions. Large-scale agribusinesses may contribute to the development of local infrastructure by investing into transport networks, providing water and electricity, and establishing educational, health and housing facilities. This can improve the livelihoods of the larger community and open up new business opportunities by facilitating access to local markets.

Fiscal Revenues and State Capacity

It is highly contested to what extent agricultural FDI really increases fiscal revenues. The media have reported cases where land was transferred to investors for up to 99 years without having to pay any land fees at all. Cotula (2011) analyses 12 publicly available land deals in nine African countries. While most land leases did involve payment of a land fee (ranging from less than two to about 14 USD per hectare/year), governments appeared to be more interested in attracting investments (including commitments to finance infrastructure) rather than public revenues (Cotula 2011, p. 24). As generous (temporary) tax exemptions are also frequently granted to lure in investors, the direct fiscal effect may be limited. Overall, fiscal revenues may not increase sizably, and thus state capacities to address poverty and food insecurity (e.g. through social security measures, food emergency reserves, or provision of food to vulnerable households) might not improve substantially.

Environmental Impact and Resource Use

The production of agricultural commodities can result in environmental degradation, be it through depletion of water and land resources or deforestation. The impact is highly project specific and depends upon various factors, such as the quantity and types of commodities produced, the production techniques applied or the use of soil and water management technologies. So far, the role of foreign large-scale producers seems mixed (UNCTAD 2009, p. 156). In some cases, e.g. the floriculture industry in Kenya, international companies have played a role in introducing farming technologies that are more environmental-friendly and have thus contributed to increased ecological sustainability. On the other hand, the heavy use of pesticides and other inputs by foreign-owned banana plantations in Latin America in the late 1980s has caused environmental degradation.

Displacement and Loss of Land

Foreign land acquisitions may result in the displacement of groups that have relied upon a piece of land for generations. Land and water resources allegedly “unused” are in fact often used by local population groups such as small-scale farmers or pastoralists, although most of them do not hold individual land titles or land or water rights. Smallholder farmers whose property and user rights on land are weak or weakly enforced risk losing their land without proper consultation or compensation. Even if adequate compensation is offered, people may

be worse off than before if they lack genuine alternatives to make a living. If displaced farmers fail to find new and adequately paid employment possibilities in the short and also in the long term, their livelihoods will likely deteriorate.

Summary: Impact on Household Economic Well-Being

FDI is not a panacea for development but entails benefits as well as risks to the recipient country – net welfare effects on different population groups need to be carefully evaluated. This holds also true with regards to its impact on poverty reduction and food security.

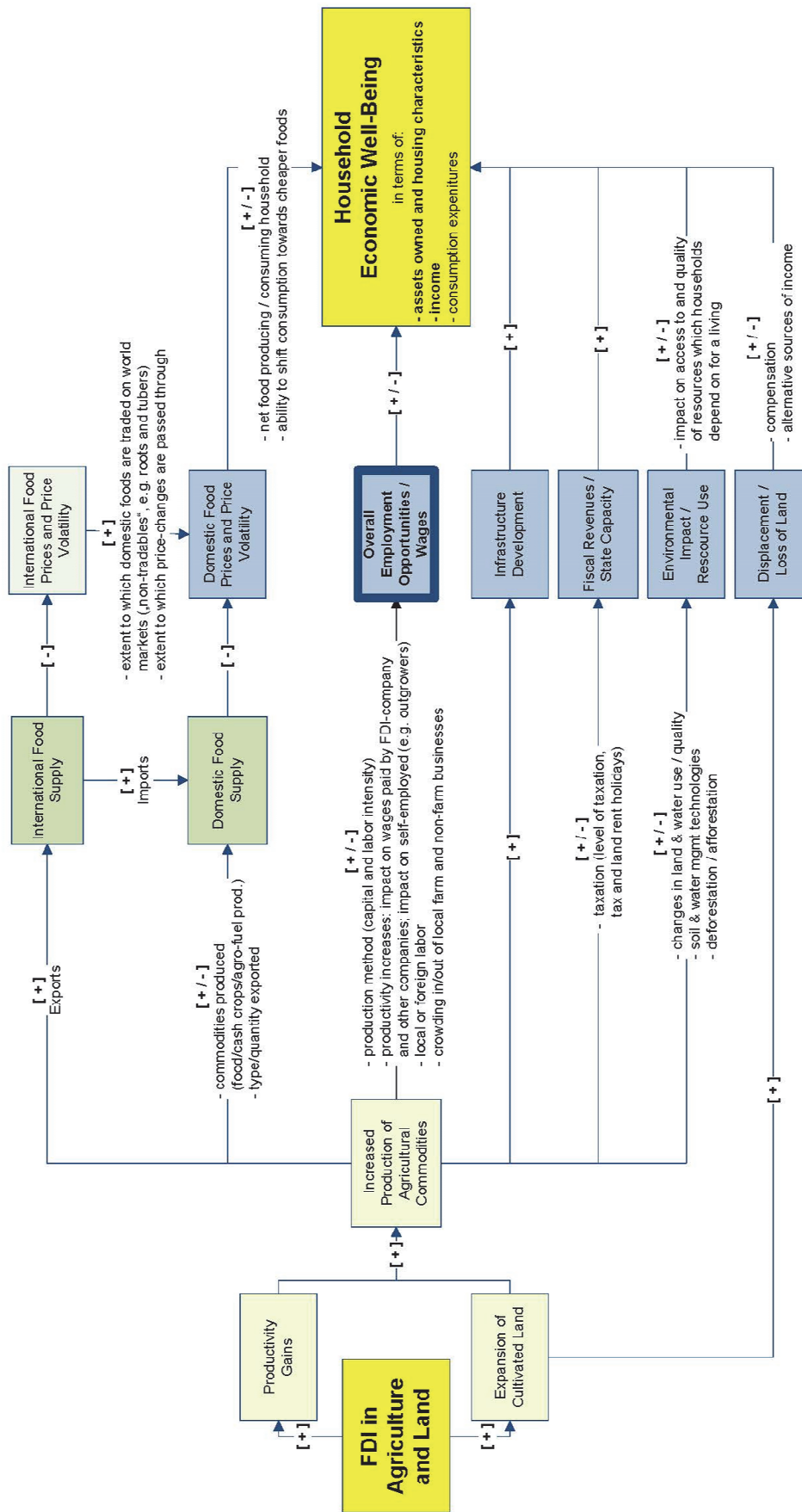
At the global level, agricultural investments can contribute to increasing food supply and thus help to meet the projected increases in food demand. As mentioned in the introductory chapter, up to 9.2 trillion USD (2009 dollars) need to be invested from 2005/07 to 2050 in order to achieve the crop and livestock production levels foreseen for developing countries in the FAO food outlook (Schmidhuber et al. 2009). Without significant increases in investments – both from the public and the private sector – and resulting supply increases, prices for food commodities are bound to rise. This would jeopardize efforts to reduce poverty and food insecurity. At the same time some arguments presented in this section suggest that agricultural FDI could also push certain households further into poverty and food insecurity.

At the household level, agricultural FDI are essentially part of a larger process of increasing commercialization of the agricultural sector. Foreign direct investments generally flow into large-scale farming and likely affect:

- a) Production and competition on food markets
- b) Demand for fertile land and water
- c) Demand for agricultural labor and associated wages in the agricultural sector
- d) Opportunities to make a living in other sectors (through spillover effects)
- e) Public service provision, by contributing to fiscal revenues or infrastructure development

Figure 2 illustrates the likely transmission mechanisms through which agricultural FDI may influence household economic well-being. The number and complexity of the linkages between FDI and households' livelihoods is very large and could not be analyzed in its totality. Therefore the present study focuses on the channel highlighted in Figure 2. It assesses the impact of FDI on household economic well-being in Zambia in terms of production and employment opportunities for small farmers in modern food supply chains. It explores whether participation in outgrower schemes and employment opportunities on large-scale farms may be fruitful avenues of integrating rural small-scale farmers into modern food supply chains. In addition, the role of income diversification into off-farm economic activities is examined in general, i.e. including business and employment activities in other sectors.

Figure 2: Impact of FDI on Household Wealth



Notes: This figure summarizes the main channels through which agricultural FDI may have an impact on household economic well-being. The brackets indicate whether the causal relation is expected to be positive $[+]$, negative $[-]$ or ambiguous $[+/-]$. For the more contested relationships, the most important factors shaping these effects are described as well.

1.3 Opportunities for Small Farmers in Modern Food Supply Chains

Increasing foreign direct investments are contributing to a fundamental transformation of the agricultural sector, which is bound to have serious implications for smallholder farmers. The depicted structural transformation of the agricultural sector in the last few decades is expected to continue or perhaps even to speed up in the future (Weatherspoon and Reardon 2003, p. 9; Binswanger-Mkhize and McCalla 2009, p. 33ff.). This trend entails a great risk of growing exclusion of smallholder farmers from modern food supply chains. This holds especially true because changes that took several decades to unfold in the developed world are occurring at a much faster pace in developing countries. Hence the pressure on small farmers to adapt is particularly high (Reardon and Timmer 2007, p. 2841).

The opportunities for smallholder farmers in developing countries to secure and improve their livelihoods through farming activities depend fundamentally on their ability to adapt to the changing structure of the modern food sector. As mentioned before, smallholder farmers often face considerable constraints to farming efficiently, particularly in Sub-Saharan Africa, where achieved yields are only a fraction of potential yields.

Farmers essentially face three possibilities. They may: a) try to improve access to finance, inputs, and markets through membership in a cooperative; b) participate in contract farming schemes of food processors or marketing companies; or c) give up or scale-down farming activities and instead look for opportunities to carry out off-farm economic activities such as running a business or taking up employment on large-scale farms or in other sectors.

1.3.1 Opportunities in Farmer Organizations

The literature suggests that large-scale processors tend to rely on small farmers when local commercial (large) farms are unable to provide sufficient supply and where transaction costs are low due to effective associations of small-scale farmers (Weatherspoon and Reardon 2003; Reardon and Timmer 2007, p. 2844ff.). One strategy for smallholders to overcome some of the challenges related to transaction costs is collaborating in farmer organizations. Such organizations come in various forms such as cooperatives, producer organizations, and self-help groups. The organization is usually owned collectively by its members and managed for their joint social and economic benefit. Services offered to members include improved access to finance, input supply, storage, processing, bulking, and providing linkages to agricultural markets (Von Pischke and Rouse 2004). Collaboration may also help to make available important skills in management and technology adaption to assist farmers in efficiently implementing new production strategies and increasing productivity levels. Furthermore, farmer organizations have played an important role in increasing the negotiation capacity and

market power of smallholder farmers, and advocating rural policies that take into account the specific needs of their members (HLPE 2013).

Many farmer organizations in developing countries have colonial origins. They were founded “as instruments of acculturation and education that could progressively uplift the traditional population” (Pollet and Develtere 2004, p. 14). This top-down ‘co-operative paternalism’ resulted in highly bureaucratic structures that served the interests of the colonial officers and their entourage rather than those of the indigenous population. Following independence the governments intensified their control over the cooperatives and used them as vehicles to pursue their own agenda while claiming to create national unity. Cooperatives were also often hijacked by international agencies and non-governmental organizations, suffered from serious mismanagement, corruption, and unreliability, with devastating consequences in many countries (Pollet and Develtere 2004). Increasing criticism of the meagre performance of cooperatives stimulated their slow transformation into grass-roots organizations which truly serve the poor. The structural adjustment programs undertaken in the 1980s and 1990s accelerated this process. Many cooperatives that had been patronized and supported by their governments went bankrupt, as they no longer benefited from monopolies, guaranteed prices, tax exemptions and subsidies (*ibid.*, p. 17).

Most cooperatives continue to partly rely on external funding by governments or donors (Von Pischke and Rouse 2004). But as external funding has been falling since the mid-1980s, farmer organizations need to increasingly mobilize member capital (Von Pischke and Rouse 2004). Although increasing competition with other types of service providers may lead farmer organizations to improve the services provided to their members, doubts are warranted whether they will be able to significantly raise productivity levels among smallholder farmers in the nearer future. Given the long history of misuse of agricultural cooperatives for purposes other than those intended, many farmers are still suspicious of collective action (Pollet and Develtere 2004).

1.3.2 Opportunities in Contract Farming (“Outgrower Schemes”)

Another possibility to address the challenges faced by small-scale farmers involves their participation in contract farming schemes of private food processors or marketing companies. Eaton and Sheperd (2001, p. 2) define contract farming “as an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices”. It is one possible strategy to strengthen vertical coordination between producers on the one hand, and processing or marketing agribusiness on the other hand (Bijman 2008). Instead of producing commodities exclusively in-house on large-scale estates, a company may outsource production to contractors, while closely managing production, processing, and distribution. The farmers

agree to provide a certain quantity and quality of a commodity to the purchasing firm, and in turn receive production support such as inputs or technical assistance and can count on guaranteed sales of their produce. This also reduces the role of the state in providing such services directly or indirectly (e.g. by supporting farmer organizations) and thus eases the burden on government budgets.

Contract farming is seen by development agencies, governments and NGOs as a promising strategy to integrate farmers into modern agrifood value chains (Eaton and Shepherd 2001). Linking small-scale farmers to domestic or foreign markets is considered a key step towards reducing poverty in rural areas in developing countries (Binswanger-Mkhize and McCalla 2009, p. 36). At the same time, this kind of collaboration may well increase productivity levels, by “combining the advantage of large farms, in terms of access to markets, infrastructure, and technology, with the local knowledge, flexibility, and superior incentives of smallholders” (Deininger and Byerlee 2012, p. 712). Given the limited motivation for private companies to directly invest in the supply-chain capabilities of small-scale farmers, it may be sensible to further smallholder participation through policy measures (Humphrey and Memedovic 2006).

Contract Farming Models

The intensity of the contractual agreement varies. Eaton and Sheperd (2001, p. 46ff.) distinguish the following five models of contract farming.

In the “centralized model”, the contracting company sources the crop from a multitude of small farmers. Usually each farmer is assigned a quota at the beginning of each growing season. Strict quality control mechanisms ensure that the produce meets the requirements set. At the end of the growing season the company takes care of processing or packaging, and markets the product. The centralized model has been used for a great variety of crops, but is most common for the production of tobacco, cotton, sugar cane, banana, coffee, tea, cocoa and rubber. In Africa, governments most commonly operated centralized schemes, where a public enterprise purchased crops from farmers. These schemes were often called outgrower schemes (Eaton and Shepherd 2001). Glover and Kusterer (1990) make a distinction between private-sector run contract farming schemes, and government run outgrower schemes. As the term outgrower scheme is still usually used even after privatization, we will, as in most literature, use the terms contract farming and outgrower schemes interchangeably.

The “nucleus estate model” is a variation of the centralized model in that the contracting company still sources produce from contract farmers of various sizes. In addition, it owns and manages a plantation estate and frequently an adjacent processing plant. The size of the estate is typically large to guarantee a certain level of throughput for the processing plant. In other cases it merely serves as a trial and demonstration farm.

Statutory bodies and private companies may jointly cooperate with farmers in the “multipartite model”. Private companies and government organizations may cooperate in a type of joint venture, with clear responsibilities for credit provision, production management, processing, and marketing. In some cases farmers are also required to belong to farmers associations in order to reduce the company’s transaction costs of dealing with individual farmers.

The “informal model” is characterized by the simplicity and informality of the production contracts between farmers and the individual entrepreneurs or usually small companies. Production agreements are often on a seasonal basis and concern crops which only require limited inputs, technical advice, and processing.

Finally, the “intermediary model” involves an intermediary such as an individual collector or farmer committee. Food processors enter into an agreement with the intermediary who again has informal arrangements with the producing farmers.

Advantages and Disadvantages of Contract Farming for Small-Scale Farmers

There is broad consensus about the potential advantages and disadvantages of contract farming for participating small-scale farmers (e.g. Eaton and Shepherd 2001; Bijman 2008; Prowse 2012).

The first and central advantage for farmers is having a guaranteed market for their produce (Eaton and Shepherd 2001). In most cases the contractor will purchase a specified quantity, provided that it fulfills the set quality requirement. Consequently, farmers save time and money searching for buyers. In some cases the contracting company even organizes the transport of their produce to the market. Having reliable markets enables small-scale farmers to increase production or diversify into new crops. At the same time purchasers are hesitant to invest in market outlets unless they are ensured sufficient supply. Contract farming can help overcome this vicious circle.

Second, prices are frequently negotiated in advance which reduces the risks associated with price fluctuations on cash market exchanges. Nevertheless, not all contracts are based on fixed prices. Price setting mechanisms may at least partially relate to the market prices at the time of delivery and hence farmers are still exposed to market volatility.

A third advantage concerns extension services provided by the firm as part of their quality management. They include the provision of various inputs such as seeds and fertilizer, but also training to ensure proper husbandry practices. In some arrangements (e.g. the sugar cane outgrower schemes discussed in Chapter 3 of this work assistance goes even further and may include land preparation, field cultivation and harvesting services.

Improved access to credit is another key advantage. Many smallholder farmers in developing countries do not have the necessary collateral to obtain credit for investments (e.g. in

machines) and recurrent inputs required to meet the demands of modern food production. Contract farming arrangements often provide small farmers access to some form of credit. This can either be directly through the contracting company or through arrangements with commercial banks or government institutions that accept the contract as collateral.

In some cases contract farming also helps to introduce new technologies more appropriate to reach the high quality standards demanded by modern food markets. Small farmers are usually not able to incur the high costs associated with the adaption of new technologies or they are risk averse and thus reluctant to invest their own savings. Private agribusiness companies can then provide the funding and necessary management to successfully rollout new technologies or procedures.

Finally, contract farming may entail the transfer of skills required to produce quality crops, to manage farm resources efficiently, and to adapt products to the demands of domestic or export markets. Skill transfer often leads to productivity increases beyond contract farming activities, as some skills or technologies may spill over into other farm activities.

Among the potential disadvantages facing small farmers in contract farming systems is the increased risk that may accompany new agribusiness schemes. Especially new crops or production methods may entail risks, both on the production side (e.g. lower than expected yields) and on the market side (e.g. insufficient market size or lower than expected price levels). Contract farming operations may interfere with the current farming activities. Contract farming crops may compete with other crops for the most suitable and fertile land or limited labor resources. The consequences may be particularly severe if a scheme fails altogether and leaves farmers with neither income from the contract farming activities nor from their previous activities. In some cases the new farm operations also require a resettlement of farmers which can have adverse social and economic impacts. In case the contract farming model comprises the mechanization of processes there is also a risk of increasing local unemployment.

The failure or impracticality to specify in advance under which circumstances quotas and quality specifications may be adjusted, can lead to conflicts between farmers and the contracting company. The contractor may for instance try to alter agreed quotas because production exceeds the targeted quantity. The same may happen if demand turns out to be smaller than expected due to increasing market competition, problems with transportation logistics, changes in government policies, or political unrest. Confrontations may also arise in the event that the contractor raises quality standards over time, especially if farmers have the impression that standards are manipulated solely to reduce purchases.

A further important potential disadvantage is the risk of becoming dependent upon a single purchaser. Especially in cases where the farmers have to invest considerably they may find themselves locked-in and unable to revert back to their previous farm operations. Furthermore,

companies may offer beneficial arrangements in the initial phase of a project, but try to exploit gaps in the contract as the project matures (Simmons 2002). This is especially likely if interest in joining an outgrower scheme is high. Contracting companies may then put in place ever-demanding participation requirements.

By the same token, contractors may try to renegotiate prices if market prices at the time of product delivery are lower than at the time the contract was agreed upon. Limited transparency in the price determination mechanisms may also lead to discontent among farmers who feel they do not receive proper remuneration (Bijman 2008).

Finally, the alleged advantage of gaining access to credit may lead to indebtedness on the part of the farmer. Changing market conditions, unsuccessful business models, production fallouts, or in extreme cases the total failure of the contract farming operation may leave farmers facing high levels of debt. Furthermore, some projects have failed because farmers did not perceive generous advances as payment. They were unsatisfied with the low resulting end-of-season payments and decided that participation in the project was overall not profitable.

Economic Impact of Outgrower Schemes

Whether the possible advantages and disadvantages of outgrower schemes do in fact materialize depends on a variety of case specific factors. The arrangement laid out in the contract shapes the distribution of risks and benefits between the contracting parties. Due to the contingent nature of all contracts both parties may try to interpret the terms of arrangement in their favor. The resulting division of value added between the contracting parties does therefore not necessarily reflect the real value added by each party. Instead it reflects the relative bargaining power of both parties (Baumann 2000). In this respect, the support and policies set by the local governments are important, as well as efforts by NGOs and farmers organizations to make contract farming work for smallholders (HLPE 2013). The following provides a brief overview of empirical evidence regarding the economic impacts of contract farming schemes.

Glover and Kusterer (1990) conducted five case studies in Canada, Latin America, and Africa. Their analysis reveals many of the potential problems mentioned above. They find defaulting by the contract growers to be the most serious although not most common problem. Especially in times when market prices are higher than the agreed contract price, side selling to other buyers becomes a great temptation. If farmers sell to companies other than the contract company that has provided costly inputs and services, this can quickly lead to the demise of the scheme. More commonly, farmers find it difficult to achieve the quantity and quality levels obtained on the contractor's test plots. As prices paid to farmers are often based on the yields achieved on these plots, farmers may not reach the income levels they expected. Lower yields may result due to failure of farmers to apply the received fertilizers and pesticides on time and

in the right quantities (e.g. because some of the inputs are instead used on other crops). In terms of the impact on incomes, Glover and Kusterer find significant positive impacts of participation for all schemes that were analyzed. They point out the problem, however, that their study was based on schemes that had been around for several seasons. Given that many ventures fail after one or two seasons due to insufficient profits for the company or the participating farmers, their study – and probably most other similar studies, including the one at hand – may inevitably contain bias.

A number of more recent studies all reveal positive impact in terms of income increases for participating smallholder contract farmers: McCulloch and Ota (2002) for export horticulture in Kenya; Miyata et al. (2009) for apple and green onion farmers in China; Birthal et al. (2005; 2008) for contract dairy farmers in several regions in India; Warning and Key (Warning and Key 2002) for peanut production in Senegal. Simmons et al. (2005) find higher returns to capital for poultry and maize seed contract farmers, but not for participants in a rice seed scheme in Indonesia). Bolwig et al. (2009), using OLS and a Heckman selection model, find positive revenue effects of a certified organic coffee farming scheme in Uganda.

Fischer and Qaim (2012) analyze the determinants, participation dynamics and impacts of small-scale banana outgrowers in the central highlands of Kenya. Employing a propensity score matching to reduce possible selection bias, they find positive income effects for group members who participate in collective marketing. Although the price advantage of collective marketing is quite small, specialization effects, access to inputs, and improvements in agricultural practices result in positive outcomes for group members.

Baumann (2000) reviews the experience of contract farming and outgrower schemes for five agricultural tree crops in Africa and Southeast Asia. His analysis suggests that contract farming often has positive effects on smallholder incomes, at least in the short term. He points out, however, that these gains “have to be offset by income spent on food and labor, and often unsustainable levels of risk” (ibid., p.43). Furthermore, beneficiaries are not among the poorest households.

A recent comparative study by Burnod et al. (2012) finds mixed results for long-running (10 to 50 years) contract farming schemes in five African and two Asian countries. Although there is some evidence that incomes increase among participating farmers, this increase was not systematic and sometimes only temporary. Inclusiveness among schemes also varied with some benefiting the more prosperous farmers.

Overall, the literature suggests rather mixed results. Many studies do reveal income increases for participating farmers, at least in the short term. But the many contract farming schemes that have failed also imply that outcomes are not always as beneficial for participating stakeholders – neither for the contracting companies nor for the participating smallholders. In

some cases living conditions may even deteriorate as a result of low bargaining power and the loss of autonomy (HLPE 2013). A big question mark further remains regarding the long-term impacts of contract farming schemes. There are only few empirical studies that explore the sustainability of benefits in the long-run (Catelo and Costales 2008). Baumann (2000, p. 31) therefore recommends more studies that focus on long-term effects, as “smallholders are often sheltered from risk in the first years”. Likewise, problems arising from unequal power relationships, market instability, poor management, or environmental degradation usually only emerge in the medium to long run.

1.3.3 Off-Farm Employment Opportunities on Large-Scale Estates and Elsewhere

The third possibility how small-scale farmers may participate in modern food supply chains is by reducing or giving up farming activities altogether and instead looking for alternative sources of income outside the own farm. In rural areas, employment on other small-scale or large-scale farms is a common “off-farm” economic activity. Besides that, smallholders may diversify their incomes by looking for work in other sectors or carrying out business activities. Benefits to employees include income and often a number of fringe benefits such as the provision of housing, food, health care, education, or access to other infrastructure. Being an employee also carries low business risk when compared with smallholder farming. Finally, clear working hours may be an advantage.

On the other hand, wage employment in the agricultural sector is usually on seasonal basis only. Furthermore, agricultural wage employment is commonly viewed as a last resort for the rural poor who have little assets available other than their unskilled labor (Lanjouw 2007). The work is physically demanding and wages are typically low, inter alia due to excess supply of (low-skilled) agricultural labor. The agricultural wage distribution is also lower than the non-agricultural wage distribution in the majority of countries (Winters et al. 2008).

1.4 Lack of Quantitative Evidence

The literature reviewed in this chapter revealed a rapidly rising number of studies on FDI in land and agriculture – especially when it comes to case studies of particular investment projects. The vast majority of these studies are based on literature reviews, the limited data available from governmental institutions and the media, or interviews with experts and local population groups. These usually qualitative studies are important as they allow deeper insights into the contextual settings and procedures of certain investment projects. They also raise awareness among governments, private enterprises, as well as the general public of the (short-term) benefits and – perhaps more importantly – the risks of certain investments. Still, they often do an insufficient job in assessing the actual and particularly the long-term impacts of such

projects. Many studies provide rather anecdotal evidence, lack a scientific set-up, and no or too little attention is paid to possible counterfactual evidence: How would the local population have fared without the investment? In addition, the emotional and sometimes ideological discussion of “land grabs” impedes the compilation of much-needed fact-based evidence.

There are also numerous and often more convincing studies that analyze the transformation of the agricultural sector and its likely impacts on smallholder livelihoods. One strand of this literature analyzes the impacts of participating in contract farming schemes of large agroprocessors on the (short-term) economic well-being of participants and finds mixed evidence. These studies usually do not emphasize the nationality of the investors, although in many cases such projects are at least partly funded by foreign investors.

What are really lacking are studies that try to assess quantitatively the long-term effects of FDI projects in agriculture and related processes of agricultural commercialization. Furthermore, only few studies have assessed the longer-term benefits of outgrower schemes. This study aims to contribute to filling this gap by studying the long-term economic impact of integrating Zambian small-scale farmers into modern food supply chains.

Chapter 2

Agricultural FDI in Zambia: Opportunities and Trends

Chapter Summary:

This chapter provides a profile of the Zambian agricultural sector. It shows why the country is seen as one of the top ten countries worldwide in terms of potential for increasing agricultural production. Nevertheless the available statistics indicate that so far investment in agriculture remains low, although recent figures suggest that the inflow of foreign direct investment in the sector has been on the upswing. The analysis of previously unpublished data on sub-sectoral level obtained from the Zambian Development Agency (ZDA) provides insight into the sectoral distribution of investments in Zambia, their geographical location, as well as the investor's country of origin.

Acknowledgement: We thank Dr. Ivan Pavletic for his contribution this chapter. We collaborated during the first year of this project and jointly undertook two fact finding missions to Zambia in 2011 to gather information and conduct interviews with numerous stakeholders.

2.1 High Dependence on Copper, Despite Ample Opportunities in Agriculture

Historically, FDI have played an important role in Zambia's economy. With the development of the copper mining industry in the 1930s, multinational corporations made substantial investments to set up one of the largest mining complexes in the world. The subsequent copper boom made of Zambia an attractive investment destination, so that at the time of independence in 1964, the country had become one of the most industrialized and wealthy nations in Africa.

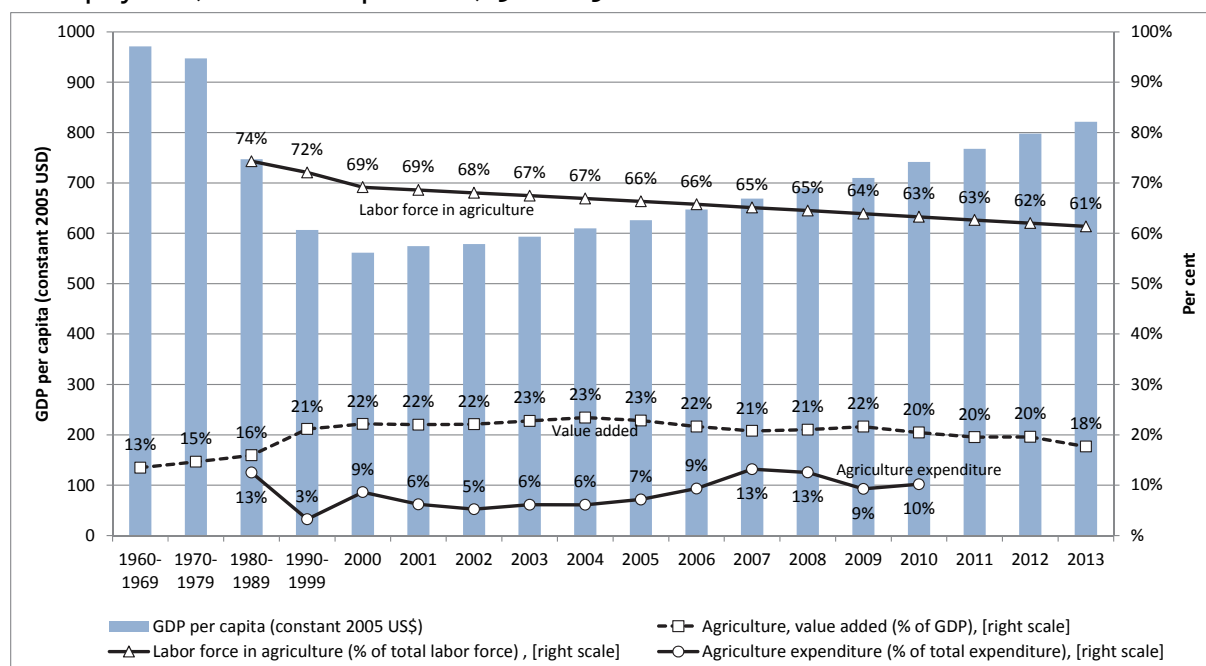
Inspired by the ideas of African socialism and economic independence, the Zambian government took control over the economy in the post-independence period and nationalized the majority of the country's former privately-owned enterprises. The heavily interventionist and protectionist economic policy that followed made the private sector virtually disappear. Notable exceptions were the banking and the agriculture sectors. But since these sectors played a relatively small role in Zambia's economy, the involvement of foreign investors remained limited during that period (Fundanga and Mwaba 1997; Rakner 2003).

The collapse in copper prices in the 1970s, exacerbated by soaring energy prices, plunged the economy into a severe depression. At that time, copper represented 40% of the country's gross domestic product, 95% of its exports, and 62% of the government's tax revenue (Murapa 1976). To finance the subsequent shortfall in public revenues, and in order to avoid the troubles of economic stabilization and restructuring, the government borrowed heavily and turned Zambia into one of the most indebted countries in Sub-Saharan Africa. Attempts in the late 1980s to reverse the deterioration of the economy through the implementation of several structural adjustment programs were unsuccessful. Zambia, from 1970 until the turn of the century, experienced three decades of economic stagnation. Figure 3 (page 33) illustrates that real GDP per capita fell by more than 40%. Other measures of welfare such as life expectancy and school enrollment deteriorated as well (World Bank 2007b). The dire economic environment scared off foreign investors and left established enterprises disinclined to put more money at risk. Confronted with a full-blown economic and social crisis, the long-serving socialist government eventually became committed to reduce its involvement in the economy, and agreed to hold multiparty elections in 1991 (Rakner 2003; Cheelo and Munalula 2005).

Under the auspices of international finance institutions, Zambia's successive democratically elected governments implemented fundamental stabilization and structural adjustment reforms designed to move the economy from state control to a market-based system. Within a decade, they brought the government's budget under control, liberalized foreign exchange and domestic financial markets, freed interest rates, removed quantitative trade restrictions, and simplified the tariff structure. They also liberalized input and output markets, removed price

restrictions, and sold loss-making state companies (World Bank 2004). The implementation of these economic reforms contributed to the recovery of the Zambian economy.

Figure 3: GDP per Capita and Significance of the Agricultural Sector in Zambia in Terms of Value Added, Employment, and Public Expenditure, 1960-2013



Source: Author's calculations using data from various sources. GDP and value added data from World Development Indicators (WDI) Online database (World Bank 2014b). Labor force in agriculture from FAOSTAT (FAO 2014). Government agriculture expenditure from ReSAKSS (2014). All data accessed August 2014.

Although the country's economy has achieved steady growth since the early 2000s, real GDP per capita in 2013 is still only about 85% of what it was in the 1960s (World Bank 2014b). Zambia achieved substantial progress in reducing poverty between the mid-1990s and mid-2000s (World Bank 2012b). Progress since then has been minor, despite high annual GDP growth of 5.7% on average between 2000 and 2010. In 2010 around 61% of the population were living in moderate poverty (i.e. had expenditures below the national poverty line), and 39% in extreme poverty, struggling to meet basic food needs (i.e. had expenditures below the food poverty line).¹³ Poverty is especially concentrated in rural areas where the majority of households depend on agriculture for a living. In these areas, 74% are moderately poor and 53% extremely poor (vs. 35% and 13% in urban areas) (ibid.). As a result, hunger is widespread. Figures from 2012 show that around 43% (up from 34% in 1991) of the population are undernourished (World Bank 2014b).¹⁴ About 15% of children under five years old suffer from malnutrition (2007 figures,

¹³ Using international poverty lines (World Bank 2014b), in 2010 about 87% of Zambians were living in poverty (on less than 2 USD per day), and 75% in extreme poverty (on less than 1.25 USD a day).

¹⁴ As measured by Millennium Development Goal 1c. It measures the proportion of people whose food intake falls below the minimum level of dietary energy requirements.

down from 21% in 1991). Poverty alleviation remains one of the central goals of the Zambian government as well as of governmental and non-governmental international organizations.

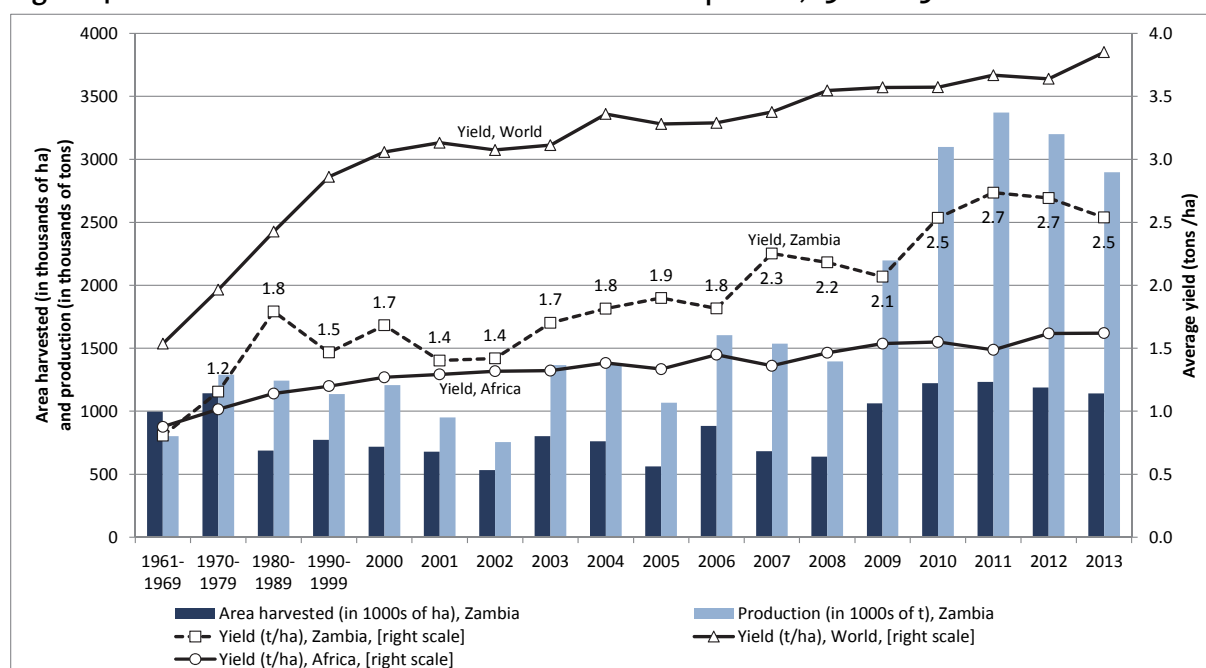
Despite the country's heavy dependence on copper, agriculture is of critical importance to Zambia. The sector accounts for more than 60% of total employment and just below 20% of GDP (see Figure 3 on page 33). In addition, it makes up for about 12% of national export earnings (World Bank 2012a, p. 1). With fertile soils, a moderate climate and considerable water resources, the country provides conditions very well suited to the production of various agricultural commodities. So far, much of this potential has not yet been tapped. According to the land inventory made by Deininger et al. (2011, p. 110), Zambia is currently cultivating only about 35% (about 4,6 million hectares) of its total land suitable for agriculture. With more than 13 million hectares of fertile and non-forested land unused, the country is on the top ten list of countries worldwide with the highest potential for increasing agricultural production. In addition to opportunities to put additional land under production, land is often farmed inefficiently. Observed farm yields on average reach no more than approximately 12% of potential yields – one of the lowest proportions in the region (ibid.).

The agricultural sector is characterized by its dual nature (ABD 2005). On the one hand there are about 800'000 small-scale farmers who cultivate between 1 and 5 hectares and account for roughly 80% of all agricultural land use. Most workers in the agricultural sector are employed on such small-scale farms or in family-run microenterprises (World Bank 2012b, p. 2). These farms usually produce rain-fed staple crops (above all maize) for own consumption, with simple technologies and cultivation practices, and at low productivity levels (World Bank 2007a). Due to the abundant supply of unskilled labor, production is highly labor-intensive and the returns to labor are extremely low in rural areas. On the other hand, there are about 50'000 “emergent” farming households (5 to 50 ha) and some 700 large-scale commercial farms (50 to 250 ha) which use modern inputs and technology and reach higher productivity (ABD 2005). For example, average yields for maize, the primary staple crop in Zambia, in the 2011/2012 planting season were 2.2 tons per hectare (ha) on small- and medium-scale farms, while large-scale farms reached yields around 4.85 tons per ha (World Bank 2012a, p. 1).

The overall positive economic development experienced in the recent years is not driven by agricultural growth, and certainly not by small-scale farming. Agriculture grew at an average rate of only 3% between 2001 and 2011. Growth increased to more than 10% in the following years, largely due to an expansion in cultivated land, favorable weather conditions, expensive fertilizer subsidies by the government, and some organic growth in commercial agriculture

(World Bank 2012a, b).¹⁵ But average agricultural productivity levels remain low in international comparison. Figure 4 illustrates the evolution of cereal production and cereal yields in Zambia from 1961 until 2013. Due to productivity increases over the years, cereal yields for Zambia in 2013 (2.5 tons per ha) are higher than the African average (1.6 t/ha). However, compared to global averages (3.9 t/ha), Zambia still falls short and has not been able to keep up with worldwide productivity improvements.

Figure 4: Zambian Cereal Production and Yields in Comparison, 1961-2013



Notes: The figure shows the area harvested (in thousands of hectares), the production (in thousands of tons), as well as average achieved yields (in tons per hectare) for cereals in Zambia. Average yields achieved globally and in Africa are added for comparison. Cereals include all cereal grains such as wheat, maize, millet, mixed grain, oats, rice, and sorghum.

Source: Author's calculations using data downloaded on August 10, 2014 from FAOSTAT (FAO 2014).

The Zambian government has attempted for a long time to increase productivity levels among smallholder farmers and to promote the commercialization process through input support programs. This strong commitment to agriculture is reflected by a higher percentage of the national budget devoted to agriculture since 2007 (see Figure 3 on p. 33). The country is one of only 13 countries that have already achieved the Maputo Declaration target of allocating at least 10% of total government budget to agriculture (Benin and Yu 2013). However, initiatives to provide subsidized inputs and credit, public extension services and market price interventions

¹⁵ In comparison, growth in value-added by the mining industry was 10% on average between 2001 and 2011, 15% in the construction sector, 11% in transport and communications, and 8% in the tourism industry (World Bank 2012b, p. 14)

did not yield the desired results. These public programs often lacked business orientation, failed to successfully link smallholders to markets, and to target those farmers in need of support (ABD 2005; World Bank 2010; Haantuba et al. 2011; Nkonde et al. 2011). Smallholders continue to face numerous supply-side constraints, such as limited area for cultivation, insufficient irrigation and drainage systems, a lack of high-quality inputs, as well as limited access to credit (World Bank 2012a).

There have been some success stories on the collaboration of entrepreneurs and small-scale farmers through outgrower schemes (World Bank 2012a). Since the mid-1990s outgrower schemes that produce high value commodities have developed in areas with better access to markets. In the 2003/2004 season, an estimated 35% to 40% of all smallholder farmers in Zambia were organized in outgrower schemes (ACI and Agridev Consult 2008, p. 283ff.).¹⁶ The majority (around 80%) of these are engaged in cotton production, even though the dominance of cotton has been decreasing due to the diversification of outgrower schemes into new types of crops like tobacco, honey and food crops. A recent publication estimates that over 400'000 households in Zambia participate in outgrower schemes (World Bank 2012a).

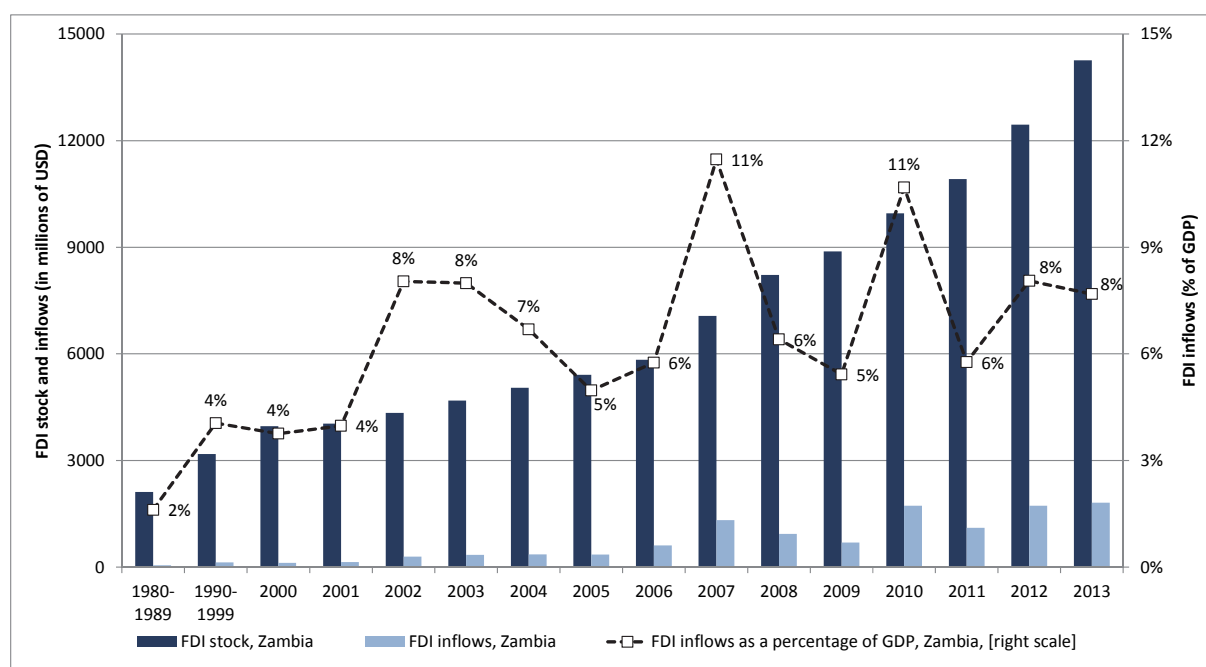
Despite this broad participation, contract farming is usually just a supplementary source of cash income. Most outgrowers continue to rely on the production of other crops as well. Contract farming does however generate significant cash income, with average revenues in the 2001/02 respectively 2003/04 season ranging between 330 and 1100 USD for tobacco, 160 to 210 USD for cotton, and 155 to 500 USD for farmers growing other crops (ACI and Agridev Consult 2008, p. 285).

¹⁶ These figures are from a survey of outgrower scheme operators who were asked to indicate how many households participate in their scheme (Droppelmann 2005). This survey used a rather broad definition of outgrower schemes and included farmer cooperatives and farmer associations as well. The analysis of household panel data in Chapter 4 suggests that merely 10-15% of all households participate in outgrower schemes. This is likely due to the strict focus on outgrower schemes. Furthermore our indicators are built upon survey items that ask about the primary source of fertilizer or the primary buyer of produce for each crop. Households where other suppliers or buyers are more important are not considered outgrowers.

2.2 Sectoral Distribution of FDI: Share of Agriculture Remains Low

Prudent macroeconomic management, political stability, market liberalization, and rapid economic growth since the beginning of the new millennium have led to a surge in investor interest and have encouraged the inflow of foreign capital. Figure 5 shows overall investment trends for Zambia from 1980 to 2013. Net inflows of foreign capital have steadily increased, although year-to-year variation has been relatively large. UNCTAD (2014) statistics reveal that Zambia compares well to its regional African neighbors in terms of total FDI inflow and FDI as a ratio of GDP. However, the country lags behind in terms of FDI per capita. The figures also show that FDI flows to Zambia, and generally to Sub-Saharan Africa, are still very low by international standards, both in total and in per capita terms.

Figure 5: FDI Stock and FDI Inflows to Zambia, 1980-2013



Notes: FDI stock and inflows are in millions of USD at current prices and current exchange rates. FDI inflows are also shown as a percentage of the Zambian gross domestic product.

Source: UNCTAD (2014), FDI/TNC database. Data retrieved on August 11, 2014.

Unfortunately, data on the sectoral distribution of FDI over the last two decades does not exist. Given the country's vast reserves of copper and other minerals, as well as growing demand and a steep increase in copper prices since 2003 on world markets (World Bank 2014a), a large share of the investments must have targeted the mining sector (UNCTAD 2011a). Although the data is patchy, agricultural investments have also likely increased in the recent past. UNCTAD reports an increase in the inward FDI stock in agriculture, forestry and fishing from 57.5 million USD in 2002 to 126.5 million USD in 2007. The share of investments in the sector of total investments grew from 6.8% to 11.7% (UNCTAD 2009, p. 237).

The Zambia Development Agency (ZDA) has compiled statistics on the annual investment pledges by foreign and domestic investors on a sectoral level since 2000.¹⁷ The figures provided in Table 1 confirm that the bulk of FDI entering Zambia has been directed to the mining sector. FDI pledges associated with manufacturing and services have been relatively low during the period, but seem to have picked up recently. At the same time, investment pledges in the agricultural sector have decreased in relative terms over the last ten years.

Table 1: FDI Pledges by Sector, 2000-2009

	Agriculture		Mining		Manufacturing		Other		Total
	mio. USD	%	mio. USD	%	mio. USD	%	mio. USD	%	mio. USD
2000	8.80	10.9%	2.32	2.9%	29.33	36.4%	40.11	49.8%	80.56
2001	25.97	24.1%	14.66	13.6%	28.54	26.5%	38.72	35.9%	107.89
2002	11.51	14.0%	6.80	8.3%	7.09	8.6%	56.65	69.0%	82.04
2003	32.94	29.7%	0.66	0.6%	26.18	23.6%	51.30	46.2%	111.07
2004	32.03	26.7%	14.45	12.1%	44.67	37.3%	28.72	24.0%	119.87
2005	30.26	12.4%	62.40	25.5%	114.28	46.7%	37.67	15.4%	244.62
2006	57.12	8.5%	63.47	9.4%	415.91	61.8%	136.93	20.3%	673.43
2007	10.03	0.6%	441.50	26.1%	565.22	33.4%	677.81	40.0%	1'694.56
2008	66.88	0.7%	7'444.92	75.7%	717.28	7.3%	1'610.48	16.4%	9'839.56
2009	44.66	4.3%	146.65	14.2%	119.64	11.5%	725.11	70.0%	1'036.06
All years	320.20	2.3%	8'197.83	58.6%	2'068.13	14.8%	3'403.50	24.3%	13'989.65

Notes: Figures only include FDI pledges by companies licensed with the Zambia Development Agency.

Source: Author's calculations using data from Zambia Development Agency, 2011.

However illustrative these figures may be, they cannot be relied upon as an indicator of sectoral investment in Zambia. First, not all investors pass through the ZDA to benefit from the agency's investment promotion and facilitation services. Those who do not are not accounted for in the statistics. Second, according to personal communication with ZDA officials, there has been a tendency for companies to overstate their pledges in order to benefit from a preferential treatment from government bodies. Third, the pledges reflect investment projections of companies over the medium to long term. Displaying the total pledged amount of investment in one year is thus somewhat misleading.

The ZDA has recognized this problem. In 2007 the agency started monitoring each year a selection of licensed – foreign as well as domestic – companies in order to get some insight how pledged investments compare to actualized investments.¹⁸ Table 2 displays the figures for the large companies monitored between 2007 and 2012 by sector. As not all companies have

¹⁷ The Zambia Development Agency (ZDA) was established in 2006 through the merger of five previously existing institutions (Zambian Investment Centre, Zambia Privatization Agency, Export Boards of Zambia, Small Enterprise Development Board and Zambia Export Processing Zones Authorities. The ZDA is responsible for promoting investments by foreign and domestic investors, and supporting exports, small business development and continued privatization of public enterprises.

¹⁸ For the monitored companies data is now available on the total amount of investment pledged, the actualized total investment, and in limited cases the actualized investment in the first year.

been monitored, it is difficult to make precise statements about the evolution of investments. Still, the analysis of this previously unpublished data permits interesting insights with regards to the sectoral and geographical distribution of large investments, the gap between pledged and actualized investments, and the origin of the investors.

Contrary to expectation, investments in the manufacturing sector constitute the majority of the projects that have gone through the ZDA, followed by mining. Investments in the agricultural sector represent only a small percentage of the ZDA portfolio. The 58 projects (9% of all monitored projects) account for a total of 113 million USD of actualized investment (around 3% of total actualized investment).

Table 2: Pledged and Actualized Investments by Sector and Year, 2007-2012

Year monitored by ZDA & sector	No. of investments monitored by ZDA	Pledged investment	Actualized investment	Investment implementation	Pledged employment	Actualized employment	Employment implementation	Jobs per mio. USD invested
		(mio. USD)	(mio. USD)	rate (%)			rate (%)	
2007	64	1'411.50	700.79	50%	17'195	8'869	52%	13
Agriculture	4	17.37	5.04	29%	3'662	619	17%	123
Mining	5	417.80	248.89	60%	1'962	1'065	54%	4
Manufacturing	26	575.31	339.45	59%	6'936	5'877	85%	17
Other	29	401.02	107.42	27%	4'635	1'308	28%	12
2008	108	2'899.97	1'030.27	36%	13'580	6'480	48%	6
Agriculture	11	32.19	19.23	60%	839	361	43%	19
Mining	7	1'119.28	288.34	26%	2'038	237	12%	1
Manufacturing	33	708.03	306.20	43%	3'908	2'147	55%	7
Other	57	1'040.47	416.50	40%	6'795	3'735	55%	9
2009	89	1'129.92	552.14	49%	11'934	8'578	72%	16
Agriculture	8	35.10	15.88	45%	650	275	42%	17
Mining	3	2.55	2.39	94%	257	102	40%	43
Manufacturing	37	607.74	429.15	71%	7'938	6'906	87%	16
Other	41	484.53	104.71	22%	3'089	1'295	42%	12
2010	81	2'062.23	726.32	35%	12'023	5'788	48%	8
Agriculture	7	21.91	8.38	38%	479	145	30%	17
Mining	5	312.78	6.34	2%	2'000	42	2%	7
Manufacturing	23	739.41	282.96	38%	3'959	2'035	51%	7
Other	46	988.13	428.64	43%	5'585	3'566	64%	8
2011	176	1'242.68	336.37	27%	14'504	8'211	57%	24
Agriculture	17	51.31	23.02	45%	1'627	2'291	141%	100
Mining	7	109.76	45.50	41%	382	502	131%	11
Manufacturing	51	180.76	100.59	56%	2'290	2'547	111%	25
Other	101	900.85	167.26	19%	10'205	2'871	28%	17
2012	119	715.50	189.74	27%	6'314	3'784	60%	20
Agriculture	11	30.60	41.58	136%	315	243	77%	6
Mining	15	128.75	11.96	9%	1'601	322	20%	27
Manufacturing	32	169.29	33.94	20%	1'826	1'103	60%	32
Other	61	386.86	102.25	26%	2'572	2'116	82%	21
All years	637	9'461.80	3'535.62	37%	75'550	41'710	55%	12
Agriculture	58	188.48	113.13	60%	7'572	3'934	52%	35
Mining	42	2'090.91	603.41	29%	8'240	2'270	28%	4
Manufacturing	202	2'980.55	1'492.30	50%	26'857	20'615	77%	14
Other	335	4'201.86	1'326.78	32%	32'881	14'891	45%	11

Notes: Figures based on a sample of 637 large companies (both domestic and foreign owned) that are licensed with the Zambia Development Agency and were monitored in the years indicated.

Source: Author's calculations using data from Development Agency, 2012.

The annual implementation rate in the first year of agricultural investment projects amounts to 29–136% in terms of actualized investment, and 17–141% in terms of actualized employment. The rates vary significantly across time and sectors. Apart from the fact that the

implementation rate in the manufacturing sector is significantly higher than in all other sectors, there does not seem to be any clear pattern.

As for the number of jobs created per sector, the manufacturing industry is ranked first, followed by the agricultural sector. Close to four thousand jobs were created by agricultural investment projects. The contribution of the agricultural sector is particularly high when looking at the number of jobs that were created in each sector per million USD invested. The mining industry is characterized by high capital intensity and only generated about 4 jobs per million USD invested. Agriculture, on the other hand, created about 35 jobs per million USD invested, which also highly exceeds the 13 and 11 jobs created in manufacturing and other sectors. Although these jobs are usually not in the upper income group, they still provide an opportunity for the rural population to diversify their economic activities and to improve their livelihood. Agricultural investment is thus likely to reduce poverty.

Table 3 shows the provinces where the investment projects are located. Close to 90% of all investment projects in the reviewed ZDA portfolio have been directed to the four Zambian provinces located along the rail and road corridor between Livingstone and the Copperbelt. Thereof, nearly 60% are in Lusaka province. This distribution is also apparent for agricultural investments. This suggests that agricultural investors cluster in the vicinity of urban markets in order to lower their transport costs.

Table 3: Pledged and Actualized Investments by Province, 2007-2012

Sector & province	Number of investments monitored by ZDA	Pledged investment (mio. USD)	Actualized investment (mio. USD)	Investment implementation rate (%)	Pledged employment	Actualized employment	Employment implementation rate (%)	Jobs per mio. USD invested
Agriculture	58	188.48	113.13	60%	7'572	3'934	52%	35
Lusaka	29	113.61	71.32	63%	5'401	2'940	54%	41
Copperbelt	8	25.80	10.73	42%	523	367	70%	34
Southern	7	12.68	8.93	70%	788	185	23%	21
Central	7	19.20	17.14	89%	362	234	65%	14
Other	3	1.70	0.66	39%	136	87	64%	131
Unknown	4	15.49	4.35	28%	362	121	33%	28
All Sectors	637	9'461.80	3'535.62	37%	75'550	41'710	55%	12
Lusaka	377	3'952.49	1'461.35	37%	39'836	19'864	50%	14
Copperbelt	121	1'470.33	687.17	47%	12'580	7'456	59%	11
Southern	49	819.01	359.01	44%	10'877	8'202	75%	23
Central	9	29.70	20.37	69%	574	248	43%	12
Other Province	17	1'460.27	300.07	21%	2'057	544	26%	2
Unknown	64	1'730.01	707.65	41%	9'626	5'396	56%	8

Notes: Figures based on a sample of 637 large companies (both domestic and foreign owned) that are licensed with the Zambia Development Agency and were monitored between 2007 and 2012.

Source: Author's calculations using data from Zambia Development Agency, 2012.

Finally, as to the origin of the investors, foreign investors account for about 70% of all reviewed investment projects, 62% of actualized investments, and 68% of actualized employment (Table 4). Foreign investors also play a similar role in the agricultural sector, accounting for 67% of projects, and 72%/85% of actualized investment/employment. British, South-African, and Indian companies have been the primary investors in agriculture in the ZDA sample. The

Chinese account for the largest number and volume of investments in Zambia across all sectors, but their involvement in agriculture so far seems to be limited.

Table 4: Pledged and Actualized Investments by Sector and Investor Origin, 2007-2012

Sector & investor origin	No. of investments monitored by ZDA	Pledged investment	Actualized investment	Investment implementation	Pledged employment	Actualized employment	Employment implementation	Jobs per mio. USD invested
		(mio. USD)	(mio. USD)	rate (%)			rate (%)	
Agriculture	58	188.48	113.13	60%	7'572	3'934	52%	35
Domestic	15	49.71	26.80	54%	647	453	70%	17
Foreign	39	123.29	81.98	66%	6'563	3'360	51%	41
Chinese	2	0.93	1.45	156%	35	14	40%	10
South African	8	43.91	20.68	47%	715	282	39%	14
Indian	5	24.90	29.32	118%	193	120	62%	4
British	8	18.02	14.25	79%	3'953	770	19%	54
Other	16	35.53	16.29	46%	1'667	2'174	130%	133
Unknown	4	15.49	4.35	28%	362	121	33%	28
All Sectors	637	9'461.80	3'535.62	37%	75'550	41'710	55%	12
Domestic	127	1'448.76	581.20	40%	16'096	7'778	48%	13
Foreign	442	6'030.04	2'207.24	37%	47'644	28'518	60%	13
Chinese	71	1'665.05	510.83	31%	6'571	4'517	69%	9
South African	65	1'193.44	564.68	47%	14'447	10'042	70%	18
Indian	56	337.43	225.84	67%	2'932	1'792	61%	8
British	55	191.40	59.83	31%	8'343	3'364	40%	56
Other	195	2'642.71	846.07	32%	15'351	8'803	57%	10
Unknown	68	1'983.01	747.18	38%	11'810	5'414	46%	7

Notes: Figures based on a sample of 637 large companies (both domestic and foreign owned) that are licensed with the Zambia Development Agency and were monitored between 2007 and 2012.

Source: Author's calculations using data from Zambia Development Agency, 2012.

Overall, the patchy data depicted in this section suggests that FDI in agriculture still account for a rather small percentage of overall investments. There are however some indications that the sector has become increasingly attractive for investors in the recent past. The Zambian government has introduced special incentives for investments in agriculture in order to increase investor interest.¹⁹ Given the “vastly untapped opportunities still awaiting development, particularly in agriculture production and agri-business” (UNCTAD 2011a, p.1), the sector is likely to attract new investors in the coming years. Some sources estimate that in Zambia agricultural investments covering at least 1.5 million hectares are already in the pipeline (Horne and Mittal 2011).

A considerable part of this land will be put under production through the government's ambitious farm block development program. Nine farm blocks throughout the country covering about one million hectares are earmarked for agricultural production (see Table 5). This would correspond to increasing the currently cultivated area by more than 20%. In each farm block a private investor will be selected through a public bidding process (Republic of Zambia 2005; MACO / MLF 2010). The investor will set up a core venture of at least 10'000

¹⁹ Sector-specific incentives for agricultural investments include exemption from tax on dividends from farming for the first five years, exemption from customs duty for agricultural equipment, and a reduced tax rate of 15% (instead of the usual 35%) on incomes from farming and export of non-traditional products (UNCTAD 2011a, p. 35).

hectares and put in place the necessary production infrastructure (e.g. processing or canning plants), in order to produce value-added products ready for export. The private company further has to establish outgrower schemes for collaboration with small and medium size farmers, who will settle the remaining area, hence contributing to improving agricultural practices and technologies among small farmers. In return, the government will fund the basic infrastructure such as roads, electricity, dams, and water boreholes to support small-scale farmers.

Table 5: Planned New Farm Blocks in Zambia

	Farm Block	Province	District	Size (ha)
1	Nansanga	Central	Serenje	155'000
2	Kalumwange	Western	Kaoma	100'000
3	Luena	Luapula	Kawambwa	100'000
4	Manshya	Northern	Mpika	147'000
5	Mikelenge/Luma	North-Western	Solwezi	100'000
6	Musakashi (SADA)	Copperbelt	Mufulira	100'000
7	Muku	Lusaka	Kafue	100'000
8	Simango	Southern	Livingstone	100'000
9	Mwase-Phangwe	Eastern	Lundazi	100'000
	TOTAL			1'002'000

Source: Zambian Development Agency (2011b)

The Nansanga Farm Block is the first block to be implemented. It covers 155'000 hectares and is located in Serenje, Central Province. The Zambian Government selected a private investor to run the approximately 17'000ha core venture. The remaining area will be operated by around 356 small and medium sized farms with plots between 10 and 900ha. Although the whole area where the farm block is being developed was populated by some 2'500 persons living in about 427 households (MACO 2006), the ZDA reports that only 43 farmers had to be relocated. They will be resettled and allocated between 30 and 50 hectares of land each and shall also become contract farmers of the core estate (Zambia Development Agency 2011a).

According to government officials, people in the area do not oppose the farm block, as attention is paid to involve the local stakeholders and make sure that the project benefits the communities within the area. Contracts with private sector investors also contain default clauses to take back the land if this should be necessary (e.g. if farming does not commence). In order to decrease the environmental impact, 30% of the land has to remain untouched. Despite these efforts there have also been critical voices on the project regarding planning problems, delays in infrastructure development, displacement of land users, and lower than expected interest from investors (Chanda 2011; Horne and Mittal 2011). It remains to be seen whether the Nansanga and the other planned farm block projects will succeed in providing the intended development opportunities for all stakeholders involved, above all the local population groups.

Chapter 3

FDI in the Zambian Sugar Cane Industry –

The Impact of Outgrower Schemes and Large-Scale Farm Employment on Rural Household Wealth

Chapter Summary:

This chapter presents a quantitative study that examines the extent to which agricultural FDI in the Zambian sugar industry has benefited the local population. Based on data from a new household survey conducted in 2012, we explore how two strategies for smallholder integration into commodity chains – contract farming and wage employment on large-scale farms – have economically benefited local population groups in Zambia’s “sugar capital”, Mazabuka. Sugar cane production in this region has been running for several decades – both in large-scale settings and in outgrower schemes – and thus permits an evaluation of its long-term impact.

Evidence using regression as well as propensity score matching points towards a positive effect of participation in the sugar industry on household wealth, as measured by a wealth index calculated by principal components analysis. Participants of sugar cane outgrower schemes exhibit significantly higher wealth than other smallholders who are not integrated into the sugar supply chain, but are otherwise very similar. Employees on large-scale sugar estates also appear to be benefit significantly, although the effect is less pronounced. Qualitative data from focus group discussions and expert interviews support the findings from the quantitative analysis and provide additional insight to the perceived benefits and risks of participation in this industry.

3.1 Introduction

This chapter presents the findings of the main part of this thesis, which looks in detail at one specific investment project in the Zambian sugar industry. The sugar value chain provides an interesting case for studying the significance of FDI in Zambia. Sugar production has been on the rise since the industry was privatized in the 1990s. The development was largely driven by the private sector and predominantly large-scale. Large amounts of FDI were allocated to the sugar industry and modern production technologies were introduced. Market concentration is extremely high with currently more than 90% of the total sugar being produced by the market leader, South African owned Zambia Sugar Plc. The company has recently invested around 200 million USD to expand the cane-crushing capacity of the sugar mill in Zambia's "sugar capital" Mazabuka.

Sugar constitutes one of the most successful non-traditional export sectors in Zambia. For this reason there are a number of projects in the pipeline to expand sugar production in the country (Kalinda and Chisanga 2014). Sugar production in Mazabuka has been around for decades – since the 1960s in large-scale settings and since the early 1980s in outgrower schemes. It therefore provides an opportunity to analyze in-depth the long-term economic impact on the local population and perhaps identify important lessons that should be taken into account in future development.

Data from a new household survey conducted in 2012 in Mazabuka specifically for this study serves to analyze how integration into the sugar industry impacts household wealth. We assess quantitatively to what extent participants in sugar cane outgrower schemes and employees on large-scale sugar estates benefit, by comparing them to small-scale farmers in the region who are not connected to the sugar industry but are otherwise very similar. In addition, qualitative data gathered during focus group discussions and expert interviews in 2012 and 2013 serve to test and complement the results of the quantitative analysis.

The chapter is organized as follows. Section 3.2 provides the background. It describes the Zambian sugar sector and in particular how smallholder farmers participate in this industry through farm employment and outgrower schemes. It also summarizes existing studies on the impacts of the industry, which arrive at rather contradictory conclusions, especially regarding the benefits of employment on large farms. Section 3.3 describes the data collected for the current study through a household survey, focus group discussions, and expert interviews. Section 3.4 explains the indicators used to proxy the dependent variable household wealth, the likely determinants thereof, and the method of analysis. Section 3.5 reports the main findings. It presents descriptive statistics, the results from the multiple regression models as well as the propensity score matching approach. The section closes with the evidence that emerged from

the qualitative analysis. Section 3.6 then draws conclusions from both the quantitative and qualitative evidence and discusses policy implications.

3.2 Mazabuka – the “Sweetest Town in Zambia”?

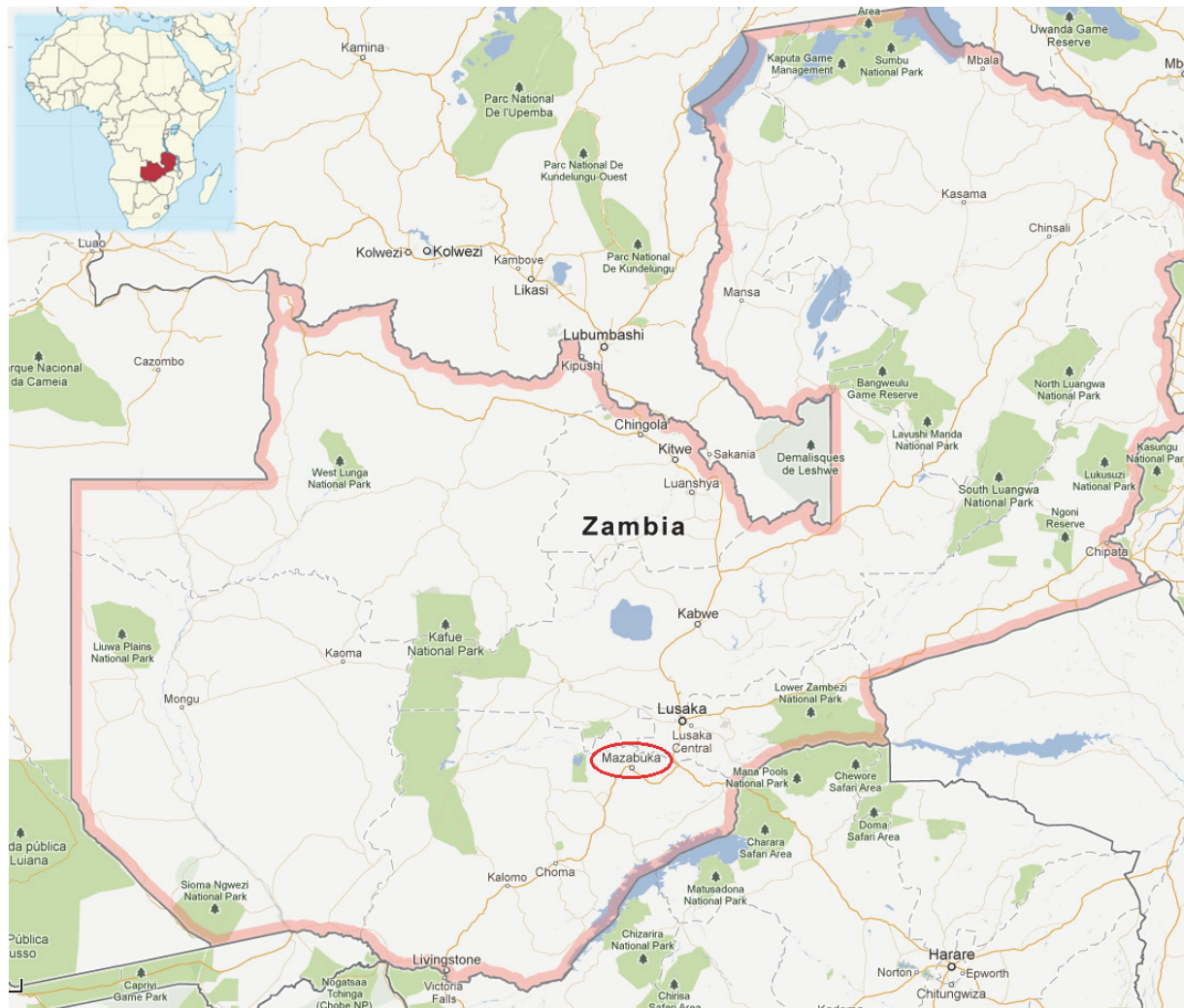
The sugar industry is one of Zambia’s most successful non-traditional export sectors and its contribution to GDP has increased considerably to an estimated 4% in the last decade (ACI and Agridev Consult 2008, p. 598; Richardson 2010a, p. 929). Certain areas of Zambia offer the combination of frost-free winters, plenty of sunshine and ample water supply and thus present ideal climatic conditions for sugar cane production. With yields averaging more than 120 tons sugar cane per hectare, Zambia achieves the highest yields worldwide (LMC 2011, p. 21ff.). Production costs are relatively low. Zambian producers are thus able to compete with other suppliers on world markets, despite the high costs of transportation to the nearest port. Still, high freight costs make it more attractive for Zambian producers to supply domestic and regional markets rather than global markets. In terms of quantity produced, Zambia is ranked 39th in the world with a total production of 430 thousand tons in the 2012/2013 season (Table 6). This corresponds to about 0.25% of world sugar production (including beet sugar).

Table 6: World Centrifugal Sugar 2012/2013

Rank	Country	Production (in 1000s of tons)	Percent
1	Brazil	38'600	22.12%
2	India	27'430	15.72%
3	EU-27	15'623	8.95%
4	China	13'977	8.01%
5	Thailand	9'900	5.67%
6	United States	8'179	4.69%
7	Mexico	6'588	3.78%
8	Russia	5'000	2.87%
9	Pakistan	4'670	2.68%
10	Australia	4'247	2.43%
39	Zambia	430	0.25%
	Rest of World	39'824	22.83%
TOTAL		174'468	100.00%

Source: Author's calculations using data from USDA (2013).

Market concentration is extremely high with just three producing companies. The smallest company is called Kalungwishi Estates and runs a 500 hectare sugar cane estate in Luapula province in northern Zambia. But most sugar cane is produced on the banks of the Kafue River. On the northern banks of the Kafue Flats lies Kafue Sugar. The company grows sugar cane on 9'000 hectares and operates its own processing mill.

Figure 6: Survey Region in Mazabuka, Zambia

Source: Google Maps (Google 2012).

Currently more than 90% of total sugar is however being produced on the southern banks of the Kafue river around Mazabuka. The town in Zambia's Southern Province is popularly known as "the sweetest town in the nation". The market leader, South African owned Zambia Sugar Ltd²⁰, runs the only sugar mill in Mazabuka district, a region that has grown around sugar cane production. Zambia Sugar runs the "Nakambala Sugar Estate" where sugar cane is grown on about 17'000 hectares, producing 1.86 million tons of sugar cane in the 2013/14 season. As the largest agricultural entity in the country, it employs around 2'000 permanent, and between 2'500 and 5'500 seasonal workers, depending on the time of the year (Zambia Sugar Plc 2014).

²⁰ Zambia Sugar is a subsidiary of Illovo Sugar Limited of South Africa. The Illovo Group is the biggest sugar producer in Africa with agricultural and manufacturing operations in six African countries. Illovo acquired a majority stake in the Zambia Sugar Company in 2001. As of 2014, Illovo holds 82% of all shares. Illovo is listed on the Johannesburg Stock Exchange and is itself a subsidiary of Associated British Foods plc, which holds 51.4% of the issued share capital (Zambia Sugar Plc 2014).

Altogether, Zambia Sugar’s mill crushed close to 3.15 million tons of sugar cane and sugar production totaled 393’000 tons (Zambia Sugar Plc 2014). The company markets the raw and refined sugar under its own brand. About 40% of total production is sold to the domestic market, with the balance exported to European and regional markets.

According to the typology of contract-farming arrangements outlined in Section 1.3.2 (p. 23), sugar production in Mazabuka falls under the nucleus-estate model category. The core estate provides about 60% of the cane throughput to the factory. Sugar cane is further grown on the fields of Zambia Sugar’s contract farmers, namely 13 commercial estates. Finally, sugar is sourced from small-scale farmers participating in soon to be three outgrower schemes, and exported to the European Union under the Fairtrade label.

All of Zambia Sugar’s contract farmers are paid based on the tons of estimated recoverable crystals (ERC), a measure of cane quality, and not simply on the amount of cane delivered to the factory. The price received per ton ERC is negotiated between Zambia Sugar and its contract farmers on a yearly basis, taking into account the market price for sugar as well as shared proceeds from the sales.²¹ However, since Zambia Sugar is the only mill operator nearby, it can dictate prices to a certain degree.

3.2.1 Participation of Smallholders in Sugar Cane Production

Besides providing employment opportunities, either directly on one of the large-scale sugar estates or indirectly in connected businesses, the industry also offers some opportunities for smallholders to participate in sugar cane outgrower schemes. This mode of production is not uncommon and can be found in several other countries as well (e.g. South Africa, Kenya, and Tanzania). In all schemes in Mazabuka district smallholder farmers sell their produce to the nearby Zambia Sugar plantation. The farmers are usually responsible for activities such as weeding and assisting irrigation, while tasks such as planting, harvesting and transportation of the cut cane to the mill are organized by a management service provider. Smallholder farmers also have access to production support such as inputs, credit or technical assistance and can count on a guaranteed market for their produce.²²

²¹ The pricing mechanism takes into account the proceeds of the sale of sugar and associated byproducts (e.g. molasses), subtracts the cost of refining, packaging and marketing, and divides the remaining net proceeds between the growers and Zambia Sugar (currently approx. 58% for the growers, 42% for the miller) (McKersie and Hichaambwa 2011, p. 25).

²² As we only have two outgrower schemes in our sample (thereof one which had only recently started production) and variation in contract modalities (smallholder’s share of revenue, type of assistance provided to smallholders etc.) is small, it was not possible to assess how the modalities impact the welfare of participating households.

The Kaleya Smallholders Company Ltd (KASCOL)

The Kaleya Smallholders Company Ltd (KASCOL) is an agribusiness company established in 1980. The company grows sugar cane on its own 1'120 hectare core estate which generates about 60 permanent and 400 seasonal jobs. It also operates the Kaleya Smallholder Scheme (henceforth KASCOL outgrower scheme), Zambia's longest running and, with 1'067 hectares, largest sugar cane outgrower scheme. From 2005 to 2009, production on the KASCOL core estate and its outgrower scheme ranged between 208 and 259 thousand tons of sugar cane per year, all of which is sold to Zambia Sugar on contract. On average, smallholder farmers in the outgrower scheme achieve yields of 112 t/ha, which is greater than the 102 t/ha average achieved on the core estate. However, mainly due to irregular water supply during frequent power cuts, average yields are still below the roughly 120 t/ha achieved on some of the other sugar estates in Mazabuka.

KASCOL was set up in 1980 as a government initiative with the goal to provide smallholder farmers with the opportunity to produce sugar cane. KASCOL was funded by four initial investors, which each acquired a 25% stake in the company: the Zambia Sugar Company (ZSC), the Development Bank of Zambia (DBZ), the Commonwealth Development Cooperation (CDC), and Barclays Bank Zambia Plc. The investment by ZSC (at the time a state-owned enterprise) and DBZ²³ underline the important role of the state in setting up the scheme. The Zambian government also appointed a high ranking official from the Ministry of Agriculture, who was committed to the interests of the small-scale farmers. The project was seen as both a development initiative and a business opportunity (Mujenja and Wonani 2012). This is expressed by the participation of two development banks (CDC and DBZ) on the one hand, who advocated the inclusion of the outgrower scheme, as well as Barclays Bank on the other hand, a private (for-profit) enterprise.

With exception of the 25% share that is still held by DBZ, the ownership structure of KASCOL has changed considerably since. In 2005, after KASCOL had fully repaid its initial loans, CDC and Barclays Bank sold their shares. KASCOL outgrowers acquired some 13% equity stake in the company.²⁴ The remainder (about 37%) of the shares was sold to a consortium of KASCOL management and strategic private investors. With this change in ownership, the Zambian

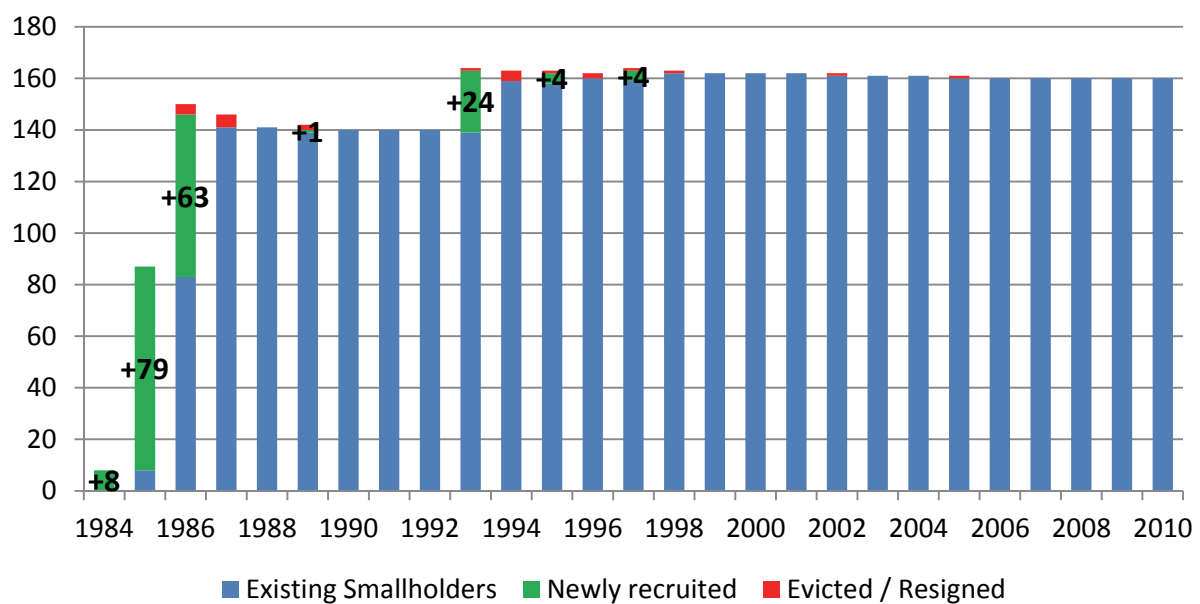
²³ The Development Bank of Zambia (www.dbz.co.zm) was established in 1972 as a joint venture between the government, public sector financial institutions, the local private sector and foreign institutions.

²⁴ The shares were bought by the Kaleya Smallholder Farmers Association (KASFA). Membership in KASFA is open to all smallholders in the KASCOL outgrower scheme and its primary objective is to promote and defend the interests of its members. The shares were bought through a loan from a commercial bank and are held in a trust, the Kaleya Smallholders Trust (KAST). In the past years, the dividends received were used to pay back the bank loan.

government withdrew its representative, and KASCOL is now a fully private company. Finally, ZSC donated its 25% equity stake to the Mazabuka Cane Growers Trust, an association created by ZSC to support local cane growers.

Today the KASCOL outgrower scheme provides a living for 160 small-scale farmers and their families (see Figure 7). It is seen by many as a successful model for including smallholder farmers in international commodity chains. Participants not only produce sugar cane, but as shareholders also have an equity stake in KASCOL, thus participating in potential earnings but also carrying greater business risk. Smallholder farmers grow sugar cane on parts of the land which is held by KASCOL on the basis of a 99-year lease. On average, each farmer has a sugar cane field of 6.5 ha and an additional 0.5 ha which is typically used for rain-fed maize production. The farmers sub-lease their land from KASCOL for renewable 14-year-periods on conditions laid out in the “Cane Farmers’ Lease Agreement”. This signed, legally binding supply contract between the farmer and KASCOL specifies the obligations and rights for both parties.

Figure 7: Number of Smallholders in the KASCOL Outgrower Scheme, 1984-2010



Source: Data provided by KASCOL, 2011.

The main responsibilities of sugar cane smallholders consist of following the fertilizer program, keeping their fields weed-free, and collaborating with KASCOL in field irrigation and crop disease control. The agreement also contains a succession clause, whereby a smallholder may nominate an immediate family member as a successor to the contract on his or her death. At the same time, farmers may be evicted from the scheme if they fail to comply with the terms of the agreement. Reasons for eviction are: 1) bankruptcy, 2) if the nominated successor does not meet the criteria set by KASCOL, 3) failure of the nominated successor to perform his activities

satisfactorily after undergoing a one to two year probationary period, and 4) failure to comply with the disciplinary code despite repeated warnings.²⁵

KASCOL provides the smallholders with all the inputs they need to fulfill their part of the agreement, including fertilizers and agro-chemicals. In addition, KASCOL management or assigned contractors take care of most production stages, including supply and delivery of water (outsourced to Zambia Sugar), land preparation, planting, as well as sugar cane harvest and subsequent transportation to the mill. Revenues from cane sales are divided between KASCOL and its outgrowers according to a revenue distribution arrangement. This arrangement was adjusted to the advantage of the smallholders several times over the years. In 2012, smallholders received 50% of the total gross sugar cane sales proceeds, while KASCOL receives 50% to cover the costs for its services.²⁶ KASCOL deducts its 50% share from the revenues realized from the sales to ZSC. From this remaining 50%, KASCOL further subtracts taxes, costs for fertilizers and chemicals, as well as for crop insurance and cane transport.

The scheme's success is well known in the area, hence many people would be interested in joining if given the opportunity. However, back in 1983 when KASCOL began recruiting smallholder farmers, the interest in joining was very limited. Mainly due to this lack of interest, the area allocated to smallholder farmers even had to be reduced from 2/3rds of the overall 2'187 ha as initially planned to just over 50% (ACI and Agridev Consult 2008, p. 615). People questioned the seriousness of the project, not comprehending why a company should offer land and infrastructure to smallholder farmers without asking payment (Mujenja and Wonani 2012, p. 41). Eight KASCOL employees, who had already worked on the large-scale estate, were the first to decide to join. A selection committee was assigned with the task of recruiting smallholders who would be able to join the scheme after a six month training program (see Box 1 for details on eligibility criteria and the selection process).

²⁵ The disciplinary code of conduct lays out the rules and regulations “for the well-being of society [...] to maintain law and order, discipline and efficiency”. Among the offenses that are punished by disciplinary measures are: performing below expectations over a period of three seasons due to bad management practices on the part of the farmer; absence from the farm for more than 30 days without making acceptable arrangements with KASCOL; damaging KASCOL's reputation; theft and other illegal activities.

²⁶ In the earlier years of the scheme, smallholders received 40% and KASCOL 60%. Successful lobbying on the part of the farmers' association led to an increase of the smallholder's share to 43% in 2005, and 45% in 2010.

Box 1: KASCOL Smallholder Selection Process

At the start of the scheme, newspaper advertisements were published and District Governor's offices throughout Zambia informed the public about the possibility to become sugar cane outgrowers, provided they met the following eligibility criteria:

- 1) Being over 21 years of age
- 2) Good health
- 3) Have a family
- 4) Motivated to grow sugar cane

The list of criteria was later extended to include the following:

- 5) No criminal record
- 6) Zambian citizen
- 7) Literate
- 8) Preference to local inhabitants

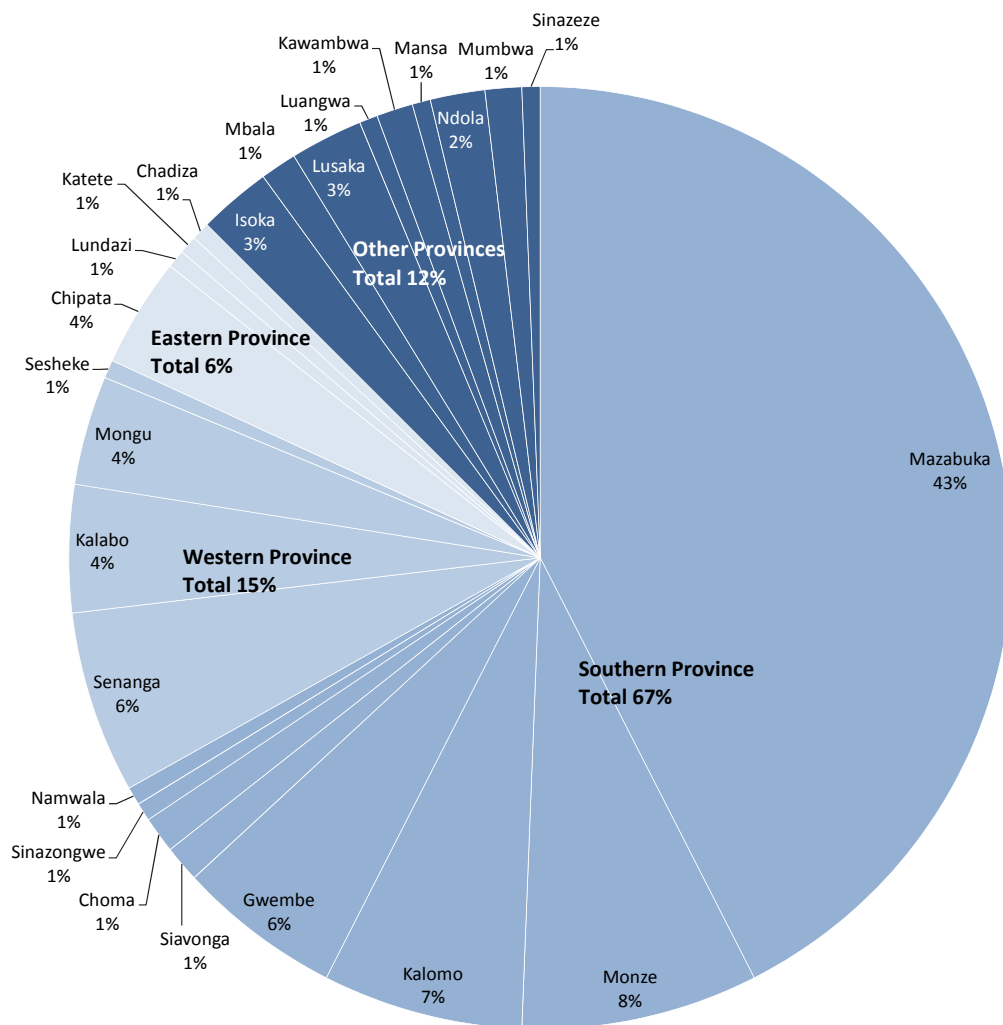
The “Selection Committee of Kaleya Smallholders” decides which applicant may join the scheme. This committee consists of five stakeholders:

- 1) District governor (chairman)
- 2) The four village chiefs in the area of the plantation (namely Chief Mwnachingwala, Hanjalika, Naluwama, and Mweemba)
- 3) District Agriculture Coordinator Office (DACO)
- 4) KASCOL management
- 5) National Government representatives

Applicants that successfully master a preliminary job interview are asked to appear before the selection committee which decides which candidates may enter a six month training program in sugar production. At the end of this half year of hands-on training the participants' performance is evaluated based on six criteria, namely: attendance rates, work performance, behavior, management understanding, cooperation, and self-motivation. After successful completion of the training and a final interview with the selection committee, candidates are invited to sign the Cane Farmers' Lease Agreement and thereby become Kaleya smallholders.

Source: KASCOL and ABD (2005, Annex 6)

The scheme started to attract more interest once the first farmers had commenced and the consistency of the project became more apparent. Within three years the majority of available plots in the scheme were filled with people from the region and beyond (see Figure 8). The median distance from KASCOL outgrowers' previous homes to the KASCOL estate is around 70 kilometers, but some relocated from villages up to 800 kilometers away, resulting in an average distance of 192 kilometers.

Figure 8: Origin of Smallholders in the KASCOL Outgrower Scheme

Source: Author's calculations using data provided by KASCOL in September 2011.

Recent Initiatives to Increase Smallholder Participation in the Sugar Value Chain

The success of the KASCOL Outgrower Scheme has spurred the establishment of two other smallholder outgrower sugar schemes in the area. The first one is in Magobbo, a small village located 12.5 km from Zambia Sugar's sugar mill. In 2007 a group of 78 households formed the Magobbo Sugar Cane Grower Association (European Commission 2007). Supported by the Government of the Republic of Zambia and funding from the European Union's 'Sugar Accompanying Measures Programme' the association proposed to grow sugar cane on their 438 ha of land and sell their produce to Zambia Sugar. Setting up the scheme required considerable upfront investments in the magnitude of 5 million Euros (approx. 6.5 million USD). The EU granted 60% (3 million EUR), while the remaining 40% (2 million EUR) were funded through the Mazabuka Cane Growers Trust and loans by private banks (European Union 2010). These figures illustrate that sugar cane production is highly capital intensive – investments per household participating in the outgrower scheme surpass 64'000 EUR. The first 433 ha of sugar

cane were planted in spring 2010. The project is expected to benefit some 900 people in the area, who were largely low-income small-scale or subsistence farmers. While most farmers seemed to be highly enthusiastic about the project from the start, others opposed it and complained that their homes had to be relocated (Hatyoka 2010).

Just like KASCOL, the Magobbo scheme depends on Zambia Sugar who is the sole buyer of their produce. The contract with Magobbo assigns Zambia Sugar control over the use of water delivered to the outgrower scheme and the crops to be grown. Zambia Sugar also has the right to the purchase of sugar cane even if alternative markets should develop (Fynn 2008, p. 11). In contrast to the KASCOL smallholders, who sublease land from KASCOL for renewable periods of 14 years, the Magobbo farmers have successfully acquired a block title deed from the Ministry of Lands. Smallholders also have more say in the selection of the management service provider. It will be interesting to see whether this will affect the level of benefits that smallholders receive in the future. Profits are divided equally among all smallholder farmers during the first couple of years after planting of the first sugar cane. Farming the land cooperatively was necessary, as the quality of land is heterogeneous, and thus the yields vary in terms of quality and quantity (Whydah Consulting Ltd 2011). After a few years, land quality and yields are expected to become more homogenous. Nevertheless, it has not yet been decided if this type of payment regime will be continued. Alternatively, each smallholder farmer may in the future be given a field of 6 ha on average, with profits divided according to the relative productivity of each block.

A third sugar cane outgrower scheme is being set up in Manyonyo, about 50 kilometers east of the Nakambala mill. The necessary infrastructure was almost completed in May 2012, with production expected to start in 2013. In total, 555 ha will be devoted to sugar cane production. The scheme is funded under a loan to the Zambian government from the African Development Bank. The Ministry of Agriculture and Livestock has been mandated to implement the project. Among the beneficiaries are 164 families who will participate in the outgrower scheme, a total of roughly 1'000 people, including extended family members (Fynn 2008, p. 13). Manyonyo smallholders have also applied for title deeds. They will each receive title and continue to live on their individual piece of land, hence relocation of households is not necessary.

3.2.2 Controversy Surrounding the Socioeconomic Impacts of the Sugar Industry

Despite the considerable number of jobs provided by Zambia Sugar and, to a lesser degree, by its contract farmers (including the mentioned outgrower schemes) it appears to be controversial to what extent the community benefits from sugar cane production.

One recent report published by the Oakland Institute (Horne and Mittal 2011) voices concerns by local businessmen and staff from the local community council who feel that benefits to the

community are marginal. While Zambia Sugar is by far the primary source of revenue for the local council (paying some ZMK 1.2 billion / USD 250'000 in taxes per year), it has been criticized that only few contracts are awarded to local businesses. Therefore spillover effects are limited to some “economic spin-offs and numerous outgrower schemes” (Horne and Mittal 2011, p. 40). At the same time the study mentions anecdotal evidence corroborating that the workers on the Zambia Sugar estate are paid considerably above the average national wage.

Some sources however report contradicting evidence. Another non-governmental organization, ActionAid, claims that up to July 2012 some of the seasonal employees on one farm recently acquired by Zambia Sugar earned wages about 20% below the government's suggested minimum wage rate (Lewis 2013).²⁷ The minimum rate is not binding in this case, as wages in the sugar sector are negotiated through collective bargaining. All the same, the authors argue that the minimum wage is intended to benchmark wages necessary for basic subsistence in Zambia. In its response to ActionAid, Zambia Sugar management stated that “not all growers pay the same rates within the agricultural sector, with variations often based on performance”. They also announced a review of wages paid on the respective farm. In fact, more recent pay slips seen by ActionAid indicate that seasonal employees on all farms owned by Zambia Sugar now earn wages about 10% above the adjusted minimum wage rate.

The research undertaken by Richardson (2010a, b) shows an equally mixed picture regarding the socioeconomic benefits of investments in the Mazabukan sugar industry. He acknowledges the considerable contribution of Zambia Sugar and its outgrowers in terms of employment opportunities, accounting for around 10% of Zambia's formal employment in 2009. While wages vary greatly for different types of work on the estate, an average worker on the Zambia Sugar estate earned ZMK 1.75 million (350\$) per month in 2009 – far above the national minimum wage. Richardson further mentions the company's investments in social amenities and its importance as the highest foreign exchange earner outside the mining sector. Nevertheless, Richardson concludes that the investment has not fully achieved the intended benefits and also entailed costs to the communities (Richardson 2010a, p. 918). For instance, some ‘squatters’ were displaced during the implementation and expansion of sugar production, and other land users such as herders lost access as well. Another criticism concerns “excessive economic concessions” awarded to foreign investors in general, in terms of low taxes, duty-free import of machinery, and preferential access to finance. In addition, Richardson argues that the economic and political power of the South African investor Illovo has enabled

²⁷ Up to July 4, 2012 the government-benchmarked minimum wage for general (non-specified) workers was ZMK419'000 (roughly USD 80) per month. It was then increased to ZMK 700'000 (roughly USD 130) (Republic of Zambia 2011, 2012).

the company to further limit their tax level, keep out unwanted competitors, and consequentially insure high local sugar prices.

Another study paints a clearly positive image of the effect of the sugar industry in Zambia in terms of wealth creation, employment and foreign exchange generation, as well as associated “immense” trickle down effects (McKersie and Hichaambwa 2011, p. vii). The study looks at the technical feasibility and economic viability of an expansion of the KASCOL outgrower scheme. Furthermore, a survey of 40 households participating in the KASCOL scheme and 20 households from another community outside the scheme was carried out to gain insight into the impact of sugar production on poverty reduction. This merely descriptive assessment points towards a positive impact of participating in the scheme, with total household income being almost twice as high as that of households outside the scheme, although this difference in incomes is much smaller when comparing per adult equivalents (McKersie and Hichaambwa 2011, Appendix 2-7).

Another recent qualitative study by Mujenja and Wonani (2012) provides a detailed insight into the history, ownership and governance structure of KASCOL. They conducted focus group discussions and interviews with various stakeholders. Their results point towards positive effects of participation in the KASCOL outgrower scheme in terms of income, living conditions and self-satisfaction when compared to employees working on the KASCOL core estate. They also report that the contribution of sugar cane production in terms of job creation is small when compared to the rural labor force. Due to low education, the rural poor are also usually only able to get low paying jobs. Furthermore, the number of employees as well as average wages on KASCOL’s large-scale estate decreased significantly after the company had been privatized and profit motives became more important.

3.3 Data

3.3.1 Household Survey

In order to address this controversy, we conducted a household survey among 819 households in the Mazabuka region in May/June 2012.

Figure 9: Sugar Cane Production in Mazabuka District: Overview of Sampled Households



Source: Household survey conducted using the mobile data collection system EpiSurveyor (Datadyne 2012) and displayed on Google Maps.

A formal questionnaire (available from the author upon request) was used to interview the household head or, in case he/she was absent, an adult household member. In case no adult household member was around, enumerators revisited the household again later during the day.²⁸ Using the mobile data collection software EpiSurveyor (Datadyne 2012), the interviews were conducted by a team of trained enumerators. The information collected included household characteristics, the main economic activities of all household members, farming activities, housing conditions and assets owned, as well as the perceived advantages and disadvantages of employment on commercial farms and participating in outgrower schemes.

The survey sample included 211 small-scale farmers who participate in sugar outgrower schemes, 287 employees on commercial sugar-cane estates, and 296 smallholders not connected to the sugar industry. Households belonging to the three comparison groups were selected by means of a two-stage sampling strategy. In a first step, nine villages respectively

²⁸ If the interview could still not be carried out a replacement household was selected randomly from employee or farmers registries. If this was not feasible the nearest neighboring household was interviewed instead. Time and budget constraints precluded visiting the household again another day.

agricultural settlements, as well as two sugar producing smallholder outgrower schemes (KASCOL and Magobbo) and eight large-scale sugar estates were chosen purposively within three agricultural camps in Mazabuka district²⁹. Locations with similar agro-ecological and socioeconomic conditions as prevailing in the area of the KASCOL Outgrower Scheme were identified in collaboration with experts from the District Agriculture Coordinator's office (DACO). The goal was to reach a representative sample of locations within each camp and, whenever possible, to include locations from each category (outgrower schemes, large-scale estates, villages with smallholders not growing sugar). In the second stage, households were randomly selected from employee or farmer registries.

Some details regarding the particular sampling strategy for each comparison group need mentioning:

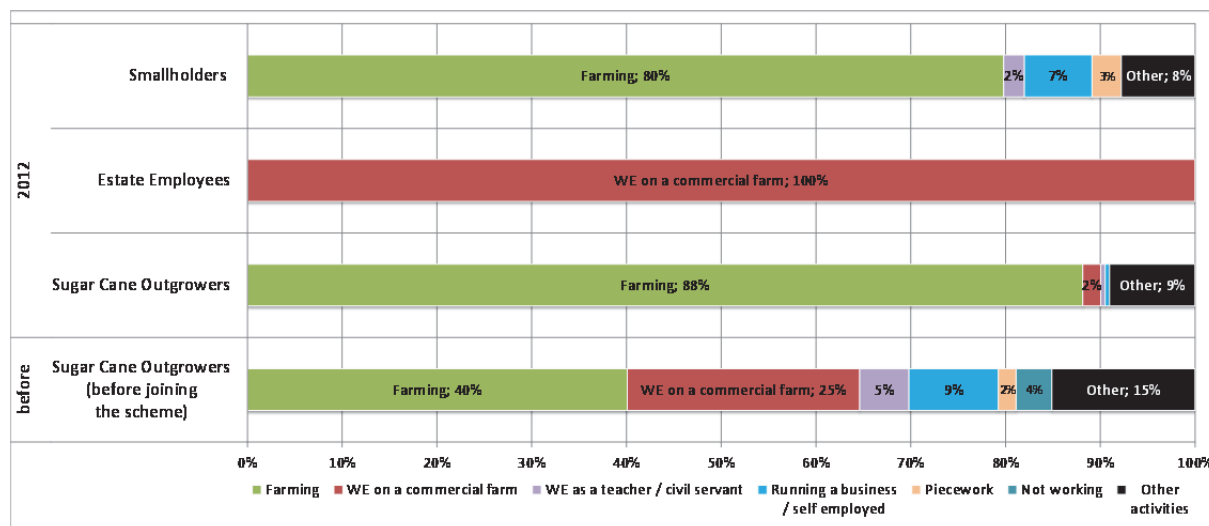
- *Current sugar cane smallholders*: As the number of households currently participating in sugar cane outgrower schemes is limited, households belonging to this category were deliberately oversampled. All 160 households participating in the KASCOL scheme were interviewed. In addition, a random sample of households participating in the most recent outgrower scheme, Magobbo, were selected.
- *Employees on large-scale sugar cane estates*: Eight commercial farms were selected in order to have a representative selection of commercial sugar cane farms in the region. Wherever possible, the interviewees were chosen randomly from a list of their currently employed farm workers. Workers employed on a short-term basis who only reside in the area for very brief periods (e.g. sugar cane cutters from other parts of Zambia) were not included in the sample, because their main domicile is located elsewhere. Such migrant workers only bring along a fraction of the assets they possess. Hence taking this partial asset base as an indicator for their living conditions would strongly bias the statistical analysis. Seasonal workers, in contrast, who live in the area, were included in the sample.
- *Control group*: Finally, the control group, households not participating in the sugar cane industry, was also sampled in two steps. In a first stage, nine agricultural camps or villages were chosen in collaboration with experts from the local DACO office, the objective being to match the agro-ecological and socioeconomic conditions prevailing

²⁹ Zambia has a nationwide structure for extension work. The country is split into agricultural blocks. These blocks are again divided into agricultural camps and every camp is assigned an agriculture extension officer, who is part of the Ministry of Agriculture and Cooperatives (MACO, now Ministry of Agriculture and Livestock MAL). Mazabuka district is split into four camps, but no locations were selected within Mapangazya, as this camp is considerably more remote and no sugar cane is produced there.

in the KASCOL area. In each of the included camps and villages, the households to be interviewed were selected at random from the farmers' registry which had been updated by DACO just before the survey commenced.

As smallholder households usually rely on several economic activities to make a living, an illustration of the main economic activities of households is helpful. Figure 10 presents the main economic activity of household heads as stated in our survey.

Figure 10: Main Economic Activities of Household Heads



Notes: Activities not mentioned by at least 3% in one comparison group are included in the other activities category. WE = wage employment.

As the households in the smallholders category were selected based upon the farmers' registry, farming is the main income source. The remaining 20% report to run a business, doing piecework, being employed as teachers or civil servants or carrying out other activities. Households in the estate employee group all reported wage employment as the main source of income for the household head.

Most sugar cane smallholder farmers (88%) consider farming their main economic activity. Nevertheless, around 12% report other activities as their main occupation. Sugar cane outgrowers also reported their main economic activity before joining the scheme. Around 40% had been farmers, 25% employees on large-scale commercial farms, and just below 10% were running a business. Close to 4% were not working at all, although the reasons thereof are not known.

3.3.2 Focus Group Discussions and Expert Interviews

Nine focus group discussions were conducted in September 2013 in order to complement the quantitative data and get a better feel for the perceived advantages and disadvantages of participation in the sugar cane industry. Three discussion rounds were organized for each of the three main groups considered in our analysis, i.e. sugar cane outgrowers, employees on large-scale sugar estates as well as smallholder farmers outside the sugar industry. For each group, an interview guide was designed in advance to lay out the most important topics to be discussed (available from the author upon request). These topic guides served to ensure that all relevant issues were covered systematically while still allowing to pursue issues that were salient to the participants (Ritchie and Lewis 2010).

At each of the purposively selected locations, a subsample of 10 participants was chosen at random from households that had already been interviewed during the household survey. Due to no-shows the total number of participants was 85 and the group size ranged between eight and ten. The sampling design was defined as to reach a mix of female and male household heads, of various ages and different years of experience in their respective economic activities.

In addition to the focus group discussions, expert interviews were conducted with other important stakeholders. Interviewees included managers on several large-scale sugar farms, as well as experts from the District Agriculture Coordinator's office.

The following table provides an overview of the sample for the household survey as well as the locations of the nine focus group discussions (FGD).

Table 7: Number of Respondents and Focus Group Discussions by Comparison Group and Camp

Agricultural camp	Sugar cane outgrowers	Employees on large-scale sugar estates	Smallholders (not growing sugar cane)	Total No.
Munenga	Kaleya Smallholder Company Limited (KASCOL) + 2 FGD	1 large-scale estate + 1 FGD	Several villages around Mbiya (Agricultural Camp) + 1 FGD	328
Magoye	-	1 large-scale estate + 1 FGD	Several villages around Magoye (Agricultural Camp) + 1 FGD	86
Nansenga	Magobbo Sugar Cane Outgrower Scheme + 1 FGD	6 large-scale estates + 1 FGD	Several villages within Nega Nega/Magobbo + 1 FGD	405
Total No.	3 FGD / 214	3 FGD / 296	3 FGD / 320	819

3.4 Methodology

The main goal of this study is to gather quantitative evidence in order to estimate how participation in the sugar cane industry, either as smallholders in sugar cane outgrower schemes or as employees on large-scale sugar estates, has impacted household wealth. Qualitative data from the focus group discussions and expert interviews serve to complement and test the validity of the quantitative evidence.

The predominantly qualitative evidence discussed earlier in this chapter point toward a positive effect of participation in the sugar industry on household economic well-being, particularly in the case of sugar outgrower schemes. More general arguments why including smallholder farmers into modern food supply chains may increase economic well-being were presented in Chapter 1. It is therefore assumed, that being a sugar cane outgrower or an employee on a large-scale sugar estate has a positive effect on household economic well-being, when compared to other smallholder farmers not integrated into the sugar industry. The central hypotheses to be tested are:

Hypothesis 1: *Participants in outgrower schemes that produce crops for sale to a foreign-owned large-scale estate achieve higher levels of household economic well-being (wealth) than smallholder farmers.*

Hypothesis 2: *Employees on foreign-owned large-scale estates achieve higher levels of household economic well-being (wealth) than smallholder farmers.*

After briefly explaining the measure of household economic well-being, this section presents the methodological approach chosen to estimate the economic effects of participation in the sugar industry. It describes the model specifications for both the regression and the propensity score matching approach and makes apparent the potential difficulties in achieving unbiased impact estimates. Finally, the likely determinants of household wealth and participation in sugar cane activities are discussed.

3.4.1 Measuring Household Economic Well-Being by Means of an Asset Index

Income, consumption and wealth are three separate yet interrelated dimensions commonly used to measure economic well-being at the micro-level (OECD 2013). In brief, consumption expenditure refers to the value of goods and services used or paid for by a household over a period of time. Another flow measure, income, “consists of all receipts, whether monetary or in-kind (goods and services), that are received by the household [...] at annual or more frequent intervals [...]” (ibid., p. 81). On the other hand, wealth refers to the accumulated total stock of economic resources at one point in time (ibid., p. 14ff.). Each dimension of economic well-being is interrelated with the other dimensions. For instance, higher incomes allow households to

increase consumption or to save up for future consumption. Likewise, greater wealth can be used to generate income or to finance consumption now or in the future.

Although the joint study of several proxies of economic well-being is likely to bring additional insight, each indicator entails its distinct measurement issues and data requirements. Monetary measures have for a long time been the preferred proxies to measure poverty and living standards (Sahn and Stifel 2003, p. 463f.). In developing countries aggregate consumption expenditures are commonly used, as the measurement of income has been found to be less reliable due to the greater seasonal variability of earnings and large shares of income from subsistence production and self-employment (Deaton 1997, p. 148ff.). However, expenditure measures also have their distinct shortcomings: First, consumption data require extensive data collection. This is time-consuming and costly and places high demands on enumerators and field staff. Second, the data are collected on the basis of recall periods of up to a month, hence measurement errors are considerable. Third, determining the value of goods consumed is complicated e.g. by the large proportion of goods consumed from own production (especially in rural settings), and the need for reliable data on nominal interest and depreciation rates for semi-durable and durable goods.

Given the difficulties in measuring household income and expenditures, Filmer and Pritchett (2001) were among the first to propose to proxy household wealth by means of an aggregate index based on household assets and basic housing characteristics.³⁰ This approach, which uses a principal components analysis (PCA), is applied for this study as it is deemed the most suitable indicator to measure the long-term effects on household economic well-being and required considerably less measurement efforts.

Principal components analysis extracts “from a set of variables those orthogonal linear combinations of the variables that capture the common information most successfully” (Filmer and Pritchett 2001, p. 116). PCA relates the indicator variables (in this case all assets included) to an underlying set of latent variables, the principal components. The first principal component is the orthogonal linear combination that captures the common information behind the variables. For the construction of an asset index, the first principal component is typically assumed to proxy the long-term wealth of a household, i.e. the ownership of assets is best explained by the latent variable long-term household wealth (Filmer and Pritchett 2001; Sahn and Stifel 2003; Vyas and Kumaranayake 2006).

³⁰ For instance, Sahn and Stifel (2003) suggested a procedure based on factor analysis instead of principal component analysis.

The index is written as:

$$A_j = \sum_{i=1}^N \frac{f_i (a_{ji} - a_i)}{s_i} \quad (1)$$

where:

- f_i is the ‘scoring factor’ for the i^{th} asset determined by the method
- a_{ji} is the j^{th} household’s value for the i^{th} asset and
- a_i and s_i are the mean and standard deviation of the i^{th} asset variable over all households

The index is normalized and has a mean value of zero and a standard deviation of one. The first principal component assigns larger weights to assets that vary the most across households, hence assets found in most households receive small weights. Each household’s position on this wealth index can then be calculated.

The wealth indices (\overline{WI}) constructed for our analysis are established using observable and verifiable indicators, which are assumed to be related to the household’s relative economic position and which capture the major dimensions of poverty. The main wealth index includes general household assets (e.g. bicycle, motor cycle, electric stove, radio, TV) and the type and characteristics of the dwelling (building materials, type of water supply, sanitation facility).³¹ In order to be able to also distinguish these two dimensions, we calculate two separate indices, which are based exclusively on assets owned respectively on housing conditions. Categorical items (e.g. type of water supply) are separated into dichotomous indicator variables (has/does not have). All variables are included together with continuous variables (e.g. number of bicycles owned) in a principal components analysis. Assets predominantly used as inputs for agricultural production (e.g. tractor, pick, shovel) are not included in the wealth index calculation. Instead, an index of agricultural production assets is considered as a right hand side explanatory variable (cf. Table 8 on p. 64).

3.4.2 Determinants of Household Wealth and Participation in the Sugar Industry

The two econometric methods applied for this study, standard ordinary least squares (OLS) regression as well as propensity score matching (PSM), both rely on the assumption of selection on observables. The treatment effect (participation in a sugar cane outgrower scheme / employment on a sugar cane estate) can only be estimated accurately if the observed variables do in fact constitute the key variables that determine assignment to treatment and at the same

³¹ See Table 9 on page 71 for a full list of assets included.

time affect the outcome of interest (household wealth). While controlling for all confounding variables is also necessary in a randomized experiment, omitted variables are much more likely in a non-randomized setup (Rubin 1974). Accordingly, a crucial step consists of defining a credible list of covariates.

Clearly, the factors that contribute to household wealth are multifaceted. For this reason we control for a number of determinants which, according to theory and other related studies, are likely to have an influence on wealth and participation in the sugar sector. Table 8 (on p. 64) provides an overview of the explanatory variables.

Starting with household characteristics, previous studies have shown that female-headed households are likely to be disadvantaged in a number of ways that negatively affect their economic wellbeing. Gender is for instance likely to affect the probability of participating in groups such as outgrower schemes or to engage in employment on large-scale farms due to differences in opportunities, motivation, and capabilities (Pandolfelli et al. 2008; Fischer and Qaim 2012). At the same time some outgrower schemes actively promote participation of female households. Gender has also been found to impact the likelihood of a household to diversify into off-farm income sources (Muyanga et al. 2010; Bigsten and Tengstam 2011; Chapoto et al. 2011).

Table 8: List of Control Variables

Variable	Description	Expected Sign
Household Characteristics:		
Female	Sex of household head: Female=1, male=0	-
Age	Age of household head in years	+
Age squared	Age of household head squared	-
Education level	A set of dummy variables measuring the level of education of the household head: None or lower primary school (grades 0-4, this is the base group); upper primary school (grades 5-7); secondary school (grades 8-12); post-secondary school (> grade 12).	+
Work experience	Years of experience of the household head in the primary economic activity	+
Household Size	No. of household members	+
Upbasic	Percentage of adult household members 12 years and older that completed upper basic school (grade 9)	+
Highered	Percentage of adult household members 12 years and older that went on to High School or tertiary education	+
Married	Head is married (mono- or polygamously)	+
Kinship	Household member is closely related to the local chief or headman	+
Farming and Shocks:		
Total Farm Size	Total area (ha) of cropland & pasture (producing & non-producing) in 2010/2011 season	+
Land title	Largest plot/field owned with title deed (yes=1, no=0)	+
Livestock	No. of livestock and poultry owned by household	+
Ag production assets	Index measuring ownership of various assets used for agricultural production (hoe, pick, shovel, axe, hammer, wheelbarrow, cart, oxen, tractor, oxplough, discplough, harrow, mill, sheller, and sprayer)	+
Fertilizer	Applied fertilizer to main crop produced in the 2010/2011 growing season (yes=1, no=0)	+
Irrigation	Main crop in the 2010/2011 growing season was irrigated (yes=1, no=0)	+
Death	Dummy variable whether any adult household member died in the past 5 years (yes=1, no=0)	-
Chronic illness/accident	Dummy variable whether any household member suffered from a chronic illness or accident in the past 5 years (yes=1, no=0)	-

Human capital is taken into account by controlling for the household head's age and its square to allow for life cycle effects. Household assets may accumulate with growing age. At the same time age, as well as being married or not, is likely to affect the probability of joining an outgrower scheme as well as the opportunities to find off-farm work. The education level of a household is taken into account by including the level of education of the household head as well as the percentage of household members who have completed higher education. The quantity and quality of labor available on and off the farm is proxied by the number of

household members and by the household head's years of experience in the primary economic activity.³²

Social capital endowments are likely to affect access to various assets (Muyanga et al. 2010; Chapoto et al. 2011). It is probably also linked to opportunities in outgrower schemes or large-scale farm employment. For instance, it makes sense to argue that people who possess higher social capital may have enjoyed privileged access to sugar outgrower schemes. Households which can rely on such connections to other individuals and social networks will probably also have fared better outside the scheme. They may find it easier to gain access to credit, land, other jobs, or pursue lucrative business opportunities. Despite the usual difficulties in measuring social capital, the questionnaire includes two possible proxies for social capital. First, households were asked if somebody in the household had kinship ties to the chief or headman in the village or area. In addition, the tribe of the household head and spouse were recorded, allowing the identification of households that belong to the local Tonga or Lozi tribes. Finally, we include the number of years that a household has lived in the community, which might impact a household's chances of participating in the sugar industry as well as the accumulation of assets.

For smallholder households like the ones in our sample, agricultural endowments are essential. The single most important asset for farmers is land. Most Zambian households at least partly depend on agriculture for their livelihoods, particularly in rural regions like Mazabuka. We include the total size of the farm, which includes both cropland and pasture. In addition, in order to test the controversial thesis whether tenure security impacts wealth, we include a dummy that indicates if the household holds a formal title deed to their largest plot or field. Hernando de Soto (1989) triggered a lively discussion on whether formalization of property rights has a causal link with the empowerment of poor people. Critics of customary tenure argue that holding a formal land title would enable farmers to use land as collateral to improve access to credit for agricultural investment. Security of tenure could also enhance the willingness to make medium- and long-term investments. Finally, functioning land markets would simplify transfer of land resources to the more productive farmers. However, empirical evidence from Zambia (Adams 2003; Smith 2004; Hichaambwa et al. 2014) as well as other developing countries suggests that the relationship is not that clear and that the particular context matters (Place 2009).

³² Families with greater dependency ratios may likely find it more difficult to accumulate assets. Including the number of economically active adults in the household (instead of total household size) did, however, not change the results markedly in our study.

The number of animals (livestock and chickens) owned by the household as well as an index measuring ownership of agricultural production assets (e.g. shovel, tractor, plough) are used to control for the stock of resources which serve to generate income and cushion from shocks (Chapoto et al. 2011).

As sugar cane is almost exclusively produced in large-scale settings (commercial estates and outgrower schemes) we do not control for the types of crops grown by a household. Although one may argue that the type of crop produced may impact household wealth, the choice of crop alone is unlikely to be the driving factor. The output of a farmer is to a large extent a function of inputs (land, water, capital, labor and intermediate inputs) and the efficient use of these inputs, i.e. the total factor productivity, which can depend on a broad range of factors such as technology, access to markets, or managerial skills. Furthermore, the yield gap between achieved and potential yields among small-scale farmers in Sub Saharan Africa is very high independent of the crop produced.

A number of shocks can lead to a significant depletion of household assets and could affect participation in the sugar industry. We include a dummy variable whether any adult household member died in the past five years. In addition, we add a variable that captures whether any household member suffered a chronic illness or accident in the past five years.

3.4.3 Estimating Wealth Effects of Participation in Sugar Cane Production

The standard framework to evaluate the impact of a treatment on the outcome goes back to Roy and Rubin (Roy 1951; Rubin 1974). They tackle the problem that it is impossible to simultaneously observe the outcome of an individual with and without treatment by proposing that the treated be compared to an untreated control group that is very similar otherwise. The key challenge therefore is to find a comparison group that represents a credible counterfactual. Ideally, one would randomly allocate households to treatment and non-treatment groups. True randomization would balance both observed and unobserved covariates, as well as potential responses to the treatment and thus provide a convincing basis for causal inference (Frölich 2008; Rosenbaum 2010). In this case, it would be possible to estimate average treatment effects without bias.

Evidently, random assignment of units to conditions is not feasible when it comes to evaluating the effects of participating in specific types of economic activity. For this reason, a quasi-experimental approach is pertinent.³³ How participation in the sugar cane industry –

³³ For a thorough discussion of experimental and quasi-experimental designs for causal inference refer to Shadish et al. (2002).

either through outgrower schemes or as estate employees – has affected household wealth will thus be estimated by comparing them to a control group of smallholder farmers in the region, who do not participate in the sugar industry, but are otherwise as similar as possible to the treatment groups.

Figure 11 provides an overview of the study design. The study is essentially a posttest-only design with nonequivalent groups: the treatments, participation in outgrower scheme or employment on large-scale farm, took place before the household survey was carried out. Some limited pre-treatment data could be obtained for participants of the KASCOL outgrower scheme only.³⁴ The lack of repeated measurements for each household, especially the absence of true baseline data collected before treatment commenced, make it difficult to differentiate true treatment effects from the effects of initial systematic differences that may have been present.³⁵

Figure 11: Quasi-Experimental Design

Treatment Groups	{	Outgrower	NR	(O ₁)	Z ₁	O ₂
		Estate employee	NR		Z ₂	O ₂

Comparison Group	{	Smallholder farmers	NR			O ₂

Notes: NR = nonrandom assignment; Z₁ and Z₂ = treatments; (O₁) = limited pretest observation; O₂ = posttest observation.

Furthermore, as in all observational studies, non-random selection mechanisms may disturb the estimation of treatment effects. For one thing, households self-select into treatment status

³⁴ Applicants to the KASCOL scheme filled out application documents and were evaluated by hiring managers with regard to their ability to become sugar cane farmers. While this descriptive data does not make up for the lack of real baseline data, it provides some insight into who became an outgrower farmer. The available data includes household head characteristics (age, gender, nationality, marital status, education, occupation), household characteristics (number of children, outstanding loans or debts, bank account), farm characteristics (total farm size, crops produced and yields, numbers and types of livestock owned), motivation for applying to the scheme / reasons for relocating, and a graded assessment by KASCOL hiring managers regarding suitability to become an outgrower farmer (family characteristics, health status, job experience and educational achievements, candidates motivation).

³⁵ Panel methods allow dealing with bias from some unobserved confounding variables (for a discussion of panel methods refer to Wooldridge 2002; Nichols 2007). For example, following the same units over time (and using individual units as their own control group) permits to eliminate bias due to time-invariant factors which were not controlled for. Even though one would have to argue that all selection on unobservables was due to unobserved time-constant factors, panel data would certainly have been an advantage.

as they decide themselves if they apply for an outgrower scheme or work on a large-scale estate. In addition, participants in these activities are typically selected following certain eligibility criteria set by the outgrower scheme management or the hiring companies. The non-random selection process poses additional challenges in drawing inferences about the effects of sugar cane production on household wealth: any correlation between an outcome Y and the treatment Z does not necessarily reflect the treatment effect. Instead, correlations may be confounded as treated and control groups possibly also differ with respect to other observable or unobservable characteristics (“selection bias”). For instance, observed differences in wealth between subsistence farmers and sugar cane outgrowers may not be due to the impact of participation in the outgrower scheme. Instead, they may (partly) reflect systematic differences between the two groups. Let’s assume for example that households receiving treatment, in this case participants of a sugar cane outgrower scheme, are particularly capable. They may then be economically better off today because of their capability, rather than their participation in the outgrower scheme.

Together, the observational setting of this study and the lack of repeated measurements for each household call for special attention to the issue of internal validity, i.e. the extent to which a causal conclusion is warranted. Even the most thoughtful selection of covariates does not eliminate the possibility that some important variable may have been missed. And neither ordinary least squares (OLS) nor propensity score matching (PSM) can control for estimation biases due to *unobserved* or *unobservable* characteristics.

We therefore test the robustness of our results by employing both a standard multiple regression model and PSM and make use of the available sensitivity tests to examine the presence of hidden bias (see Nichols 2007). It is often argued that matching may allow for better causal inference than regression models, as comparisons are only made between households with similar observed characteristics. These matched households are also more likely to resemble each other on unobserved variables (Gerring 2007, p. 134ff.).

Fortunately, one must not rely on this assumption alone, as matching methods incorporate some procedures to test whether results are sensitive to “hidden bias”. The robustness test that was carried out for this analysis, the Rosenbaum bounds approach, examines how large the bias resulting from unobservable covariates would have to be to explain the associations actually observed (Rosenbaum 2004, 2010). DiPrete and Gangl (2004) implement the Rosenbaum bounds approach for continuous outcomes. Their procedure assesses how much an unmeasured covariate would have to influence the selection process to significantly alter the estimates. The procedure postulates the existence of a single unobserved variable which influences assignment to treatment. The sensitivity test involves calculation of Wilcoxon

signed-rank tests which give upper and lower bound estimates of significance levels at different hypothesized levels of hidden bias (Gangl 2004).

Standard Multiple Regression Model

A standard OLS regression model is employed to estimate the effect of participating in an outgrower scheme or taking up wage employment on a large-scale estate. Variables indicating the treatment status are included alongside a parsimonious vector of regressors that are expected to be correlated with both the dependent variable, household wealth, and the treatment variables.

$$\overline{WI} = \beta_0 + \beta_1 \text{outgrower} + \beta_2 \text{estate employee} + \beta_3 \overline{X} + \varepsilon \quad (1)$$

where:

- \overline{WI} stands for an index of household wealth calculated as described in Section 3.4.1.
- \overline{X} denotes a vector of control variables as described in Section 3.4.2 (see p. 91ff.)
- *outgrower* and *estate employee* are dummy variables for households belonging to the respective treatment groups. The control group consists of households – predominantly small-scale farmers (cf. Figure 10 on page 58) – in the region who do not participate in the sugar cane industry.

The model allows for wealth differences among the three comparison groups: smallholder farmers (base group), sugar cane outgrowers, and estate employees. β_2 measures the proportionate difference in wealth of households participating in sugar outgrower schemes relative to households in the base group, i.e. smallholder farmers that have no connection with the sugar industry.

The coefficient β_3 measures the proportionate difference in wealth of estate employees relative to the base group. According to hypotheses 1 and 2 (p. 60), the effect of both modes of integration into the sugar industry is expected to be positive.

Propensity Score Matching

Matching techniques have gained popularity in recent years as an explicit alternative to regression models (Ho et al. 2007; Caliendo and Kopeinig 2008). The matching approach relies on fewer assumptions and restricts the sample from which effects are estimated to subjects deemed comparable. It relaxes the linearity assumption and attempts to compare the outcomes of treated and control group participants who are similar in all relevant pre-treatment covariates.

The most frequently applied matching estimator is propensity score matching (PSM), which goes back to Rosenbaum and Rubin (1983). The basic idea consists of estimating with a logit or probit model the probability – the propensity score – of each unit of analysis (in this case each household) to receive a binary treatment ($T=1$) based upon a number of observable pre-treatment characteristics X :

$$P(T = 1 | X) = P(X) \quad (3)$$

One main assumption of PSM is that all covariates that affect treatment and are possibly related to the outcome of interest have been included in the selection equation. Put differently, treatment assignment and outcomes need to be conditionally independent given the vector of observed covariates. This property is referred to as unconfoundedness, as selection on observables, or as conditional independence (Caliendo and Kopeinig 2008). This conditional independence assumption (CIA) is a strong assumption and therefore the robustness of the results needs to be carefully tested. In addition, unbiased estimates rely on what Rubin (1980) termed the stable unit treatment value assumption (SUTVA). This property assumes principally that the treatment status of any unit does not influence the potential outcomes of other units. In the case at hand this assumption is assumed to hold. The number of sugar cane outgrowers and employees on large-scale estates is small and therefore it is unlikely that they influence significantly the outcomes of other units.

Once the propensity scores are calculated, treated households are then matched to one or several non-treated households with similar propensity scores. All unmatched treated and non-treated households are discarded from the analysis. If matching is successful, the overall distribution of observed covariates among matched treated and non-treated households should be similar (“balanced”): knowing the covariates within matched pairs would not increase the probability to correctly guess if a unit was treated or not.³⁶ Whether this balancing property is met can be evaluated by means of balancing tests (Caliendo and Kopeinig 2008; Rosenbaum 2010, p. 187ff.). PSM further requires that there be sufficient overlap between groups, in the sense that persons with the same covariates have a positive probability of belonging to both the treatment and non-treatment group. Restricting the analysis to this “region of common support” rules out the perfect predictability of treatment status based upon the covariates.

Once matching on an estimate of the propensity score has achieved balancing observed covariates, and provided that both the conditional independence and the stable unit treatment

³⁶ Rosenbaum (2010, p. 73) explains intuitively the difference between successful matching and true random sampling: while matching methods can at best balance observed covariates, randomization balances observed and unobserved covariates, as well as potential outcomes.

value assumption hold, a multitude of average treatment effects can be estimated without bias. In the study at hand, the main treatment effect of interest is the average treatment effect on the treated (ATT), that is the average effect of participation in the sugar industry as outgrowers or as employees on large estates on the participating households' wealth. The PSM estimator of the ATT is the mean difference in outcomes between treatment and control households, weighted by the propensity score distribution $P(X)$ over the region of common support:

$$\tau_{ATT}^{PSM} = E_{P(X)|T=1}\{E[Y(1)|T = 1, P(X)] - E[Y(0)|T = 0, P(X)]\} \quad (4)$$

The estimated ATT is the difference between expected outcomes with treatment ($T=1$) and without treatment ($T=0$), for those in the sample that actually received the treatment. Focusing on effects on those who are treated reveals the realized gross gain from being treated for those for whom participation was intended.

Since successful matching hinges on the conditional independence assumption (CIA), the choice which covariates to include or to exclude from the model is of equally high importance as with regression models. Theoretically, unbiased estimates require inclusion of all important covariates that simultaneously affect treatment and the outcome of interest. In practice, researchers aim at building a model that credibly satisfies this assumption by choosing a convincing set of covariates as suggested by theory, previous research, and information regarding the institutional setting (Caliendo and Kopeinig 2008). However, there is some disagreement regarding the effects of overspecifying a model. Rubin and Thomas (1996, p. 253f.) advise against excluding a potentially relevant variable (even if it is statistically insignificant) unless there is clear consensus that the variable is either unrelated to the outcome or not a proper covariate. The authors further argue that including possibly irrelevant variables does not substantially hamper finding suitable matches with similar estimated propensity scores, nor is it likely to result in biased propensity score estimates.

Nonetheless, while a comprehensive model is advisable, there are some limits as to which variables should be included. First, the common support condition rules out perfect prediction of selection into treatment based upon the included covariates. For instance, if the model is so good that households with certain characteristics always or never receive treatment, matching cannot be performed. Some randomness in the selection into treatment is needed so that matches with identical characteristics can be observed in both states (Heckman et al. 1998, p. 266).

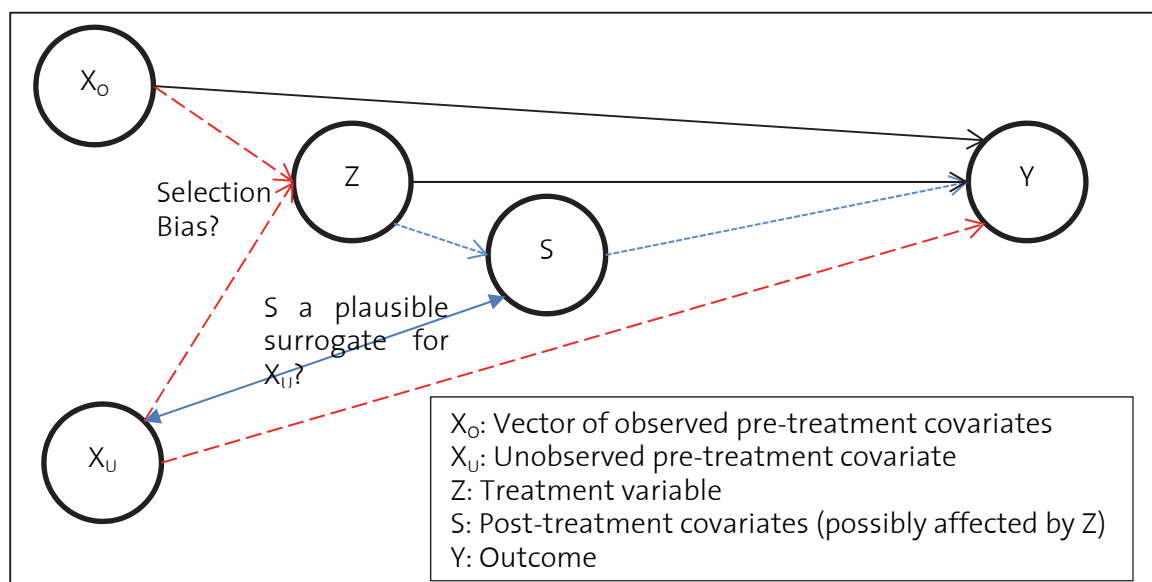
A second note of caution concerns the inclusion of covariates that may themselves have been influenced by treatment or merely anticipation thereof. As the data at hand was in many cases collected many years after treatment had begun, the possibility that certain control variables

may have been affected by the treatment cannot be dismissed. If matching is performed based on outcomes rather than pre-treatment differences, estimates may be biased (Rosenbaum 1984; Wainer 1989; Rosenbaum 2005). Hence, included covariates should either be constant over time or measured prior to the treatment.

Nevertheless, there are several reasons why matching for such variables may still be carried out in practice (Rosenbaum 1984). First, it may be reasonable to assume that certain variables are constant (e.g. gender). Second, a variable may be considered changing over time, but for reasons other than the treatment, and hence any post-treatment differences between treatment and control groups would indicate some form of bias rather than a treatment effect. Third, although the variable is likely affected by the treatment, this effect is expected to be negligible when compared to the effect of treatment on the outcome variable. Finally, pre-treatment data may simply not be available.

Adjustments on post-treatment variables are not recommended and not necessary if the treatment assignment is strongly ignorable given the vector of measurable and observed pre-treatment covariates X_0 . However, if the ignorable treatment assignment assumption is not met based upon pre-treatment variables only, then adjustment for available post-treatment variables may be pertinent in certain cases. This applies particularly if a post-treatment variable is available that is thought to be a close surrogate (S) of an unmeasured pre-treatment variable believed to have a relevant impact on both treatment assignment and outcomes (X_U).

Figure 12: Considerations Regarding the Matching Specification



To deal with this potential endogeneity, matching will be performed by means of both a fully specified and a reduced selection equation. The reduced form excludes covariates that may have been influenced by treatment. Section 3.5.1 provides descriptive statistics and discusses which variables are more likely to be endogenous. Second, instead of excluding a variable altogether, robustness tests will be performed excluding cases where endogeneity is more

likely. The education level of household heads for instance, is unlikely to have changed for those sugar cane outgrowers and employees on large estates who were already above say 25 years old when they joined the outgrower scheme or took up work on a large-scale estate. A separate analysis by age groups may thus be indicated.

3.5 Results and Discussion

3.5.1 Descriptive Statistics

Asset Index Weights

The main wealth index calculated for this study takes into account an extended list of assets as well as housing conditions. Table 9 contains the scoring factors for this “wealth index”. In addition, summary statistics are displayed for the overall sample and for each quintile, i.e. dividing the sample into five groups of equal size based upon their wealth index (from lowest to highest wealth).

Table 9: Scoring Factors and Summary Statistics for Variables Entering into the 1st Principal Component for the Wealth Index (Based on Household Assets and Housing Characteristics)

	Scoring Factors	Overall mean	sd	Scoring Factor / sd	1st quintile mean	sd	2nd quintile mean	sd	3rd quintile mean	sd	4th quintile mean	sd	5th quintile mean	sd
Radio (#)	0.108	1.13	0.86	0.13	0.78	0.66	0.96	0.70	1.10	0.76	1.26	0.95	1.53	0.99
Color or b&w tv (y/n)	0.231	0.46	0.50	0.46	0.01	0.08	0.11	0.31	0.36	0.48	0.84	0.37	0.99	0.08
Sattelite dish (y/n)	0.223	0.26	0.44	0.51	0.00	0.00	0.01	0.08	0.05	0.23	0.38	0.49	0.87	0.34
Video player/DVD (y/n)	0.228	0.39	0.49	0.47	0.00	0.00	0.04	0.19	0.27	0.45	0.71	0.45	0.92	0.27
Computer (y/n)	0.122	0.05	0.23	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.25	0.21	0.41
Refrigerator and/or freezer (y/n)	0.239	0.27	0.45	0.54	0.00	0.00	0.00	0.00	0.02	0.13	0.44	0.50	0.91	0.29
Bicycle (#)	0.064	1.36	1.11	0.06	0.93	0.76	1.28	1.04	1.55	1.23	1.45	1.12	1.62	1.21
Motor cycle (#)	0.068	0.06	0.25	0.27	0.00	0.00	0.01	0.08	0.07	0.28	0.07	0.26	0.15	0.37
Motor vehicle (#)	0.156	0.18	0.54	0.29	0.02	0.13	0.04	0.22	0.06	0.24	0.13	0.35	0.66	0.97
Sewing machine (#)	0.115	0.19	0.52	0.22	0.01	0.08	0.06	0.36	0.13	0.36	0.24	0.60	0.52	0.76
Charcoal brazier / Mbaula (#)	0.153	1.05	0.78	0.20	0.57	0.59	0.86	0.64	0.98	0.64	1.26	0.82	1.60	0.75
Gas or electric cooker / hot plate (#)	0.076	0.20	0.42	0.18	0.01	0.08	0.04	0.20	0.22	0.42	0.49	0.56	0.22	0.47
Full electric or gas stove (#)	0.217	0.21	0.42	0.51	0.00	0.00	0.00	0.00	0.04	0.19	0.17	0.38	0.83	0.47
(Wooden) stool (#)	0.043	2.86	2.28	0.02	2.30	1.88	2.76	2.02	2.95	2.64	2.92	2.40	3.36	2.26
(Dining) chair (#)	0.163	1.41	2.47	0.07	0.35	1.11	0.57	1.43	0.99	1.93	1.41	2.26	3.72	3.35
(Dining) Table (#)	0.103	0.57	0.83	0.12	0.24	0.51	0.48	0.91	0.51	0.67	0.56	0.69	1.04	1.04
Sofa / Armchairs (# of seats)	0.182	5.22	3.26	0.06	2.48	2.61	4.21	2.61	5.44	2.74	5.98	2.39	8.01	3.10
Mattress (#)	0.239	2.52	1.97	0.12	0.93	0.67	1.48	0.88	2.15	1.07	2.98	1.49	5.09	2.10
Bed (#)	0.211	2.33	1.84	0.11	1.00	0.89	1.52	0.99	2.04	1.23	2.68	1.57	4.42	2.07
Closet / Armoire / Wardrobe (#)	0.193	0.34	0.67	0.29	0.01	0.11	0.07	0.26	0.20	0.43	0.29	0.50	1.13	0.97
Clock / Watch (#)	0.176	0.56	0.79	0.22	0.10	0.33	0.33	0.53	0.45	0.60	0.67	0.62	1.26	1.10
Mirror (#)	0.130	1.22	0.98	0.13	0.79	0.61	0.98	0.65	1.18	0.82	1.21	0.92	1.95	1.31
Total number of rooms (#)	0.195	4.83	2.46	0.08	2.96	1.52	3.86	1.83	4.57	2.10	5.37	2.20	7.39	2.04
Persons per room (#)	-0.096	1.87	1.23	-0.08	2.50	1.78	1.97	1.16	1.86	1.08	1.67	0.93	1.36	0.61
Separate kitchen (y/n)	0.030	0.78	0.41	0.07	0.77	0.42	0.76	0.43	0.73	0.44	0.82	0.39	0.84	0.37
Roof made of asbestos or iron sheets (y/n)	0.145	0.85	0.36	0.40	0.43	0.50	0.84	0.37	0.98	0.15	1.00	0.00	1.00	0.00
Walls made of brick (y/n)	0.038	0.97	0.17	0.23	0.95	0.23	0.99	0.11	0.93	0.25	0.99	0.08	1.00	0.00
Floor made of mud (y/n)	-0.191	0.29	0.45	-0.42	0.89	0.31	0.45	0.50	0.10	0.31	0.02	0.13	0.00	0.00
Floor made of concrete (y/n)	-0.010	0.08	0.28	-0.04	0.04	0.20	0.12	0.33	0.12	0.32	0.09	0.29	0.04	0.20
Floor made of covered concrete (y/n)	0.184	0.62	0.49	0.38	0.07	0.25	0.43	0.50	0.77	0.42	0.88	0.32	0.95	0.22
Dwelling has windows (y/n)	0.097	0.91	0.29	0.34	0.73	0.45	0.87	0.34	0.98	0.15	0.99	0.11	1.00	0.00
Windows made of glass (y/n)	0.199	0.40	0.49	0.41	0.01	0.11	0.13	0.34	0.38	0.49	0.59	0.49	0.88	0.32
Surface water (y/n)	-0.010	0.00	0.07	-0.14	0.01	0.11	0.00	0.00	0.00	0.00	0.01	0.11	0.00	0.00
Traditional (Dug) Well (y/n)	-0.074	0.12	0.32	-0.23	0.26	0.44	0.16	0.37	0.12	0.32	0.05	0.22	0.01	0.08
Private pump or pipe to yard/plot or into dwelling (y/n)	0.190	0.44	0.50	0.38	0.09	0.29	0.18	0.39	0.29	0.45	0.72	0.45	0.90	0.30
Public pump or tap/standpipe (y/n)	-0.143	0.41	0.49	-0.29	0.59	0.49	0.65	0.48	0.55	0.50	0.19	0.39	0.05	0.22
Electricity used for lighting (y/n)	0.224	0.42	0.49	0.45	0.00	0.00	0.11	0.31	0.28	0.45	0.76	0.43	0.94	0.23
Electricity used for cooking (y/n)	0.172	0.27	0.44	0.39	0.00	0.00	0.02	0.13	0.21	0.41	0.47	0.50	0.64	0.48
No sanitation facility / bush / field / bucket toilet (y/n)	-0.110	0.08	0.27	-0.40	0.32	0.47	0.05	0.23	0.03	0.17	0.00	0.00	0.00	0.00
Pit latrine without slab (y/n)	0.086	0.36	0.48	0.18	0.09	0.29	0.37	0.48	0.38	0.49	0.41	0.49	0.57	0.50
VIP or pit latrine with slab (y/n)	0.001	0.07	0.25	0.00	0.03	0.17	0.05	0.23	0.15	0.35	0.04	0.20	0.06	0.23
(Pour)flush toilet (y/n)	0.105	0.13	0.34	0.31	0.00	0.00	0.03	0.17	0.08	0.27	0.31	0.46	0.25	0.43
Shared toilet facility (y/n)	-0.130	0.29	0.45	-0.29	0.54	0.50	0.40	0.49	0.34	0.48	0.13	0.34	0.02	0.13
Wealth index (1st component)		0.00	3.24		-3.80	0.69	-2.23	0.40	-0.70	0.50	1.73	0.90	5.03	1.64
Wealth index recoded		6.33	3.24		2.52	0.69	4.10	0.40	5.63	0.50	8.06	0.90	11.36	1.64
N	819	819			164		164		164		164		163	

Notes: The percentage of the covariance explained by the first principal component is 24.8%. The first eigenvalue is 10.7 and the second is 4.2. The scoring factor is the weight assigned to each variable (normalized by its mean and standard deviation) in the linear combination of variables that constitute the first principal component. The summary statistics report the mean and standard deviation for the overall sample and for each quintile. As an example for a count variable (#), a household on average owns 1.36 bicycles, the poorest quintile 0.93, and the richest quintile 1.62 bicycles. For dummy variables (y/n) the figures are percentages, e.g. 46% of all households own a TV. For these variables, a move from zero to one changes the asset index by the factor score of that index divided by its standard deviation. For instance a household that owns a TV has a wealth index 0.46 points higher than one that doesn't.

Variables that have a positive scoring factor are associated with higher wealth, while a negative sign is associated with lower wealth. All household asset variables in Table 9 have positive signs. All other factors equal, households that own, or respectively own more of, these assets will be ranked higher on the wealth index. With regards to housing conditions, the signs are as expected. Households living in dwellings with higher quality floors, roofs, and walls are ranked higher on the index. More advanced sanitation and water facilities, too, have positive factor scores. As suggested by Filmer and Pritchett (2001) and McKenzie (2005), we do not adjust for household size, as most assets and housing characteristics benefit the whole household and may be used by several people. We do however include the number of persons per room (the household size divided by total number of rooms in the house), a popular measure of how crowded a household is.

The mean values per quintile suggest a high level of internal coherence. Most variables show clear and expected trends in mean asset ownership by quintile. For instance, only 1% of the poorest households (1st quintile) own a television set, while ownership increases steadily to 99% for the wealthiest households (5th quintile). With regard to the typical housing situation, the poorest quintile lives in three rooms/huts³⁷, with mud floors, water from a public pump or tap, and one third has no sanitation facility i.e. practice open defecation. The middle quintile live in 4.5 rooms/huts, have a higher quality roof (asbestos or iron sheets), floors made of concrete or covered concrete, water from a public pump and increasingly a private pump or pipe, and have access to some type of sanitation facility (usually a pit latrine without slab). The top quintile commonly have electricity, live in 7.5 rooms/huts, have a higher quality roof, floors predominantly made of covered concrete, water supply is by private pump, and the sanitation facility is a private pit latrine or a flush toilet.

The difference in the average index between the 1st and 2nd quintile is 1.58. One combination of (additional) assets that would produce a similar difference (1.54 index points) is owning a television (0.46), having a separate kitchen (0.07), and living in a higher-quality house with a covered concrete floor (0.38), brick walls (0.23), and a roof made of asbestos/iron sheets (0.40).³⁸

³⁷ The number of rooms refers to all rooms that a household have at their disposal (including kitchen and bathroom). Given the rural setting, it was common that households live in several huts. In such cases the number of “rooms” was added up. In case the rooms were located in different houses/huts etc. the building materials (roof, walls, floor etc.) were recorded for the main house/hut.

³⁸ Note that, for easier interpretation and readability, a recoded asset index was calculated that takes on positive values only. The index score of the poorest household (i.e. the greatest negative value) was added to all asset index scores, shifting the distribution so that the lowest observed score becomes zero.

The first principal component explains nearly 25% of the variation in the variables. This is quite substantial; thus the index may well serve as a reasonable overall index (cf. Filmer and Pritchett 2001). The distribution of assets supports this assessment – higher asset scores are indeed associated with indicators that measure higher living standards. Accounting for a large number of variables, this aggregate wealth index allows to capture and analyze also subtle differences in wealth, e.g. separating poor from very poor households.

Still, in order to be able to also separate the two dimensions of wealth – asset ownership and housing conditions – that go into the main wealth index, two further indices are calculated. The “assets-only-index” includes the same list of household assets, but does not account for housing conditions (Table 10). The “housing-only-index” measures housing conditions only (Table 11). Using these different subsets of variables does not significantly change the classification of households into wealth quintiles. The correlation between the overall wealth index and the asset-only-index is 0.95, and 0.88 with the housing-only-index. Hence the index is quite robust to changes in the inclusion of variables.³⁹

Table 10: Scoring Factors and Summary Statistics for the Assets-Only-Index (1st Principal Component)

	Scoring Factors		Overall		Scoring Factor / sd		1st quintile		2nd quintile		3rd quintile		4th quintile		5th quintile	
			mean	sd			mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Radio (#)	0.166	1.13	0.86		0.19		0.61	0.57	0.94	0.54	1.13	0.75	1.27	0.81	1.68	1.12
Color or b&w tv (y/n)	0.245	0.46	0.50		0.49		0.01	0.11	0.18	0.39	0.41	0.49	0.73	0.44	0.96	0.19
Sattelite dish (y/n)	0.254	0.26	0.44		0.58		0.00	0.00	0.01	0.11	0.08	0.27	0.40	0.49	0.82	0.38
Video player/DVD (y/n)	0.245	0.39	0.49		0.50		0.01	0.11	0.09	0.28	0.30	0.46	0.65	0.48	0.89	0.31
Computer (y/n)	0.155	0.05	0.23		0.68		0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.24	0.21	0.41
Refrigerator and/or freezer (y/n)	0.274	0.27	0.45		0.61		0.00	0.00	0.00	0.00	0.07	0.25	0.43	0.50	0.87	0.34
Bicycle (#)	0.110	1.36	1.11		0.10		0.66	0.65	1.23	0.86	1.57	1.16	1.58	1.14	1.77	1.28
Motor cycle (#)	0.092	0.06	0.25		0.37		0.00	0.00	0.01	0.08	0.04	0.20	0.10	0.32	0.15	0.38
Motor vehicle (#)	0.217	0.18	0.54		0.40		0.01	0.11	0.01	0.11	0.07	0.27	0.15	0.37	0.66	0.97
Sewing machine (#)	0.157	0.19	0.52		0.30		0.02	0.13	0.01	0.11	0.10	0.31	0.29	0.67	0.54	0.77
Charcoal brazier / Mbaula (#)	0.205	1.05	0.78		0.26		0.43	0.53	0.90	0.58	1.00	0.63	1.24	0.73	1.70	0.79
Gas or electric cooker / hot plate (#)	0.047	0.20	0.42		0.11		0.04	0.20	0.12	0.32	0.23	0.44	0.38	0.54	0.21	0.46
Full electric or gas stove (#)	0.268	0.21	0.42		0.63		0.00	0.00	0.01	0.08	0.02	0.13	0.22	0.42	0.79	0.49
(Wooden) stool (#)	0.085	2.86	2.28		0.04		1.87	1.67	2.69	2.01	2.99	2.28	3.15	2.62	3.61	2.34
(Dining) chair (#)	0.229	1.41	2.47		0.09		0.11	0.47	0.46	1.22	1.04	1.88	1.54	2.30	3.89	3.36
(Dining) Table (#)	0.154	0.57	0.83		0.19		0.13	0.34	0.41	0.61	0.56	0.92	0.66	0.74	1.07	1.04
Sofa / Armchairs (# of seats)	0.237	5.22	3.26		0.07		1.97	2.42	4.46	2.14	5.31	2.52	6.31	2.51	8.07	3.14
Mattress (#)	0.312	2.52	1.97		0.16		0.76	0.58	1.50	0.73	2.12	0.92	3.09	1.35	5.17	2.09
Bed (#)	0.288	2.33	1.84		0.16		0.70	0.71	1.51	0.86	2.10	1.02	2.79	1.47	4.56	2.00
Closet / Armoire / Wardrobe (#)	0.265	0.34	0.67		0.39		0.01	0.11	0.03	0.17	0.14	0.35	0.36	0.55	1.17	0.94
Clock / Watch (#)	0.236	0.56	0.79		0.30		0.04	0.19	0.27	0.47	0.52	0.60	0.69	0.65	1.28	1.08
Mirror (#)	0.185	1.22	0.98		0.19		0.73	0.58	0.93	0.60	1.17	0.80	1.27	0.87	2.02	1.32
Assets-only index (1st component)		0.00	2.68				-2.78	0.38	-1.74	0.26	-0.74	0.32	0.94	0.72	4.34	2.02
Assets- only index recoded		3.73	2.68				0.95	0.38	1.99	0.26	2.99	0.32	4.67	0.72	8.07	2.02
N	819	819					164		164		164		164		163	

Notes: The percentage of the covariance explained by the first principal component is 32.6%. The first eigenvalue is 7.2 and the second is 2.4.

³⁹ Several alternative methods to principal components analysis have been suggested with regards to the choice of weights or which assets to include (Vyas and Kumaranayake 2006; Howe et al. 2008; Filmer and Scott 2012). To confirm the robustness of the results we employ two further aggregation methods. First, we again use PCA but only include a shortlist of indicators commonly used in most comparable studies. Second, the proportion of households that do not own an asset is multiplied by the number of units owned for each asset. The sum of all weighted assets equals a household's asset index score (cf. Morris et al. 2000). Assets that are owned by fewer households are taken to reflect greater household wealth and are thus assigned a higher weight. These tests confirmed that the characterization of households into wealth quintiles is insensitive to changes in the asset index specification.

Table 11: Scoring Factors and Summary Statistics for the Housing-Only-Index (1st Principal Component)

	Scoring Factors	Overall		Scoring Factor / sd	1st quintile		2nd quintile		3rd quintile		4th quintile		5th quintile	
		mean	sd		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Total number of rooms (#)	0.220	4.83	2.46	0.09	3.27	1.72	4.02	1.91	4.72	2.37	5.59	2.68	6.55	2.12
Persons per room (#)	-0.164	1.87	1.23	-0.13	2.55	1.86	1.98	1.09	1.92	1.04	1.65	0.81	1.27	0.58
Separate kitchen (y/n)	0.004	0.78	0.41	0.01	0.80	0.40	0.82	0.38	0.73	0.44	0.70	0.46	0.87	0.34
Roof made of asbestos or iron sheets (y/n)	0.271	0.85	0.36	0.75	0.35	0.48	0.88	0.32	1.00	0.00	1.00	0.00	1.00	0.00
Walls made of brick (y/n)	0.065	0.97	0.17	0.39	0.95	0.23	0.98	0.13	0.93	0.25	1.00	0.00	1.00	0.00
Floor made of mud (y/n)	-0.348	0.29	0.45	-0.76	0.96	0.20	0.48	0.50	0.02	0.13	0.00	0.00	0.00	0.00
Floor made of concrete (y/n)	-0.022	0.08	0.28	-0.08	0.03	0.17	0.18	0.39	0.10	0.31	0.10	0.30	0.00	0.00
Floor made of covered concrete (y/n)	0.338	0.62	0.49	0.70	0.01	0.08	0.34	0.47	0.88	0.33	0.90	0.31	0.99	0.08
Dwelling has windows (y/n)	0.181	0.91	0.29	0.63	0.72	0.45	0.85	0.36	0.99	0.11	1.00	0.00	1.00	0.00
Windows made of glass (y/n)	0.291	0.40	0.49	0.59	0.01	0.11	0.07	0.25	0.44	0.50	0.60	0.49	0.87	0.34
Surface water (y/n)	-0.029	0.00	0.07	-0.42	0.01	0.11	0.00	0.00	0.01	0.08	0.01	0.08	0.00	0.00
Traditional (Dug) Well (y/n)	-0.144	0.12	0.32	-0.45	0.29	0.45	0.19	0.39	0.09	0.28	0.03	0.17	0.00	0.00
Private pump or pipe to yard/plot or into dwelling (y/n)	0.314	0.44	0.50	0.63	0.04	0.19	0.18	0.39	0.21	0.41	0.77	0.42	0.99	0.11
Public pump or tap/standpipe (y/n)	-0.212	0.41	0.49	-0.43	0.62	0.49	0.60	0.49	0.68	0.47	0.13	0.34	0.00	0.00
Electricity used for lighting (y/n)	0.348	0.42	0.49	0.71	0.01	0.08	0.02	0.13	0.27	0.45	0.79	0.41	1.00	0.00
Electricity used for cooking (y/n)	0.286	0.27	0.44	0.65	0.00	0.00	0.00	0.00	0.16	0.37	0.31	0.46	0.87	0.34
No sanitation facility / bush / field / bucket toilet (y/n)	-0.207	0.08	0.27	-0.76	0.35	0.48	0.04	0.20	0.02	0.13	0.00	0.00	0.00	0.00
Pit latrine without slab (y/n)	0.120	0.36	0.48	0.25	0.10	0.31	0.27	0.44	0.51	0.50	0.51	0.50	0.43	0.50
VIP or pit latrine with slab (y/n)	0.020	0.07	0.25	0.08	0.00	0.00	0.06	0.24	0.17	0.38	0.06	0.24	0.04	0.19
(Pour)flush toilet (y/n)	0.208	0.13	0.34	0.61	0.00	0.00	0.01	0.08	0.01	0.08	0.18	0.38	0.48	0.50
Shared toilet facility (y/n)	-0.157	0.29	0.45	-0.35	0.50	0.50	0.30	0.46	0.38	0.49	0.17	0.38	0.07	0.26
Housing-only index (1st component)		0.00	2.24		-3.21	0.79	-1.45	0.56	0.11	0.34	1.64	0.49	2.93	0.34
Housing-only index recoded		6.02	2.24		2.81	0.79	4.57	0.56	6.13	0.34	7.66	0.49	8.95	0.34
N	819	819			164		164		164		164		163	

Notes: The percentage of the covariance explained by the first principal component is 24.0%. The first eigenvalue is 5.0 and the second is 2.4.

Averages and Tests of the Inequality of Variable Means per Group

Table 12 reports sample mean values for the three main groups in our study. It also contains figures for several subgroups in the sugar outgrower category, which provide helpful insights with regard to the validity of the causal claim. First, participants in the long-running KASCOL scheme are distinguished from those in the very recent Magobbo outgrower scheme. Second, summary statistics are calculated separately for 1st generation as well as 2nd generation KASCOL outgrowers. In the case of the former, the household head did not change since the family joined the scheme (i.e. the farm was not taken over by a successor). In order to test whether systematic differences in observable variables exist between the most relevant comparison groups, tests of the inequality of variable means are shown in Table 13.

On average, household heads in the sugar cane outgrower group are a bit older (3.6 years) than in the smallholder category. They are slightly more educated, although the difference is only statistically significant at the 0.1 level using the ordinally scaled education variable. Compared to smallholders, outgrowers are significantly less likely to have completed upper primary school (25.5% vs. 36.9%), and more likely to have completed secondary school (48.1% vs. 36.6%). Outgrowers have larger household sizes (10.3 vs. 7.9 persons), and exhibit a higher percentage of household members who have achieved higher education levels. The descriptive evidence does not corroborate the hypothesis that outgrower farmers or employees are likely to benefit from better social networks than other households in the region. Both groups are significantly less likely to be related to a headman or to belong to the main local tribe.

Comparing the average wealth indices for the various groups yields some interesting first insights. On average, sugar outgrowers have wealth indices significantly higher than smallholder farmers. This holds true especially for participants in the long-running KASCOL schemes, but also for the Magobbo outgrowers who just started growing sugar cane 2 year ago. Notice that Magobbo outgrowers have significantly higher education levels on average than smallholders. They also seem better educated than KASCOL outgrowers, but still reach significantly lower scores on all wealth indices.

Employees on large-scale sugar estates are significantly more likely to be male, younger, to have higher education levels, and smaller household sizes than both the smallholders and the sugar outgrowers. Also, as expected, their farm sizes and other farming indicators reflect the lower involvement in subsistence farming. Their overall wealth index is significantly higher than for smallholders. This is driven by higher scores on the housing conditions for employees, while their assets-only index is lower, albeit at a nonsignificant level.

Table 12: Descriptive Statistics for Smallholder Farmers, Estate Employees and Sugar Cane Outgrowers (Averages)

Variable	Averages											
	Overall	Smallholders	Estate Employees	Sugar OG	KASCOL Sugar OG	1st generation KASCOL Sugar OG	2nd generation KASCOL Sugar OG	Magobho Cane OG	mean	sd	mean	sd
Household Characteristics:												
Female hh head (y/n)	0.161	0.199	0.070	0.26	0.244	0.206	0.310	0.176	0.176	0.39		
Age hh head	44.491	47.539	36.290	8.93	51.174	64.912	40.037	52.700	40.037	13.01		
Married mono- or polygamously (y/n)	0.817	0.39	0.850	0.36	0.773	0.762	0.702	0.882	0.702	0.46		
Education level hh head (ordinal scale from 1=none to 7=tertiary)	4.681	4.486	4.852	1.27	4.745	4.290	4.939	4.941	4.939	1.43		
None and lower primary (0-4 years)	0.141	0.35	0.102	0.30	0.163	0.274	0.122	0.098	0.274	0.33		
Upper primary (5-7 years)	0.322	0.47	0.318	0.47	0.255	0.290	0.195	0.333	0.290	0.40		
Secondary (8-12 years)	0.433	0.50	0.366	0.48	0.481	0.371	0.573	0.471	0.371	0.50		
Post-secondary (>12 years)	0.104	0.31	0.106	0.31	0.102	0.065	0.110	0.098	0.065	0.25		
Years experience in primary econ activity of hh head	12.892	15.127	8.316	6.45	15.816	24.033	12.795	10.265	24.033	5.58		
Head would rather be small farmer than employed on large-scale farm (y/n)	0.917	0.28	0.832	0.37	0.976	0.984	0.976	0.961	0.984	0.13		
Total hh members (#)	7.678	7.913	5.465	2.63	10.318	11.444	11.024	7.824	11.444	4.13		
Kinship with local chief/headman (y/n)	0.127	0.33	0.056	0.23	0.090	0.095	0.071	0.137	0.095	0.30		
Adults who completed grade 9 (%)	41.447	35.789	43.393	36.40	47.445	51.609	47.705	39.227	51.609	30.87		
Adults who completed grade 9+ (%)	23.539	18.392	24.120	32.22	30.608	32.150	31.396	27.539	32.150	29.33		
Farming and Shocks:												
Total farm size (ha)	8.684	14.651	1.921	7.38	9.200	8.593	7.824	10.510	8.593	4.52		
Total heads livestock + poultry (#)	22.792	34.394	11.049	61.12	21.005	27.476	17.321	22.784	27.476	53.23		
Index of agricultural production assets	2.499	3.288	1.208	1.21	3.044	3.750	2.438	3.268	3.750	1.97		
Largest plot/field owned with title deed (y/n)	0.092	0.29	0.027	0.16	0.059	0.000	0.025	0.200	0.000	0.16		
Primary crop is fertilized	0.934	0.25	0.907	0.29	0.995	1.000	0.988	1.000	1.000	0.00		
Primary crop is irrigated	0.296	0.46	0.013	0.11	0.928	0.935	0.964	0.843	0.935	0.25		
Commodities besides sugar cane produced in outgrower schemes (y/n)	0.164	0.37	0.028	0.17	0.019	0.016	0.012	0.039	0.016	0.13		
Experience in growing sugar cane (y/n)	0.545	0.50	0.368	0.48	0.517	0.429	0.679	0.294	0.429	0.50		
Death of adult hh member in past 5 years (y/n)	0.200	0.40	0.177	0.38	0.346	0.286	0.429	0.314	0.286	0.46		
Chronic illness/accident of any hh member in past 5 years (y/n)	0.220	0.41	0.233	0.42	0.270	0.302	0.274	0.275	0.302	0.46		
Dependent variables: wealth indices												
Wealth index	6.329	3.24	5.722	2.51	9.317	10.625	9.747	6.549	10.625	2.04		
Assets-only index	3.731	2.68	2.819	1.84	6.143	7.347	6.163	4.237	7.347	2.21		
Housing-only index	6.020	2.24	6.239	2.12	7.664	8.225	8.226	5.838	8.225	0.88		
N	819	322	286	211	160	63	84	51				

Notes: 1. Sample mean values and standard deviations for household and farm characteristics, shocks, as well as wealth indices; 2. Due to missing data for certain indicators the sample size varies and ranges between 693 and 819 observations overall. Sample size falls below 800 for the following variables: landtitle (693), crop_1 variables (700), tot_area (779), age (791). Missings for the first three indicators are largely due to these questions not being asked to households that indicated that they did not own or cultivate any plots in the 2010/2011 growing season.

Table 13: Descriptive Statistics for Smallholder Farmers, Estate Employees and Sugar Cane Outgrowers (t-Tests Group Differences)

Variable	t-Test Group Differences											
	Employees vs Smallholders	Sugar OG vs Smallholders	KASCOL Sugar OG vs Smallholders	1st Generation KASCOL Sugar OG vs Smallholders	Magobbo Sugar OG vs Smallholders	Sugar OG vs Employees	1st vs 2nd Generation KASCOL Sugar OG	KASCOL vs Magobbo Sugar OG	b	t	b	t
Household Characteristics:												
Female hh head (y/n)	-0.129*** (-4.67)	0.029 (0.80)	0.045 (1.13)	0.008 (0.14)	-0.022 (-0.37)	0.158*** (5.18)	-0.103 (-1.40)	0.067 (1.00)				
Age hh head	-11.248*** (-11.09)	3.635*** (2.62)	3.130** (2.04)	17.374*** (8.57)	5.161** (2.33)	14.884*** (12.86)	24.876*** (12.08)	-2.031 (-0.77)				
Married mono- or polygamously (y/n)	0.033 (1.08)	-0.044 (-1.25)	-0.079** (-2.02)	-0.055 (-1.01)	0.066 (1.15)	-0.077** (-2.20)	0.060 (0.80)	-0.145*** (-2.16)				
Education level hh head (ordinal scale from 1=none to 7=tertiary)	0.366*** (3.20)	0.259* (1.96)	0.196 (1.33)	-0.195 (-0.93)	0.455** (2.06)	-0.106 (-0.86)	-0.649** (-2.59)	-0.260 (-1.11)				
None and lower primary (0-4 years)	-0.058** (-2.11)	0.003 (0.08)	0.024 (0.65)	0.113** (2.13)	-0.063 (-1.16)	0.061** (2.00)	0.152** (2.35)	0.087 (1.45)				
Upper primary (5-7 years)	-0.051 (-1.31)	-0.114*** (-2.75)	-0.140*** (-3.09)	-0.079 (-1.18)	-0.036 (-0.49)	-0.063 (-1.52)	0.095 (1.33)	-0.104 (-1.48)				
Secondary (8-12 years)	0.108*** (2.68)	0.115*** (2.63)	0.118** (2.48)	0.005 (0.08)	0.105 (1.43)	0.007 (0.16)	-0.202** (-2.44)	0.013 (0.17)				
Post-secondary (>12 years)	0.002 (0.08)	-0.003 (-0.12)	-0.002 (-0.07)	-0.040 (-0.96)	-0.006 (-0.13)	-0.005 (-0.18)	-0.045 (-0.93)	0.004 (0.08)				
Years experience in primary econ activity of hh head	-6.812*** (-8.42)	0.688 (0.67)	2.420** (2.20)	8.905*** (5.58)	-4.862*** (-2.62)	7.500*** (10.08)	11.238*** (9.17)	7.282*** (4.67)				
Head would rather be small farmer than employed on large-scale farm (y/n)	-0.121*** (-4.99)	0.023 (1.36)	0.028 (1.52)	0.031 (1.12)	0.007 (0.23)	0.144*** (5.28)	0.008 (0.33)	0.020 (0.83)				
Total hh members (#)	-2.448*** (-9.23)	2.404*** (6.69)	3.199*** (8.35)	3.531*** (6.52)	-0.090 (-0.16)	4.853*** (15.10)	0.421 (0.57)	3.289*** (4.78)				
Kinship with local chief/headman (y/n)	-0.158*** (-5.76)	-0.124*** (-3.82)	-0.139*** (-3.90)	-0.119** (-2.17)	-0.077 (-1.27)	0.034 (1.47)	0.024 (0.52)	-0.062 (-1.35)				
Adults who completed grade 9 (%)	7.604** (2.70)	11.657*** (4.06)	14.276*** (4.57)	15.820*** (3.52)	3.438 (0.69)	4.053 (1.30)	3.904 (0.76)	10.838** (2.15)				
Adults who completed grade 9+ (%)	5.728** (2.47)	12.215*** (5.15)	13.194*** (5.26)	13.758*** (3.91)	9.147** (2.33)	6.487** (2.30)	0.754 (0.16)	4.047 (0.85)				
Farming and Shocks:												
Total farm size (ha)	-12.729** (-3.74)	-5.451 (-1.34)	-5.887 (-1.27)	-6.057 (-0.82)	-4.141 (-0.51)	7.279*** (7.27)	0.770 (1.32)	-1.747 (-0.75)				
Total heads livestock + poultry (#)	-23.345** (-5.09)	-13.390** (-3.12)	-13.957** (-2.90)	-6.918 (-0.96)	-11.610 (-1.55)	9.956** (2.03)	10.155 (1.30)	-2.347 (-0.34)				
Index of agricultural production assets	-2.079*** (-12.73)	-0.243 (-1.20)	-0.315 (-1.41)	0.463 (1.38)	-0.019 (-0.05)	1.836*** (13.01)	1.312*** (4.50)	-0.295 (-0.95)				
Largest plot/field owned with title deed (y/n)	-0.130*** (-4.62)	-0.098*** (-3.38)	-0.144*** (-4.78)	-0.157*** (-3.33)	0.043 (0.77)	0.032 (1.57)	-0.025 (-1.22)	-0.187*** (-5.17)				
Primary crop is fertilized	0.003 (0.11)	0.088*** (4.30)	0.087*** (3.67)	0.093** (2.51)	0.093** (2.28)	0.085*** (4.16)	0.012 (0.86)	-0.006 (-0.57)				
Primary crop is irrigated	0.034** (2.31)	0.915*** (54.18)	0.942*** (62.88)	0.922*** (45.31)	0.830*** (31.35)	0.881*** (36.81)	-0.028 (-0.78)	0.113*** (2.74)				
Commodities besides sugar cane produced in outgrower schemes (y/n)	-0.351*** (-11.63)	-0.360*** (-10.49)	-0.366*** (-9.41)	-0.363*** (-5.89)	-0.340*** (-4.92)	-0.009 (-0.65)	0.004 (0.20)	-0.027 (-1.22)				
Experience in growing sugar cane (y/n)	0.397*** (8.94)	0.148*** (3.13)	0.219*** (4.33)	0.060 (0.87)	-0.074 (-0.99)	-0.248*** (-5.43)	-0.250*** (-3.11)	0.293*** (3.75)				
Death of adult hh member in past 5 years (y/n)	-0.058** (-2.01)	0.169*** (4.52)	0.179*** (4.44)	0.109** (2.00)	0.137** (2.30)	0.227*** (6.32)	-0.143* (-1.79)	0.043 (0.55)				
Chronic illness/accident of any hh member in past 5 years (y/n)	-0.065** (-2.00)	0.037 (0.97)	0.036 (0.86)	0.069 (1.16)	0.042 (0.65)	0.102*** (2.78)	0.028 (0.37)	-0.006 (-0.08)				
Dependent variables: wealth indices												
Wealth index	0.814*** (3.75)	4.408*** (17.76)	5.291*** (21.34)	5.716*** (15.35)	1.640*** (3.80)	3.595*** (15.07)	0.879*** (2.74)	3.651*** (9.82)				
Assets-only index	-0.141 (-0.80)	3.182*** (14.55)	3.790*** (16.94)	4.387*** (13.38)	1.277*** (3.41)	3.324*** (16.84)	1.184*** (3.50)	2.512*** (6.72)				
Housing-only index	1.490*** (9.06)	2.916*** (18.33)	3.498*** (21.73)	3.477*** (13.95)	1.090*** (3.77)	1.426*** (8.26)	-0.001 (-0.01)	2.408*** (12.85)				
N	608	533	482	385	373	497	147	211				

Notes: 1. Tests of inequality of variable means between the most important comparison groups; 2. Significance: *** p<0.01, ** p<0.05, * p<0.1.

As designated descendants of KASCOL sugar cane outgrowers have the right to take over the farm from their parents, 2nd generation farmers are not subject to the KASCOL selection procedure. To analyze the degree of selection bias, it therefore makes sense to look in more detail at the 1st generation KASCOL smallholders. When comparing 1st generation KASCOL outgrowers to the smallholders in the sample, the former's education levels are somewhat lower, albeit at a nonsignificant level. This is likely due to the fact that 1st generation outgrowers are on average 64 years old, while the average age of smallholders is 44 years. For this reason it makes sense to look at descriptive statistics per age group separately.

Tables 14 and 15 report the same statistics for all households with heads older than 54 years. The figures support the notion that selection bias is not likely to have been a relevant issue when becoming a member of an outgrower scheme. Except for "upper primary education" and "kinship with the local chief/headman", there are no statistically significant differences in the variables relating to the household head when comparing all sugar outgrowers to smallholder farmers in the same age category (Table 15, column 2). KASCOL outgrowers, respectively 1st generation KASCOL outgrowers, only differ to smallholders with regards to the kinship variable (Table 15, columns 3 and 4). These 1st generation KASCOL outgrowers were at least 26 years of age when they joined the scheme (recall that the first KASCOL outgrowers started in 1984 and that the survey data was collected 28 years later in 2012). At that age, people had very likely already completed their education. The fact that the majority of household head variables become nonsignificant for this age group thus indicates that those who joined the outgrower scheme were probably not very different from other smallholder farmers. If anything, they seem to have slightly lower education levels and were less likely to be related to the local chief or headman. This interpretation also holds true when looking at those aged 45 to 54 years (not shown). It appears that differences are due to the two remaining younger age categories (35-44 and <35 years old, not shown). This possibly reflects an endogenous effect of participation in an outgrower scheme, i.e. higher education levels as a consequence of higher wealth among participants.

Table 14: Descriptive Statistics for Household Heads Older than 54 (Averages)

Variable	Averages															
	Overall		Smallholders		Estate Employees		Sugar OG		KASCOL Sugar OG		1st generation KASCOL Sugar OG		2nd generation KASCOL Sugar OG		Magobbo Cane OG	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Household Characteristics:																
Female hh head (y/n)	0.268	0.44	0.318	0.47	0.100	0.32	0.235	0.43	0.262	0.44	0.217	0.42	0.583	0.51	0.150	0.37
Age hh head	66.219	8.60	66.341	8.42	57.600	3.89	67.106	8.70	67.538	8.13	68.087	8.67	66.000	8.34	65.700	10.46
Married mono- or polygamously (y/n)	0.699	0.46	0.648	0.48	0.900	0.32	0.729	0.45	0.692	0.47	0.739	0.44	0.417	0.51	0.850	0.37
Education level hh head (ordinal scale from 1=none to 7=tertiary)	4.138	1.66	4.080	1.70	4.600	1.43	4.145	1.65	3.905	1.66	4.000	1.63	3.300	1.83	4.900	1.37
None and lower primary (0-4 years)	0.298	0.46	0.273	0.45	0.200	0.42	0.337	0.48	0.381	0.49	0.370	0.49	0.500	0.53	0.200	0.41
Upper primary (5-7 years)	0.309	0.46	0.364	0.48	0.400	0.52	0.241	0.43	0.254	0.44	0.283	0.46	0.200	0.42	0.200	0.41
Secondary (8-12 years)	0.287	0.45	0.250	0.44	0.200	0.42	0.337	0.48	0.302	0.46	0.300	0.44	0.300	0.48	0.450	0.51
Post-secondary (>12 years)	0.105	0.31	0.114	0.32	0.200	0.42	0.084	0.28	0.063	0.25	0.087	0.28	0.000	0.00	0.150	0.37
Years experience in primary econ activity of hh head	21.758	12.76	23.349	15.64	18.100	9.67	20.635	9.44	22.938	6.19	23.870	5.91	21.083	7.17	13.150	13.70
Head would rather be small farmer than employed on large-scale farm (y/n)	0.978	0.15	0.977	0.15	1.000	0.00	0.976	0.15	0.985	0.12	0.978	0.15	1.000	0.00	0.950	0.22
Total hh members (#)	9.169	4.39	8.159	3.71	6.300	2.75	10.553	4.77	11.523	4.81	11.630	5.23	11.417	3.18	7.400	2.96
Kinship with local chief/headman (y/n)	0.180	0.39	0.227	0.42	0.200	0.42	0.129	0.34	0.108	0.31	0.109	0.31	0.167	0.39	0.200	0.41
Adults who completed grade 9 (%)	39.001	32.38	33.991	32.67	35.357	30.52	44.616	31.71	47.278	30.90	46.952	30.54	38.109	29.79	35.964	33.57
Adults who completed grade 9+ (%)	23.450	27.62	18.264	24.78	27.262	29.52	28.372	29.47	28.439	27.60	30.880	29.96	24.469	19.31	28.155	35.70
Farming and Shocks:																
Total farm size (ha)	16.913	69.62	26.377	99.95	3.050	6.14	9.024	10.81	9.657	12.15	8.290	4.49	8.023	1.10	7.063	4.28
Total heads livestock + poultry (#)	34.038	66.06	46.250	81.75	14.200	18.88	23.729	46.74	25.677	52.18	30.022	58.52	19.750	37.97	17.400	20.81
Index of agricultural production assets	3.590	2.45	3.972	3.05	1.758	1.52	3.411	1.60	3.355	1.52	3.633	1.60	2.627	1.10	3.589	1.89
Largest plot/field owned with title deed (y/n)	0.145	0.35	0.220	0.42	0.000	0.00	0.084	0.28	0.000	0.00	0.000	0.00	0.000	0.00	0.350	0.49
Primary crop is fertilized	0.953	0.21	0.901	0.30	1.000	0.00	1.000	0.00	1.000	0.00	1.000	0.00	1.000	0.00	1.000	0.00
Primary crop is irrigated	0.453	0.50	0.000	0.00	0.000	0.00	0.929	0.26	0.953	0.21	0.933	0.25	1.000	0.00	0.850	0.37
Commodities besides sugar cane produced in outgrower schemes (y/n)	0.164	0.37	0.330	0.47	0.000	0.00	0.012	0.11	0.015	0.12	0.022	0.15	0.000	0.00	0.000	0.00
Experience in growing sugar cane (y/n)	0.420	0.50	0.293	0.46	0.714	0.49	0.482	0.50	0.523	0.50	0.478	0.51	0.500	0.52	0.350	0.49
Death of adult hh member in past 5 years (y/n)	0.295	0.46	0.273	0.45	0.200	0.42	0.329	0.47	0.338	0.48	0.326	0.47	0.417	0.51	0.300	0.47
Chronic illness/accident of any hh member in past 5 years (y/n)	0.290	0.45	0.239	0.43	0.400	0.52	0.329	0.47	0.323	0.47	0.283	0.46	0.583	0.51	0.350	0.49
Dependent variables: wealth indices																
Wealth index	7.537	3.58	5.752	3.46	6.736	2.57	9.479	2.71	10.271	1.82	10.362	2.02	9.703	1.03	6.907	3.51
Assets-only index	4.918	3.09	3.699	3.07	3.417	1.88	6.357	2.58	6.917	1.89	7.047	2.10	6.173	1.01	4.537	3.60
Housing-only index	6.463	2.16	5.199	2.11	7.143	1.84	7.691	1.38	8.167	0.93	8.187	0.93	8.097	0.96	6.142	1.47
N	183	88	10	85	65	46	12	20	65	46	12	20	12	46	20	12

Notes: 1. Sample mean values and standard deviations for household and farm characteristics, shocks, as well as wealth indices; 2. Due to missing data for certain indicators the sample size varies.

Table 15: Descriptive Statistics for Household Heads Older than 54 (t-Tests Group Differences)

Variable	t-Test Group Differences											
	Employees vs Smallholders	Sugar OG vs Smallholders	KASCOL Sugar OG vs Smallholders	1st generation KASCOL Sugar OG vs Smallholders	Magobbo Sugar OG vs Smallholders	Sugar OG vs Employees	1st vs 2nd generation KASCOL Sugar OG	KASCOL vs Magobbo Sugar OG				
Household Characteristics:												
Female hh head (y/n)	-0.218 (-1.43)	-0.083 (-1.22)	-0.057 (-0.76)	-0.101 (-1.23)	-0.168 (-1.50)	0.135 (0.97)	-0.366** (-2.58)	0.112 (1.02)				
Age hh head	-8.741*** (-3.23)	0.765 (0.59)	1.198 (0.88)	1.746 (1.13)	-0.641 (-0.29)	9.506*** (3.40)	2.087 (0.75)	1.838 (0.82)				
Married mono- or polygamously (y/n)	0.252 (1.62)	0.082 (1.16)	0.045 (0.58)	0.091 (1.07)	0.202* (1.77)	-0.171 (-1.17)	0.322** (2.17)	-0.158 (-1.39)				
Education level hh head (ordinal scale from 1=none to 7=tertiary)	0.520 (0.93)	0.065 (0.25)	-0.175 (-0.63)	-0.080 (-0.26)	0.820** (2.01)	-0.455 (-0.84)	0.700 (1.20)	-0.995** (-2.42)				
None and lower primary (0-4 years)	-0.073 (-0.49)	0.065 (0.91)	0.108 (1.41)	0.097 (1.15)	-0.073 (-0.67)	0.137 (0.87)	-0.130 (-0.76)	0.181 (1.49)				
Upper primary (5-7 years)	0.036 (0.22)	-0.123* (-1.75)	-0.110 (-1.43)	-0.081 (-0.94)	-0.164 (-1.40)	-0.159 (-1.08)	0.083 (0.53)	0.054 (0.49)				
Secondary (8-12 years)	-0.050 (-0.35)	0.087 (1.25)	0.052 (0.70)	0.011 (0.14)	0.200* (1.79)	0.137 (0.87)	-0.039 (-0.25)	-0.148 (-1.22)				
Post-secondary (>12 years)	0.086 (0.78)	-0.029 (-0.64)	-0.050 (-1.04)	-0.027 (-0.48)	0.036 (0.45)	-0.116 (-1.16)	0.087 (0.96)	-0.087 (-1.21)				
Years experience in primary econ activity of hh head	-5.249 (-1.03)	-2.714 (-1.37)	-0.411 (-0.20)	0.520 (0.22)	-10.199** (-2.68)	2.535 (0.80)	2.786 (1.39)	9.788*** (4.49)				
Head would rather be small farmer than employed on large-scale farm (y/n)	0.023 (0.48)	-0.001 (-0.03)	0.007 (0.32)	0.001 (0.04)	-0.027 (-0.67)	-0.024 (-0.49)	-0.022 (-0.51)	0.035 (0.89)				
Total hh members (#)	-1.859 (-1.54)	2.394*** (3.69)	3.364*** (4.88)	3.471*** (4.45)	-0.759 (-0.85)	4.253*** (2.76)	0.214 (0.13)	4.123*** (3.62)				
Kinship with local chief/headman (y/n)	-0.027 (-0.19)	-0.098* (-1.68)	-0.120* (-1.93)	-0.119* (-1.68)	-0.027 (-0.26)	-0.071 (-0.61)	-0.058 (-0.54)	-0.092 (-1.07)				
Adults who completed grade 9 (%)	1.366 (0.13)	10.625** (2.17)	13.287** (2.54)	12.961** (2.23)	1.973 (0.24)	9.259 (0.88)	8.843 (0.90)	11.314 (1.40)				
Adults who completed grade 9+ (%)	8.998 (1.07)	10.108** (2.44)	10.175** (2.39)	12.617** (2.60)	9.891 (1.48)	1.110 (0.11)	6.411 (0.70)	0.284 (0.04)				
Farming and Shocks:												
Total farm size (ha)	-23.327 (-0.73)	-17.352 (-1.56)	-16.719 (-1.31)	-18.087 (-1.20)	-19.314 (-0.86)	5.974* (1.71)	0.267 (0.19)	2.595 (0.93)				
Total heads livestock + poultry (#)	-32.050 (-1.23)	-22.521** (-2.21)	-20.573* (-1.78)	-16.228 (-1.19)	-28.850 (-1.56)	9.529 (0.64)	10.272 (0.58)	8.277 (0.69)				
Index of agricultural production assets	-2.214** (-2.26)	-0.562 (-1.51)	-0.617 (-1.50)	-0.339 (-0.70)	-0.383 (-0.54)	1.652*** (3.10)	1.006** (2.05)	-0.234 (-0.57)				
Largest plot/field owned with title deed (y/n)	-0.220 (-1.39)	-0.135** (-2.45)	-0.220*** (-4.18)	-0.220*** (-3.49)	0.130 (1.21)	0.084 (0.79)	0.000 (.)	-0.350*** (-5.75)				
Primary crop is fertilized	0.099 (0.87)	0.099*** (3.02)	0.099*** (2.63)	0.099** (2.20)	0.099 (1.47)	0.000 (.)	0.000 (.)	0.000 (.)				
Primary crop is irrigated	0.000 (.)	0.929*** (32.25)	0.953*** (40.30)	0.933*** (33.41)	0.850*** (21.21)	0.929*** (9.43)	-0.067 (-0.91)	0.103 (1.57)				
Commodities besides sugar cane produced in outgrower schemes (y/n)	-0.330** (-2.19)	-0.318*** (-6.05)	-0.314*** (-5.22)	-0.308*** (-4.30)	-0.330*** (-3.11)	0.012 (0.34)	0.022 (0.51)	0.015 (0.55)				
Experience in growing sugar cane (y/n)	0.421** (2.28)	0.189** (2.29)	0.230*** (2.64)	0.185* (1.95)	0.057 (0.47)	-0.232 (-1.18)	-0.022 (-0.13)	0.173 (1.35)				
Death of adult hh member in past 5 years (y/n)	-0.073 (-0.49)	0.057 (0.81)	0.066 (0.87)	0.053 (0.64)	0.027 (0.24)	0.129 (0.83)	-0.091 (-0.58)	0.038 (0.32)				
Chronic illness/accident of any hh member in past 5 years (y/n)	0.161 (1.10)	0.091 (1.32)	0.084 (1.15)	0.044 (0.55)	0.111 (1.02)	-0.071 (-0.44)	-0.301* (-1.98)	-0.027 (-0.22)				
Dependent variables: wealth indices												
Wealth index	0.983 (0.87)	3.727*** (7.86)	4.518*** (9.58)	4.610*** (8.30)	1.155 (1.34)	2.744*** (3.04)	0.659 (1.09)	3.363*** (5.68)				
Assets-only index	-0.282 (-0.28)	2.659*** (6.15)	3.219*** (7.47)	3.348*** (6.63)	0.838 (1.07)	2.941*** (3.48)	0.874 (1.39)	2.380*** (3.89)				
Housing-only index	1.944*** (2.80)	2.491*** (9.17)	2.968*** (10.61)	2.987*** (9.15)	0.942* (1.90)	0.547 (1.15)	0.090 (0.30)	2.025*** (7.36)				
N	98	173	153	134	108	95	58	85				

Notes: 1. Tests of inequality of variable means between the most important comparison groups; 2. Significance: *** p<0.01, ** p<0.05, * p<0.1; 3. Due to missing data for certain indicators the sample size varies.

3.5.2 Regression Results

Main Results: Impact of Outgrower Schemes and Employment in the Sugar Industry

The main results for the OLS regression are reported in Table 16. Estimates are shown for the three different versions of the asset index, i.e. accounting for both household assets and housing conditions, for assets only, and for housing conditions only (cf. Section 3.5.1 on p. 74f.).

Table 16: Main OLS Results (Model 1) for the Three Versions of the Wealth Index

	Dependent Variable:		
	Wealth Index	Assets-Only Index	Housing-Only Index
Comparison group (reference category = smallholder farmers):			
Sugar cane outgrower (y/n)	3.963*** (0.222)	2.862*** (0.191)	2.627*** (0.158)
Employee on large-scale sugar estates (y/n)	2.081*** (0.199)	1.136*** (0.147)	1.975*** (0.175)
Household Characteristics:			
Female household head (y/n)	0.407* (0.229)	0.302 (0.194)	0.257 (0.173)
Age household head	0.003 (0.007)	0.006 (0.006)	-0.002 (0.005)
Upper primary education (5-7 years)	0.062 (0.220)	0.041 (0.172)	0.092 (0.196)
Secondary education (8-12 years)	0.573** (0.255)	0.431** (0.207)	0.410* (0.211)
Post-secondary education (>12 years)	2.056*** (0.379)	1.736*** (0.340)	1.193*** (0.281)
Years experience in primary econ activity of household head	0.033*** (0.011)	0.022** (0.009)	0.024*** (0.008)
Total household members (#)	0.063*** (0.023)	0.054** (0.021)	0.028* (0.016)
Adults who completed grade 9 (%)	0.012*** (0.004)	0.009*** (0.003)	0.007** (0.003)
Adults who completed grade 9+ (%)	0.013*** (0.005)	0.009** (0.004)	0.009** (0.004)
Farming and Shocks:			
Total farm size (ha)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)
Total heads livestock + poultry (#)	0.003 (0.003)	0.004 (0.003)	0.001 (0.001)
Index of agricultural production assets	0.442*** (0.062)	0.465*** (0.064)	0.160*** (0.034)
Constant	1.014*** (0.369)	-0.637** (0.291)	2.904*** (0.322)
Adj R-sqr	0.56	0.59	0.40
Observations	743	743	743

Notes: Robust standard errors in parentheses. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Household survey (see Section 3.3.1).

Participation in sugar cane activities exhibits a positive and highly significant effect on household wealth. Participating in sugar cane outgrower schemes seems to be especially beneficial, as it is associated with significantly higher wealth compared to smallholder farmers who do not participate in the sugar industry. Holding all other factors constant, being a sugar cane outgrower increases the overall wealth index by almost four index points. According to Table 9 on page 74, this increase would for example constitute a greater uplift than advancing from the average wealth index for the 1st to the 3rd quintile. Such a difference would for instance

mean owning in addition a television (scoring factor / sd = 0.46), satellite dish (0.51) and video player (0.47), a refrigerator (0.54), a motor cycle (0.27), plus living in a higher-quality house with a covered concrete floor (0.38), brick walls (0.23) and windows (0.34), and a roof made of asbestos or iron sheets (0.40), and having access to water from a private pump or pipe (0.38) and sanitation in the form of a (pour) flush toilet (0.31). The respective coefficients for the assets-only index and the housing-only index suggest that outgrowers are better off than smallholders with regards to both dimensions of wealth.

Employees on large-scale estates also exhibit significantly higher wealth than smallholder farmers. Their overall wealth index is on average two points higher than for the reference group, other smallholder farmers. An increase of this magnitude would still for example constitute a greater uplift than advancing from the average wealth index for the 1st to the 2nd quintile (see Table 9 on page 74). A similar difference would be achieved, e.g. by owning in addition a television (0.46) and a refrigerator (0.54), plus living in a higher-quality house with a covered concrete floor (0.38), brick walls (0.23), and a roof made of asbestos or iron sheets (0.40). Controlling for a range of explanatory variables also reveals that being an employee is also associated with significantly higher score on the assets-only and the housing-only index (recall that simple descriptive statistics showed no statistically significant difference in the assets-only index between employees and smallholders).

While both, being a sugar cane outgrower and being an employee on commercial sugar farms, is associated with higher wealth compared to smallholder farmers, the effect of participating in a sugar outgrower scheme is particularly large. The null hypothesis, i.e. that the effects of being an employee and participating in an outgrower schemes are equal, is rejected at the 0.1 significance level for Model 1, independently of the version of the wealth index. This indicates that the strong effect from participating in an outgrower scheme is not simply due to taking part in the sugar industry. The mode of participation indeed matters for household wealth.

Robustness Tests

Sensitivity and robustness tests are performed to check the validity of the above results.

The first two columns in Table 17 report again the results for Model 1, but standard errors are not only robust, but also cluster-corrected in the second column.⁴⁰ Models 2 and 3 introduce additional variables, in order to examine if the results are sensitive to the inclusion of additional covariates that may affect both household wealth and participation in the sugar sector. In Model 2, the following household characteristics are added: a squared term of age (to check whether the effect of age is non-linear), the household heads marital status, as well as kinship with the local chief or headman in an attempt to control for social capital. None of these variables are statistically significant. Likewise, having a formal land title or experiencing shocks in the form of deceased or chronically ill household members in the past five years does not seem to affect the wealth index considerably.⁴¹

In Model 3 we further control for whether the main crop produced in the 2010/2011 growing season was irrigated or not and whether any fertilizer was applied to this crop. Including the irrigation variable greatly reduces the estimated impact of outgrower scheme participation. This comes as no surprise, as 92.8% of sugar outgrowers, but merely 1.3% of smallholders and 4.8% of employees reported to irrigate their crop (see Table 12 on p. 79). Fertilizer is also commonly used among smallholders and employees (both around 91%), but still outgrowers seem to enjoy considerably better access (99.5%). These results only underline that the provision of infrastructure such as irrigation systems and access to fertilizer are important mechanisms how outgrower schemes may benefit their participating farmers.

⁴⁰ As households were interviewed in only 19 villages, the number of clusters in our sample is very low. Furthermore, the number of households per cluster is quite variable, since the size of the “villages” in the study area is very heterogeneous (e.g. some contain just a few farms). Kézdi (2004) and Nichols and Schaffer (2007) caution against using clustered standard areas when the number of clusters is small (less than 50) or if cluster sizes are very unbalanced, as this is unlikely to improve inference and may even make matters worse. Therefore, robust standard errors rather than cluster-robust standard errors are used for the remaining models.

⁴¹ These variables were neither significant individually nor did the test for joint significance suggest that they should be included. Adding the other available proxy for social capital, namely whether the head belonged to the local Tonga or Lozi tribe, yielded similar results.

Table 17: OLS Results for Alternative Model Specifications (Dependent Variable = Wealth Index)

	Dependent Variable: Wealth Index			
	Model 1	Model 1: cluster corrected SE	Model 2	Model 3
Comparison group (reference category = smallholder farmers):				
Sugar cane outgrower (y/n)	3.963*** (0.222)	3.981*** (0.965)	3.956*** (0.233)	2.483*** (0.497)
Employee on large-scale sugar estates (y/n)	2.081*** (0.199)	2.078*** (0.365)	2.195*** (0.230)	2.175*** (0.226)
Household Characteristics:				
Female household head (y/n)	0.407* (0.229)	0.413** (0.162)	0.424 (0.297)	0.505* (0.303)
Age household head	0.003 (0.007)	0.001 (0.008)	0.035 (0.036)	0.033 (0.036)
Age household head squared			0.000 (0.000)	0.000 (0.000)
Married mono- or polygamously (y/n)			0.094 (0.291)	0.153 (0.297)
Upper primary education (5-7 years)	0.062 (0.220)	0.061 (0.249)	-0.127 (0.251)	-0.042 (0.248)
Secondary education (8-12 years)	0.573** (0.255)	0.569** (0.257)	0.490* (0.284)	0.489* (0.281)
Post-secondary education (>12 years)	2.056*** (0.379)	2.012*** (0.444)	1.864*** (0.433)	1.854*** (0.425)
Years experience in primary econ activity of household head	0.033*** (0.011)	0.036*** (0.012)	0.033*** (0.011)	0.031*** (0.011)
Total household members (#)	0.063*** (0.023)	0.062 (0.037)	0.062*** (0.024)	0.058*** (0.023)
Kinship with local chief/headman (y/n)			-0.388 (0.241)	-0.351 (0.238)
Adults who completed grade 9 (%)	0.012*** (0.004)	0.011* (0.005)	0.016*** (0.004)	0.016*** (0.004)
Adults who completed grade 9+ (%)	0.013*** (0.005)	0.014** (0.006)	0.013** (0.005)	0.012** (0.005)
Farming and Shocks:				
Total farm size (ha)	0.000 (0.001)	0.000 (0.002)	0.002 (0.002)	0.002 (0.002)
Total heads livestock + poultry (#)	0.003 (0.003)	0.004 (0.003)	0.001 (0.001)	0.001 (0.001)
Index of agricultural production assets	0.442*** (0.062)	0.439*** (0.053)	0.459*** (0.061)	0.469*** (0.062)
Largest plot/field owned with title deed (y/n)			0.011 (0.317)	0.042 (0.309)
Primary crop is fertilized				0.207 (0.281)
Primary crop is irrigated				1.643*** (0.497)
Death of adult household member in past 5 years (y/n)			-0.043 (0.228)	-0.118 (0.235)
Chronic illness/accident of any household member in past 5 years (y/n)			0.014 (0.206)	0.058 (0.201)
Constant	1.014*** (0.369)	1.058** (0.382)	0.236 (0.884)	-0.044 (0.916)
Adj R-sqr	0.56	0.56	0.59	0.59
Observations	743	740	625	623

Notes: Robust standard errors in parentheses (cluster-corrected in col. 2). Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Household survey (see Section 3.3.1).

Regarding the control variables, the estimated coefficients for covariates generally exhibit the expected signs. Interestingly, and contrary to similar studies at the national level, female-headed households in the sample achieve higher wealth, although the effect is only significant

at the 10% significance level.⁴² The results underline the importance of education, both in statistical and economic terms. Households whose heads have acquired secondary or post-secondary education reach significantly higher wealth. The positive impact of higher education can also be seen in the coefficients for the variables measuring the percentage of adults who completed upper basic school (grade 9) or even went on to high school or tertiary education (grade >9).

The negative and significant effect of being related with the local chief or headman may be counterintuitive, but has also been observed in another recent Zambian study (Chapoto et al. 2011). The authors see complacency among households with social ties to local authorities and a failure to take advantage of these connections as possible explanations.

As explained in section 3.4.3, we cannot rule out that some of our control variables may have been affected by the treatment. For instance, education levels may be (partly) endogenous. The KASCOL outgrower scheme and many of the surveyed large-scale farms provide or support local education services for their employees and close relatives in some way. KASCOL, for instance, supports an on-site basic school and provides transport to schools outside the estate. Furthermore, higher household incomes make education more affordable. Any existing bias due to treatment is likely to be positive, since this may increase education levels due to better access and better affordability of education services. On the other hand, there is little reason to believe that participating in a sugar outgrower scheme or being employed on large-scale farms has a negative effect on education levels. If education is in fact endogenous, including it might lead to measuring only the direct effect of treatment on wealth, while the total effect (via higher education) would be larger than estimated. The estimated treatment effects in the above models would hence constitute a lower bound estimate (i.e. the treatment effect would be underestimated).

While this endogeneity bias seems plausible for younger family members, it is less likely for household heads that usually had already completed their education when joining the outgrower scheme or taking up work on a large farm. KASCOL for instance requires outgrowers to be at least 21 years of age. In fact, the average age when joining the scheme is around 41 years – a point in life where virtually all individuals have completed their education. Therefore education levels of household heads are unlikely to be endogenous.

⁴² Evidence in Chapter 4 asserts a negative yet insignificant association of female household headship and household incomes. Two other studies based upon the same panel data from Zambia suggest a weak negative relationship (Bigsten and Tengstam 2011; Chapoto et al. 2011). However, McKersie & Hichaambwa (2011) find in their assessment of the KASCOL outgrower scheme that female-headed households were performing better, reaching higher total household income, savings, net sugar cane sales, maize yields, cane yields as well as total cultivated areas and area under cane.

To account for potential endogeneity, we rerun the main model (Model 1) with disaggregating by age group (Table 18). The effect of both modes of participation in the sugar cane industry appears to be quite robust across all age groups. For those households with heads above 54 years old, where endogeneity of household head variables is less likely, we still find strong significant effects of participation in sugar activities.

Table 18: Main OLS Results (Model 1) by Age Group (Dependent Variable = Wealth Index)

	Dependent Variable: Wealth Index				
	Overall	age <35	age 35-44	age 45-54	age >54
Comparison group (reference category = smallholder farmers):					
Sugar cane outgrower (y/n)	3.963*** (0.222)	4.289*** (0.410)	3.762*** (0.460)	3.187*** (0.574)	3.967*** (0.392)
Employee on large-scale sugar estates (y/n)	2.081*** (0.199)	1.636*** (0.365)	2.325*** (0.318)	2.546*** (0.486)	2.144*** (0.502)
Household Characteristics:					
Female household head (y/n)	0.407* (0.229)	0.681 (0.500)	0.731* (0.421)	-0.125 (0.536)	0.376 (0.393)
Age household head	0.003 (0.007)				
Upper primary education (5-7 years)	0.062 (0.220)	0.395 (0.452)	-0.476 (0.406)	0.391 (0.536)	0.038 (0.394)
Secondary education (8-12 years)	0.573** (0.255)	0.830* (0.496)	0.567 (0.473)	1.123 (0.767)	0.161 (0.473)
Post-secondary education (>12 years)	2.056*** (0.379)	2.612*** (0.648)	1.069 (0.844)	2.248** (0.958)	1.824*** (0.611)
Years experience in primary econ activity of household head	0.033*** (0.011)	0.106*** (0.029)	0.130*** (0.022)	0.032 (0.021)	-0.004 (0.014)
Total household members (#)	0.063*** (0.023)	0.084 (0.056)	0.084* (0.044)	0.013 (0.055)	0.004 (0.036)
Adults who completed grade 9 (%)	0.012*** (0.004)	-0.001 (0.005)	0.011 (0.007)	0.032*** (0.011)	0.019*** (0.007)
Adults who completed grade 9+ (%)	0.013*** (0.005)	0.015** (0.007)	0.014 (0.009)	0.005 (0.014)	0.017* (0.009)
Farming and Shocks:					
Total farm size (ha)	0.000 (0.001)	-0.010 (0.007)	0.008 (0.009)	0.023** (0.011)	0.001 (0.001)
Total heads livestock + poultry (#)	0.003 (0.003)	-0.003 (0.004)	0.002** (0.001)	-0.014 (0.009)	0.009** (0.004)
Index of agricultural production assets	0.442*** (0.062)	0.431*** (0.117)	0.298*** (0.109)	0.458*** (0.169)	0.441*** (0.093)
Constant	1.014*** (0.369)	1.070* (0.630)	0.572 (0.505)	0.904 (0.745)	2.143*** (0.604)
Adj R-sqr	0.56	0.57	0.54	0.54	0.65
Observations	743	209	223	141	170

Notes: Robust standard errors in parentheses. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Household survey (see Section 3.3.1).

Overall, the effect of participation in sugar activities is robust and quite insensitive to a range of model specifications. Thus, there is considerable evidence in support of both hypothesis 1 and hypothesis 2 (cf. p. 60): Participants in sugar outgrower schemes that produce crops for sale to a foreign-owned large-scale estate reach significantly higher levels of wealth, on average, than the smallholder farmers in the sample. Taking up wage labor on a foreign-owned large-scale estate is also associated with significantly higher wealth, although the effect is not as large as for outgrowers.

3.5.3 Matching Estimates

Determinants of Participation in the Sugar Industry

The first stage of the propensity score matching consists of calculating a household's propensity to participate in the sugar cane industry. The probability is modeled in a random utility framework, on a vector of covariates considered to be affecting participation of households in sugar cane activities.

As we attempt to evaluate the effects of two treatments (participation in sugar outgrower schemes and employment on large-scale sugar estates) a series of binomial models are estimated comparing outcomes between all possible pairs of comparison groups. This procedure is computationally less demanding than multinomial logit or particularly multinomial probit models and has the advantage that misspecification in one model will not compromise the others (Bryson et al. 2002; Lechner 2002). Table 19 shows the estimates for the probit models predicting participation in a sugar outgrower scheme or taking up employment on large-scale sugar estates. The first five columns predict membership in an outgrower scheme for the subsample of outgrowers and smallholders only (i.e. excluding employees). The next two columns predict employment on large-scale farms for the subsample of employees and smallholders (excluding sugar cane outgrowers). The last two columns contrast outgrowers with employees while excluding smallholders.

As mentioned before, some of the covariates may possibly be endogenous. For instance, education levels of outgrowers could be higher because they are wealthier due to their participation in the scheme and can thus afford investing in better education. As discussed above, this problem of reverse causality is however less likely for older household heads (e.g. first generation KASCOL outgrowers) than for younger household members (including second generation household heads at KASCOL). At the time of joining an outgrower scheme or starting work on large-scale estates, the former usually have already reached an age at which education is generally completed.

Another possibility is that the treatment could directly impact the education levels, for instance if an employer or outgrower scheme encourages and supports education. While KASCOL and some sugar producers do support education as a part of their corporate social responsibility, this is predominantly directed towards lower education levels (e.g. by providing primary school).

One variable that is clearly partly endogenous is land size. All participants in the KASCOL Outgrower Scheme moved to the KASCOL area when they joined the scheme. They were allocated plots of four hectares each for sugar cane growing, which was later increased to 6.5 hectares on average. Employees on large-scale sugar farms, on the other hand, are often able to

find housing on the estate. While these dwellings usually comprise some gardens where crops can be grown, these plots are quite small. Both treatments therefore affect land sizes.

In order to deal with this potential endogeneity the following probit models are estimated:

- Model 1: This is the base model and includes a comprehensive set of covariates. The model is again also estimated for those households with household heads above 54 years of age in order to address endogeneity concerns in the comparisons of (KASCOL) outgrowers and smallholders.
- Model 2: A reduced model excluding potentially endogenous variables, e.g. education levels of all household members and land size.
- Models 3 and 4: These extended models include farming indicators and are only estimated to compare sugar cane outgrowers with the other small-scale farmers who don't grow sugar. Model 3 controls for the size of the farm. Model 4 matches households based upon available pre-treatment data about farm sizes that were available for KASCOL sugar cane outgrowers only. The purpose is to compare smallholders who today have similar farm sizes as those KASCOL outgrowers had before they joined the scheme.

Table 19 reveals that the household head's age and the household size have a positive, significant effect on the probability of participation in an outgrower scheme. Previous experience in growing sugar cane also increases the probability.⁴³ Finally, a larger percentage of adults who completed higher education increases the probability of membership. The education level of the household head, however, has no significant effect. This corresponds to our findings in Sections 3.5.1 and 3.5.2, which suggest only negligible differences in education levels between heads on outgrower compared to smallholder farms. The household head's gender does not significantly affect participation – female headship is equally common among sugar outgrowers (23%) and smallholders (20%).

On the other hand, predicting employment on large-scale farms reveals a clear gender bias. Having a female household head significantly reduces the probability of belonging to the employee category. Age, household size, and kinship with local headmen also exhibit negative and significant effects. Employment opportunities on large-scale farms are commonly for the younger and physically fit males, who are willing to move to the large-scale estates and do not yet have large families. Household heads that stated they would rather be small-scale farmers

⁴³ Sugar cane outgrowers had been asked whether they had experience in growing sugar cane before joining the scheme. The positive effect is due to the fact that around 50% of the outgrowers, but only 37% of smallholders report having experience with the crop (e.g. from working on a sugar outgrower's farm or a large-scale sugar estate).

than employees on large-scale farms are less likely to take up employment on commercial farms. Understandably, experience in growing sugar cane increases the probability of working on a sugar estate.

Finally, the probit model predicting participation in sugar outgrower schemes for the subsample of outgrowers and employees alone mirrors the observations for employees and smallholders. Sugar outgrower households are generally similarly and comparable to other smallholders, hence the same variables come out significant. Female headship, age, household size, kinship, and inclination to being a small-scale farmer rather than an employee increase the probability of being a sugar outgrower. Experience in growing sugar-cane has a negative effect on participation. This is because outgrowers were asked if they had experience with the crop when they joined the scheme, while employees were asked about their current situation (e.g. a mechanic or a driver on a sugar farm does not necessarily have experience in growing sugar).

Table 19: Probit Models of Participation in Sugar Cane Activities

	Outgrowers (Y) vs. Smallholders				Employees (Y) vs. Smallholders		Outgrowers (Y) vs. Employees	
	Model 1	Model 1 (age > 54)	Model 2	Model 3	Model 4	Model 1	Model 2	Model 2
Household Characteristics:								
Female household head (y/n)	0.094 (0.226)	-0.313 (0.461)	0.06 (0.222)	0.018 (0.237)	-0.201 (0.293)	-0.941*** (0.310)	-0.905*** (0.310)	0.819*** (0.298)
Age household head	0.011** (0.005)	0.025* (0.014)	0.009** (0.004)	0.012** (0.005)	0 (0.006)	-0.039*** (0.006)	-0.039*** (0.006)	0.037*** (0.006)
Married mono- or polygamously (y/n)	-0.252 (0.224)	-0.179 (0.433)	-0.257 (0.225)	-0.304 (0.282)	-0.664** (0.282)	-0.383 (0.262)	-0.361 (0.254)	-0.259 (0.284)
Education level household head (ordinal scale from 1=none to 7=tertiary)	0.048 (0.056)	0.006 (0.088)	0.049 (0.056)	0.049 (0.056)	-0.015 (0.063)	0.009 (0.073)		0.163* (0.088)
Total household members (#)	0.094*** (0.018)	0.085*** (0.030)	0.085*** (0.017)	0.098*** (0.018)	0.148*** (0.025)	-0.079*** (0.024)	-0.086*** (0.023)	0.233*** (0.025)
Kinship with local chief/headman (y/n)	-0.255 (0.200)	-0.171 (0.336)	-0.307 (0.193)	-0.186 (0.202)	0.089 (0.234)	-1.127*** (0.278)	-1.166*** (0.279)	0.662* (0.368)
Experience in growing sugar cane (y/n)	0.390*** (0.134)	0.432* (0.235)	0.352*** (0.131)	0.381*** (0.136)	0.465*** (0.171)	1.020*** (0.150)	0.979*** (0.147)	-0.519*** (0.176)
Head would rather be small farmer than employed on large-scale farm (y/n)	0.54 (0.376)	0.126 (0.654)	0.126 (0.379)	0.549 (0.379)	0.716 (0.503)	-0.498** (0.253)		1.063*** (0.342)
Adults who completed grade 9 (%)	-0.001 (0.003)	0.003 (0.005)	-0.001 (0.003)	0 (0.003)	-0.002 (0.004)	-0.001 (0.003)		-0.001 (0.004)
Adults who completed grade 9+ (%)	0.009*** (0.003)	0.005 (0.006)	0.005 (0.003)	0.008** (0.003)	0.017*** (0.004)	0.003 (0.004)		0.006 (0.004)
Farming:								
Total farm size (ha)				-0.005 (0.006)				
Total farm size (ha) (matching on KASCOL OG pretreatment data)					-0.006 (0.006)			
Total heads livestock (#)					-0.017* (0.009)			
Constant	-2.292*** (0.574)	-2.556** (1.302)	-1.176*** (0.348)	-2.320*** (0.589)	-2.230*** (0.746)	2.431*** (0.503)	2.110*** (0.366)	-4.923*** (0.717)
Pseudo R2	0.13	0.11	0.1	0.14	0.24	0.31	0.3	0.41
Observations	409	141	414	396	303	409	413	398
Log Likelihood	-246.351	-85.223	-259.42	-236.864	-144.128	-194.625	-199.549	-153.445
								-164.777

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

Checking the Common Support

Once the propensity scores are calculated one has to check if the common support condition is satisfied. Figure 13 shows the density of propensity scores for outgrowers and smallholders for Models 1 through 4. High propensity scores reflect a high probability of receiving the treatment given the observed covariates. Propensity score distributions for both models overlap largely and thus the common support condition is fulfilled.

Figure 13: Propensity Score Distribution for Sugar Cane Outgrowers and Smallholders

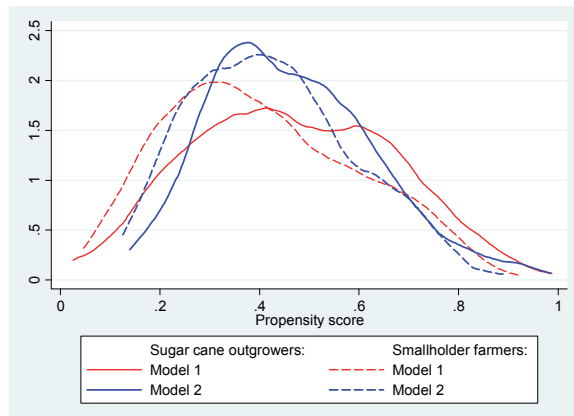


Figure 14: Propensity Score Distribution for Estate Employees and Smallholders

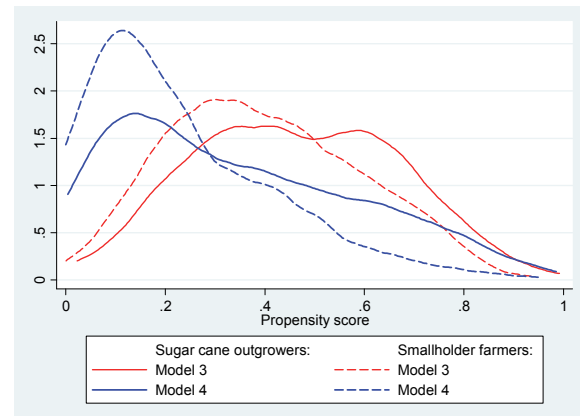
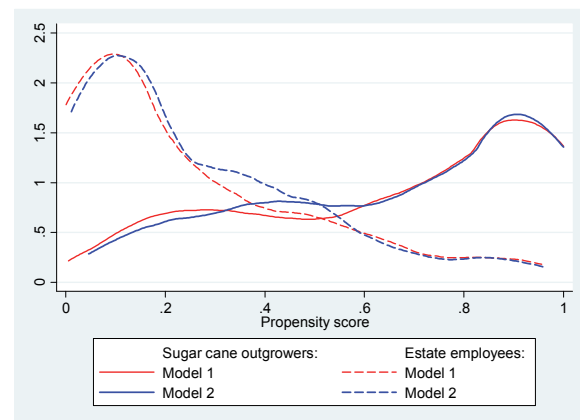
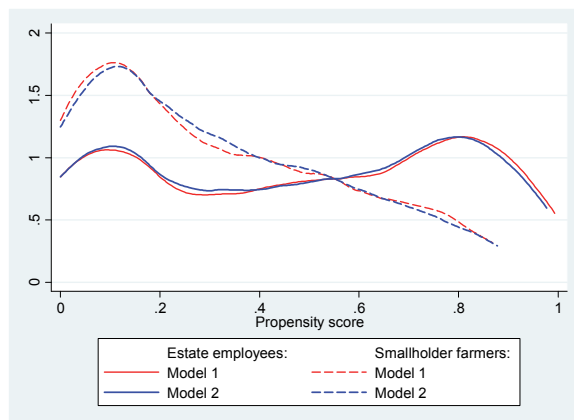


Figure 15: Propensity Score Distribution for Sugar Cane Outgrowers and Estate Employees



In contrast, the density plots for the models comparing employees on large-scale sugar estates with smallholders (Figure 14) and outgrowers respectively (Figure 15) raise concerns whether these groups are in fact comparable. Certain combinations of characteristics of one group are not observed among households of the other comparison groups. As mentioned before, employees tend to be younger and have smaller families than smallholder farmers and sugar cane outgrowers.

In the next step, households in treatment groups are matched to non-treated households based upon the calculated propensity scores. Following a radius matching strategy, a treated household is matched with all untreated households whose propensity scores fall within a

defined propensity range, the caliper (Caliendo and Kopeinig 2008). The tolerance level is set to 0.002 in order to avoid bad matches and to increase matching quality. On the other hand, setting such a tight caliper leads to a greater number of cases which cannot be successfully matched. While unmatched cases are in a reasonable range in most model versions (see Table 21 on p. 96), there are some models where the number is high and here some concerns may be raised about the representativeness of the effect estimates. Nonetheless, as the principal goal of propensity score matching is to remove imbalances in observed covariates, proper balancing is given priority.

Propensity score matching attempts to match units with similar propensity scores, i.e. the conditional probability of assignment to treatment given the observed covariates. It thus dodges the problem of finding units which are identical in all respects relevant to the selection process. By the same token, it needs to be tested if the matching procedure was able to balance the distribution of the covariates in both the treated and the control group. Matching is successful when conditioning on the propensity score removes all significant differences in the relevant variables.

Table 20: Balancing Test Results for All Matching Covariates (Model 1: Outgrowers vs. Smallholders)

	Unmatched			Radius matching		
	Treated	Control	p> t	Treated	Control	p> t
Female household head (y/n)	0.22	0.17	0.206	0.21	0.31	0.321
Age household head	51.06	47.25	0.012	50.19	51.68	0.442
Married mono- or polygamously (y/n)	0.78	0.84	0.099	0.80	0.71	0.043
Education level household head (ordinal scale from 1=none to 7=tertiary)	4.72	4.56	0.290	4.79	4.82	0.482
Total household members (#)	10.37	7.80	0.000	9.25	8.89	0.645
Kinship with local chief/headman (y/n)	0.10	0.19	0.009	0.09	0.12	0.640
Experience in growing sugar cane (y/n)	0.51	0.37	0.003	0.49	0.44	0.820
Head would rather be small farmer than employed on large-scale farm (y/n)	0.98	0.95	0.127	0.98	0.97	0.311
Adults who completed grade 9 (%)	46.91	37.82	0.005	43.04	44.99	0.074
Adults who completed grade 9+ (%)	29.62	20.27	0.001	25.72	27.47	0.016
<i>Median bias</i>		25.6			8.6	
<i>Pseudo R2</i>		0.131			0.051	
<i>p-value of LR</i>		0.000			0.080	

Whether the balancing condition is met is indicated for each model in the results table (Table 21 below). As an example, Table 20 shows the balancing test results for the base model (Model 1), comparing sugar cane outgrowers with smallholder farmers. The balancing property is satisfied. The only variables where a significant difference between groups remains at the five percent level is for marital status and the percentage of adult household members who completed higher education (grade 10 or above). Overall the median bias is reduced, as is the variance explained by the model. The nonsignificant p-value of the likelihood ratio test of the joint insignificance of all regressors implies that matching was successful. None of the covariates remain helpful to predict membership in one group or another.

Impact on Wealth

Once the matching has been successful, the average treatment effects (ATT) on the treated can be calculated according to equation 4 (p. 67). The resulting ATTs for all models and for the three calculated wealth indices are shown in Table 21. All models use a caliper of 0.002, except Model 1 for those aged 54 and older, where a less stringent caliper of 0.008 was used in order to reduce the number of unmatched cases.

Table 21: Average Treatment Effects on the Treated (ATT)

		Outcome	Treated	Controls	ATT	SE	Balanced Covariates (p-value of LR)
Outgrowers (Treated) vs. Smallholders (Controls)	Model 1:	Wealth Index	9.100	6.163	2.937 ***	0.47	yes (0.08)
		Asset-Only-Index	5.887	3.878	2.009 ***	0.43	
		Housing-Only-Index	7.645	5.654	1.991 ***	0.28	
		<i>No. of households with match:</i>	235 of 409				
	Model 1 (Age >54): (Caliper = 0.008)	Wealth Index	9.631	7.175	2.456 ***	0.86	yes (0.324)
		Asset-Only-Index	6.581	4.930	1.651 **	0.79	
		Housing-Only-Index	7.660	6.005	1.655 ***	0.49	
		<i>No. of households with match:</i>	103 of 141				
	Model 2:	Wealth Index	9.289	5.423	3.866 ***	0.42	yes (0.276)
		Asset-Only-Index	6.054	3.356	2.697 ***	0.37	
		Housing-Only-Index	7.725	5.101	2.624 ***	0.26	
		<i>No. of households with match:</i>	258 of 414				
	Model 3:	Wealth Index	8.930	5.800	3.130 ***	0.47	yes (0.231)
		Asset-Only-Index	5.843	3.789	2.055 ***	0.42	
		Housing-Only-Index	7.432	5.216	2.215 ***	0.28	
		<i>No. of households with match:</i>	220 of 396				
	Model 4:	Wealth Index	9.736	5.743	3.993 ***	0.65	yes (0.532)
		Asset-Only-Index	6.331	3.818	2.513 ***	0.61	
		Housing-Only-Index	8.038	5.083	2.955 ***	0.37	
		<i>No. of households with match:</i>	99 of 303				
Employees (Treated) vs. Smallholders (Controls)	Model 1:	Wealth Index	6.238	4.849	1.388 ***	0.45	yes (0.55)
		Asset-Only-Index	3.256	2.836	0.419	0.35	
		Housing-Only-Index	6.520	4.798	1.722 ***	0.35	
		<i>No. of households with match:</i>	157 of 409				
	Model 2:	Wealth Index	6.405	4.890	1.514 ***	0.54	no (0.007)
		Asset-Only-Index	3.336	2.803	0.533	0.42	
		Housing-Only-Index	6.611	4.884	1.727 ***	0.41	
		<i>No. of households with match:</i>	160 of 413				
Outgrowers (Treated) vs. Employees (Controls)	Model 1:	Wealth Index	8.780	6.357	2.423 ***	0.69	yes (0.391)
		Asset-Only-Index	5.753	3.266	2.487 ***	0.55	
		Housing-Only-Index	7.339	6.652	0.686	0.48	
		<i>No. of households with match:</i>	89 of 398				
	Model 2:	Wealth Index	9.518	6.789	2.729 ***	0.54	no (0.016)
		Asset-Only-Index	6.208	3.707	2.501 ***	0.46	
		Housing-Only-Index	7.947	6.812	1.135 ***	0.37	
		<i>No. of households with match:</i>	131 of 401				

Notes: Average treatment effects (ATT) and standard errors (SE) for the three wealth indices. Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All models are calculated with a caliper of 0.002, except Model 1 for those older than 54 (caliper 0.008).

Beginning with the results comparing sugar outgrowers with smallholders, the models suggest that participation is associated with significantly higher scores on all three wealth indices. The association is strong and robust for all 4 models. The overall wealth index increases by 2.9 to 3.9 index points when compared to small-scale farmers who are not connected to the sugar industry, but are otherwise very similar. This corresponds to an increase of between 48% and 71%. As can be seen from the ATT for the disaggregated wealth indices, the positive impact on

household welfare is driven both by increases in assets owned as well as by improvements in housing conditions.

The results for the two models comparing employees on large-scale estates with smallholders affirm a significant positive effect, although it is only roughly half as large as in the outgrower case. Households whose primary source of income is working on a large sugar farm score around 1.4 index points (+29%) higher than small-scale farmers. For employees, the effect is largely due to improvements in housing conditions. The Asset-Only-Index is not significantly higher than for smallholders. Part of this may be explained by the fact that many employees only live on the estate while they are hired. Hence they do not keep as many assets at this temporary home. We tried to exclude employees who do not live in the area and are only working on the farm for very brief periods. However, focus group interviews brought to light that living on a large-scale estate is still in many cases provisional, as most employees (have to) return to their family's farm once the contract ends.

The last two rows in Table 21 compare sugar cane outgrowers with employees. A large number of households could not be matched due to a lack of common support, i.e. certain combinations of characteristics in the outgrower group did not exist among households in the employee group. Therefore some questions remain regarding the representativeness of these effect estimates. Again, the results show, however that participants in the outgrower scheme are better off. Their overall wealth index is significantly higher, which seems to be mostly due to higher asset accumulation. Housing conditions are not significantly better in the main model (where balancing was achieved).

Sensitivity to Remaining Selection Bias

So far, the results from matching are quite comparable to the OLS results and suggest a positive impact of participating in the sugar cane industry on household wealth. Nonetheless, matching relies on the conditional independence assumption (CIA), i.e. it delivers robust estimates of treatment effects only if all variables that affect assignment to treatment and the outcome variable simultaneously are included in the model. As this is a strong identifying assumption, sensitivity of results to deviations from the CIA is checked by the procedure proposed by DiPrete and Gangl (2004), which implements Rosenbaum bounds for continuous outcomes (for details see Section 3.4.3, p. 66).

Table 22 reports the one-sided p-values from Wilcoxon signed rank tests for the ATT for different levels of hidden bias (i.e. different values of gamma Γ) for the overall wealth index in Model 1. The critical p-values indicate how high the potential bias would have to be to call into question a positive treatment effect. A gamma level of 1 would be appropriate in the case of a randomized experiment or if no hidden bias existed.

Table 22: Rosenbaum Bounds for ATT (Model 1)

Gamma	Outgrowers vs. Smallholders		Employees vs. Smallholders		Outgrowers vs. Employees	
	Min	Max	Min	Max	Min	Max
1	<0.0001	<0.0001	0.0017	0.0017	<0.0001	<0.0001
2	<0.0001	<0.0001	<0.0001	0.3519	<0.0001	0.0220
2.25	<0.0001	<0.0001	<0.0001	0.5162	<0.0001	0.0399
2.5	<0.0001	0.0004	<0.0001	0.6618	<0.0001	0.0640
3	<0.0001	0.0030	<0.0001	0.8582	<0.0001	0.1286
4	<0.0001	0.0359	<0.0001	0.9832	<0.0001	0.2954
4.25	<0.0001	0.0541	<0.0001	0.9907	<0.0001	0.3394
4.5	<0.0001	0.0771	<0.0001	0.9949	<0.0001	0.3829
5	<0.0001	0.1372	<0.0001	0.9985	<0.0001	0.4665

Notes: Sensitivity analysis for one-sided significance levels. The table gives the range of possible significance levels (lower and upper bounds) for unobserved biases of various magnitudes (gamma).

When comparing outgrowers to smallholder farmers, the null hypothesis of no treatment effect on the wealth index is rejected at the 5% level for gamma values up to approximately 4.25. If $\Gamma = 4$, then in a matched pair of households one household might have a probability of $\Gamma/(1 + \Gamma) = 4/5$ of treatment, while the other might have a probability of $1/(1 + \Gamma) = 1/5$. Therefore even such a considerable hypothetical departure from random assignment would be unlikely to explain the observed differences in outcomes (cf. Rosenbaum 2010, p. 80ff.). In other words, even if matching failed to control an unobserved characteristic strongly related to household wealth and $\Gamma = 4$ times more common among participants in outgrower schemes, this would still not explain the higher wealth among participants. Only if an unobserved covariate caused the odds ratio of treatment assignment to differ between treatment and control cases by a factor greater than 4.25, the asserted positive treatment effect could be spurious.

The gamma levels for Model 1 comparing employees on large-scale estates with smallholders, and sugar outgrowers with employees reveal critical gamma levels of around 2.25 respectively 2.5. Although the comparisons with employees are less robust than those between small-scale farmers inside and outside sugar outgrower schemes, the critical gamma level is still high. Furthermore, as Rosenbaum bounds are worst-case scenarios, even for critical gamma values a positive treatment effect may still be present. However, the confidence interval would include zero if there actually was a confounding variable causing a bias of the level gamma and, at the same time, this variable had a strong effect on the outcome. In contrast, if the confounding variable was only strongly correlated with treatment assignment, but weakly with the outcome variable, the confidence interval would not include zero (DiPrete and Gangl 2004, p. 291).

We have returned repeatedly to looming econometric issues that are common for observational data, above all endogeneity of independent variables and selection bias. The strategy so far was the careful selection of the independent variables, the analysis of

descriptive statistics, and testing the robustness of results of both OLS and PSM to different model specifications. The Rosenbaum bound approach was then employed to test the sensitivity of the PSM results to unobserved variable bias. The sensitivity tests shown above suggest that the bias due to unobserved covariates would have to be considerable to render spurious the asserted positive treatment effects. But which are potential factors that our analysis so far has not been able to account for?

One common example for an unobserved variable that could play a role in our case as well is ability. Individuals with more innate ability may be more productive and thus acquire higher wealth. At the same time one could argue that individuals with greater ability will be more likely to join an outgrower scheme or find work on a large-scale farm. However, at least for participation in the KASCOL Outgrower Scheme ability or entrepreneurship are not likely to present a problem. Being a KASCOL smallholder farmer does not require more talent or agricultural managerial capabilities than running an average smallholder farm outside the scheme. Most management services are provided through the KASCOL Company. The company and assigned contractors are in charge of land preparation, provision of inputs and irrigation, planting, as well as sugar cane harvest and subsequent transportation to the mill. The main responsibilities of sugar cane smallholders consist of following the fertilizer program, keeping their fields weed-free, and collaborating with KASCOL in field irrigation and crop disease control. Even if one argues that entrepreneurship does make a difference, it seems that those that joined KASCOL are probably not more equipped with it. KASCOL management voiced repeatedly that the screening process should have been undertaken more thoroughly to assess the business capabilities of the applicants (ABD 2005, p. 38). This view is affirmed by a sugar employee interviewed for another study: “The ‘farmers’ chosen to run the plots were mainly retired government officials or villagers connected to the local chief, meaning that a lack of commercial farming experience and community solidarity resulted in burdensome management and frequent squabbles” (Richardson 2010a, p. 927). Although this might be seen as an indication that social capital may have played a role in admittance to the scheme, this would if at all have negatively affected the schemes performance and hence the impact of scheme participation would be underestimated.

Preexisting differences in wealth could of course confound results. For instance, if the majority of sugar cane smallholders were already wealthier than others when they joined the outgrower scheme, then their higher wealth would not be due to participation in the scheme. Lacking baseline data for the whole sample, it is difficult to assess the magnitude of this problem empirically. An ex-post survey of assets did not seem sensible particularly due to the long existence of the KASCOL scheme and associated long recall periods that would compromise data quality. The evidence from the focus group discussions as well as interviews with KASCOL

management does not at all suggest that program participants were especially wealthy. Participation did not require any funds and was intended by design to integrate poor small-scale farmers into sugar production. KASCOL smallholders attending the focus group interviews made it very clear that they were not among the wealthier when they joined.

Overall the case for selection bias does not seem to be compelling for KASCOL outgrowers. When KASCOL began recruiting smallholder farmers in 1983, the interest in joining the scheme was very limited, as people were very sceptic about the seriousness of the project. Those who did join are therefore not likely to have been the ones with the most promising alternative opportunities to make a living.

All in all, the quantitative analysis of the survey data by means of OLS as well as propensity score matching indicate significant and sizeable treatment effects of being integrated into the sugar industry. The impact of participation in sugar outgrower schemes is particularly high, but employees on large-scale sugar estates also achieve significantly higher wealth than comparable small-scale farmers.

3.5.4 Attitudes Towards Participation in the Sugar Industry: Findings from the Focus Group Discussions and the Household Survey

This section presents the evidence from the focus group discussions and some additional data from the household survey. This predominantly qualitative evidence serves to learn more about the three groups that are at the center of our analysis. We aim at getting a better understanding of how the local people feel about investment in the sugar industry and the perceived benefits and risks associated with it. Furthermore we want to look closer at potential selection bias.

The section begins by taking a closer look at smallholder farmers. We explore what led them to become small-scale farmers, what they like about it, and which problems they commonly face. Thereafter we discuss parallels and differences in the assessment of life as a smallholder that emerged during the focus group discussions with the other two comparison groups. This procedure is then broadly repeated for sugar outgrowers and employees on large sugar estates.

Perceived Advantages and Disadvantages of Being a Smallholder Farmer

The vast majority of the 31 small-scale farmers who participated in the focus group discussions grow maize, often in combination with groundnuts (peanuts), cotton, beans and/or sweet potatoes. Reported farm sizes typically range from three to 10 hectares. However, a part of this land is often left fallow, simply due to the lack of inputs or as part of a crop rotation strategy to maintain respectively restore soil productivity. In general, farming is the main economic activity carried out by these individuals, although a few also raise cattle or chickens, or are involved in other activities such as employment on large-scale farms or running a business.

Many participants stated that they were born into a farmer family. Others were employed or running a business in addition to farming. It was also very common to return to the ancestors' farm after retirement from jobs carried out in the agricultural and other sectors. Some also saw farming as a way of survival after failing in school or being laid off.

Asked about what they liked about being a farmer, many expressed that being independent and able to determine their own activities and work schedule was an advantage.

"What I enjoy being a smallholder farmer is the sense that all assets I have are purely mine. In an event that I have some financial demand I just sell some livestock. I also have free time to work in my carpentry shop." (358: male farmer)⁴⁴

⁴⁴ The focus group discussions were conducted in English and simultaneously translated into the local languages. Participants could speak in the language they felt most comfortable. All discussions were audio-recorded with the interviewee's consent, and subsequently translated and transcribed ad verbatim

Related to this is the feeling that the benefits of working one's own land directly improve one's own livelihood.

Numerous interviewees emphasized that farming was a good business provided that the required funds are available to buy inputs. In one of the sampled villages, smallholder farmers seemed better able in this regard. This subgroup thought that farmers reach higher incomes than employees on large-scale estates, as they benefit from not having to pay taxes and manage to find a ready market. Farming was also seen as a good way to make a living, as producing their own food ensures that their families are fed.

"[...]for those of us who do piece work, the whole year you just get maybe K 2 million, but the one on the farm can get maybe K 20 or K 30 million, so it is better farming than working." (886: male farmer)

Among the main problems faced by small-scale farmers was the inability to afford the necessary inputs and implements to farm efficiently as well as irrigation infrastructure. In terms of inputs, access to fertilizers or pesticides poses a problem. Most small-scale farmers cannot afford to buy fertilizer at regular prices and rely on the limited supply of subsidized fertilizer that is available through the Zambian Food Reserve Agency (FRA). However, frequent delays in receiving the FRA fertilizer also entailed production losses. Respondents in two of the three farming communities tended to report that the lack of implements was limiting their productivity. One contributor mentioned conservation agriculture (minimal soil disturbance, permanent soil cover and crop rotation) as a successful measure to deal with irregular rain fall and maintaining soil fertility despite limited use of fertilizers. Several farmers lost animals to diseases and now cultivate their fields by means of hand hoes.

Insufficient water management was mentioned as the most pressing problem during all three focus group interviews with small-scale farmers. As irrigation systems are almost non-existent among smallholders, farmers usually practice rain-fed agriculture, supplemented by water drawn from the limited and often congested public boreholes. Accordingly, yields fluctuate greatly in periods of intensive drought as well as during excessive rains. In one community, water logging caused by inadequate drainages was seriously affecting yields. Measures to effectively prevent or mitigate the effects of such natural calamities are only rarely implemented due to insufficient funds available to farmers and limited support from public or private agencies.

Although respondents acknowledged that credit facilities and micro-finance institutions exist, small-scale farmers still frequently fail to receive credit as they do not have the necessary

by our local collaborators. The number in the bracket refers to the identification number of that segment assigned by the qualitative computer software package used for this analysis (Atlas.ti, version 6.28).

collateral. Difficulties arising from limited market access were also common. At times, finding a market for agricultural produce was difficult, or payments were delayed.

Due to these difficulties, many small-scale farmers were not able to cultivate all of their fields. These individuals commonly talked about their struggle to provide sufficient food for their families and to send their children to school. In two of the three farming communities some farmers stated that their situation had been very challenging, seriously calling into question their self-perception as a farmer.

“This time rainfall is poor and I have nothing to use at the farm and I have no animals. I just try, but struggling. I look for money to buy food. How can I be called a farmer?” (789: female farmer)

Asked about their personal assessment of life as a small-scale farmer, focus group participants who were employed on large-scale farms usually voiced that they would like to be small-scale farmers. Being your own boss was attractive not least because it entailed greater job security and being rewarded directly for working extra hard. In contrast to the smallholder farmers who are often unable to farm all of their fields, various employees stated that access to land was expensive. For this reason they were working on the large farm only, even though they would like to carry out farming alongside their work or switch to small-scale farming altogether. However, employees were quite aware of the previously mentioned difficulties that smallholder farmers commonly face (e.g. lacking the necessary capital to buy fertilizer and other inputs, being exposed to natural calamities such as drought or floods). Overall, employees had mixed opinions about whether small-scale farmers were currently better off than those working on commercial farms.

“Farmers may have difficulties, but when I look at what they get per season compared to what I get, I think they are better off than us.” (281: female employee)

“Looking at the current rainfall pattern I think we are better off than farmers. Most of them even envy us.” (292: female employee)

“Unless one is in the [outgrower] scheme where everything is given, farming is not good.” (704: male employee)

It became very clear though, that most employees favored being a smallholder farmer if access to inputs and especially irrigation was taken care of.

Perceived Advantages and Disadvantages of Sugar Cane Outgrower Schemes

Given the potential problems associated with the presence of selection bias, the focus group discussions with a total of 24 current participants in sugar outgrower schemes also served to find out more about who actually joined the sugar cane outgrower schemes. This issue was above all discussed during the discussion with participants who had been members of the KASCOL outgrower scheme for many years. As already reported by KASCOL management, some who had been among the very first outgrowers explained that they had been seasonal employees on the KASCOL core estate. Among them were former general workers, capitaos (assistant supervisor) and one man reported he had been a foreman. KASCOL management then informed them about the intended government project and the involved parties to allocate some land to smallholders.

“It was the government’s decision to bring this KASCOL here [...]. The project was for poor people, even not for those who were educated [...] in order to bring development to the people [...] from all chiefdoms around Mazabuka. [...] We who were workers were put as pioneers. Then from there on an announcement was made saying whoever wishes to join should apply. Then people came from different areas. Some are Lozi, Western Province, some from Copper Belt. Whoever wished to join this scheme applied and was accepted [...] so long as they were married. [...] Those who were rich were refused.” (592: male outgrower)

There was mutual consent that access to the scheme was otherwise very open and that it was certainly not the most affluent that were admitted to the scheme.

“[...] The system was very simple and cheap. They wanted local people though not educated to settle here. We were not bringing anything like capital to start. Everything – fertilizer, water and cutting – was provided by the company but they were charging at the end of the day.” (587: male outgrower)

Those who applied for a position and successfully mastered a six month training program were then assigned land in the outgrower scheme. With time, word spread that applications to the scheme were being accepted and other people started to become interested. However, in the beginning there was widespread skepticism about the project, as reflected by the following statements of two male outgrowers:

“Unfortunately some people were not of the idea. They thought that, why? Are you sure that the company can develop an area like that and put cane and then you are given a hectare so that you benefit yourself? No, it would be sort of indirectly we shall be working for them. Then the company gets more than ourselves. But that was not the aim of the government.” (592: male outgrower)

“My fellow Tongan chaps from Mwanachingwala [local chiefdom] were failing to come here because they thought that we were just workers indirectly. But from the time they came to know that it was free for all the chances were slim.” (590: male outgrower)

When asked for the reasons why they became sugar cane outgrowers, two sugar cane farmers explained that they preferred to join the scheme as it assured that – contrary to their situation as employees – their children would be entitled to become their successors. One early KASCOL outgrower said that the general manager at the time had advised them to join the scheme and that they had decided to take the chance.

“Our hope was that there could be something better in the future. We didn’t know how good it was going to be, so we were just trying.” (596: male outgrower)

The vast majority of KASCOL smallholder farmers agreed that they were benefiting from participation in the scheme. Being supplied with all the necessary infrastructure and inputs certainly helped to raise their living standards. Higher incomes, being able to build their own houses and afford costly assets such as automobiles thanks to lump sum payments, taking their children to school, and assisting relatives financially were mentioned as the main advantages. They also reported that there was “plenty of spare time” left to generate extra income, especially since sugar cane was a perennial crop and thus there were times with low work input. This was illustrated by the statement of a 61 year old male who had been part of the scheme since the beginning:

[...] Advantages are so many here. [...] Here we get all inputs on loan, talk of water, fertilizer, cutting and transport. There is nothing that we touch. We just sit and watch what is happening at our farm. We just supervise and direct what to do, but at the end of the day after deductions we get good money [...]. (609: male outgrower)

Among the economic activities besides growing sugar cane were farming, raising cattle, employment on large-scale sugar cane estates, or running their own business. One farmer stated that he was not living in the scheme but was managing it from his home on the outskirts of Mazabuka. Somebody also added that by taking part in the scheme they gained helpful know-how that could also be used for other tasks and to find employment elsewhere.

The vast majority of KASCOL smallholders agreed that they were better off than outside the scheme. Still, some discontent was expressed regarding the distribution of profits and a lack of transparency and communication between the scheme’s management and smallholder farmers. One reason for the perceived low disposable incomes was that their profits from sugar

cane production were lower due to high costs of irrigation and fertilizer.⁴⁵ The smallholders feel that they are not adequately informed by the management how these deductions are calculated.

Another area of concern was the cane field sizes that each smallholder was given. At the time of the interviews, KASCOL was planning to put an additional 150 hectares under sugar cane production. It had not yet been decided whether to allocate these fields to the existing smallholders or to bring in some additional farmers from outside the scheme. The existing KASCOL smallholder farmers complained that many people depended on the scheme and that they themselves were very capable to supervise a larger area. They argued that this would also help to compensate for the decreases in yields which had occurred during the past years (cf. McKersie and Hichaambwa 2011). The household survey conducted for the present study revealed that KASCOL smallholders had larger family sizes on average when compared to farmers outside the scheme. This leads to a dilution of profits and hence lowers per capita incomes. One man who used to be a mechanic, had taken over the farm as a successor. He believed that he was better off in his old job because so many people depended on him now.

“These people always complain no matter what you give them. [...] I am just a successor who has no control over the farm. There is nothing I can do to develop the farm because of differences.”
(579 & 583: male outgrower)

KASCOL smallholders were also dissatisfied about the insufficient representation of their interests in the company board. As mentioned earlier in Section 3.2.1, the Zambian government had appointed a representative in the management board up to the early 2000s. However, after KASCOL had paid off the loan by the Commonwealth Development Corporation (CDC), the government pulled out. From then on KASCOL was considered a private company. The outgrowers felt that they had shouldered financial sacrifices in order to pay back the loans, but when this was achieved the respective shares were not handed over to them as originally planned. Instead, the outgrowers were only able to acquire a small percentage of these shares and the rest were sold to private companies. As the previous example on the calculation of deductions showed, these complications with the management also result from a perceived lack of transparency and information sharing.

Several KASCOL outgrowers thought that the current land leasehold system could be improved. During the first four years after the scheme started, people had gotten only one-year leases which were annually renewed. After that, the leasehold period was increased to 14 years. One

⁴⁵ KASCOL Management explained that the costs of fertilizer are higher than the market price because their fertilizer is blended specifically to suit the nutrient requirements of the soil.

outgrower voiced the opinion that the leasehold period should be further increased to 95 years, but that management opposed this change.

“That is why we say our management is not good. They have their own interests and want us to be staying temporarily. I have stayed for almost 30 years now but I have no power because anytime and day I can be evicted.” (630: male outgrower)

While all agreed that only subleasing the land from the company did constitute an imbalance of power between the company and the smallholder farmers, there was also consensus that this setup was one of the scheme’s main success factors. Farmers who repeatedly fail to abide by the rules set by KASCOL can be evicted.⁴⁶

“Many schemes in Africa have closed because there were no major rules. This scheme has survived up to now because of the strong rules that were put. [...] If they would give us the chance to do what we want the scheme would die. [...] Because of the conditions which we signed ... I know if I don’t do better, how must I stay here. [...] So I work extra hard, I stay longer. I get more tons [harvest], I stay longer. [...] The only people who are getting warning letters are those that are not doing fine in their fields.” (626 & 634: male outgrower)

Focus group participants in the small-scale farmers’ category also voiced their views on who got to participate in the outgrower schemes. A female small-scale farmer reported that she had applied to join the scheme when it was being set up, but that there were so many applicants that chances of being accepted were very small. In addition she suspected that clanship might have been at play with those belonging to the same tribe as members in the selection committee receiving preference. Smallholder farmers in the Magobbo region reported unanimously that households were asked to join the Magobbo sugar outgrower scheme depending on their geographical location. Those who had not been consulted lived outside the area of the planned project but may be able to join in case the outgrower scheme expands.

The vast majority of respondents in the category of smallholder farmers stated that they would like to go into sugar cane production. This desire was driven by the perception that sugar cane smallholders were better off in terms of income, that they managed to send all their children to school, and that they were able to afford higher quality and quantity of nutrition.

Responding to the question why sugar cane farmers fared so well, participants in one focus group thought that this was not due to them working harder, but much rather a result of

⁴⁶ The offenses that are punished by disciplinary measures are explained on page 49. Since the start of the KASCOL outgrower scheme 16 people have been evicted, although two were reinstated later on. The reasons for the evictions included being absent from the farm for more than 30 days, failing to manage their cane fields, and brewing illegal beer (Mujenja and Wonani 2012, p. 29).

better access to inputs and infrastructure. One farmer agreed that implementing proper infrastructure was critical, but felt that alternative crops might be preferable to sugar cane due to the monopsony power of Zambia Sugar:

“The problem that we have here is that the people that give us water want us to produce cane only. But when you look at cane, it cannot be put in a granary and has only one buyer just like cotton.” (395: male farmer)

A female farmer pointed out that one must bear in mind that growing sugar cane would have clear impacts on all members of the community. Everybody would have to agree to grow sugar cane, as for instance neighbors would have to make sure that their animals would not roam in the sugar cane fields. The vast side-effects of switching to sugar cane became apparent by the experience of one smallholder farmer close to the Magobbo scheme. He had lost his job as a distributor in the cotton industry when many of the households in the community shifted production from cotton to sugar cane.

Some participants demurred that farmers in the nearby Magobbo outgrower scheme had to surrender their personal land titles in order to gain one joint block title, which might constitute a risk later on. Similar concerns were mentioned during another interview with regards to the land rights situation at KASCOL.

“[...] At KASCOL the land belongs to the company. If there is any case that they feel they cannot accommodate you in the scheme you can be pushed out unexpectedly and now you are depressed.” (883: male farmer)

In one focus group several farmers brought up the issue of the long-term sustainability of monocultures. They were aware of the observed decreases in sugar cane yields at KASCOL and propagated crop rotation as a means to counteract ecological issues such as erosion, loss of soil fertility, or the depletion of nutrient reserves.

Furthermore, one participant advocated that having separate smaller fields on crop rotation instead of one large sugar cane field was also preferable from a social point of view.

“[...] what I don’t like is moving away from where I am staying to be put on one side so that fields are put on one side. [...] Now being put on one side you find different people with different behaviors – drunkards, witches, noise makers put on one side there cannot be order.” (884 & 885: male farmer)

In addition, the difficulties within the Magobbo Sugar Cane Trust as well as financial difficulties among sugar cane outgrowers due to insufficient financial management and untrustworthy money lenders were mentioned.

“[They fall prey to shylocks] because they [the outgrowers] become big spenders and they just become overambitious.” (384: male farmer)

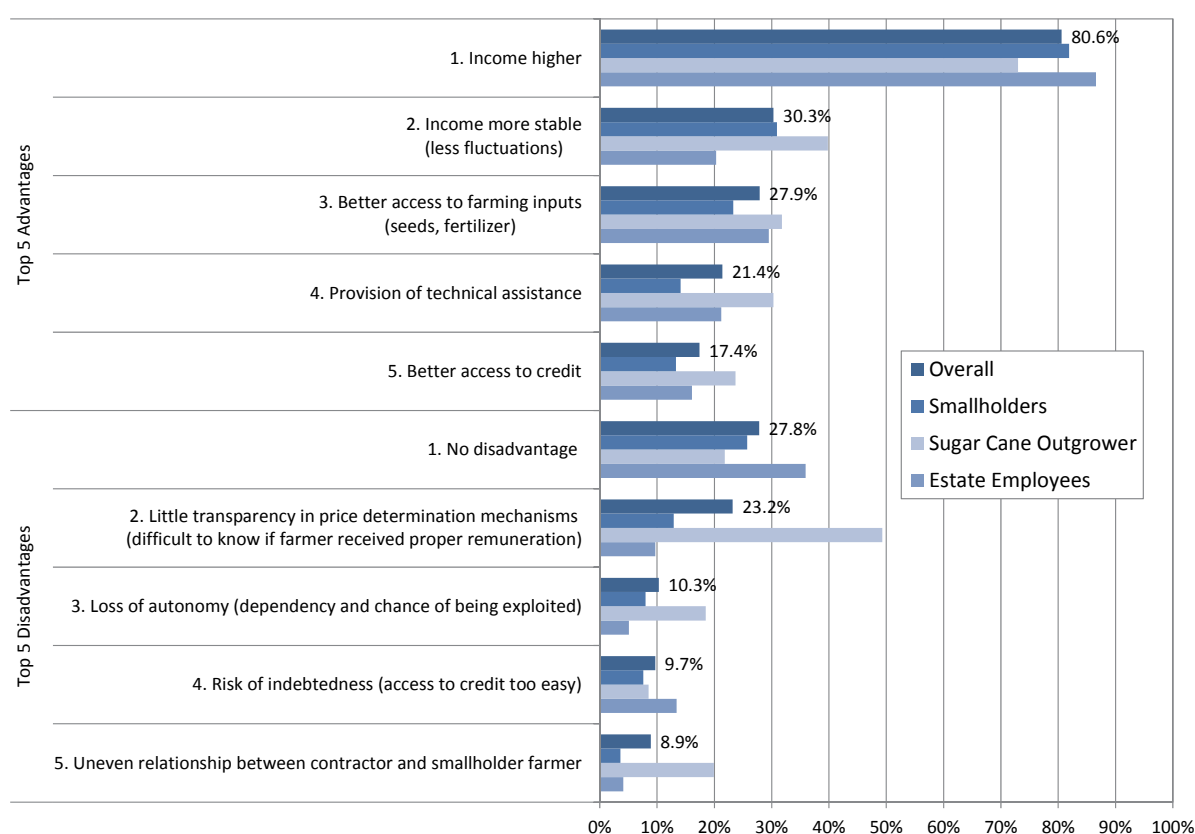
The employees' impression about the sugar cane outgrower schemes very much mirrored what has been discussed before. They all agreed that these schemes were beneficial, particularly as farmers gained access to irrigation. As a result, participants enjoyed unseen wealth, and were much better off than the average employee.

"They are better off because they are given inputs on time and their cane is watered on time. If they have challenges it's only during weeding because they have to do it on their own." (519: male employee)

"They [KASCOL outgrowers] realize up to 50 million ZMK the whole year, but as a general worker you can only earn up to eight or nine million ZMK per year." (681: male employee)

To conclude the part on perceived advantages and disadvantages of sugar cane outgrower schemes, we now take another look at evidence from the quantitative household survey. One section of the questionnaire was devoted to this issue. Figure 16 shows the top 5 most commonly mentioned advantages and disadvantages of sugar cane outgrower schemes, overall, and for each comparison group.

Figure 16: Top 5 Perceived Advantages and Disadvantages of Sugar Cane Outgrower Schemes



Notes: This figure reflects the five most common responses of those 685 households, who knew about the existence of sugar cane outgrower schemes in the area.

Source: Household survey conducted for this project (see Section 3.3.1).

Just as during the focus group interviews, a clear majority in all comparison groups see higher incomes as the main benefit. Other frequently mentioned advantages were having more stable incomes, and gaining access to farming inputs, technical assistance, and credit. With regards to possible negative aspects, about 28% of the respondents see no disadvantage at all. About 23% overall, and nearly half of the sugar outgrowers, reported the discussed issues about limited transparency in price determination. Roughly 10% had concerns about the loss of autonomy and associated problems due to unequal power relations, as well as becoming indebted due to easy access to credit.

Perceived Advantages and Disadvantages of Employment on Large-Scale Farms

A total of 30 employees from three different commercial farms took part in the focus group discussions. They were engaged in different kinds of activities on the farm. Some were general workers, cane cutters, or irrigators, while others were employed as technicians, security guards, or drivers. Participants were usually married and had children. Several employees stated that they had worked on other large-scale farms before, others had to earn money to support their parents and their own families after their business failed. Others had been smallholder farmers, growing maize and other crops. But for various reasons, such as not owning enough land, or lack of money to buy fertilizer, they felt that looking for employment would improve their livelihoods. A view expressed by some younger employees was that working on a large-scale estate offers more advantageous opportunities to the young and physically fit. Therefore it was also common to look for employment right after finishing school.

Although many are happy to have found a job on a commercial farm, the low wages were a universal source of concern. But due to the lack of better alternatives, people take whatever job they can get.

“Jobs are scarce in Zambia [...] and because of this, people accept whatever salaries or wages they are given. [...] I came to Mazabuka at least to have something to do, even if I am not happy with my pay.” (273: female employee)

“The conditions here are really bad. We just work to survive. If you had to visit our homes you would see how people are suffering. Some don’t afford even blankets.” (312: female employee)

Insufficient or, as some put it, inexistent job security was a further source of concern. Job contracts were usually renewed at least on a yearly basis, and employment was in some cases only for six, but usually from 9 to 11 months per year. Furthermore, sometimes people were only informed on the last workday that they would not be rehired. As housing on the estate is commonly tied to a working contract, those who retire or are laid off have to leave their houses, sometimes within a one-week period. On another farm, people were permitted to stay in company housing when contracts end usually at the end of the year, but have to pay “very expensive” rents in case they are not hired again when the new farming season starts in April.

On one farm employees were very unhappy with their working conditions.

“We work from 06.00hrs to 18.00hrs without food. No lunch break, no housing allowance [...], even advance salaries to take our children to school we are denied.” (503&505: male employee)

These employees felt that working conditions in general were much better on other sugar cane farms in the region, primarily as those workers are organized in labor unions recognized by the government. Those other farms follow guidelines regarding working conditions.

There was general consensus in all three groups that employees on the Zambia Sugar plantations were better off than employees on other sugar estates in terms of wages as well as general working conditions. While most said that they were sufficiently well equipped with regards to protective clothing, they thought that Zambia Sugar offered the better amenities, i.e. providing higher quality company-funded private schools and health clinics. In one group participants were asked about their attitude regarding foreigners investing in their region. These employees all stated that it was not very important whether they worked for a foreign or a domestic company. What matters are the working conditions.

Overall, employment on large estates emerges as something temporary that was carried out for a certain time only before returning back to their hometowns due to retirement or termination of the contract. Some said that employment helped them to buy fertilizer and other inputs for their parallel farming activities. There seemed to be some consensus that these activities could easily be carried out in parallel, but sometimes employees were not able to get a piece of land to farm on the side. Others saw the opportunity to save some money before returning to their farms or starting a business. Still, in general, all felt that the benefits of working on commercial farms were small and that opportunities to work hard and then to be promoted were scant.

During the focus group discussion with sugar cane outgrowers, only little time remained to talk about the advantages and disadvantages of employment on large-scale farms. However, a few farmers stressed the point that employment always implied the risk of being laid off. These individuals valued highly having a place to settle, while housing on large-scale farms was only temporary and families were in danger to be left without a place to live in the event of job loss or death.

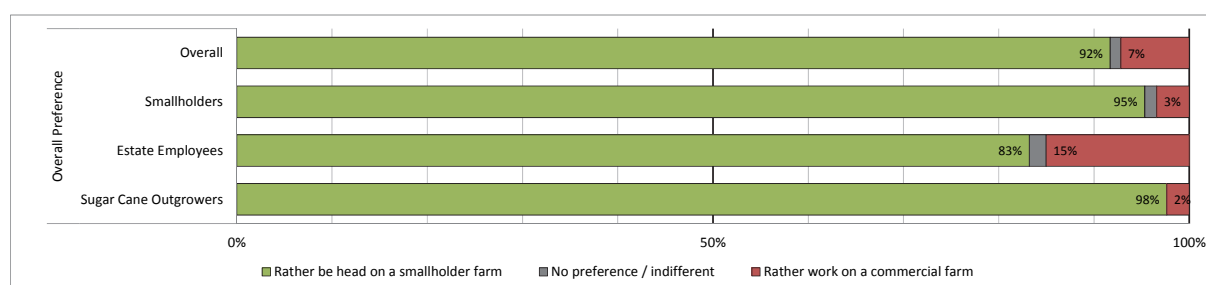
In one of the focus group interviews with smallholder farmers, the majority of participants thought that they would be slightly better off as employees on large-scale estates. One woman, whose husband had previously worked on a sugar cane estate, agreed in principle. But she also reported that a great part of the small benefit of being a worker was abrogated by the new dependence on food purchases. In addition, she had experienced times of food shortage while waiting for the next salary. Several people also explained that it was difficult to find employment in the first place and that the chances were especially slim for the uneducated.

Another group of smallholders had a very different impression. Here, the majority opinion was that one was better off as a small-scale farmer, since wages on large farms were low compared to the earnings of a farmer with a reasonably large piece of land. By the same token, one farmer who only owned a small plot expressed a slight preference for employment on large estates.

Again, some stated that working on large farms in addition to their own farming could be beneficial.

As before, we conclude this part with some further evidence from the household survey. Respondents had been asked to rate the labor conditions as a small-scale farmer in comparison to an employee on a commercial farm. Figure 19 (p. 114) reveals that most respondents, and across all comparison groups, rate the working conditions as the head of a small-scale farm higher in the majority of categories. For this reason, over 90% of all respondents report an overall preference for being the head on a smallholder farm rather than being employed on a commercial farm (Figure 17).

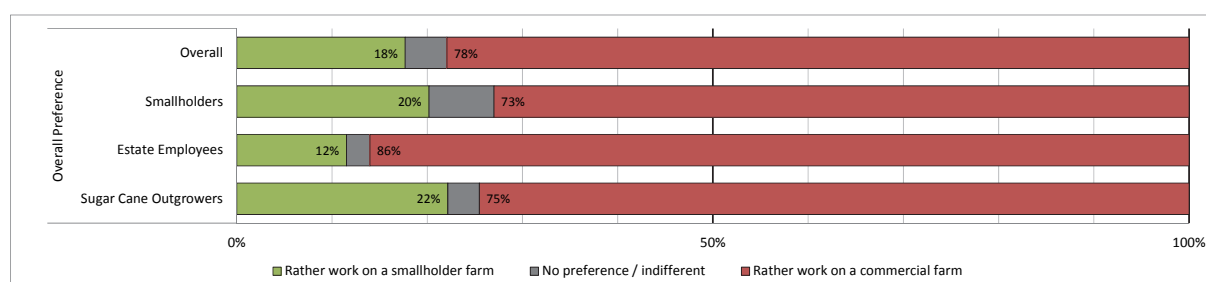
Figure 17: Overall Preference – Head on a Smallholder Farm or Employee on a Commercial Farm?



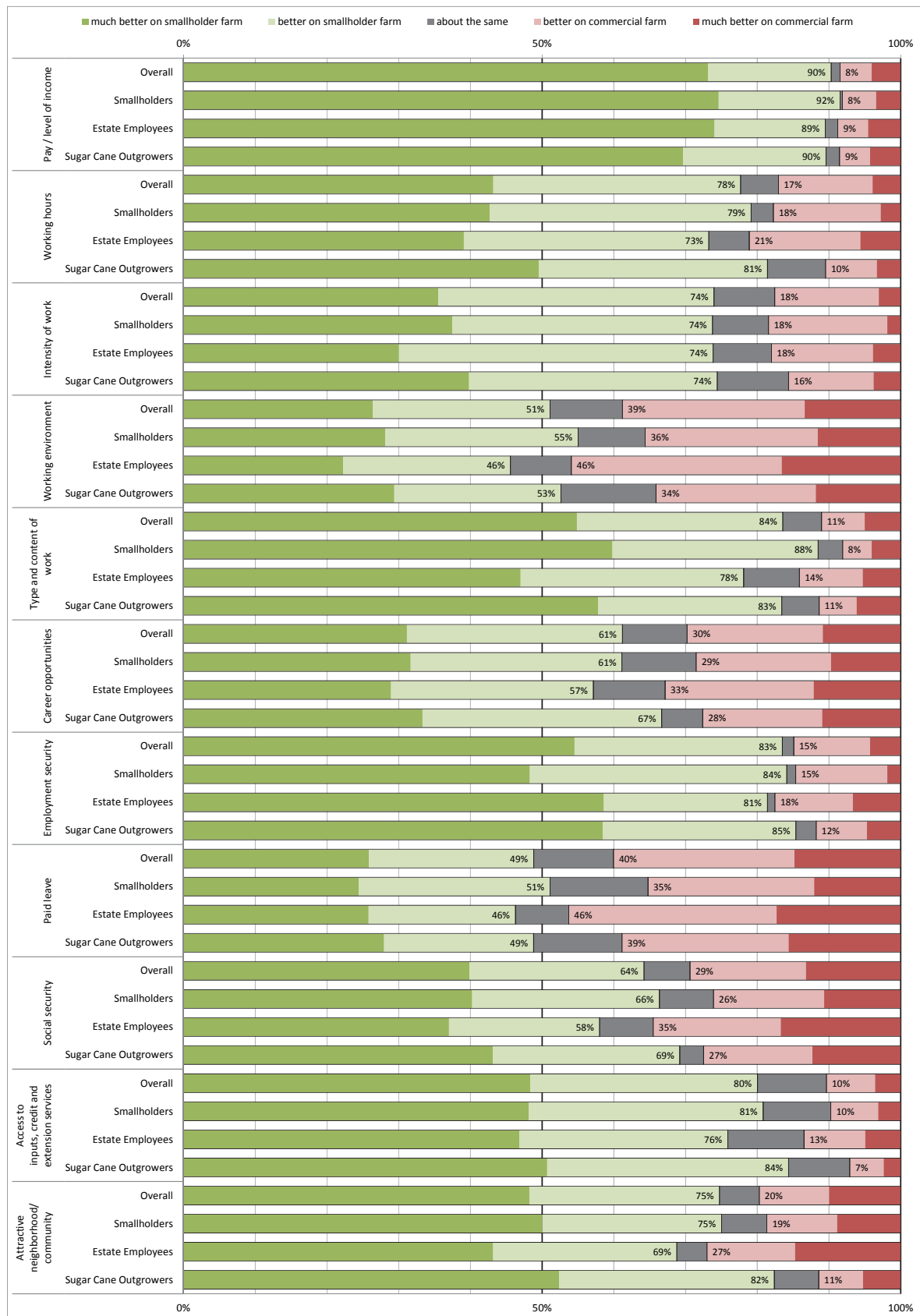
Source: Household survey (see Section 3.3.1).

The picture changes, however, when comparing employment conditions not as the head, but as a worker on a small-scale farm to those of a worker on a commercial farm. Figure 20 (p. 115) shows that only the workload (shown as intensity of work in the table) is judged to be higher on a commercial farm. All other categories show a clear preference for working on larger farms. Figure 18 hence reveals that – when having the choice between employment on a small or on a large farm – nearly 80%, particularly the current employees on sugar estates, would prefer to work on a large farm.

Figure 18: Overall Preference – Employee on a Smallholder or Employee on a Commercial Farm?

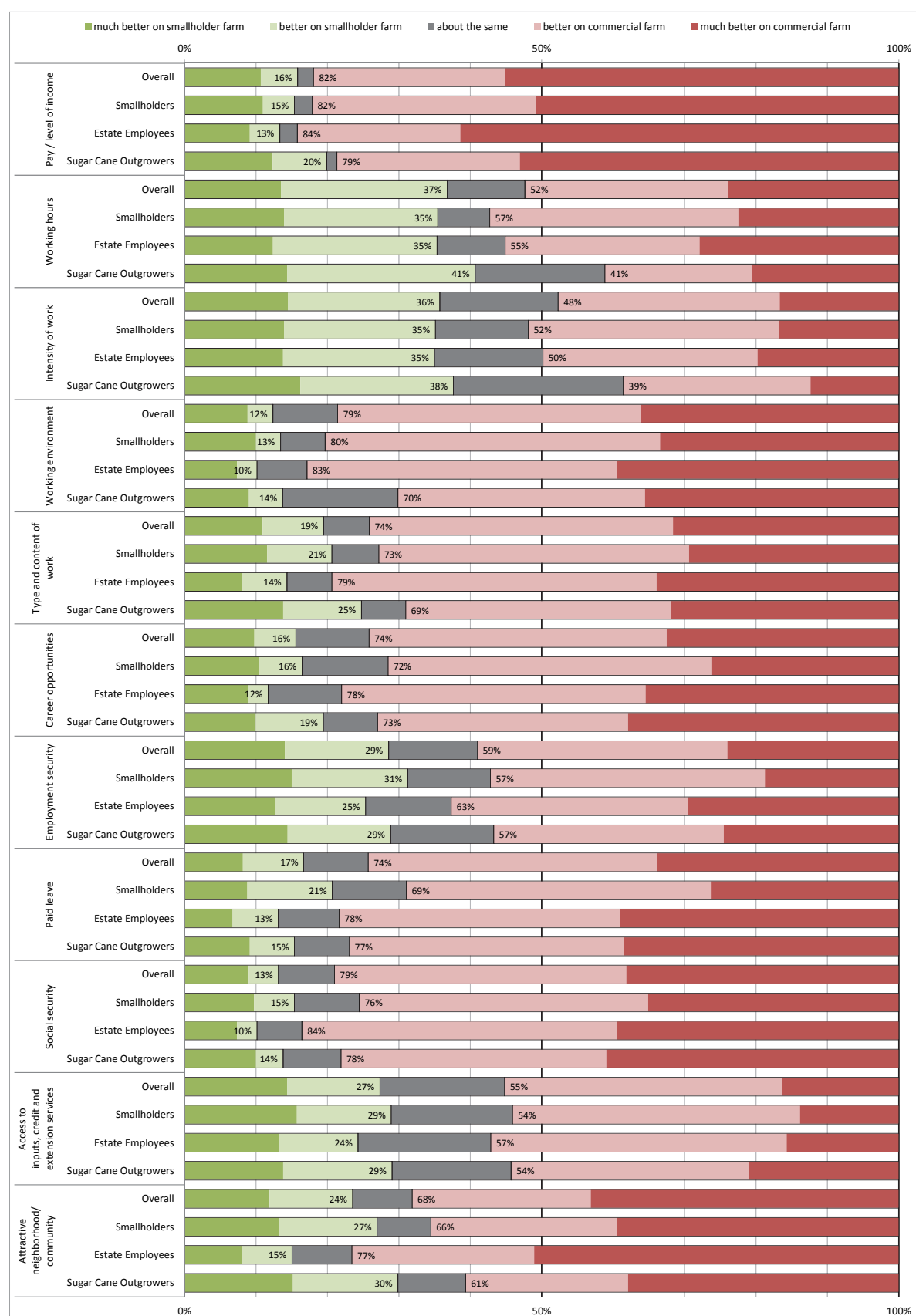


Source: Household survey (see Section 3.3.1).

Figure 19: Pros and Cons of Being the Head on a Smallholder Farm or an Employee on a Commercial Farm

Source: Household survey (see Section 3.3.1).

Figure 20: Pros and Cons of Being an Employee on a Smallholder or a Commercial Farm



Source: Household survey (see Section 3.3.1).

3.6 Conclusions

In this chapter we analyzed the extent to which agricultural FDI in the Zambian sugar industry benefit local households involved in sugar production. Contract farming and wage employment on large-scale farms were explored as two strategies for smallholder integration into commodity chains. The analysis drew upon data from a household survey carried out in 2012 specifically for this study, as well as on focus group discussions and expert interviews with the relevant stakeholders in Zambia's "sugar capital", Mazabuka.

The quantitative analysis of the household survey data, by means of multiple regression analysis as well as by propensity score matching, point towards a positive effect of participation in the sugar industry on (long-term) household wealth, as measured by a wealth index obtained by principal components analysis. Controlling for a range of factors and taking into account possible non-random selection, we find a significant and sizeable positive effect of participation for both sugar cane outgrower schemes and employment on large-scale sugar estates.

Participation in sugar cane outgrower schemes is associated with an increase in wealth of around 3.9 index points in all regression models. In addition, results from propensity matching suggest an increase in the magnitude of 2.9 to 3.9 index points compared to (similar) small-scale farmers unconnected to the sugar industry. The propensity matching results correspond to an increase by 48% to 71% in the wealth index. Employees on large-scale sugar estates also appear to achieve significantly higher wealth, although this effect is less pronounced. There are also some indications that employment on large sugar estates causes improved housing conditions rather than greater asset accumulation. In the regression models, households whose primary source of income is working on a large sugar farm score around two index points higher than small-scale farmers. The matching models estimate an increase of 1.4 points in the wealth index (+29%) compared to smallholders.

The descriptive statistics as well as the qualitative evidence from focus group discussions and interviews with KASCOL staff indicate that selection bias for sugar outgrowers in our data sample is not likely. The case for employees on large-scale farms is not that clear. Therefore, in addition we tested the sensitivity of the propensity score matching results to unobserved variable bias by calculating Rosenbaum bounds. These sensitivity tests suggest that the bias due to unobserved covariates would have to reach unlikely high levels in order to render spurious the asserted positive treatment effects.

Qualitative evidence from focus group discussions and expert interviews supports the results of the quantitative analysis to a large extent. Although participants in the sugar cane outgrower schemes certainly encounter difficulties of their own, their level of wealth is perceived higher compared to other small-scale farmers in the region by all focus groups.

Participation in a sugar outgrower scheme helps to overcome the major barriers that smallholder farmers in the region typically face. Irrigation infrastructure, farm machinery, crop transport as well as various services are provided at a cost by the scheme's management service provider. Participants can also rely on timely delivery of high quality inputs such as fertilizers and pesticides. Finally, supply agreements with the local sugar processor, Zambia Sugar Plc, assure them a secure market for their crop.

Despite the fact that the majority of participants in the focus group interviews clearly stated that they would like to join a sugar outgrower scheme if the opportunity arose, several farmers also pointed out possible negative effects. Mono cropping was seen to possibly lead to a high dependency on the local sugar mill and was also associated with environmental and social problems. For these reasons some interviewees stated that they would rather grow other crops or pursue alternative farming methods such as crop-rotation or intercropping, provided that they had access to irrigation infrastructure and inputs.

Perceptions about the benefits of employment on large-scale sugar estates were quite mixed. Households from all comparison groups generally stated that they would rather be small-scale farmers than work on a large-scale farm. However, given the repeatedly discussed problems that plague many small-scale farmers, employment can be a preferable alternative to farming one's own fields. Or it may be part of a household's income diversification strategy. Opportunities certainly exist, particularly for the young and healthy, as employment on large-scale sugar farms is to a large degree temporary. Contracts are usually on a short-term basis only. And after being laid off, or at latest upon retirement, employees have to move back to their villages.

Undoubtedly, wages in the agricultural sector remain low, inter alia due to a large supply of (low-qualified) labor. Workers feel that they are benefiting little despite rising operating profits from sugar cane production. In June 2012, these conflicts erupted into a three-day strike on the Zambia Sugar plantation, and at least 50 workers were charged with gross misconduct including setting fire to several cane fields (IUF 2012a, b; Zambia Daily Mail 2012). In response to these conflicts and the increase in the national minimum wage for domestic workers, Zambia Sugar and also some other commercial sugar farms increased their wages.

One manager on a sugar estate however pointed out that the wage increases may turn out to be a double-edged sword.⁴⁷ Due to continuing low labor productivity, companies are seeking to reduce the high share of labor costs (roughly 18% of total costs, considerably more on those farms that pay higher wages) by increasing mechanization or outsourcing to farms that pay lower wages. Labor-saving technologies are already being used in many countries in several

⁴⁷ Source: Expert interview conducted in September 2013.

stages of sugar cane production (e.g. mechanical application of fertilizer underground, sugar cane harvesting by chopper harvester instead of hand cutting). This aspect also needs to be taken into consideration when advocating higher wages.

Overall, the empirical results from both the quantitative and qualitative analyses reveal considerable support for both hypotheses 1 and 2. Participants in the sugar outgrower schemes achieve significantly higher levels of wealth than comparable smallholder farmers. Employees on sugar estates also achieve higher wealth, but the effect is not as large as for outgrowers and they appear to be less satisfied with their condition. Our results suggest that foreign direct investments in agriculture can have sizeable potential to improve the living conditions of smallholder farmers. Especially outgrower schemes seem to provide a successful strategy to overcome many of the main constraints to increasing productivity among smallholder farmers.

As the results may be context-specific to the sugar cane sector and local circumstances, there are limits as to which extent the findings may be generalized to settings or contexts beyond our sample. Generally, sugar cane outgrower schemes in other countries are similar to the ones in our sample. Still, sugar cane is almost exclusively produced in large-scale settings (commercial estates and outgrower schemes) hence our comparison is with smallholder farmers who farm other crops. Ideally, to avoid the problem that some of the positive impacts could be due to a generally higher profitability of producing sugar cane, one would compare smallholder farmers with outgrowers and employees on large-scale farms that all produce the same crop(s).

Despite the lack of a perfect counterfactual, there are strong indications that insufficient access to irrigation, to other agricultural inputs and technological know-how, and to input and output markets, is the key problem that most small-scale farmers in developing countries face – not the type of crop they produce. The yield gap between achieved and potential yields among small-scale farmers in Sub Saharan Africa is very high, independent of the crop produced. After all, the output of a farmer is a function of inputs (land, water, capital, labor and intermediate inputs) and the efficient use of these inputs, i.e. the total factor productivity, which can depend on a broad range of factors such as technology, access to markets, or managerial skills. Hence, for every crop produced there are rich and poor farmers, and the wealth differences are explained by the mode of production. In other words, our observed wealth increase resulting from participating in an outgrower scheme or from being employed on a large estate is predominantly affected by the mode of production and not by the switch to sugar. This is also confirmed in Chapter 4, where we observe similar effects with panel data for Zambia and for a variety of other crops. Moreover, as we analyze a long-term wealth effect, we can also exclude temporary price hikes as an influential covariate.

Chapter 4

Agricultural Commercialization and Smallholder Income in Zambia

Panel Data Evidence

Chapter Summary:

This chapter presents a quantitative analysis of the effects of smallholder commercialization in Zambia. Three rounds of representative household panel data from all Zambian provinces (MSU/FSRP/CSO 2001, 2004, 2008) serve to examine one particular group of small-scale farmers, namely those who are linked in some way to commercial farms – either through participation in outgrower schemes or as farm workers. We assess the impact of these linkages on overall household income as well as income from agricultural activities. Results from fixed effects estimation suggest considerable positive income effects of joining outgrower schemes. Households that increase their engagement in off-farm activities in general also achieve higher overall income. This is also the case for large-scale farm employment, even though non-agricultural off-farm work seems to contribute more to income growth.

4.1 Introduction

After an analysis of the sugar sector, this chapter now takes a wider stance, moving to an analysis of the impact of participation in outgrower schemes as well as large-scale farm employment in Zambia in general. Based upon longitudinal data from a nationwide household survey carried out in 2001, 2004, and 2008, we examine whether participation in outgrower schemes may constitute a viable way to enable small-scale farmers to participate in modern food production. Furthermore, we explore how other strategies of income diversification contribute to raising household income among rural households. These off-farm strategies include carrying out business activities, and taking up employment opportunities outside the own farm in general, and on large-scale commercial farms in particular.

The chapter is organized as follows. Section 4.2 presents the data and methodological strategy applied to analyze how outgrower schemes and off-farm activities affect incomes of rural households in Zambia. Section 4.3 discusses the findings, and conclusions are drawn in Section 4.4.

4.2 Data and Methodology

4.2.1 Supplemental Survey to the 1999/00 Post Harvest Survey

To analyze the impact of off-farm economic activities and participation in outgrower schemes on household income, we draw upon nationally representative data from the Zambian households surveyed as part of the Supplemental Surveys to the 1999/00 Post Harvest Survey. The Supplemental Survey (SS) was initiated by the Zambian Central Statistical Office (CSO) in conjunction with the Ministry of Agriculture and Cooperatives (MACO, now Ministry of Agriculture and Livestock MAL) and Michigan State University's Food Security Research Project (FSRP), to obtain panel data on rural incomes and livelihoods in Zambia. The first three rounds of the survey were conducted in 2001, 2004, and 2008 and covered the 1999/2000, 2002/03, and 2006/07 crop years.⁴⁸ The data collected include a broad range of demographic characteristics of households, off-farm income activities and earnings, land holdings, actual estimates of crop sales and purchases, fertilizer purchases, services offered by farmer organizations, farmer adoption of conservation farming practices, milk and egg production, asset holdings and general perceptions.

⁴⁸ For a detailed description of the Supplemental Survey refer to FSRP (2008). A fourth survey round was carried out in 2012. Unfortunately this survey did not follow the same panel households as in the previous years. Therefore we restrict our analysis to the first three rounds of the survey.

The sampling frame of the Supplemental Surveys (SS) is based on the nationally representative 1999/2000 Post Harvest Survey (PHS) which builds upon information and cartographic data from the 1990 Zambia Census of Population and Households. The Supplemental Survey includes only households that engage in agricultural activities such as cultivating crops, raising livestock or poultry, or fish farming. Non-agricultural households were excluded. The sample size for the 2001 SS was 6'922 households. In the following survey waves, the same households were revisited, but fairly high attrition rates reduced the sample size to 5'420 households for SS 2004, and 4'286 households for SS 2008.

4.2.2 Income Sources among Smallholder Households in Zambia

Smallholder farmers in Zambia usually carry out different kinds of economic activities. The Post Harvest Survey includes an in-depth coverage of a households income sources. It accounts for both monetary and in-kind receipts received by household members for employment, property income, income from the production of goods and services for own consumption, and current transfers received (incl. social transfers). Therefore for this study our dependent variable, household economic well-being, is measured by two different components of household income. First, we use the logarithm of the net household income (in 2008 Zambian Kwacha). This is the sum of the following six sources of household income generated by any household member: 1) the net income from agricultural production (which is the sum of the gross value of crop production and the value of vegetable sales minus the total cost of all fertilizer used on the farm), 2) total income from live and slaughtered animal sales, 3) the value of production of eggs and milk, 4) net income from informal or business activities, 5) total income from salary or wage employment, and finally 6) cash and in-kind remittances received. While net values are not available for all income sources, this measure takes into account the costs of fertilizer and the costs of running a business. Our proxy for net household income is therefore believed to represent a better measure of a household's income than gross household income.

Second, we look specifically at the determinants of agricultural production, with the logarithm of the net income from agricultural production (calculated as just mentioned and again in constant 2008 prices) as our dependent variable.

4.2.3 Determinants of Household Income

Two previous studies, which use the same panel data set, have analyzed important determinants of smallholder economic well-being in Zambia. Bigsten and Tengstam (2011) study data from the 2001 and 2004 rounds of the Supplemental Survey. They find that a higher diversification of income sources contributes to raising incomes among smallholder households. Their study also suggests that endowments (e.g. human capital, land) as well as access to markets and finance are the factors that influence which economic activities are

carried out by a household (farming, agricultural wage work, non-agricultural wage work, and owning a business).

Chapoto et al. (2011) analyze all three round of the Supplemental Survey – like the analysis in this chapter – to identify factors associated with chronic and transient poverty in Zambia. The authors suggest two major pathways out of poverty for rural households. One entails agricultural asset accumulation and commercialization, the other creating off-farm employment opportunities through investments in secondary and post-secondary education.

Our study now aims to contribute to this research by analyzing how participation in outgrower schemes affects household wealth. In addition, we study in more detail which types of off-farm employment opportunities are especially beneficial, i.e. differentiating between business activities, wage employment in general, and wage employment on large-scale farms in particular.

Unfortunately, despite the broad scope of data collected, the survey does not allow to study the effects of FDI on the livelihoods of smallholder farmers. No information was collected regarding the ownership of companies or commercial farms where household members are employed or regarding the ownership of the outgrower schemes in which households participate. It is therefore impossible to say whether the economic impact of foreign-owned companies or foreign-owned outgrower schemes is any different from that of domestic firms. However, it is worth mentioning that FDI have historically played a substantial role in the Zambian economy, not only in the mining sector (cf. Chapter 2). Therefore large companies in Zambia are often at least partly foreign owned.

Furthermore, the majority of outgrower schemes in the sample are involved in cotton production. Cotton is produced almost entirely by small-scale farmers, but within outgrower schemes run by ginning companies. Since privatization in the mid-1990s, cotton ginning is firmly in the hands of multi-national companies. The two current major competitors Dunavant Cotton and Cargill make up about 80% of the Zambian market. Together with other multi-national companies they accounted for about 90% of ginning capacity and 95% of throughput in 2006, while the remainder was produced by locally owned companies (ACI and Agridev Consult 2008, p. 40ff.).

Given the lack of data on ownership, the two hypotheses from Chapter 3 are adapted as follows:

Hypothesis 1:	Participants in outgrower schemes achieve higher levels of household economic well-being (income) than smallholder farmers.
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Hypothesis 2:	Employees on large-scale estates achieve higher levels of household economic well-being (income) than smallholder farmers.
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In addition, a third hypothesis addresses the impact of off-farm economic activities in general:

Hypothesis 3: Households that diversify their incomes through off-farm economic activities such as running a business or taking up wage employment achieve higher levels of household economic well-being (income) than households relying on agriculture alone.

To this end we construct from the available data several indicators that measure a household's linkages to outgrower schemes as well as whether household members earn money from off-farm activities. A household's connections to outgrower schemes are measured as follows. First, we have an overall dummy variable which indicates whether the household received any services from a private outgrower firm. In the next step we further differentiate the nature of these services by means of three dummy variables. We distinguish whether a household received:

1. Information or training
2. Inputs or credit in cash or kind
3. Transportation services or links to a buyer

In addition we calculate the percentage of all area cultivated that was cropped with links to at least one outgrower scheme. Here an area under a certain crop is counted as having such links if the household received most seeds from a private outgrower firm and/or where the largest sales transaction for this crop was with this type of buyer. This information is only available for the years 2004 and 2008.

To assess the impact of off-farm employment activities, we use several measures.

1. Like Chapoto et al. (2011), we use the percentage of net income from off-farm activities (salary and wage income, formal and informal business income activities) in relation to net household income. This serves to account for how diversified the income portfolio of a household is overall. It is hypothesized that households with a more diversified income portfolio achieve higher incomes than those who rely mainly on farm income (cp. Chapoto et al. 2011).

In addition, we use the following variables to differentiate further the impact of different off-farm income sources.

2. The percentage of net income from business activities in relation to net household income.
3. The percentage of income from salary or wage employment activities in relation to net household income.

4. The percentage of income from salary or wage employment activities on a large-scale farm in relation to net household income.

The remaining explanatory variables were selected according to theory and similar studies which analyze the determinants of household wealth (Deininger and Okidi 2003; Muyanga et al. 2010; Chapoto et al. 2011). We control for household demographics by including characteristics of the household head, namely the head's gender, age and education level. We control for a household composition by including the number of adult equivalents.⁴⁹

A household's landholding size (including both cultivated and fallow land) directly influences its possibilities to carry out farming or other activities. In addition, larger farm sizes may increase the likelihood and benefits of participating in outgrower schemes, as it lowers the average fixed costs associated with participation (time spent to attend meetings, possible fees and other costs of participation). At the same time, the size of a farm affects the amount of labor required and thus will likely have an impact on the number of household members carrying out off-farm activities. We also included an indicator whether the household used fertilizer in some regression models. Including this variable did not affect the results substantially. As there is no data on the use of irrigation and the available proxy for fertilizer use is of questionable quality, we chose not to include this indicator in our main models.

A variety of shocks are known to have potentially large effects on a rural household's income. We capture such adverse events by a measure of the number of chronically ill adults (age 12 and older) and infants (younger than 5). Furthermore, the number of deceased adult and non-adult (age younger than 12) household members is included.

Year dummies are included to address general trends in overall economic development that are not captured by the included explanatory variables.

⁴⁹ Adult equivalents as measured in the survey are calculated based upon a weighting mechanism that takes into account the age and gender of all adult household members as well as children aged seven and above. Males between 30 and 60 years old are weighted with one. Children between 7 and 14, and household members older than 60 are weighted lower depending on their age and sex (for details refer to the SS syntax files (MSU/FSRP/CSO 2001, 2004, 2008)).

4.2.4 Impact Estimation Methodology

Our empirical approach to analyze the main determinants of household income can be formalized in the following equation:

$$\log Y_{it} = \alpha_i + \beta_1 \text{outgrower}_{it} + \beta_2 \text{off-farm}_{it} + \beta_3 X_{it} + u_{it} \quad (2)$$

The dependent variable is the logarithm of income Y_{it} of household i at year t ($\log Y_{it}$). outgrower_{it} is one of the measures whether the household participated in any outgrower schemes (both domestic and foreign-owned). off-farm_{it} is one of the variables indicating the percentage of income that a household earns from off-farm activities (both in domestic and foreign-owned businesses). X_{it} denotes a vector of control variables affecting both the dependent variable and the participation in outgrower schemes or off-farm employment. α_i is the unknown intercept for each household (n entity-specific intercepts). u_{it} is the error term capturing unobservable survey characteristics.

We estimate several models using different indicators to measure a household's integration into commercial commodity chains by means of a multivariate regression model. The coefficients β_1 and β_2 approximate the income effect of participating in an outgrower scheme or being involved in off-farm economic activities. u_{it} indicates the household-year fixed effects that reflect time-varying unobservable characteristics. This solves the problem of unobserved characteristics such as ability, as long as they do not change over time. As it is unlikely that the unobserved heterogeneity is uncorrelated with the variables in the model, we consider the fixed effects estimator to deliver a more convincing estimation of the ceteris paribus effects than random effects. Hausman tests were carried out and confirm indeed that fixed effects are preferable to random effects.⁵⁰

⁵⁰ Nonetheless, estimates using random effects and pooled OLS are very similar. Finally, we consider the possibility that the idiosyncratic errors u_{it} are serially correlated. If we expect the unobserved factors that change over time to be serially correlated, first differencing may be more efficient. Results are not sensitive to the choice of the first difference or fixed effects estimator and are available from the author upon request.

4.3 Results and Discussion

4.3.1 Descriptive Statistics

The following table gives an overview of the relevance of each income source between 2001 and 2008. The average real net household income in the sample increased from 2'820'062 Zambian Kwacha (ZMK) in 2001 to 3'280'930 ZMK in 2008 (both figures are in 2008 ZMK). This corresponds to approx. 1'788 USD respectively 2'080 USD (at USD 2008 PPP, i.e. using purchasing power parity rates). The corresponding net household income per adult equivalent is about 622'435 ZMK (395 USD) in 2001 and 713'711 ZMK (453 USD) in 2008 (not shown).

Table 23: Composition of Net Household Income in 2001, 2004, and 2008 (in 2008 ZMK and Percent)

	2001 (Observations= 4176)		2004 (Observations= 4178)		2008 (Observations= 4177)	
	Mean	Percent	Mean	Percent	Mean	Percent
Net Household income	2'820'062	100.0%	3'272'104	100.0%	3'280'930	100.0%
<i>Net farm income</i>	1'600'774	56.8%	2'115'961	64.7%	1'753'669	53.5%
<i>Net income from agricultural production</i>	1'459'650	51.8%	1'893'552	57.9%	1'490'007	45.4%
Gross value of crop production	1'412'484	50.1%	1'865'395	57.0%	1'489'141	45.4%
Value of vegetable sales	161'257	5.7%	158'167	4.8%	173'516	5.3%
- Total cost of all fertilizer used on farm (excl. transport)	-114'091	-4.0%	-130'011	-4.0%	-172'651	-5.3%
<i>Total income from live and slaughtered animals</i>	70'568	2.5%	151'591	4.6%	167'669	5.1%
<i>Value of production of eggs and milk</i>	70'557	2.5%	70'818	2.2%	95'993	2.9%
<i>Net off-farm income</i>	1'219'287	43.2%	1'156'143	35.3%	1'527'261	46.5%
<i>Net income from informal or business activities</i>	644'183	22.8%	575'498	17.6%	808'411	24.6%
<i>Total income from salary or wage employment</i>	511'845	18.2%	540'728	16.5%	497'146	15.2%
Agricultural off-farm wage income	61'001	2.2%	84'518	2.6%	51'675	1.6%
On large farms	43'693	1.5%	57'125	1.7%	31'102	0.9%
On small farms	17'307	0.6%	27'393	0.8%	20'573	0.6%
Non-agricultural off-farm wage income	450'844	16.0%	456'209	13.9%	445'471	13.6%
<i>Cash and in kind remittances received</i>	63'259	2.2%	39'918	1.2%	221'704	6.8%

Notes: All mean values are in 2008 Zambian Kwacha. Percent figures indicate each income source's share of net household income. Weights are used. Households with the top and bottom one percentile of net household income are excluded in order to deal with likely measurement errors.

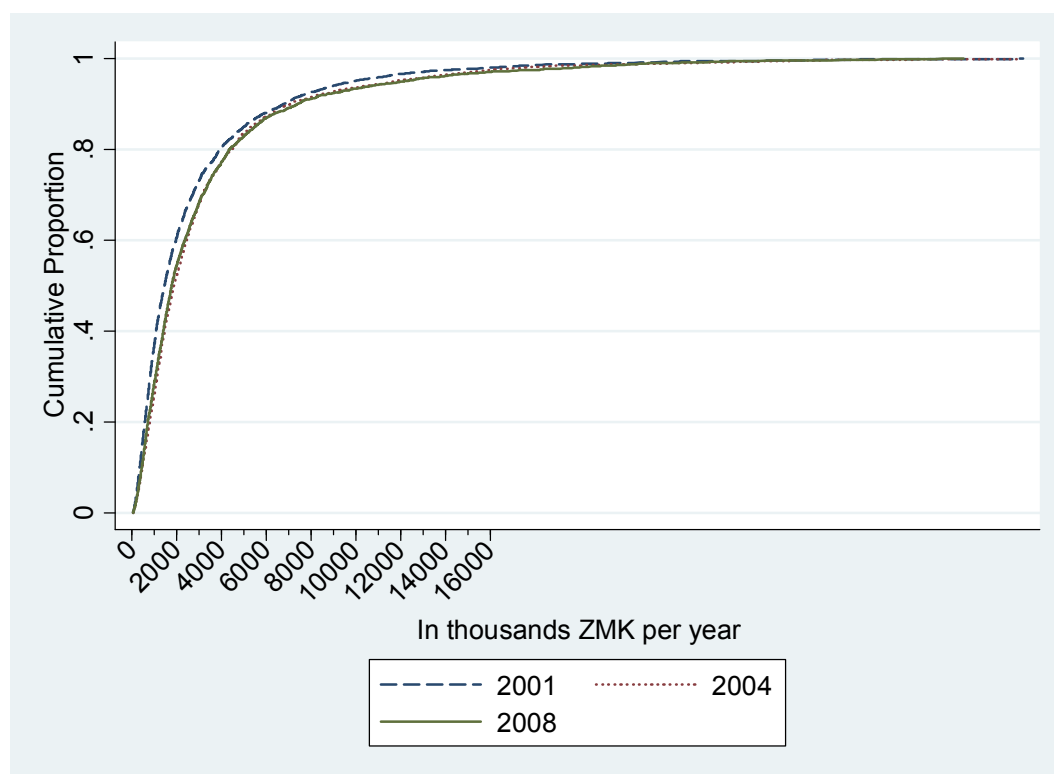
Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

Farming activities account for between 54 and 65% of net household income. The vast majority thereof originates from the agricultural production of crops and vegetables, although the share of net income from agricultural production is somewhat smaller in 2008 than in 2001 due to higher expenses for fertilizer. Income from live and slaughtered animals and the production of eggs and milk account for roughly 6% of net household income.

Among the "off-farm" activities, i.e. economic activities carried out outside the household's own farm, income from informal or business activities contribute the most. Salary or wage employment declined over the study period, as both its subcategories – wage in the agricultural sector and in other sectors – have decreased in absolute as well as relative terms. Wage employment on small and large farms only account for around 2% of overall net incomes, and figures suggest that wage employment on large-scale farms has declined from 2001 to 2008.

The distribution of income is highly skewed to the left. Figure 21 shows the cumulative distribution of real net income for all survey years. The figure reveals that about 80% of all households in the sample earn less than 4 million Kwacha per year (approx. 2'536 USD at 2008 PPP). This is less than 1 million Kwacha (634 USD at 2008 PPP) per year per adult equivalent (not shown). The high income inequality also becomes apparent when looking at the average net household income per quintile (first row in Figure 22). In 2008, the average net income for the poorest 20% of households was 446'000 ZMK, while the average for the richest quintile was close to 10.6 million ZMK – roughly 23 times more.

Figure 21: Household Income Distribution, 2001, 2004, and 2008

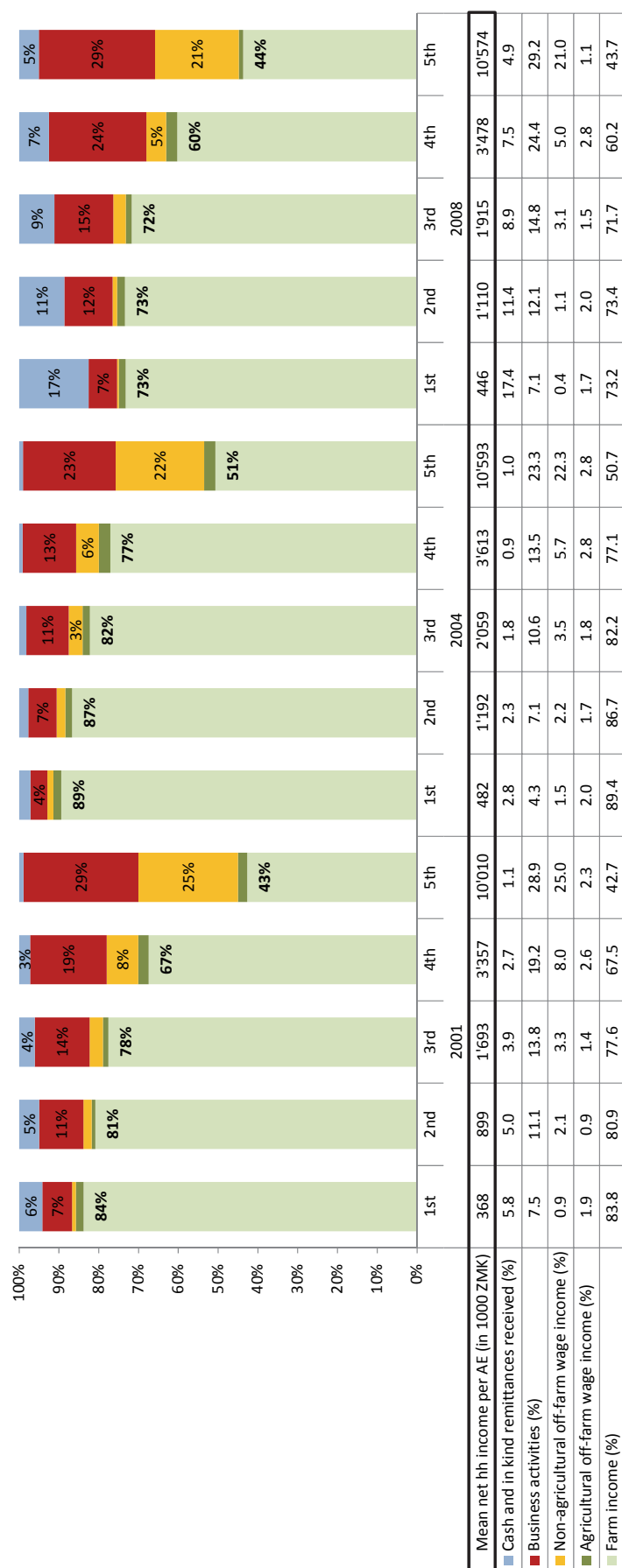


Notes: Weights are used. Households with the top and bottom one percentile of net household income are excluded in order to deal with likely measurement errors.

Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

As mentioned, the composition of household incomes reveals the high importance of agricultural activities for the majority of rural households. However, farming activities become less important for more affluent households. Figure 22 shows the share of income from the most important sources by quintile. The households with the lowest net household incomes in the first quintile earn between 73 and 89% of their income through farming. This figure drops continuously to between 44 and 51% for the households with the highest overall incomes. Higher quintiles depend more on business and non-agricultural off-farm incomes. Employment in the agricultural sector plays a low, but comparable role in all quintiles. Finally, remittances constitute a bigger share of income in poorer households.

Figure 22: Household Income Sources by Quintile in 2001, 2004, and 2008



Notes: Households were split into income quintiles based upon yearly net household income from all income sources. The first row shows the mean net household income in each quintile (in thousands of 2008 ZMK). The other figures denote each category's income share. Weights are used. Households with the top and bottom one percentile of gross household income are excluded to deal with likely measurement errors.

Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

Summary statistics for all other variables used in the analysis are shown in Table 24. Reported are the overall means, standard deviations, minima and maxima. In addition, the standard deviation is decomposed into between and within components.

Table 24: Descriptive Statistics of Selected Variables

		Mean	Std. Dev.	Min	Max	Observations
Dependent Variables:						
Net hh income in 2008 Kwacha (log)	overall	14.450	1.151	10.897	17.499	N = 12531
	between		0.923	11.734	17.492	n = 4281
	within		0.713	10.915	17.369	T-bar =2.9
Net income from agricultural production in 2008 Kwacha (log)	overall	13.858	1.167	7.044	17.464	N = 12242
	between		0.931	9.686	17.146	n = 4270
	within		0.737	9.571	17.319	T-bar =2.9
Participation in Outgrower Schemes:						
Received some services from private outgrower firm (y/n)	overall	0.120	0.325	0.000	1.000	N = 12531
	between		0.258	0.000	1.000	n = 4281
	within		0.199	-0.546	0.787	T-bar =2.9
Received some services from private outgrower firm (y/n)	overall	0.023	0.151	0.000	1.000	N = 12531
	between		0.092	0.000	1.000	n = 4281
	within		0.121	-0.643	0.690	T-bar =2.9
Received information or training from private outgrower firm (y/n)	overall	0.095	0.294	0.000	1.000	N = 12531
	between		0.226	0.000	1.000	n = 4281
	within		0.188	-0.571	0.762	T-bar =2.9
Transportation services or link to buyer through private outgrower firm (y/n)	overall	0.087	0.282	0.000	1.000	N = 12531
	between		0.210	0.000	1.000	n = 4281
	within		0.189	-0.579	0.754	T-bar =2.9
Area cropped with links (seed/buyer) to outgrower schemes (% of cultivated area)	overall	5.659	15.472	0.000	100.000	N = 7754
	between		12.890	0.000	100.000	n = 4151
	within		8.276	-44.341	55.659	T-bar =1.9
Off-farm Economic Activities:						
Net income from off-farm activities (% of overall net income)	overall	26.760	32.528	0.000	100.000	N = 12531
	between		24.694	0.000	100.000	n = 4281
	within		21.557	-39.659	93.427	T-bar =2.9
Net income from business activities (% of overall net income)	overall	13.720	25.548	0.000	100.000	N = 12531
	between		18.455	0.000	99.731	n = 4281
	within		17.924	-52.418	80.387	T-bar =2.9
Income from salary or wage employment (% of overall net income)	overall	7.647	21.175	0.000	100.000	N = 12531
	between		17.578	0.000	97.604	n = 4281
	within		12.286	-58.209	74.314	T-bar =2.9
Income from wage activities on large-scale farms (% of overall net income)	overall	1.050	8.410	0.000	100.000	N = 12531
	between		6.626	0.000	89.321	n = 4281
	within		5.270	-64.415	67.717	T-bar =2.9
Household Characteristics:						
Adult equivalents	overall	5.121	2.671	0.083	34.340	N = 12531
	between		2.294	0.617	26.280	n = 4281
	within		1.409	-5.891	18.245	T-bar =2.9
Female household head (y/n)	overall	0.221	0.415	0.000	1.000	N = 12531
	between		0.381	0.000	1.000	n = 4281
	within		0.166	-0.446	0.887	T-bar =2.9
Age of household head (years)	overall	49.223	15.081	15.000	104.000	N = 12383
	between		13.989	19.667	94.000	n = 4280
	within		5.636	10.890	84.556	T-bar =2.9
Upper primary (4-7 years)	overall	0.442	0.497	0.000	1.000	N = 12377
	between		0.402	0.000	1.000	n = 4280
	within		0.293	-0.225	1.109	T-bar =2.9
Secondary (8-12 years)	overall	0.192	0.394	0.000	1.000	N = 12377
	between		0.338	0.000	1.000	n = 4280
	within		0.202	-0.475	0.859	T-bar =2.9
Post-secondary (>12 years)	overall	0.018	0.133	0.000	1.000	N = 12377
	between		0.116	0.000	1.000	n = 4280
	within		0.077	-0.649	0.685	T-bar =2.9

		Mean	Std. Dev.	Min	Max	Observations
Farming and Shocks:						
Household owns any livestock (excl. chickens) (y/n)	overall	0.420	0.494	0.000	1.000	N = 12531
	between		0.391	0.000	1.000	n = 4281
	within		0.303	-0.246	1.087	T-bar =2.9
Number of chickens owned (log)	overall	1.617	1.268	0.000	6.399	N = 12531
	between		0.917	0.000	5.707	n = 4281
	within		0.884	-1.183	5.274	T-bar =2.9
Area (ha) under crops plus fallow land (log)	overall	0.508	0.888	-2.813	5.456	N = 12364
	between		0.724	-2.324	3.652	n = 4273
	within		0.541	-2.247	3.115	T-bar =2.9
Number of deaths of adult household members (age 12+)	overall	0.091	0.316	0.000	5.000	N = 12531
	between		0.190	0.000	1.667	n = 4281
	within		0.253	-1.576	3.424	T-bar =2.9
Number of deaths of non-adult household members (age<12)	overall	0.009	0.097	0.000	2.000	N = 12531
	between		0.056	0.000	0.667	n = 4281
	within		0.080	-0.658	1.342	T-bar =2.9
Number of chronically ill adults (age>11)	overall	0.142	0.447	0.000	9.000	N = 12531
	between		0.274	0.000	3.333	n = 4281
	within		0.353	-3.191	5.809	T-bar =2.9
Number of chronically ill infants (age <5)	overall	0.051	0.255	0.000	6.000	N = 12531
	between		0.148	0.000	2.000	n = 4281
	within		0.208	-1.949	4.051	T-bar =2.9

Notes: Reported are the overall means, standard deviations, minima and maxima. In addition, the standard deviation is decomposed into between and within components. For example, looking at the number of chronically ill infants (last row), the mean for the 12'531 observations is 0.051 with a standard deviation of 0.255. The average number of ill infants for the 4'281 households varied between 0 and 2. The within numbers refers to the deviation from each household's average over time, i.e. some households deviated from their average between -1.949 and +4.051 ill children. T-bar refers to the average number of years that this variable was observed for each household. Descriptive statistics generated using Stata/SE 12.1's xtsum command. Weights are not supported by xtsum. Households with the top and bottom one percentile of gross household income are excluded to deal with likely measurement errors.

Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

4.3.2 Regression Results

Main Results: Impact of Outgrower Schemes and Off-Farm Earnings

This section presents the findings. All estimates discussed are calculated with year and household fixed effects. There is little reason to believe that all unobserved effects are uncorrelated with each explanatory variable. The Hausman specification test confirms that fixed effects are more appropriate than random effects.⁵¹

Table 25 presents the results for the main model (Model 1). It evaluates the impact of outgrower scheme participation and off-farm employment on overall net household income (column 1) as well as on net agricultural production (column 2).⁵² Both dependent variables are log-transformed.

Model 1 confirms the positive effect of a household being linked to an outgrower scheme, as postulated in Hypothesis 1. The overall dummy variable equals one (zero otherwise) if a household received any of the following services from private outgrower schemes: information or training, inputs or credit in cash or kind, and/or transportation services or link to a buyer. The results confirm that participation in outgrower schemes is associated with higher overall household income as well as higher income from agricultural production. Participating in an outgrower scheme raises overall net household income by about 23% [$0.225 = \exp(0.203) - 1$], *ceteris paribus* (column 1).

How do results change when we use net agricultural production as our dependent variable, the key income source for most smallholder farmers? Taking part in outgrower schemes is associated with potential benefits in terms of better access to input and output markets, but may also involve costs such as membership fees, transportation costs or time devoted to group coordination and related activities. These factors directly impact incomes from agricultural production which is just one (although a central) source of overall household income. The income effect of outgrower scheme participation on agricultural production is thus greater

⁵¹ Estimates by pooled OLS as well as random effects are very similar and are available from the author upon request.

⁵² The net household income is the sum of all on-farm (net income from agricultural production, income from live and slaughtered animals, and the production of eggs and milk) and off-farm activities (running a business, carrying out wage activities, and receiving remittances) observed during all survey waves. The net income from agricultural production is equal to the sum of the gross value of all crops harvested and total vegetable sales, minus the total cost of all fertilizer. Estimates using the gross household income and the gross value of agricultural production yielded very similar results and are available from the author upon request. Models with the net household income per adult equivalent respectively net agricultural income per adult equivalent as the dependent variable also yield very similar results.

than the effect on overall household income, as confirmed by the larger coefficients in column 2 in the magnitude of 25%.

Table 25: Main Results (Model 1): Effect of Outgrower Schemes and Off-Farm Economic Activities on Net Household Income and on Net Value of Agricultural Production (Fixed Effects)

	Dependent Variable	
	Log of net household income	Log of net value of agricultural production
Participation in Outgrower Schemes:		
Received some services from private outgrower firm (y/n)	0.203*** (0.031)	0.221*** (0.033)
Off-farm Economic Activities:		
Net income from off-farm activities (% of overall net income)	0.012*** (0.000)	-0.009*** (0.000)
Household Characteristics:		
Adult equivalents	0.035*** (0.005)	0.029*** (0.005)
Female household head (y/n)	-0.226*** (0.049)	-0.148*** (0.050)
Age of household head (years)	0.020*** (0.007)	0.020*** (0.007)
Squared age of household head	-0.000*** (0.000)	-0.000*** (0.000)
Upper primary (4-7 years)	0.023 (0.028)	0.017 (0.028)
Secondary (8-12 years)	0.102** (0.041)	0.114*** (0.044)
Post-secondary (>12 years)	0.360*** (0.089)	0.280** (0.128)
Farming and Shocks:		
Household owns any livestock (excl. chickens) (y/n)	0.182*** (0.023)	0.061** (0.024)
Number of chickens owned (log)	0.066*** (0.008)	0.053*** (0.008)
Area (ha) under crops plus fallow land (log)	0.386*** (0.014)	0.464*** (0.015)
Number of deaths of adult household members (age 12+)	0.034 (0.029)	0.016 (0.030)
Number of deaths of non-adult household members (age<12)	-0.085 (0.105)	-0.163 (0.105)
Number of chronically ill adults (age>11)	-0.052** (0.020)	-0.050** (0.021)
Number of chronically ill infants (age <5)	-0.007 (0.034)	0.016 (0.036)
Survey year dummy variables (reference category = 2008)		
Year 2001	-0.098*** (0.023)	-0.104*** (0.024)
Year 2004	0.146*** (0.019)	0.143*** (0.020)
Constant	13.068*** (0.176)	13.109*** (0.180)
Observations	12212	12074
Adj R-sqr FE	0.57	0.54
F-test (model)	137.107***	132.536***
F-test(fixed effect)	1.602***	1.447***

Notes: All models include household (not shown) and year fixed-effects. Robust and cluster-corrected (Huber/White) standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

Model 1 also confirms the importance of off-farm earnings as stated in Hypothesis 3. Households that gain a greater percentage of their income through off-farm activities (running a business, carrying out wage activities, and receiving remittances) reach higher incomes than households that rely on agriculture alone. Holding all other variables in the model constant, a one percent increase of a household's income share from such activities increases household income by about 1.2%. The estimates for column 2 show that households that earn a higher share of income from off-farm activities achieve lower agricultural production in the magnitude of 0.9%. This makes sense as greater involvement in such activities is likely to happen at the expense of farming activities.

Regarding the control variables, results are consistent with the empirical evidence from the two studies presented in section 4.2.3. As expected, households with greater household equivalents reach higher incomes. Education plays an important role in poverty alleviation. All models corroborate that, *ceteris paribus*, households with heads completing education levels higher than the reference category of 0-3 years of education earned higher net incomes as well as agricultural incomes. However, this effect is only statistically significant for higher education levels with eight or more years of education.

Land availability constitutes a strong determinant of household income. Model 1 suggests that increasing land ownership by one percent leads to an increase in a household's net income of around 0.38% [$1.01^{0.386} = 1.00385$]. As can be expected, the same increase has a greater effect on net incomes from agricultural production, in the magnitude of 0.46%.

Female household headship is associated with significantly lower household income. The age variable has a significant positive effect, although with diminishing returns. While a household member's death does not seem to have a clear effect on incomes, the number of chronically ill adults does. This may reflect that ill members may not contribute as much to household incomes. At the same time they may require medical supplies as well as support by other household members.

Disentangling the Effects of Outgrower Schemes and Off-Farm Economic Activities

We now differentiate further the respective effects of participation in outgrower schemes and off-farm employment opportunities. Alternative model specifications serve to better understand how these activities influence incomes and to test the robustness of the main results. We begin with alternative models specifications to analyze the effects of participating in outgrower schemes. The main model showed a positive correlation between receiving services from a private outgrower scheme and the dependent variables. Models 2 to 5 in Table 26 and Table 27 distinguish further the type of services provided.

Receiving information or training seems to have a positive effect, although the effect is not significant in the fixed effects model. Receiving more comprehensive services such as access to inputs or credit, provision of transportation services, or linkages to buyers have highly significant positive income effects. Households receiving such services increase their net household income by an estimated 20 to 25%, and net income from agricultural production by 22 to 26%. As the correlation matrix reveals rather high correlations between some of these indicators, controlling for several outgrower indicators simultaneously might result in multicollinearity. Indeed, controlling for all types of services at the same time (not shown) corroborates consistent positive, yet often insignificant effects of each of these indicators. However, the F test for the joint hypothesis that all three variables are jointly statistically insignificant is rejected. This supports the interpretation that the correct partial effect of each variable in one single model may prove difficult to uncover due to collinearity.

Using the percentage of all cultivated area farmed linked to outgrower schemes (seed supply or buyer), the effect remains positive and significant. Farming one additional percent of land linked to an outgrower scheme is associated with 0.4% higher overall net income as well as net agricultural production. If for instance a household increases the area under outgrower production from 0 to 50%, the crop income will increase by an estimated 22% [$0.221 = \exp(0.004 \cdot 50) - 1$], holding other variables constant. This indicator catches the degree of integration into outgrower schemes. It thus is arguably the most precise measurement of a household's involvement in outgrower schemes, but is only available for 2004 and 2008.

Overall the results underline the positive association between participation in outgrower schemes and a household's net income from agricultural production as well as overall net income. And the effect is larger when taking into account the "degree of involvement in outgrower schemes" – it seems to pay off to intensify integration. Both the indicators for more wide-ranging linkages to outgrower schemes as well as farming a greater fraction of land under such schemes point toward large positive effects.

Table 26: Alternative Model Specifications for Impact of Outgrower Schemes on Income (Fixed Effects)

	Dependent Variable: Log of net household income			
	Model 2	Model 3	Model 4	Model 5
Participation in Outgrower Schemes:				
Received information or training from private outgrower firm (y/n)	0.018 (0.049)			
Received inputs or credit in cash or kind from private outgrower firm (y/n)		0.220*** (0.031)		
Transportation services or link to buyer through private outgrower firm (y/n)			0.184*** (0.032)	
Area cropped with links (seed/buyer) to outgrower schemes (% of cultivated area)				0.004*** (0.001)
Off-farm Economic Activities:				
Net income from off-farm activities (% of overall net income)	0.012*** (0.000)	0.012*** (0.000)	0.012*** (0.000)	0.013*** (0.001)
Household Characteristics:				
Adult equivalents	0.036*** (0.005)	0.035*** (0.005)	0.036*** (0.005)	0.028*** (0.009)
Female household head (y/n)	-0.229*** (0.049)	-0.226*** (0.049)	-0.224*** (0.049)	-0.235*** (0.078)
Age of household head (years)	0.020*** (0.007)	0.020*** (0.007)	0.020*** (0.007)	0.015 (0.014)
Squared age of household head	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	0.000 (0.000)
Upper primary (4-7 years)	0.021 (0.028)	0.024 (0.028)	0.020 (0.028)	0.010 (0.038)
Secondary (8-12 years)	0.099** (0.041)	0.100** (0.041)	0.100** (0.041)	0.083 (0.055)
Post-secondary (>12 years)	0.353*** (0.090)	0.361*** (0.089)	0.361*** (0.090)	0.398*** (0.140)
Farming and Shocks:				
Household owns any livestock (excl. chickens) (y/n)	0.185*** (0.023)	0.182*** (0.023)	0.182*** (0.023)	0.229*** (0.032)
Number of chickens owned (log)	0.066*** (0.008)	0.066*** (0.008)	0.066*** (0.008)	0.046*** (0.012)
Area (ha) under crops plus fallow land (log)	0.392*** (0.014)	0.387*** (0.014)	0.386*** (0.014)	0.381*** (0.021)
Number of deaths of adult household members (age 12+)	0.035 (0.029)	0.035 (0.029)	0.033 (0.029)	0.013 (0.040)
Number of deaths of non-adult household members (age<12)	-0.083 (0.105)	-0.088 (0.105)	-0.086 (0.105)	-0.244** (0.102)
Number of chronically ill adults (age>11)	-0.052*** (0.020)	-0.051** (0.020)	-0.051** (0.020)	-0.090*** (0.029)
Number of chronically ill infants (age <5)	-0.010 (0.034)	-0.007 (0.034)	-0.006 (0.034)	-0.014 (0.077)
Survey year dummy variables (reference category = 2008)				
Year 2001	-0.109*** (0.023)	-0.098*** (0.023)	-0.090*** (0.023)	
Year 2004	0.148*** (0.019)	0.150*** (0.019)	0.149*** (0.019)	0.116*** (0.023)
Constant	13.089*** (0.176)	13.076*** (0.176)	13.072*** (0.177)	13.490*** (0.382)
Observations	12212	12212	12212	7621
Adj R-sqr FE	0.57	0.57	0.57	0.58
F-test (model)	131.431***	138.584***	136.029***	65.517***
F-test(fixed effect)	1.624***	1.610***	1.606***	1.445***

Notes: All models include household (not shown) and year fixed-effects. Robust and cluster-corrected (Huber/White) standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

Table 27: Alternative Model Specifications for Impact of Outgrower Schemes on Agricultural Production (Fixed Effects)

	Dependent Variable:			
	Log of net value of agricultural production			
	Model 2	Model 3	Model 4	Model 5
Participation in Outgrower Schemes:				
Received information or training from private outgrower firm (y/n)	0.006 (0.054)			
Received inputs or credit in cash or kind from private outgrower firm (y/n)		0.229*** (0.033)		
Transportation services or link to buyer through private outgrower firm (y/n)			0.193*** (0.035)	
Area cropped with links (seed/buyer) to outgrower schemes (% of cultivated area)				0.004*** (0.001)
Off-farm Economic Activities:				
Net income from off-farm activities (% of overall net income)	-0.009*** (0.000)	-0.009*** (0.000)	-0.009*** (0.000)	-0.007*** (0.001)
Household Characteristics:				
Adult equivalents	0.031*** (0.005)	0.029*** (0.005)	0.030*** (0.005)	0.016* (0.009)
Female household head (y/n)	-0.152*** (0.050)	-0.149*** (0.050)	-0.146*** (0.050)	-0.176** (0.078)
Age of household head (years)	0.019*** (0.007)	0.019*** (0.007)	0.019*** (0.007)	0.014 (0.015)
Squared age of household head	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	0.000 (0.000)
Upper primary (4-7 years)	0.014 (0.028)	0.018 (0.028)	0.014 (0.028)	0.008 (0.039)
Secondary (8-12 years)	0.109** (0.044)	0.111** (0.044)	0.111** (0.044)	0.096* (0.058)
Post-secondary (>12 years)	0.272** (0.129)	0.280** (0.128)	0.280** (0.129)	0.073 (0.181)
Farming and Shocks:				
Household owns any livestock (excl. chickens) (y/n)	0.064*** (0.024)	0.061** (0.024)	0.062** (0.024)	0.096*** (0.034)
Number of chickens owned (log)	0.053*** (0.008)	0.053*** (0.008)	0.053*** (0.008)	0.022* (0.012)
Area (ha) under crops plus fallow land (log)	0.470*** (0.015)	0.465*** (0.015)	0.465*** (0.015)	0.451*** (0.022)
Number of deaths of adult household members (age 12+)	0.017 (0.031)	0.017 (0.031)	0.015 (0.030)	0.013 (0.043)
Number of deaths of non-adult household members (age<12)	-0.161 (0.105)	-0.166 (0.105)	-0.164 (0.105)	-0.255** (0.112)
Number of chronically ill adults (age>11)	-0.051** (0.021)	-0.049** (0.021)	-0.050** (0.021)	-0.074** (0.030)
Number of chronically ill infants (age <5)	0.012 (0.036)	0.015 (0.036)	0.016 (0.036)	0.008 (0.080)
Survey year dummy variables (reference category = 2008)				
Year 2001	-0.117*** (0.024)	-0.105*** (0.024)	-0.097*** (0.024)	
Year 2004	0.146*** (0.020)	0.148*** (0.020)	0.147*** (0.020)	0.121*** (0.024)
Constant	13.133*** (0.180)	13.119*** (0.179)	13.115*** (0.180)	13.544*** (0.402)
Observations	12074	12074	12074	7582
Adj R-sqr FE	0.54	0.54	0.54	0.55
F-test (model)	128.025***	134.852***	131.120***	57.475***
F-test(fixed effect)	1.473***	1.454***	1.452***	1.391***

Notes: All models include household (not shown) and year fixed-effects. Robust and cluster-corrected (Huber/White) standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

The main model points towards a strongly significant positive relation between a household's income share from off-farm economic activities and overall net household income. At the same time, greater diversification is accompanied by a moderate reduction in net income from agricultural production. Table 28 shows alternative model specifications to analyze the effects of different subcomponents off-farm economic activities on household incomes.

Model 6 distinguishes the two principal components of off-farm income, business activities as well as wage activities. When separately controlling for the percentage of overall household income earned through these activities, both are associated with significantly higher overall net household income. Holding all other variables constant, a one percent increase of a household's income share from business activities increases household income by about 1.5%. For wage employment the effect is a bit smaller, around 1.3%, but still positive and highly significant. At the same time, increasing diversification of incomes is again associated with lower agricultural production. A one percent increase in the share of income from business respectively wage activities is associated with a 0.6% respectively 0.8% decrease in net agricultural production.

Model 7 analyzes the effect of one particular type of wage activity, namely employment on large-scale farms. A one percent increase in the income share from employment on large-scale farms increases household net income by 0.9%. The effect is highly significant but smaller as for other types of wage employment or business activities – off-farm activities in other sectors than agriculture seem to contribute more to increasing incomes. Regressing the net value of agricultural production on the same set of explanatory variables confirms that increasing involvement in off-farm activities is accompanied by lower agricultural production. Interestingly, a one percent increase in income from working on large-scale estates reduces agricultural production by about 0.3% only. This is considerably less than the effect of overall employment and suggests that employment in the agricultural sector is more often carried out in parallel to farming activities than employment in other sectors.

Table 28: Alternative Model Specifications for Impact of Off-Farm Economic Activities (Fixed Effects)

	Dependent Variable			
	Log of net household income		Log of net value of agricultural production	
	Model 6	Model 7	Model 6	Model 7
Participation in Outgrower Schemes:				
Received some services from private outgrower firm (y/n)	0.190*** (0.030)	0.200*** (0.031)	0.224*** (0.033)	0.218*** (0.033)
Off-farm Economic Activities:				
Net income from business activities (% of overall net income)	0.015*** (0.000)	0.014*** (0.000)	-0.006*** (0.000)	-0.005*** (0.000)
Income from salary or wage employment (% of overall net income)	0.013*** (0.001)		-0.008*** (0.001)	
Income from wage activities on large-scale farms (% of overall net income)		0.010*** (0.001)		-0.003** (0.001)
Household Characteristics:				
Adult equivalents	0.028*** (0.005)	0.033*** (0.005)	0.031*** (0.005)	0.027*** (0.005)
Female household head (y/n)	-0.191*** (0.049)	-0.203*** (0.051)	-0.167*** (0.051)	-0.159*** (0.052)
Age of household head (years)	0.017*** (0.007)	0.015** (0.007)	0.022*** (0.007)	0.023*** (0.007)
Squared age of household head	-0.000** (0.000)	-0.000** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Upper primary (4-7 years)	0.024 (0.027)	0.031 (0.028)	0.005 (0.029)	0.000 (0.029)
Secondary (8-12 years)	0.088** (0.040)	0.108** (0.042)	0.107** (0.045)	0.094** (0.045)
Post-secondary (>12 years)	0.335*** (0.088)	0.471*** (0.107)	0.285** (0.134)	0.198 (0.135)
Farming and Shocks:				
Household owns any livestock (excl. chickens) (y/n)	0.173*** (0.022)	0.173*** (0.023)	0.070*** (0.025)	0.071*** (0.025)
Number of chickens owned (log)	0.063*** (0.008)	0.065*** (0.008)	0.053*** (0.009)	0.052*** (0.009)
Area (ha) under crops plus fallow land (log)	0.378*** (0.014)	0.361*** (0.014)	0.476*** (0.015)	0.487*** (0.016)
Number of deaths of adult household members (age 12+)	0.034 (0.029)	0.043 (0.030)	0.016 (0.031)	0.009 (0.032)
Number of deaths of non-adult household members (age<12)	-0.105 (0.105)	-0.084 (0.105)	-0.163 (0.104)	-0.178* (0.105)
Number of chronically ill adults (age>11)	-0.050*** (0.019)	-0.046** (0.020)	-0.055** (0.021)	-0.059*** (0.022)
Number of chronically ill infants (age <5)	0.005 (0.033)	0.017 (0.033)	0.010 (0.036)	0.004 (0.037)
Survey year dummy variables (reference category = 2008)				
Year 2001	-0.164*** (0.022)	-0.152*** (0.023)	-0.048** (0.024)	-0.056** (0.024)
Year 2004	0.065*** (0.018)	0.067*** (0.018)	0.227*** (0.020)	0.225*** (0.020)
Constant	13.245*** (0.172)	13.362*** (0.178)	12.905*** (0.181)	12.841*** (0.182)
Observations	12212	12212	12074	12074
Adj R-sqr FE	0.59	0.56	0.53	0.52
F-test (model)	156.906***	124.157***	108.661***	100.554***
F-test(fixed effect)	1.609***	1.818***	1.443***	1.444***

Notes: All models include household (not shown) and year fixed-effects. Robust and cluster-corrected (Huber/White) standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculations using data from CSO/FSRP Supplemental Surveys 2001, 2004, and 2008.

4.4 Conclusions

A considerable body of literature has shown that greater diversification of income sources among smallholder farmers is associated with higher overall income. At the same time, off-farm income may enable farmers to invest in key farming inputs and thus increase agricultural productivity. Another strategy to overcome prevalent constraints to efficient agricultural production is to integrate small-scale farmers into larger food supply chains through outgrower schemes. Despite the potential benefits of both these avenues of smallholder commercialization, there is a lively discussion about the impact of large-scale commercial farms on the surrounding communities. The most frequent criticism is that agricultural wage work is poorly paid and that commercial farms may aggravate land shortage by occupying and perhaps even driving off smallholders from the most valuable farmland. Studies on the impact of outgrower schemes on participating smallholders provide mixed evidence. Case studies reveal that collective action and institutional support can enable smallholders to participate in high-value markets, although there are also various cases documented where such groups failed to improve the livelihoods of participating farmers.

The presented study aims to contribute to this discussion by examining empirically two specific ways how small-scale farmers may be integrated into international food supply chains. One is through participation in outgrower schemes, the other through employment opportunities on large-scale farms. In addition, we examine how diversification of income sources through other off-farm activities such as running a business or wage employment in other sectors than agriculture affect smallholder economic well-being. Unlike most of the literature on smallholder diversification in Africa, we use panel data evidence from three rounds of a large, nationally representative household survey conducted among small-scale farmers in Zambia. Our analysis suggests that both participation in outgrower schemes and off-farm employment (including agricultural wage work) are associated with significantly higher net incomes.

The analysis supports the argument that outgrower schemes may constitute a promising strategy to increase agricultural productivity among small-scale farmers. Using several indicators to measure participation in such schemes suggests significant positive effects on net agricultural incomes and also on overall net household incomes. Households that receive services from an outgrower scheme increase overall net income by approximately 23%, and net income from agricultural production by around 25%.

Our results confirm the importance of off-farm earnings as a pathway out of poverty found in similar studies. Households that earn greater shares of their income through off-farm activities tend to increase their net household income significantly. Holding all other variables constant, households that increase the share of overall income earned through off-farm activities by one percent, reach about 1.2% higher total income. When differentiating further into business and

wage activities, the former seem to have particularly strong positive effects. Households which diversify their income through agricultural wage work also reach higher incomes, although wage earning activities in other sectors than agriculture seem to have stronger positive effects. Households that earn higher shares of their overall income through off-farm activities do this partly at the expense of agricultural production. A one percent increase in the income share from off-farm activities is associated with 0.9% lower agricultural production.

Overall, the results support all three hypotheses. Participation in outgrower schemes as well as employment on large-scale farms is associated with significantly higher household economic well-being. Both seem to provide important opportunities for rural households. Outgrower schemes may help to overcome the main constraints that smallholder farmers struggle with, reduce transaction costs and thus allow them to partake in the procurement systems of large-scale agroprocessors and supermarket chains. Employment on large-scale farms also increases overall income, although our results suggest that employment in other sectors contributes more to increasing rural incomes. The wages in the agricultural sector are low, but still the sector provides opportunities – not least for the lower educated. Finally, in confirmation of Hypothesis 3 and previous studies in this regard, households that diversify their incomes through off-farm economic activities in general achieve higher economic well-being. Households that earn greater shares of their income through activities such as running a business or taking up wage employment reach higher incomes – abandoning agriculture altogether will in the long run likely become a more promising prospect for growing numbers of Zambia's rural poor.

Chapter 5

Synthesis and Concluding Remarks

There is broad agreement that immense investments in agriculture are necessary in order to increase food supply and thus meet the projected increases in world food demand (Schmidhuber et al. 2009). Although governments in many countries have recently allocated greater parts of their budgets to the agricultural sector, public investment will not be sufficient in the long run, and the private sector will need to play an essential role.

Nevertheless, the fact that the recent upsurge in foreign direct investment (FDI) in large-scale agriculture is largely concentrated in developing countries, above all in Sub-Saharan Africa, has raised concerns about the benefits and risks of such investments to host countries. Critics have dubbed these investments as “land grabs”, arguing that the low transparency in negotiation and decision processes and the serious lack of information about land transactions open the doors to corruption. This poses considerable risks, especially for population groups whose property and land use rights are weakly defined or enforced.

Undoubtedly, FDI in agriculture and in other sectors can have adverse impacts on the local population. Ongoing efforts to increase transparency in land transactions are certainly necessary. Traditional land users should not only be informed in advance about the conditions of envisaged land use changes, but should have a real say in such processes. In addition, adverse impacts should be mitigated as far as possible and local stakeholders compensated adequately.

As there is a severe lack of quantitative evidence on the economic impact of FDI in land and agriculture, the primary goal of the study at hand was to collect and analyze empirical evidence to better understand the potential benefits and pitfalls of such investments and related processes of agricultural commercialization. In the course of globalization, all levels of the agribusiness value chain have seen decisive changes. Input suppliers, producers, food processors, as well as wholesale and retail are becoming more consolidated and multinational. The impact of this process on smallholder farmers in developing countries is yet to unfold. In Sub-Saharan Africa the “supermarket revolution” is still at an early stage, and subsistence farming remains the prevalent form of agricultural production.

Agricultural production, in contrast to marketing and processing, has only few technical economies of scale – the modest economies of scale arising from the indivisibility of inputs (draft animals, machinery, farm management skills) are at least partly offset by agency costs arising from the need to supervise wage labor (Binswanger and Deininger 1993). Provided that farmers have access to the necessary inputs, machinery, and infrastructure, a wide range of production forms have been proven to operate efficiently (Deininger et al. 2011).

However, the majority of small-scale farmers in Sub-Saharan Africa continue to farm at productivity levels far below their potential. They lack the necessary funds to buy high quality seed and fertilizer, and to invest in infrastructure (e.g. irrigation, technology, roads, water,

electricity). In addition, rising quality and safety standards as well as the need for higher coordination in modern food supply chains, carry the risk of increasing exclusion of smallholder farmers. This prospect is particularly critical as farming provides a living for the majority of people in many developing countries, particularly the poor.

For this reason, we tested two possible strategies for integrating small-scale farmers into agricultural commodity chains. We explored how participation in outgrower schemes, on the one hand, and employment on large-scale farms, on the other hand, affects the economic well-being of rural households. Finally, we analyzed the impact of income diversification in general by studying how off-farm activities, such as running a business or taking up wage employment in other sectors than agriculture, affect household incomes.

The main part of our work is the case-study of one specific investment project, namely FDI in the Zambian sugar cane sector. Data from a household survey conducted specifically for this research project in 2012 in Zambia's "sugar capital" Mazabuka, served to assess the effects of two different models of farmer participation in the sugar industry: one involving sugar cane outgrower schemes and the other wage employment on large-scale sugar estates. The quantitative evidence from multiple regression analysis as well as propensity score matching point towards a positive effect of participation in the sugar industry on (long-term) household wealth, while controlling for a range of factors and taking into account possible non-random selection. Small-scale farmers who participate in sugar outgrower schemes achieve significantly higher wealth (as measured by a wealth index) compared to the comparison group consisting of other smallholder farmers in the region who are not linked to the sugar industry but are otherwise similar. Employees on large-scale sugar estates also appear to benefit significantly, although this effect is less pronounced.

As in all observational studies, possible unobserved heterogeneity complicates the calculation of unbiased treatment effects. For this reason we tested the sensitivity of the propensity matching results to unobserved variable bias by means of the Rosenbaum bound approach (DiPrete and Gangl 2004; Rosenbaum 2004, 2010). The sensitivity tests suggest that the bias due to unobserved covariates would have to be considerable to render spurious the asserted positive treatment effects.

Qualitative research methods were used to complement the quantitative evidence. Nine focus group discussions were conducted among outgrower scheme participants, employees on large-scale farms, and regular smallholder farmers. The outcome largely corroborates the findings from the quantitative analysis. There is a widespread perception among all three comparison groups that participation in a sugar cane outgrower scheme entails large benefits. The cooperation with large-scale farms can help to overcome the major barriers that smallholder farmers in developing countries typically face. The farmers gain access to high quality inputs,

are provided with the necessary infrastructure, and benefit from the know-how and wide-ranging services provided by the scheme's management.

Perceptions about the benefits of employment on large-scale sugar estates were quite mixed – employment on large-scale sugar farms is to a large degree temporary, and wages as well as job security are low. Most households stated that they would rather be small-scale farmers than employees. Still, due to the mentioned problems that many small-scale farmers are confronted with, employment on a large-scale farm may be preferable to farming on one's own or interesting as part of a household's income diversification strategy.

In Chapter 4, the sectoral focus on the sugar cane industry was supplemented by a broader, cross-sectoral analysis of the impact of outgrower schemes (mostly associated with cotton production), employment on large-scale farms, and off-farm economic activities in general. Using a large, nationally representative panel survey covering more than 4'200 smallholder households in Zambia in 2001, 2004, and 2008 (MSU/FSRP/CSO), we employed panel data methods that are more suitable to solve the omitted variables problem inherent to cross-sectional studies. Controlling for unobserved time-invariant heterogeneity by using a fixed effects estimator, our analysis also suggests a significant positive effect of participating in outgrower schemes. Using several indicators to measure participation, we find significant positive effects on net agricultural incomes and also on overall net household incomes. The effect is even larger when taking into account the "degree of involvement in outgrower schemes" – it seems to pay off to intensify integration.

Diversifying into off-farm economic activities is also associated with higher net incomes. At the same time, increasing diversification is accompanied by a moderate reduction in net income from agricultural production. Households that gain a greater percentage of their income through off-farm activities (running a business, carrying out wage activities, and receiving remittances) reach significantly higher incomes than households that rely on agriculture alone. Running a business or taking up wage employment in sectors other than agriculture seems to be particularly beneficial. Nevertheless, households that enter into agricultural wage employment also achieve significantly higher incomes.

Unfortunately, the panel data did not allow to differentiate whether the outgrower firms or companies offering employment opportunities were domestic or foreign-owned. One promising avenue for future research would thus be to collect panel data permitting this distinction. Separating foreign and domestic investments is often not straightforward. However, this would permit to answer the question whether the nationality of the investor matters. Purely descriptive evidence from our research does not suggest that foreign-owned companies in general are those with the worst employment conditions. Larger companies, and perhaps especially those foreign-owned, stand under close(r) public supervision.

Another limitation of this study is the only limited information available on possible negative externalities when large-scale farms and outgrower scheme are set up. Sugar production in Mazabuka started back in the 1960s, hence collecting reliable data on potential negative impacts during the start-up phase was not possible. We do not know whether those who did not become integrated into the sugar cane industry may have experienced negative impacts because of the increasing sugar production. For instance, some may have lost land access in the beginning or perhaps had and still have to farm on less fertile grounds because of land scarcity. In this regard, case studies would be useful that follow a panel of households over several years – starting before a major investment takes place and revisiting households again several times after. This could provide important information on the impacts on those who participate as well as on those who do not. Furthermore, it would allow analyzing both the short-term and the currently rarely studied long-term effects. For example, the planned implementation of various farm blocks throughout Zambia would constitute a great opportunity to study the wider effects of large-scale investments in agriculture as well as outgrower schemes. Given the scale of the government's ambitious farm block development program, covering around a million hectares, a thorough scientific analysis of its effects would be appropriate.

An important issue not addressed here is that positive economic impacts of investment projects are of course not the only dimension to be taken into account. Although the focus of our study was deliberately set on economic factors, the social or environmental consequences need to be analyzed as well. Negative externalities in these areas can also reduce the long-term economic benefits, e.g. when productivity of monocultures decreases due to soil depletion.

Nevertheless, the evidence in this study suggests that large-scale investments by foreign as well as domestic companies, and especially the model of cooperation with smallholder farmers in outgrower schemes, can indeed have positive and significant effects on the income and wealth of rural households. There can be no doubt that many recent FDI deals bear the risks of discriminating (or have already discriminated) smallholder farmers whose property and user rights on land are weak or weakly enforced. Such practices must be eliminated to the largest extent possible. At the same time, dismissing such projects indiscriminately as harmful “land grabs” is not adequate. Even if negative welfare effects occur at the very beginning of such projects subsequent effects may create a trade-off: our research results lead us to advocate more nuanced research on adequate policies and the short- and long-term impacts of FDI projects.

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NEWSLETTER ABONNIEREN

Foreign direct investment in agriculture and land has increased substantially since the 2007–2008 food price crisis. However, there is a severe lack of quantitative evidence on its economic impact. Therefore, the primary goal of this study was to collect and analyze empirical evidence, in order to better understand the potential benefits and pitfalls of such investments and related processes of agricultural commercialization.

In particular, the study tests the effect of two strategies for including smallholder farmers into modern food supply chains:

1. Outgrower schemes, i.e. a type of contract farming whereby small-scale farmers produce crops for large-scale farming enterprises
2. Wage employment on large-scale estates

The central part of the study looks at one specific investment project in the Zambian sugar cane sector. This sectoral focus was supplemented by a broader, cross sectoral analysis of a large, nationally representative panel survey.

Overall, the evidence suggests that large-scale investments by foreign as well as domestic companies, and especially the model of cooperation with smallholder farmers in outgrower schemes, can indeed have positive and significant effects on the income and wealth of rural households.

