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IMPACTS OF LARGE–SCALE LAND INVESTMENTS ON INCOME, PRICES, AND EMPLOYMENT: EMPIRICAL ANALYSES IN ETHIOPIA

Philipp Baumgartner,[1] Joachim von Braun,[1] Degnet Abebaw,[2] and Marc Müller[1]

[1] Department of Economic and Technological Change,
Centre for Development Research (ZEF) | www.zef.de
University of Bonn, Germany
pbaumgartner@uni-bonn.de

[2] Ethiopian Economics Association | Ethiopian Economic Policy Research Institute
Addis Ababa, Ethiopia
www.eeaecon.org

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DRAFT

Abstract: Ethiopia recently experienced a significant increase in land transactions for the purpose of large-scale commercial farming. We review this trend since 1992 and note a sharp increase in transactions since 2007. Most of the investors came from the Middle East, South Asia, and Europe. We assessed the impacts of one such investment on the income and employment situations of a local population using a model that integrated extensive primary data collected at the site in 2010–11. The impacts on incomes, livelihoods, and factor prices were simulated using four scenarios: (i) a baseline scenario depicting the situation prior to the investment; (ii) the forest loss resulting from the land transfer; (iii) the operation of the investment at full scale (10,000 ha); and (iv) an alternative scenario of a smaller investment paired with a more inclusive rural development policy. Results showed that forest resources are important for different groups of rural poor, but that the losses can be offset by gains from employment generation and business opportunities resulting from the investment. The alternative scenario indicated opportunities for social and environmental sustainability when the investment is combined with rural development initiatives.

Key words: rural development, agricultural labour markets, land rights, land markets, Ethiopia, Africa

1. INTRODUCTION

Since food prices peaked in 2007–08, increased acquisition of farmland abroad has been documented (Cotula, Vermeulen, Leonard, & Keeley, 2009; Deininger et al., 2010; von Braun & Meinzen-Dick, 2009). Other factors contributing to increased interest in the improvement of agricultural production include the tightening of factor market constraints in Asia and increased demand for food in parts of Asia and the Middle East. This has stemmed from population growth and rising income levels, leading to diet changes as well as an improved business climate in many countries of the Global South. According to data presented by The Land Matrix[1] (Anseeuw, Wily, Cotula, & Taylor, 2012), East Africa has experienced the most land transactions in recent years.

[1] The authors are aware of deficiencies in the Land Matrix database; however, it is the only available global data base and is useful for a preliminary overview.

Ethiopia has seen a significant rise in ‘large-scale land acquisitions’ (LSLAs), with an earmarked area of above three million hectares and huge demand for land by foreign investors (EIA, 2011). Ethiopia’s agriculture is heavily dependent on smallholder production, commercial farms produced less than 5% of the country’s total agricultural output in 2008 (CSA, 2009). However, the impacts of recent large-scale land transactions on the poverty and livelihood situations of local populations are not well understood. Evidence of the impacts of large-scale land investments and analyses of country-level trends and patterns are scarce. The lack of reliable data on land transactions is the main reason for this situation.

In principle, LSLAs can have both positive and negative impacts on the poverty and livelihood situations of local populations. There might be several pathways through which LSLAs become beneficial or detrimental to local populations. For instance, they can positively contribute to poverty reduction and the improvement of local livelihoods by generating new employment opportunities for local populations (Otsuka & Yamano, 2006). Additionally, LSLAs can stimulate agricultural commercialisation (i.e., increased share of marketed inputs and outputs of the existing agricultural production system). The potential benefits of commercialisation include: the stimulation of rural economic growth (which poor people can gain from directly); diversification of employment opportunities (depending on the labour intensity of cultivation methods or the introduction of new crop types); increased agricultural labour productivity; direct income benefits for employees and employers; and increased food supply and potentially improved nutritional status (von Braun & Kennedy, 1994). Finally, agriculture has received comparatively little investment—private or public—in many countries of the Global South during the past two decades. To meet increased global demand for agricultural produce due to population increases, increasing welfare, and changing diets, investments in agriculture are needed (HLPE, 2011). On the negative side, investments in large-scale commercial agriculture may also exacerbate the difficult conditions under which smallholder farmers often operate by depriving them of rights to land and thus increasing poverty, food insecurity, environmental degradation, social marginalization, and the loss of identity (Borras JR & Franco, 2012; Bues, 2011; Guillozet & Bliss, 2011; HLPE, 2011; Smaller & Mann, 2009).

While determining the net effect of large-scale land investments is an empirical pursuit, appropriate policy measures are needed to manage any trade-offs. In the literature there are documented cases of politicians who have attracted criticism for their apparent unwillingness to improve the governance of land transactions in favour of affected local populations (Cotula & Vermeulen, 2011; Dessalegn, 2011), particularly regarding opaque negotiations and overly simple contracts.

In this paper we contribute to answering some of the relevant questions within this discussion, drawing on country-level data on land transactions in Ethiopia and primary data collected in the context of one specific investment. Specifically, we address two research questions: (i) How is the recent increasing trend of large-scale land transactions in Ethiopia different from the historical context and what types of investments are likely to prevail? (ii) What are the impacts of large-scale investment on the livelihoods of local population, especially regarding contributions to employment and income?

We begin with a country-wide analysis of the extent and trends of large-scale investments in agricultural land. Thereafter we evaluate the case of the Gambela Region, which has received much attention from international and domestic investors in the past decade and outline the institutional setting of the land transactions in that location. Finally, we used a programming model to examine the potential impacts of a large-scale rice farm on a local population, including simulations of alternative policy scenarios and stakeholder involvement.

2. ANALYTICAL APPROACH AND DATA

This effort builds on extensive field work conducted in Ethiopia, specifically in the Gambela Region during 2010–11. Data from different sources were compiled to address the two research questions. For the country-level analysis we mainly used two databases sources, nationwide data on investment licenses granted for the 1992–2011 period that involved agricultural land of 100 ha or more (EIA, 2011), and regional data on land parcel sizes requested by large-scale land investors and the land parcel sizes that were actually allocated to each investor, for the case of the Gambela region between 1999 and 2010 (Gam-EIA, 2010).[2]

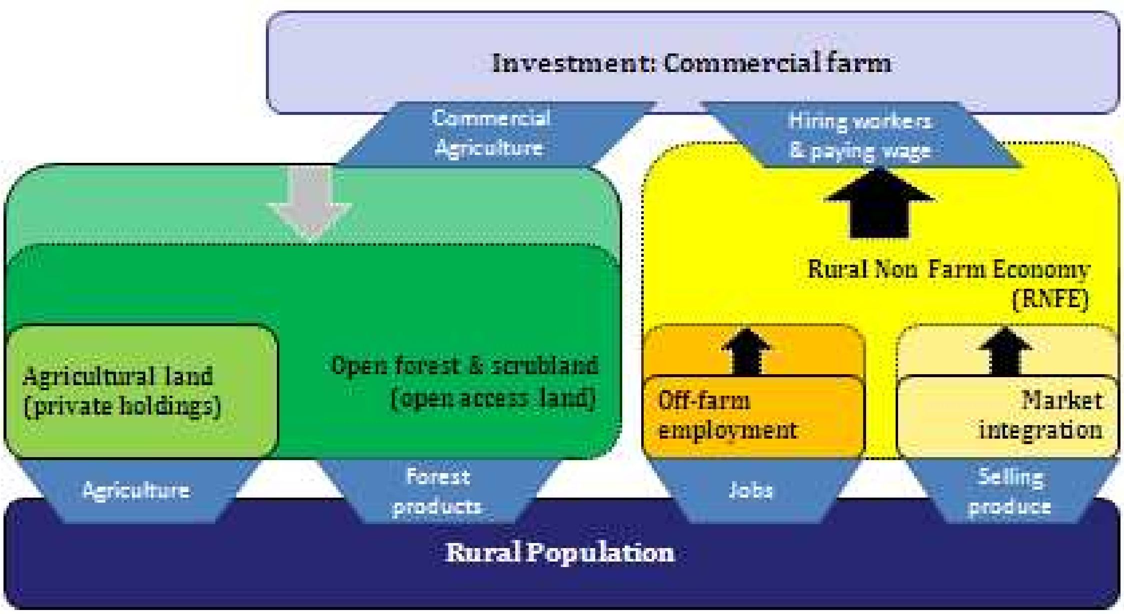
To analyse the impacts of LSLAs on the livelihoods of local populations we used household survey data, results from focus group discussions and village visits conducted by one of the authors during a site visit in early 2011 to define parameters for a programming model (Hazell & Norton, 1986). The model simulates the impacts of the LSLA due to local changes in access to

[2] This part of the paper builds on Baumgartner (2012).

land. The strength of the model is that it allows the examination of (a) a scenario of future impacts as LSLAs increase in size and (b) the potential impacts of alternative policies on local income and employment situations.

The appearance of large-scale commercial farms in such a setting can be conceptualized as a re-distribution of the available land. Often the land these farms become established on has been previously used less intensively for purposes other than agricultural production, which incidentally plays a significant role in rural incomes, especially in the absence of sufficient off-farm employment opportunities and insurance protection against risks. For local populations the loss of access to traditionally utilized land is paired with a change (or emergence) of the rural non-farm economy (RNFE), especially regarding off-farm employment opportunities and an increasing market for locally produced goods and services (Figure 1).

Figure 1 Conceptual linkages between LSLA investments and local populations



In the following analysis we discuss the effects of changes in land user rights on the livelihoods of local populations. We define a livelihood as a set of "*capabilities, assets (including both material and social resources) and activities for a means of living*" (Chamber & Conway, 1992; in Scoones, 2009, p. 176). A rural person's livelihood is thus comprised of a range of 'livelihood activities,' such as farming, raising livestock, off-farm employment, small-scale entrepreneurship, etc.

3. GOVERNANCE OF LAND AND LAND TRANSACTIONS IN ETHIOPIA[3]

In a traditional agrarian society like Ethiopia's, land is the most important natural resource. Access to land (and water) is key for agricultural and pastoral activities, and therewith indispensable for most people's existence. As declared by the federal and regional constitutions as well as by land laws issued, all land is property of the state. Private ownership of land is not permitted. Land users can only acquire user rights over 'their' land. It is forbidden to sell, mortgage, or exchange land in any way. The allocation of user rights, registration, adjudication, and taxation lies with the regional authorities.[4] The user rights of landholders are dependent on a number of conditions: residence in a *kebele* (sub-district), personal engagement in agriculture, proper management of the land, and other restrictive conditions (Dessalegn, 2011). Holders who violate any of these conditions are subject to penalties or can even lose their rights to the land.

Throughout the country, three types of land tenure exist for agricultural land. The first is the prevailing basic administrative system described above. In recent years a second, market-based tenure system has increasingly emerged. This was partly due to regulatory changes that allow renting out shares of one's land with legal contracts, and also partly due to remaining informal traditional practices (such as share-cropping). Finally, in the low-land areas a third system of customary, non-market arrangements defines land tenure. Families often transfer land based on ancestral relations and heritage, or clear forest/bush-land themselves. In addition, there are communal land titles (e.g., for forest land or pasture), which are not bound to an individual but to a group of people. For private holders and commercial investors, land transfers are limited to a certain period of time (usually 25 years).

Since the early 1990s the government's rural development strategy has been focused on smallholders. Policies were biased towards small-scale agricultural production and the land tenure system put in place was considered to be 'peasant-friendly.' Beginning in the early 2000s

[3] For an extended discussion on types and governance of land deals see Baumgartner (2012).

[4] For a detailed discussion on the legal framework of agricultural land see Dessalegn (2009).

a policy shift has occurred. The government started to talk about capitalist farming and large foreign investors, replacing peasant cultivation and small entrepreneurship approaches, based on the logic that once "*the objective of accelerated agricultural development is achieved…[t]he key actor[s] in the sector's development will be relatively large-scale private investors and not the semi subsistence small farmers*" (Dessalegn, 2011, p. 9). Such a change in governmental policy focus became apparent as a number of investment-stimulating legal changes and proclamations where issued, especially to attract foreign investors to the agricultural sector.[5]

Through a new proclamation in 2009 the federal government was entitled to carry out all aspects of land transfers to foreign entities involving 5,000 ha or more. The Agriculture Investment Support Directorate (AISD) was created within the Ministry of Agriculture and Rural Development (MoARD) with the mandate to assist investors with land acquisitions and facilitate the process of land transfer, identification and review of business plans, and other documents. The AISD established a Land Bank where potential land for agricultural expansion is listed. Regional governments were advised by the federal government to identify suitable lands and earmark them for agricultural investment activities.

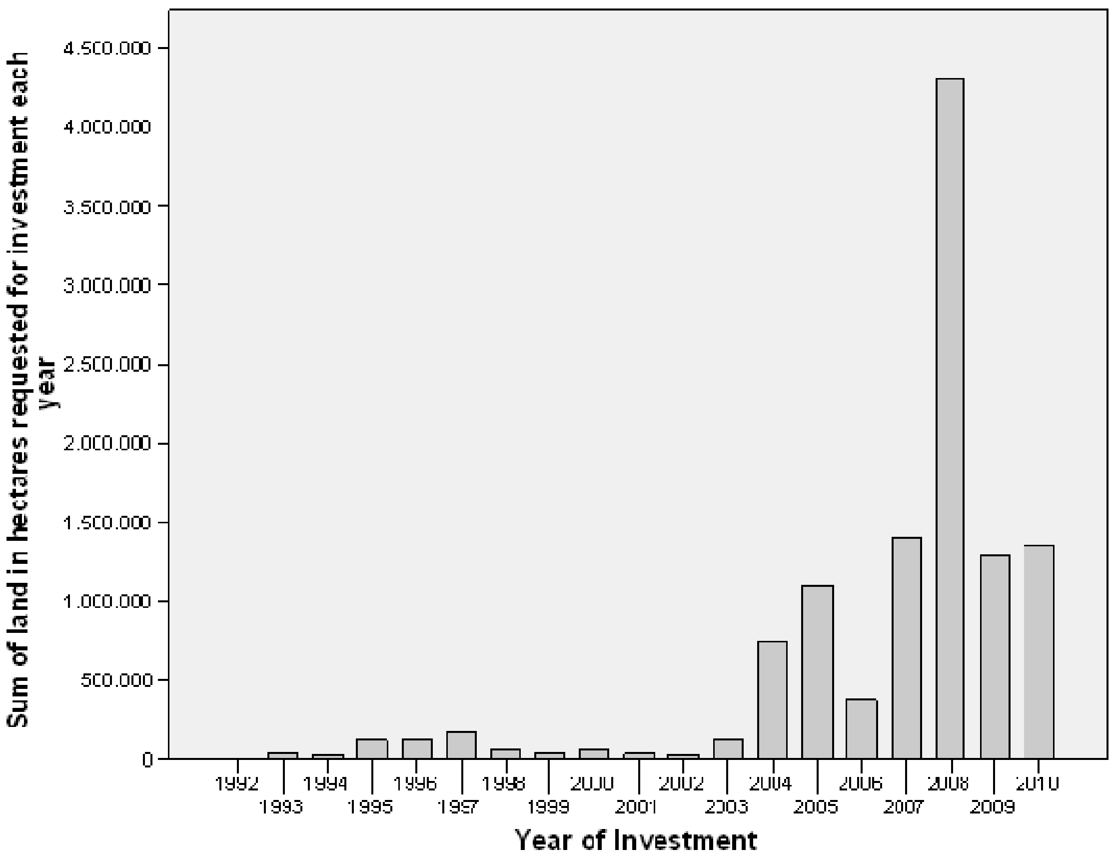
In Ethiopia, demand for agricultural land by both foreign and domestic investors has soared in the last decade. We used data received from the Ethiopian Investment Agency (EIA) that listed licenses issued to foreign and domestic investors in agricultural activities involving a minimum of 100 ha of land for the period 1992–2010. These licenses are given to investors prior to acquiring land parcels. The amount of land specified in each license is *not* necessarily fully granted, nor are all of these projects operational. Some do not even reach implementation. The overall amount of land is therefore most likely inflated, as investors often request larger sized land areas before realizing the difficulties of managing such large commercial farms. Plus, we found evidence suggesting that the stated demands for land are not necessarily fully met or supplied by government agencies. Nonetheless, the figures presented in Figure 3.1 provide an approximation of the *demand for land* in Ethiopia.

The histogram in Figure 2 represents the total amount of land requested by agricultural investors each year for the period 1992–2010. Requests for large parcels of land started to increase from 2004 onwards. This coincides with governmental changes in the investment policy

[5] Before, foreign investments were mainly incentivized to invest in manufacturing and industrial production.

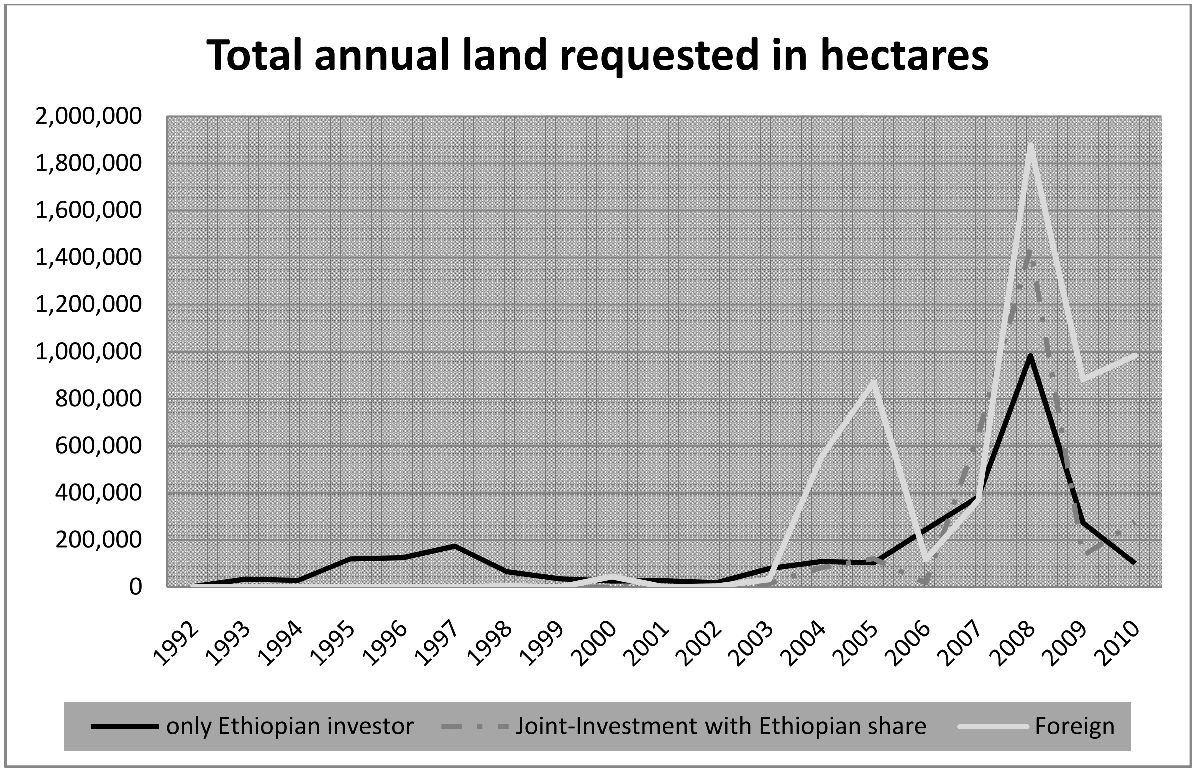
in the early 2000s. Beginning in 2007, however, interest in farmland has increased significantly. This is consistent with the globally observed trend of increasing interest in the acquisition of farm land following the global spike in food prices in 2007 and the remaining high food costs since then. For the first time in 2005, an annual total of more than one million hectares was requested, and in 2008 a peak quantity of more than 4.3 million hectares of land were requested by both domestic and international investors.

Figure 2Total land requested from the federal government in Ethiopia by investors per year in hectares (1992–2010). Source own calculation based on EIA 2011 data. (Baumgartner, 2012, p. 182)



We grouped investment licenses into three categories according to the origins of the investors: (i) fully Ethiopian (domestic) investments, (ii) joint-investments involving Ethiopian and foreign stakeholders, and (iii) fully foreign investments. We analyzed the data to observe whether historic trends of the total annual amounts of land requested on investment licenses were consistent for the three groups (Figure 3).

Figure 3 Total land area requested annually (1992–2010) in Ethiopia by investor category. Source: Authors' calculations based on EIA (2011) data.



Prior to 2003, land requests by domestic investors accounted for almost all of the land requested. They rose sharply from 2005 onwards, with a peak volume close to one million hectares in 2008. Thereafter, their demand fell again to ca. 100,000 ha in 2010. Similarly, joint investments started to gain significance in 2005, with an annual total of more than 120,000 ha. Demand was very high in 2008, at about 1.4 million hectares, but dropped to about 200,000 ha for the following two consecutive years. On the other hand, the total area corresponding to foreign investment did not exceed 50,000 ha prior to 2003. In 2004 foreign demand for land surpassed 500,000 ha. This sharp increase correlates with the country's changing investment policy beginning in the early 2000s. Following a short drop in the year after the national elections in 2005, the increasing trend resumed with total requests peaking close to two million hectares in 2008, and reaching around one million hectares of land in both 2009 and 2010. The overall trend for the period indicates an increasing share of foreign investment activities, or 'internationalization' of land transactions in Ethiopia since the early 2000s.

From the total count of investment licenses, domestic investments account for 2,246 of the total of 2,813 (ca. 80%). However, foreign investment licenses tended to represent more large and medium sized land parcels than domestic investments. Looking at the origin of foreign investors,[6] four regions stand out as having especially large shares of the total amount of land requested (see also Table 6 in the Appendix): the Middle East and Western Europe with combined demand of about 2.5 million hectares (21.5% and 22.4% of the total amount respectively), as well as South Asia with around 1.5 million hectares (13.2% of the total) and North America with around one million hectares (8.4% of the total).

Using the amount of land (in hectares) requested for investment also enabled us to analyse trends in the allocation of land across the country's regions over the two decades under consideration. For the entire period from 1992 until Jan 2011, Oromia accounted for one-third of the requested land, followed by Amhara with approximately 15%. Including the multi-regional licenses, these two regions accounted for over 75% of the land requested. This indicates that most investments were located in the central highlands of Ethiopia. However, there was a regional shift in the distribution of land investment licenses. About 73% of the total land area solicited was requested after 2007, and since then increasing shares have been requested from areas in Benishangul Gumuz, Gambela, and SNNPR.[7] This shift can be explained by: (i) a priority shift of the federal government to attract investors to these remote areas of the country, and (ii) that these areas of the country are less densely populated and thus land is more easily made available for commercial investments. It is worth noting that the areas of the Afar and Somali regions did not (yet) receive many investment licenses. Overall the data indicate a geographical shift of land investments towards the western part of the country.

During an extended research visit in Gambela, we accessed another data set from a regional investment office, including information on how much land was solicited by individual investors and how much was actually allocated to them by the government. The data set began in the year 1992, but with the exception of a handful of cases in the late 1990s and early 2000s, investment activities in that western region only began in earnest after 2004–05. The period from 2004 until

[6] Many authors have highlighted the increasing interest of foreign investors in acquiring farmland abroad (GRAIN, 2008; Smaller & Mann, 2009; von Braun & Meinzen-Dick, 2009, among others). Others have highlighted for West and Southern Africa that national elites and investors from the diaspora may play a significant role, too (Hall, 2011; Hilhorst, Nelen, & Traoré, 2011). Our results confirm both hold for Ethiopia.

[7] Southern Nations, Nationalities and Peoples Region.

mid-2010 therefore accounts for the vast majority of licenses presented in Table 1 below, which includes a summary of the investment activities involving land acquisition by domestic and foreign investors in the five *woredas* (districts) of the Gambela region. Clearly most investment activities (more than half) took place around the regional capital, Gambela Town. This can be explained by relatively better access to infrastructure and labour in that part of the region, while other *woredas* are less densely populated and therefore suffer from a shortage of labour.[8] For the 93 investment projects in Gambela *woreda*, only 22.4% (38,659 ha) of the total number of hectares solicited (172,350 ha) were actually approved for investment. A similar pattern was observed for the Itang, Dimma, and Abobo *woredas*. Only the three projects in Godere were provided the full amount of land requested.

Table 1 Investments by district level for the Gambela region (1992–Aug 2010). Source: Authors' calculations based on regional level data (Gam-EIA, 2010)

District	Number of Investments	Hectares requested (demand)	Hectares allocated (supply)	% of demand met
Abobo	63	146,350	61,270	41.9%
Gambela (semi-urban)	93	172,740	38,650	22.4%
Godere	3	11,588	11,588	100.0%
Dimma	5	8,000	6,100	76.3%
Itang	12	41,900	12,100	28.9%
Total	**176**	**380,578**	**129,708**	**34.1%**

Note: These only include investments handled by the regional office, there are other investments within Gambela that were administered through a federal-level agency.

This indicates an important finding that is missing from the discussion about LSLAs: the local government, at least for the period documented here, tested the capabilities of investors and assessed their business plans. Following such assessments they granted land, but often less than what was initially requested by the investor. The fact that only one-third of the area requested for the Gambela region was provided to investors indicates a rather conservative practice of allocating land. In 2010 there was a notable change in the governance of land within the region following increased political attention at the federal level beginning 2007–08. The regional president's office established a secretariat for handling large-scale land leases. Such a transfer of

[8] It is important to highlight that parts of Ethiopia, as in many other African countries, are very sparsely populated, thus making labour the scarcer factor (when compared to land). This is especially pronounced during harvest time.

authority to the president's office reflects the increasing political relevance of the issue, also on the regional level.

4. GAMBELA CASE STUDY: CONTEXT, METHODS, AND SETUP OF THE MODEL

We examined one investment in detail that was located in the Abobo *woreda* of the Gambela region¸ approximately 800 km west of Addis Ababa. Gambela is one of Ethiopia's poorest regions, with 34.9% of the population living in the lowest quintile of the country's wealth-ranking range (CSA, 2012a). Geographically the region is located in the western lowlands and borders Southern Sudan. The climate is semi-arid with an extended rainy season from May through August, during which most agricultural activities take place.[9] The region is sparsely populated, and had a total population of 306,916 in 2007 (Census Commission, 2008).

There are currently two social groups of actors living in the area proximal to the investment site. One is a group from the Ethiopian highlands who were resettled to the area under a *Derg* (former regime) resettlement scheme in 1984. This group typically uses oxen as draught animals for agricultural activities, cultivates maize and sorghum, engages in some fresh water fishing, and collects firewood and occasionally wild plants or roots. These 'settlers' are concentrated in two settlements, Village 17 and Abobo Town. The town has 4,090 inhabitants and a number of shops, restaurants, and hotels, as well as a hospital and two offices of small non-governmental organizations (NGOs). The communal administration is also located in Abobo, which was the largest local employer prior to the arrival of Saudi investment in the area. The second social group is an ethnic group known as the Anyuak, who have lived in the lowlands of Ethiopia and the Sudan for the last two centuries (Kurimoto, 1997). The Anyuak live in group-villages, they use digging sticks (*Chala*) to cultivate their fields, and practice a shifting cultivation system (changing areas every 3–7 years). The Anyuak mainly cultivate maize (intercropped with pumpkin) and sorghum. In the dry season they cultivate some maize and vegetables near the river, and supplement their diet through fishing, hunting, and collecting wild fruits and roots. The Anyuak are only involved in cash commerce to a limited extent, selling a small share of their output to purchase necessary goods (salt, jerrycans, cloth, etc.). Wage employment in the area is

[9] A short rainy season during Jan-Feb sometimes allows a second harvest, especially on river side plots.

rare, but occasional work for investors or wealthier highlanders was available historically. The Anyuak (indigenous) account for 70% of the local population and the Highlanders (settler) are 30%. The two groups live in separate villages, which may be partly due to a history of conflict between them over political power.

It is interesting to note that the local population pursues a diverse mix of livelihood activities. In addition to farming, the local population also undertakes a number of other activities. Livestock herding is limited, partly due to an unfavourable climate, but also to insufficient income levels for purchasing cattle. The use of forest products, fishing, and self-employment activities contribute an important share of local incomes (Mengistu, 2005). The rural non-farm economy (RNFE) is small, with a very limited labour market and a relatively small share of produce sold in local markets. In the survey conducted, less than 10% of the farmers hired labour for cultivating plots, and the number of businesses in the small provincial capital of Abobo was rather low (but has been growing in recent years). Studies of the Central Statistical Agency (CSA) on farm management practices in Gambela revealed that a very small share of local farmers utilised modern inputs. Extension service coverage was also very low, leading to a lack of extension packages, and limited access to credit and advisory services (CSA, 2012b).

We used the theoretical framework of the material and behavioural determinants of agricultural production systems in scarcely populated semi-arid tropics by Binswanger & McIntire (1987) to evaluate local conditions. Table 2 lists the assumptions about the initial setting (I-s) from that work and discusses to what degree they hold true in the context of Abobo.

Table 2 Material and behavioural characteristics of agricultural production systems in low-population density, semi-arid tropical areas of Gambela (prior to investment—initial stage). Sources: (Binswanger & McIntire, 1987, pp. 75–76) (Census Commission, 2008[+]; Mengistu, 2005[#]; Tadesse et al., 2006[*]) (group interviews [a]; household survey [b].

	Initial stage assumption about agricultural production system (from literature)	**Context Abobo *woreda*** (case study)	**Validity for both relevant groups**		
	Source: Binswanger & McIntire 1987	**From field experience, primary & secondary data**	**Group1 (Indigenous Anyuak)**	**Group2 (Settler/ Highlander)**	**Sources**
I-1	**“Population density is low**; therefore, cultivable land is abundant and has no sales price”.	5–7 person/km²	Yes	Yes	*, +
I-2	**“Indigenous populations have access to land-use rights at no cost** or in exchange for token payments. External powers have not created property or user rights for expatriates.”	Anyuak: clear new forest patch every 3–4 years (shifting cultivation) Highlander: have main plots, sometimes registered	Yes	Yes (two waves of land certification)	#, a
I-3	**“Arid climate and crop production**: (a) Seasonality is pronounced because, in the absence of irrigation, there is one short growing season. (b) Weather risk is high. (c) Yield risks are highly covariant within small areas.”	Rainy Season: May–August Severe drought in 2008, that affected most households	Yes	Yes	*, #, b
I-4	**“Arid climate and animal husbandry**: (a) The cheapest way of producing cattle usually involves transhumance, the seasonal migration of cattle among different geographic subzones. (b) Animal husbandry has lower production risks than cropping. […] (c) Covariance between animal husbandry and crop production is lower than the covariance of yields among different crops […]. Secular droughts imply failure of both crop and animal husbandry enterprises.”	Anyuak traditionally limited livestock herding Highlander try to accumulate cattle, but no transhumance. (mainly goats and chickens)	Little/no cattle (only 3% of households have cattle)	Yes	*, #, a, b
I-5	**“Technology is simple and confined to hand tools and, possibly, to draft animals**. Management skills are unimportant and technical economies of scale are limited. Gathering and hunting provide supplemental income to agriculture.”	Prior to first state-owned farm, no tractor in the area. Local farmers only use hand digging (*chala*—Anyuak) or Ox plough (Highlander)	Yes; Only manual	Yes; Manual + Oxen	#, a, b
I-6	**“Transport and communication costs are high**; that is, the region is geographically isolated.”	Along the main road, one bus per day. Several Anyuak villages without road access in rainy season. Lack of electricity and landlines.	Yes (very high)	Yes	*, a

Based on the initial conditions in Table 2, twelve *propositions* (P–1 to P–12) about the rural agricultural production system (prior to the arrival of the investment) can be derived (Binswanger & McIntire, 1987, p.76–80).[10] Given the easy access to land (I–2) and simple technology (I–5) a worker's output would be at least as high on his own plot as it is on the plot of a potential employer. Thus, an employer cannot compensate a worker for his forgone output (given the costs of administration), leading to the absence of a non-cultivating labour class and a very limited labour market, with only occasional group work in the off-season (P–1). During weeding and sowing seasons there is practically no hiring or exchange of labour (P–2).[11] Because of geographic isolation (S–2), trade is limited to lightweight goods and self-sufficiency in agricultural and non-agricultural commodities is prevalent. Consequently, there is no regular output market every year, as most famers are self-sufficient with respect to food (P–4). The amount of area cultivated per household is determined by household size or wealth (P–3). The limited durability of food grains and risk of weather-related shocks makes stock accumulation an unattractive venture. Thus, once output levels provide for self-sufficiency little incentive exists for extra effort (P–5).

Credit and insurance markets are absent. Given the limited output markets and absence of labour markets, neither market-credit links nor labour-credit links can serve as collateral. Limited options for collateral therefore reduce the supply of credit (P–6), and the lack of an incentive for additional investment reduces the demand for credit (P–7). Extended families and tribal networks serve as insurance against specific risks, but cannot insure against covariant risks (e.g., drought in the agro-ecological zone) (P–8). Thus, capital accumulation is the major insurance substitute (P–9), and households must store their own food stocks (P–10). In the absence of output markets, in combination with the high cost of storing stocks and self-sufficient cultivation, household storage capacity is bound by expected consumption and does not qualify as accumulation. The main means of capital accumulation are therefore livestock, or gold and jewellery (P–11). Beside this individual accumulation, common property resources provide an insurance substitute (P–12).

[10] For an extended derivation of each propositions see Binswanger & McIntire (1987, pp. 76–80).

[11] Exception to this occurs if a farmer cannot grow sufficient food during the peak season to sustain his livelihood and thus has to enter a patron-client relationship with a wealthier household (Binswanger & McIntire, 1987, p. 77).

This set of theoretical postulations about semi-arid agriculture production systems are an accurate description of the situation in the Abobo *woreda* before the advent of the LSLA project.

Case Study: The Saudi Star Agricultural Development Plc. (hereafter 'Saudi Star') commercial rice project was granted 10,000 ha of irrigable farm land. In 2008, MIDROC Ethiopia, an international umbrella company consisting of 41 companies that are active in all sectors of Ethiopia's economy owned by an Ethiopian-born Saudi, Sheikh Mohamed al-Amoudi, received the license to 10,000 ha of land in this part of the Gambela region. This contract also included exclusive rights to the water retained by the Alwero dam. The lease price per hectare was initially 30 birr/ha per year, but was revised and increased according to the subsequently established national land pricing scheme, and is now 151 birr/ha per year (ca. 9.20 US$ or 48.1 US$ [PPP]). In June 2009, Saudi Star began clearing the land, and soon established a small nursery on 10 ha to test rice varieties and produce seed. A team of Pakistani rice experts planned and organized the farm management, the site preparation and construction of facilities is mainly performed by Ethiopian sub-contractors and a Swedish sister company of MIDROC Ethiopia.

To simulate the impacts of the emerging large-scale agro-investment on the livelihood strategies and income levels of the local population, we developed and used a mathematical programming model. The model fulfils two important tasks: it provides the link between economic theory and data, and it allows a practical consideration of problems and policy orientations (Hazell & Norton, 1986). During the course of one year, each individual farmer has to continuously make decisions on how to allocate his resources across different production options and seasons. These decisions reflect physical (land, etc.), labour, and financial constraints. Such a prescriptive design is possible if the individual farmer makes decisions based on his defined objective(s). The problem is to find a farm management plan with the largest possible total gross margin, but which does not violate any of the fixed resource constraints, or involve any negative activity levels. This problem is known as the *primal linear programming problem*.

The mathematical solution of such a problem assumes certain characteristics.[12] To allow for proper specification, any farm-level model requires the following information:

1) The alternative farming activities, their units of measurement, their resource requirements and any specific constraints of their production
2) The fixed resource constraints of the farm
3) The forecast activity net-returns (gross margins)

To simulate the change, we modelled each of the two local groups operating a single large farm, with all of each group's households as members and their cumulative endowments as resources. Both farms follow a mix of income strategies to meet their basic needs and generate income. These activities are: (i) cultivation using hand tools (*AGR1*); (ii) cultivation using draught animals (*AGR2*); (iii) land preparation for cultivation (LC); (iv) hunting of game meat (*HN*); (v) gathering of wild fruits, roots, and fuel wood (*GATH*); (vi) self-employment activities such as beer brewing or small businesses (*SELF*); and (vii) off-farm employment paid in cash on a monthly or daily basis (*JOB*). Each of these activities has different resource requirements, on which the groups spend their endowed resources. The resources (code, unit) are: (i) agricultural land (*Aland*, in hectares); (ii) open access land (*Oland*, in hectares); (iii) labour during peak harvest season (*Lp,* in days); (iv) labour during off-peak season (*Lop,* in days); (v) draught animal (*Ox,* in days); and (vi) cash and assets (*Capital,* in birr).

We assumed that each farm is maximizing its gross-return from all activities. Such profit-maximization behaviour might not accurately reflect risk-aversion normally inherent to small holder farming. However, given the high prevalence of poverty and in-line with proposition five stated above, it is convincing that each group would be trying to maximize its return to reach self-sufficiency, or to use its resources in a way that the greatest amount of food and income is generated with the least effort.

To establish the parameters of the model we used cross-sectional household survey data collected at the site in early 2011 by one of the authors. The survey consisted of a stratified random sample including 131 rural households from six villages near the Saudi Star property and Abobo Town. The first step was deriving the value of initial endowments of both groups. Mean values for both groups were used and multiplied by the amount of households to reach each of

[12] Table 7 (Appendix) lists assumptions and states their applicability to the Gambela case study context.

the ‘large farm’s’ total endowment levels at the initial stage. In addition the results of six village-level surveys, over 40 expert interviews, and five focus group discussion were used to provide contextual information.

To derive the input requirements for each of the seven activities, four analytical steps were performed. First, the reported and observed livelihood activities or “sub-activities” of both groups where grouped into the seven groups of *activities* described above (*AGR1*, *AGR2*, *LC*, *HN*, *GATH*, *SELF*, and *JOB*). Second, to create the coefficient matrix, the resource requirements for each sub-activity were derived. Third, the returns of each sub-activity were valued in monetary terms to allow comparison across activities and optimization.[13] Finally, weights for each of the sub-activities were determined and applied to the model. For each activity the weighted sum of sub-activities accounted for 1.

In this way a coefficient matrix for each group was derived listing the resource requirement and respective return of one activity level. For example, one hectare of land cultivated manually (*AGR1*) for the indigenous group requires one hectare of agricultural land (*ALand*), no open land, 155 days of labour input during the three months of the peak season (*Lp*), and another 230 days of labour input during the remaining nine months of the year (*Lop*). No oxen are used and capital invested is the marginal sum of 12.5 birr (mainly for tools) as no modern inputs are used. The respective values were derived using information from maize and sorghum plots cultivated manually during the 2010 season. Maize accounted for the large majority of plots, thus weights were 0.875 for maize and 0.125 for sorghum. Yields averaged around seven quintals for maize and nine quintals for sorghum, which both sold at a local market price of 200 birr/quintal, from which we subtracted transportation costs (50 birr/quintal) for an estimate of 150 birr net-revenue per quintal. Multiplied by the yield per hectare and weighted, this estimate yields a total net-return from one year of cultivation on a hectare agricultural land of 1087.5 birr (ca. 67 US$ or 346 US$ [PPP]). Similarly, values were derived for the other activities for both groups.

The choice of activities is constrained by the initial endowment of each group (resource-constraint). In addition, we assumed four constraints given the context and nature of activities:

- **Peak labour constraint**. Given the high degree of seasonality for some activities and the lack of a local landless class (I–1), we can define peak demand during land preparation

[13] For households that were considered, net-buyer and net-seller transportation costs were added or subtracted.

and planting, weeding, and later at harvesting times, equivalent to a total of three months (i.e., 25% of the annual labour capacity).

- **Oxen constraint**. Ploughing has to take place close to the onset of the rainy season to allow for a good seed bed and the proper levels of moisture. Early ploughing would lead to erosion problems; late ploughing will not allow optimal germination of seeds and thus reduce yields. In our model we assumed a window of 25 working days (four weeks) around the onset of the rainy season as the limit. To properly prepare a seed bed a team of oxen needs four ploughing days (Aune, Bussa, Asfaw, & Ayele, 2001; McCann, 1995).
- **Market constraint**. The area of Abobo is not well integrated into regional or national markets. Villagers mainly rely on flat local demand (absence of market for output and therefore no trade - P–4). Lacking precise expenditure data, we relied on secondary data at the national level. A recent analysis by Tafere, Taffese, & Tamru (2010) that explores households demand elasticity in Ethiopia using country-wide data (from CSA 2004–05). The study reports expenditure shares per staple good, and other food and non-food items. For the purpose of the model we took the total capital stock available as the potential maximum expenditure and thus calculated the upper bound (market constraint) by taking 42% of this maximum expenditure for both groups. The levels reached are 1,256.54 and 1,864.25 units of *SELF* for both Anyuak and Settlers, respectively (upper limit for *SELF*).
- **Labour market constraint.** As described above and consistent with Binswanger & McIntire (1987), the study context is characterized by a very limited labour market. There is little opportunity for off-farm employment apart from the few daily labour jobs offered by 3–4 medium-scale Ethiopian operations in the area, the local hospital, and the *woreda* administration and some NGO offices located in Abobo Town. Using estimates of how many monthly jobs these different employers offer, we derived initial maximum monthly jobs per group of 1,228 and 818 for the indigenous and settlers respectively (upper limit *JOB*).

Finally, the model was tested for sensitivity within the confidence interval of each endowment. Behaviour of the model was consistent with theory and the observed evidence. Labour inputs for the peak season were slightly reduced for agricultural activities and returns to gathering activities were cut. Thereafter the model, within its limitations, was found to be robust and the simulations of scenarios were performed.

5. SIMULATION RESULTS

The base run of the model revealed two main characteristics: (i) the *composition* of each farm's total gross return and (ii) the *level* of the total income (Table 3). The indigenous group (*Ind*) has a balanced mix of income strategies to meet its annual income and nutritional needs. Agriculture (*AGR1*) accounts for 22.3%, gathering and hunting together account for more than 40%, and business activities account for another 18.5%. Wage employment only contributes 13.3% of annual income. For the Settler group farming (*AGR1* + *AGR2*) is the major source of livelihood accounting for 43% of total gross revenue. Business activities are secondary with a share of 37.5%, gathering fuel wood and other forest products contributes about 7%, and wage employment contributes 12.1%. The indigenous and settler groups (*Set*) generate an annual gross return of approximately 6.1 million birr and 4.7 million birr respectively. In purchasing power parity US$ (Jan 2011 exchange rate), this translates into an average annual household income of 1,871 US$ and 2,695 US$ for the indigenous and settler groups respectively. In daily per capita income terms, this averages 0.93 US$ and 1.32 US$ for the respective groups.

Table 3 Composition and level of total gross-return of indigenous and settler groups, base run Ethiopia model

Group	**Composition** of total gross return *Activity share of total gross-return*							**Level** of gross return *Absolute returns & per HH/capita*		
	AGR1	*AGR2*	*LC*	*HN*	*GATH*	*SELF*	*JOB*	TOTALs-Gross-Rev (birr)	US$ (PPP)/ HH/year	US$ (PPP)/capita/day
Indigenous	22.3%	0.0%	0.0%	16.7%	29.3%	18.5%	13.3%	6,111,975	1,871	0.93
Settler	1.6%	41.8%	0.0%	0.0%	7.0%	37.5%	12.1%	4,741,383	2,695	1.32

Note: Base scenario; %-shares of total gross-income per group/large farm

Scenario 1: If we assume that after the establishment of Saudi Star operations there will be changes in access to land, we can simulate the impacts on the income levels of both groups. We assume a size for the commercial farm of 10,000 ha of land cleared, and thus lost to local use. Table 4 lists the changes in overall income, per capita levels, and relative change to the base-scenario for both groups. It appears that the indigenous group would lose significantly higher shares of income (4.4%) compared to the settler group (0.6%) due to the reduced access to land resulting from Saudi Star operations.

Table 4 Predicted income changes due to reduced access to land (both groups) as a result of commercial rice production

Scenario (ha converted)	**Indigenous** Total net revenue (birr)	Net-revenue per Capita/ day (US$ PPP)	% Change (from base)	**Settler** Total net revenue (birr)	Net Revenue per Capita/ day (US$ PPP)	% Change (from base)
Base (0)	6,111,976	0.93	0%	4,741,384	1.32	0%
10,000	5,845,718	0.89	-4.4%	4,711,089	1.31	-0.6%

Scenario 2: The emergence of the commercial rice operations, however, will not only reduce access to land, but will also create a significant and growing demand for manual and skilled labour. This demand might only be partly met by local supply, as a result of the aforementioned lack of a landless working class and the lack of demanded skills (skill-gap). In many interviews with Saudi Star managers, it was apparent that there would not be sufficient reliable and skilled workers to meet operation needs. In February 2011 Saudi Star already employed more than 750 people (company data), out of which only a small proportion came from the surrounding villages. Approximately 20% of the workforce were local workers from the Indigenous group. The local Settler group share of the workforce was not clear, since many migrant workers had already settled near the farm, and were working as semi-skilled and un-skilled workers there.

In our model, the emergence of the Saudi Star operations will affect the initial upper limits for wage employment and self-employment activities. The farm will operate on 200 ha units (blocks). Each of these units will be run by a block manager, a number of foremen, several tractor drivers, field workers, and technical staff. Depending on the capital-intensity there will be a trade-off between more technical staff/tractor drivers vs. more manual labour (e.g., for transplanting of seedlings). We assumed low-labour intensity conditions (for rice production) for 0.2 of the jobs created per hectare (i.e., 40 per block). This adds up to a total of 2,400 monthly jobs created for every 1,000 ha under operation (per year). We further assumed that these jobs will be filled mainly by migratory workers (2/3) and to a smaller share by local labour (1/3). Finally, consistent with field observation and our analysis of company data, we assumed a slightly disproportionate distribution of jobs among the two groups. The Indigenous group will account for 60% of the jobs and the Settler group 40% (based on their respective local population proportions of 70% to 30% respectively).[14]

Additionally, the demand for locally produced non-food items, services, and beverages (e.g., local beer) is assumed to increase, as workers will spend some of their monthly income on these goods locally. Assuming that only 10% of monthly salaries will be allocated to these local products, there will be an increase of slightly above 5% in demand for local *SELF* products for every 1,000 ha under rice production.

Subsequent step-wise operation of the model wields a significant change in the composition of activities (see Figure 7 and Figure 8 in the Appendix). Table 5 presents the relative shares of each activity before Saudi Star operations started (*Base*) and again after becoming fully operation at 10,000 ha (*Full operation*), for both groups.

Table 5 Changes in composition and income levels between the 'base' and 'full operations' scenarios for both groups

Code	Group	*AGR1*	*AGR2*	*HN*	*GATH*	*SELF*	*JOB*	Total (Mill. birr)	Total (%-Change)
Base	Ind	22.3%		16.7%	29.3%	18.5%	13.3%	6.1	100.0%
(no operations)	Set	1.6%	41.8%		7.0%	37.5%	12.1%	4.7	100.0%
Full operation	Ind	12.4%		9.8%	17.2%	18.1%	42.5%	9.4	153.3%
(10,000 ha)	Set	0.0%	22.7%		4.0%	35.7%	37.6%	7.5	157.8%
Ratio	Ind	-44%		-41%	-41%	-2.1%	+220%	-	-
(End/Base)–100%	Set	-100%	-46%		-43%	-4.9%	+211%	-	-

In the last two rows of Table 5 the figures for subsistence agriculture were significantly reduced for both groups (by almost 50%). This implies that less land would be cultivated by the local population, making more land available. This change is also likely to have a negative effect on local food supply from subsistence agriculture. Gathering and hunting also declined significantly in importance for the indigenous group (from above 45% of total income to below

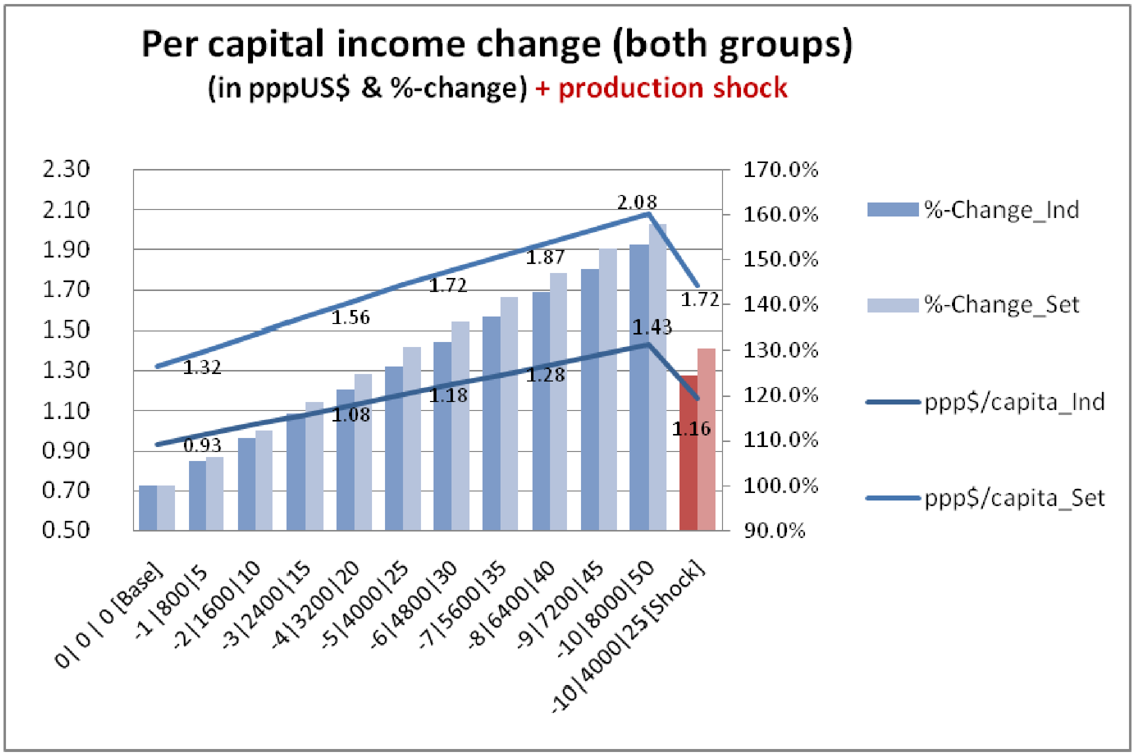
[14] Analysis of company employment data from February 2011 showed that the Anyuak group only accounted for 20% of the workforce. However, it was not possible to disaggregate the share of migratory labour. The survey analysis showed that the settler group had a higher share of household members working for Saudi Star, partly because of greater access to the farm for members of this group.

30%). However, they still comprise a very significant portion of indigenous income (ca. 27%). The importance of *SELF* activities remained at very similar proportions, however, this conceals their increased value, as overall income increased by above 50% for both groups. Lastly, wage-employment increases considerably in its importance and contribution to total income.

Figure 4 depicts the per-capita increases for each of the ten steps of the simulation. Significant increases in income were predicted for each group. Indigenous group members rise above the poverty line (1.25 US$/day) to 1.43 US$/day once the Saudi Star operations reach a level of 10,000 ha. For the Settler group, there is a greater increase from 1.32 US$/day to 2.08 US$/day. The predicted income levels represent overall income increases of 52.4% and 57.8% for the Indigenous and Settler groups respectively.

Scenario 3: The commercial farm, as natural to any agriculture enterprise, is subject to various risks. These can take the form of a price collapse for the crop produced (rice) or financial problems of the company that owns the farm (MIDROC Ethiopia) etc. In this scenario we simulated the effects of a drop in the price of rice that makes production beyond a certain threshold unprofitable. Production is cut by 50%, leading to subsequent cuts to the workforce hired and the amount of money spent on locally produced goods (production shock). Under these conditions the model predicted a sharp decline in the income of both groups (Figure 4). Per capita income would drop by 18.9% and 17.3% for members of the Indigenous and Settler groups respectively, indicating a more negative impact on the Indigenous group.

Figure 4 Changes in income levels due to evolution of the large-scale investment (absolute and relative)

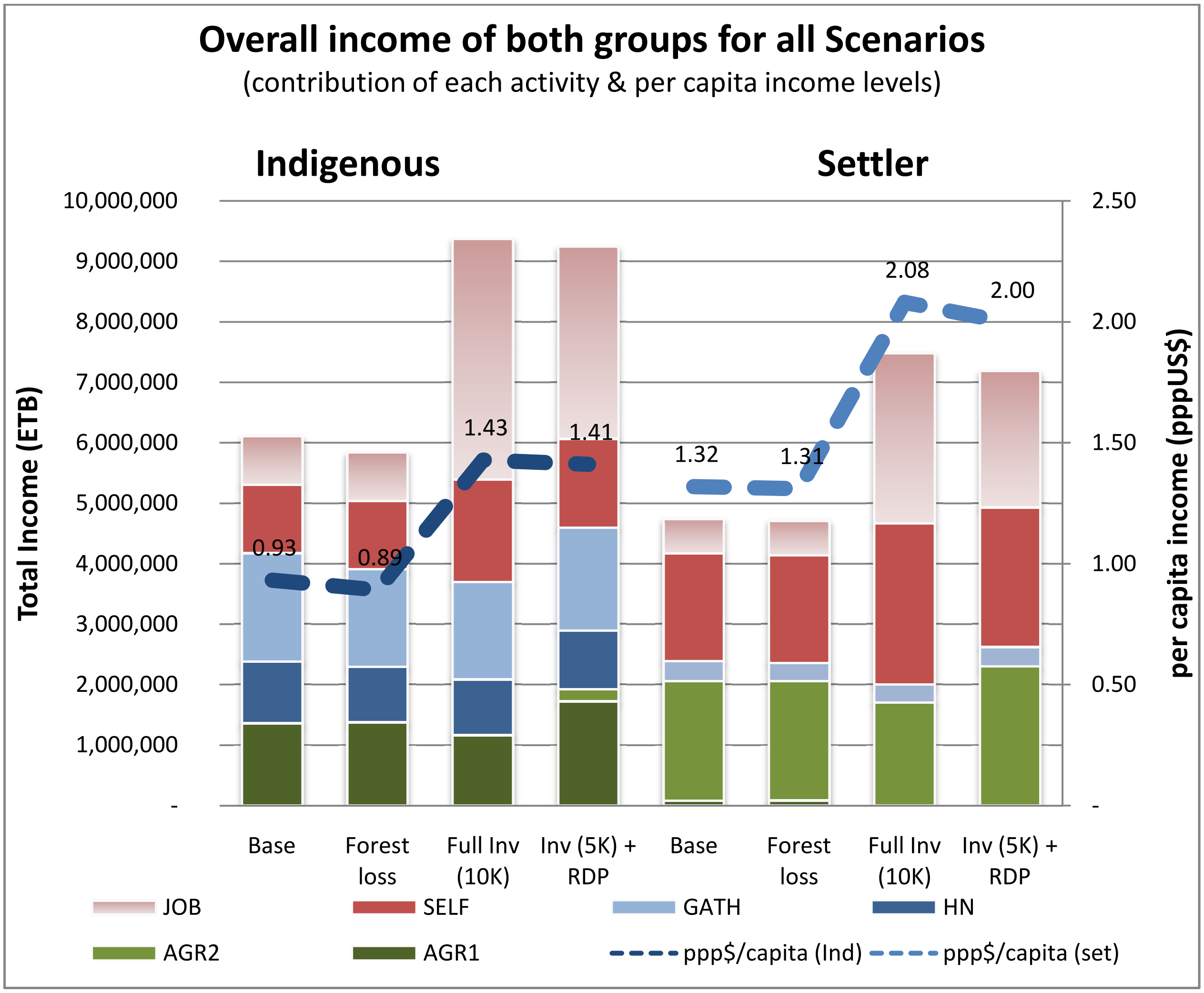


Note: codes describe the change in factors: -K ha *Oland* | +*Jobs* | +%*SELF*-demand.

Scenario 4: At the moment, production yield rates of farmers are very low, ranging around seven to nine quintals per hectare for maize and sorghum for manual agriculture and 16 to 18 quintals per hectare for using draught animals. In the very similar agro-ecological context of the town of Gambela (only 80 km away), yields of up to 26 quintals per hectare can be reached (i.e., an increase of 40–75%) (CSA, 2012b). In this scenario we simulated the effects of a smaller commercial operation (5,000 ha) paired with improved production, which might result from some sort of public investment in higher yielding seeds, extension services, and/or infrastructure. In addition, we assumed greater availability of draught animals or tractor rental services, either through public or private investment. In quantitative terms, we programmed yield increases of 50% for manual agriculture and 25% for draught animals, plus a public investment equivalent to 40 additional oxen to the area. The demand for self-employment was programmed to increase by 15% due to the development of infrastructure and the resulting introduction of new technology implies a change in the labour market (relaxing P–4), which is consistent with (Binswanger & McIntire, 1987). As discussed broadly in the literature, small-scale production is more labour intensive, and the assumed push for more commercialized agriculture also requires more business people and traders, etc. We therefore provided an additional 165 jobs annually to the scenario on an initial basis. We simulated the impacts of such an inclusive rural development policy (RDP) scenario in a step-wise process, introducing the improved seeds or measures to boost yields, then additional draught animals or tractor services and improved connectivity to markets and infrastructure, and finally an commercial production scale of only 5,000 ha (see Figure 9 in the appendix).

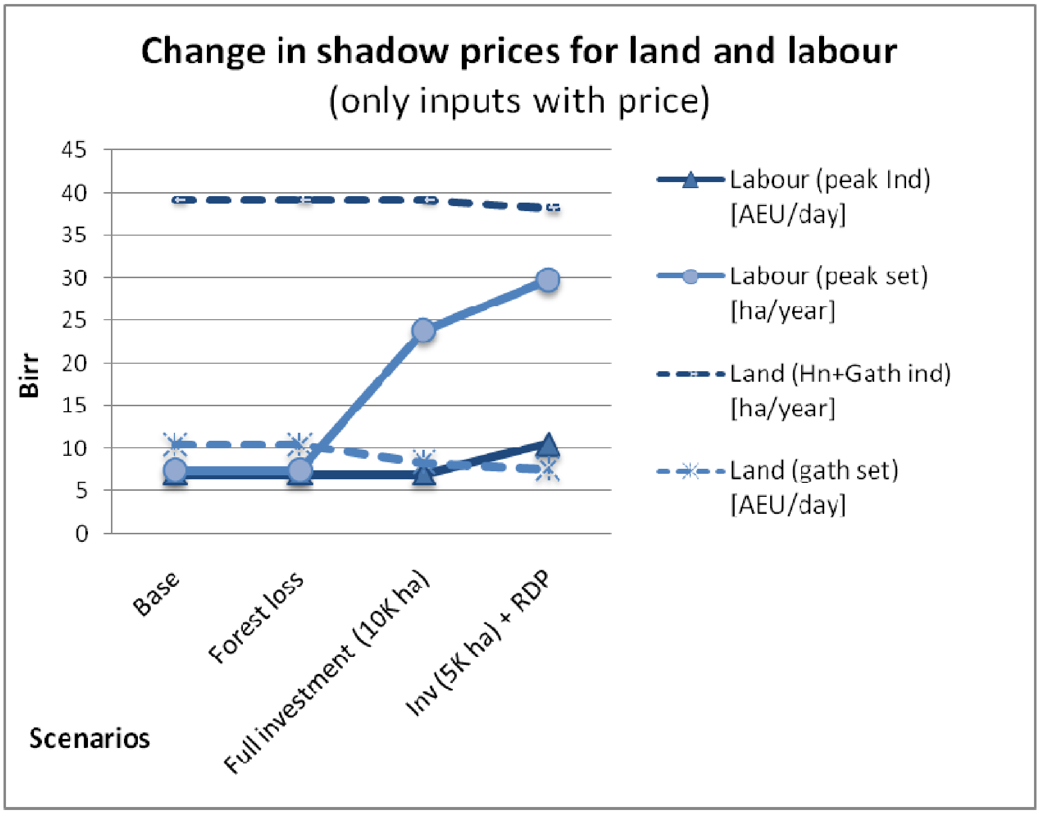
Comparison across scenarios: Figure 5 shows the changes in per-capita income (in PPP US$) as well as both groups overall outputs and income composition. Regarding the poverty effects, scenario three was predicted to cause similar income increases for both groups. The Settler group, however, would be expected to gain more from a larger investment, which is partly explained by their greater willingness and ability to find work on the commercial operation. The composition of gross-revenues indicates that agriculture activities would increase for the Indigenous group under the last scenario. For the Settler group activities would stay very similar, even under the last scenario, indicating a transition to the off-farm sector, such a business opportunities and trading. The Indigenous group would gain greater revenue from agriculture and adopt using draught animals, and partially substitute some hunting activities as agriculture becomes more profitable. However, the Indigenous group would still rely on access to land/natural resources for a large share of their income.

Figure 5 Comparison of composition and level of income across all four scenarios.



Shadow prices: The model can derive the marginal return if one (limited) unit becomes available (*shadow price*). In our model, agricultural land is not scarce and thus has no positive value throughout the simulations. The same condition applies to labour during the off-season. However, labour during the peak season and forest land have shadow prices, which also change throughout the simulations. Figure 6 presents these changes for land and labour by social group for all four scenarios. Starting with forest land (dotted lines), we can see that the marginal utility for the annual use of one hectare is very different for both groups. This is mainly because settlers do not hunt. Gathering wild food resources by the Indigenous group yields a shadow price above 14 birr/ha. This is nearly 40% higher than the benefit to the Settler group. The value of forest drops as other livelihood activities become more available or profitable. It is noteworthy that the values for the Settler group drop with the evolution of the investment and subsequent increased income from employment and business activities. The Indigenous group only reduces its use of forest land as agriculture becomes more profitable.

Figure 6 Comparison of shadow prices for land and labour for all four scenarios



Labour becomes more valuable as opportunities increase. Among the Settler group, where shadow prices already increase sharply with the arrival of the commercial farming operations, and increase even further if a rural development policy was paired with commercial operations on a smaller scale.[15] For the Indigenous group, a slight increase from the initial values of around seven birr were predicted under the investment scenario. Under the last scenario, this is even higher. Comparing both social groups, labour is predicted to be even higher among the Settler group which is more integrated in business activities and off-farm employment, while the Indigenous group has a relative higher reliance on forest land.[16]

[15] Interestingly these shadow prices coincide with wages at the investment site in early 2011 (23–30 birr/day).

[16] For further discussion on the importance of forest products for rural income, especially of the poor, see (Arnold & Pérez, 2001; Vedeld, Angelsen, Bojö, Sjaastad, & Kobugabe Berg, 2007). Controversy remains about whether forest resources serve as a safety net or bind poor household to low-productivity activities.

6. CONCLUSION

We found evidence of a significant increase in land investments in Ethiopia, especially after the global food price crisis of 2007 and earlier policy changes. In addition to increased foreign investment in agriculture, there have been corresponding increases of Ethiopian and joint-venture investments. While domestic investors account for the majority of cases, these investments are typically in much smaller parcel sizes. Most foreign investors came from the Middle East, Western Europe, and South Asia. While most investments take place in the central highlands of Ethiopia, investors have started to move westward into the fertile lowland areas of the Gambela and Benishangul Gumuz regions.

Regarding the governance, we identified evidence of an increasing trend of LSLAs, which is supported by the creation of high-level institutions to govern the process of land investments. From regional-level data we observed that investor's demand for land was only partly met. A recent interruption of land transfers by AISD from April to October 2012 reinforces this impression, which might also be explained by a lack of capacity to facilitate all requests.

We developed a model that links theory with data in the context of a case of foreign investment in the *woreda* of Abobo. Model simulations revealed various impacts on the composition and levels of income of the two major social groups of the local population. A number of **limitations** to the analysis remain. (i) Our model assumes complete flexibility of household members across activities (i.e., if a job opens up, we assume that labour will have access to this new opportunity, regardless of factors such as proximity to family, etc.). (ii) The profit maximisation behaviour assumption does not capture risk aversion of local actors. Using conservative estimates with regard to changes in work availability for the local population (only 1/3 of the projected workforce) we tried to incorporate this concern into the simulation parameters. (iii) We did not attempt to capture gender specific impacts of the land investment context, however, these are likely to be significant as—depending on the technology applied—labour demand is highly skewed towards men. This may have implications for the work burden of women, who may increasingly be responsible for domestic household work and also subsistence agriculture tasks.

Finally, there are a number of aspects that the analysis does not capture. (i) Food security is not part of the model. The sharp decline in subsistence agricultural production due to a shift to increased reliance on wage-employment might contribute to a shortage of local food supplies, which can only be compensated for when local food markets are available. (ii) The model only predicted the value of direct economic benefits from the land and natural resources, such as value of forest products. This fails to consider the value of ecosystem services that forest and bush land that are converted to commercial agriculture provide on a broader context, such as watershed preservation, protection against wind erosion, etc. If those “losses” were valued, the direction of the impacts of commercial land investments might change. (iii) The model also did not include potential local economy-wide gains from large commercial agriculture investments.

Comparing the four scenarios revealed some interesting findings. The loss in access to forest land would negatively affect the income levels of both social groups; however the effect is expected to be much more significant for the members of the Indigenous group, who are more reliant on natural resources for their livelihoods.

The model predicted that these negative income effects would be offset by increased employment generation and demand for locally produced goods and services. Both social groups are expected to gain significantly in overall and per capita income once the commercial agricultural investment reaches its full operational size. However, proportion of agriculture in the composition of local livelihood activities is expected to decrease by almost half for both groups. This indicates that less land would be used by farm households and that less food would be produced by farm households. Unless local food markets are able to compensate for the expected decreases in subsistence agriculture paired with increased immigration of workers to the area, could push up local prices for food.

A simulated production cut of the large-scale commercial farm operations had strong negative impacts on the income of both social groups, with more negative effects on the Indigenous group. Local workers primarily perform daily labour and are paid at the end of each month on a per day worked basis without much job security. This labour situation makes the simulated effects of a production cutback a reasonable scenario of the potential threat to local income.

Finally, when we considered a more integrated development strategy that included investments to improve the productivity of small-scale producers, paired with a smaller scale of commercial operations (5,000 ha), the model predicted similar negative income effects accompanied with improved local food production.

Shadow prices for labour and forest land changed across the four scenarios simulated with the model. Private agricultural land had no positive shadow price, because it can be procured by households capable of investing the labour necessary for clearing the forest. Labour was more valuable among the Settler social group, indicating higher opportunity costs of labour. Members of the Indigenous group were predicted to retain forest product activities to support their livelihoods.[17]

Policy recommendations: The smaller (5,000 ha) scale commercial farm operations (relative to the 10,000 ha scale) paired with public or private investment in smallholder commercialization was predicted to have more significant and longer lasting positive effects on local livelihoods than the other simulated scenarios. The environmental impacts of LSLAs remain an important dimension that requires additional research, especially given the already high deforestation rates in Ethiopia. Improving local food production should be part of any development strategy. Even though market integration can improve food security for local producers, the reduction of agricultural activities might pose challenges for segments of the local population, e.g. in times of drought. Where they are already important to local livelihoods and remain available, forest resources will continue to play an important source of income and market alternative resources for the rural poor. The loss of access and use rights and the degradation of forest and other natural resources should thus be mitigated by government policies, either through direct compensation, inclusive design, and/or job training and empowerment for sustainable resource management by these vulnerable groups.

The development of large-scale commercial farm operations in low population density areas might have greater impacts on the factor prices of labour than land, which might not be scarce initially. In our opinion politicians and researchers should pay increased attention to this interrelationship when designing policies and planning future research efforts. Off-farm employment remains an important opportunity for poverty reduction in many parts of Africa. If it comes at a cost of uncompensated loss of direct access to natural resources and in the context of insecure labour benefits, there is a legitimate risk of not improving local livelihood situations and leaving significant proportions of the rural population out of the potential economic benefits derived from LSLAs.

[17] The shadow price of the indigenous group for annual use of one hectare of forest land, as derived by the mathematical programming model, was at approximately 40 birr. The initial rent charged by the government to the investor was 30 birr, increased after revision to 151 birr.

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APPENDIX

Table 6 Characteristics of investments by origin. Source: EIA data (1992–2010) in Baumgartner (2012).

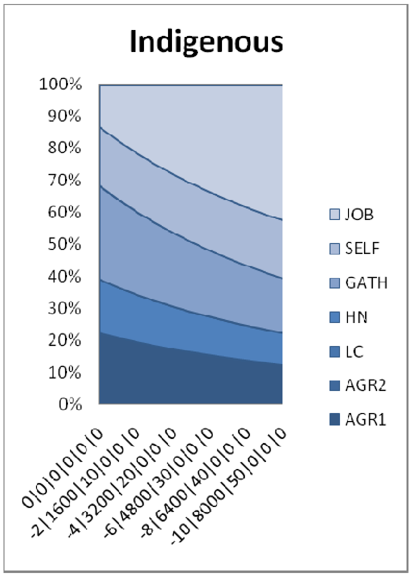
	Investments grouped by size				Land solicited in hectares			
Origin of Inv. by Region *	**Medium (100-1,000 ha)**	**Large (1,001-10,000 ha)**	**Mega (> 10,000 ha)**	**Total count**	**Median**	**Min.**	**Max.**	**Sum**
Ethiopia (domestic)	1.790	437	19	**2.246**	500	102	153.713	**2.918.909**
North Africa	28	18	10	56	1.500	150	150.000	659.608
Middle East	84	75	29	**188**	2.000	120	**400.000**	**2.455.239**
Sub-Saharan Africa	4	1	2	7	800	400	22.100	52.300
East Europe & Central Asia	2	1		3	350	200	3.000	3.550
West Europe	62	35	20	**117**	1.000	110	**500.000**	**2.558.495**
South Asia	22	25	18	65	**4.000**	110	**500.000**	**1.510.051**
China	4	2	2	8	1.500	500	100.000	160.700
Southeast Asia & Pacific	5		2	7	500	200	100.020	133.820
Latin America & Caribbean	4			4	400	300	1.000	2.100
North America	58	42	12	**112**	1.000	120	**300.000**	**956.586**
Total	**2.063**	**636**	**114**	**2.813**	**500**	**102**	**500.000**	**11.411.358**

**Comment*: For joint-investments the grouping is based on the majority investor. As there are several joint-investments between foreigners and Ethiopians, the Ethiopian role should not be underestimated.
Note: Only investments requesting 100 ha or more are listed. There exist no reliable data on how much land has actually been allocated, nor the amount that is operational at the moment. These figures only indicate the demand side of land investments.

Table 7 Underlying assumptions about the agricultural model for Ethiopia. Source: (Hazell & Norton, 1986, p. 13)

	General Assumptions for *any* LP Model	Reaction regarding Ethiopia LP Model
1.	*Optimization*: An appropriate objective function is either maximized or minimized.	**Assumption:** locally maximized returns under given resource constraints. Especially until self-sufficiency is met. (P-5)
2.	*Fixedness*: at least one constraint has a nonzero right hand side coefficient.	**Holds:** both groups do have initial endowments (Land, Labour, Capital, Oxen, etc.)
3.	*Finiteness*: There are only a finite number of activities and constraints to be considered so that a solution may be sought.	**Holds:** realistic to reduce to 5-7 activities to describe their livelihood strategy.
4.	*Determinism*: All coefficients in the model are assumed to be known constants.	**Holds:** We derived values from survey data or secondary literature.
5.	*Continuity*: Resources can be used and activities produced in quantities that are fractional units.	**Holds:** coefficients calculated based on units; valuation in monetary terms allows continuity.
6.	*Homogeneity*: All units of the same resource or activity are identical.	**Assumption**: that all HHs of one group react uniformly to the model change (**limitation**).
7.	*Additivity*: The activities are additive. When two or more are used, their total product is the sum of their individual products. That is, no interaction effects between activities are permitted.	**Holds:**
8.	*Proportionality*: The gross margin and resource requirements per unit of activity are constant regardless of the level of the activity used. A constant gross margin per unit of activity assumes a perfectly elastic demand curve for the product, and perfectly elastic supplies of any variable inputs that may be used. Constant resource requirements per unit of activity are equivalent to a Leontief production function (that is, a linear ray through the origin).	**Holds:** We do not assume decreasing returns; constraints are given (e.g., for off-farm employment which is limited initially).

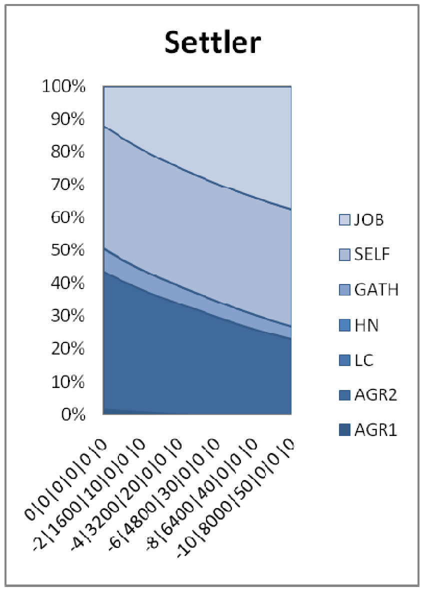
Figure 7Composition of Income _Scen1_ind (share of respective activities)



Note: codes describe the change in factors as commercial farm grows:

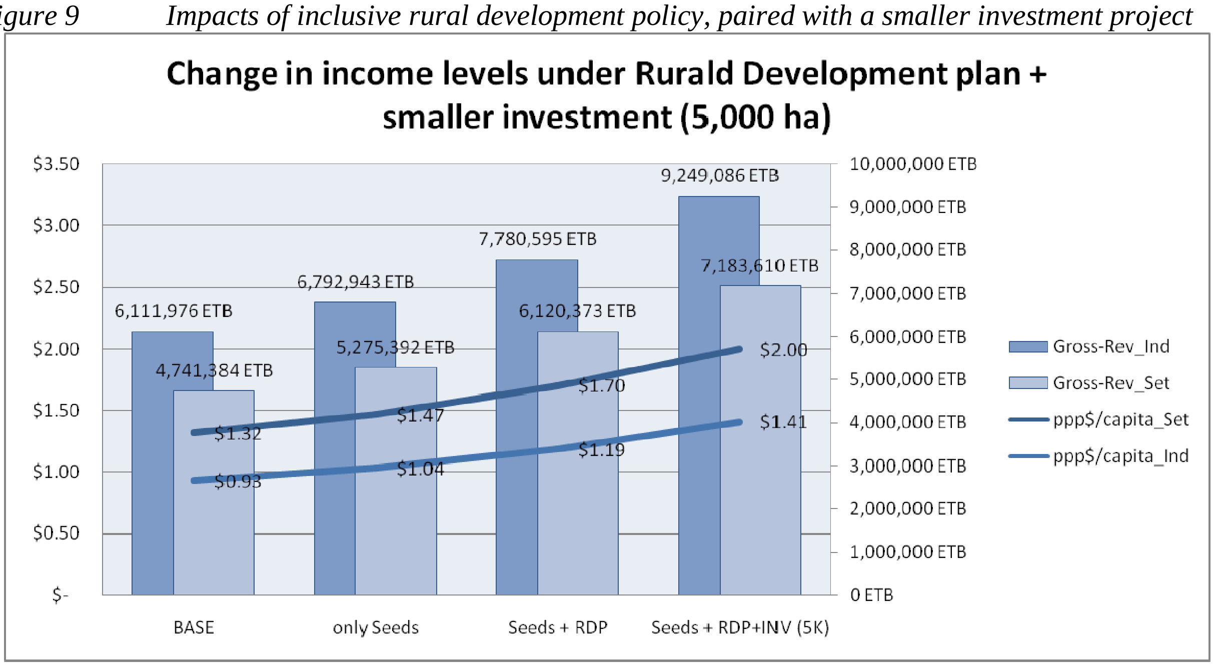
-K ha Oland | +Jobs | +%SELF-demand.

Figure 8Composition of Income _Scen1_set



Note: codes describe the change in factors as the commercial farm grows: -K ha Oland | +Jobs | +%SELF-demand.

Figure 9 Impacts of inclusive rural development policy, paired with a smaller investment project



Note: for assumptions of this simulation see discussion in 5. SIMULATION RESULTS.